COMMUNITY-SCALE SOLAR

WHY DEVELOPERS AND BUYERS SHOULD FOCUS ON THIS HIGH-POTENTIAL MARKET SEGMENT

INSIGHT BRIEF

March 2016

HIGHLIGHTS

- Despite impressive growth to date, **solar PV only represents a small fraction of U.S. electricity generation** and millions of households are being left out.
- **Community-scale solar** (0.5–5 MW projects) **represents a substantial untapped market** of up to 30 GW by 2020.
- Community-scale solar is **inclusive of low- and moderate-income households**.
- Community-scale solar **avoids constraints** facing other markets and can reach utility-scale economics while leveraging distributed benefits.
- Buyers and sellers together can innovate and unlock **cost reductions of up to 40%**.
- **RMI's Shine initiative works** with public utilities (rural electric cooperatives and municipal utilities), community organizations, and developers **to unlock this market**.

INTRODUCTION

Solar PV in the United States has been growing impressively, driven in part by steep cost reductions. From 2005 to 2015, the average installed cost for PV systems dropped almost 70%, from $8.00/W to $2.60/W.[i] Over the same period, U.S. solar PV installed capacity grew an average 57% annually, from 79 MW installed in 2005 to 7,000+ MW installed in a record-breaking 2015. For the first time ever, in 2015 solar PV beat natural gas for U.S. electric generating capacity additions.[ii]

Despite this growth, solar PV generated only 1% of U.S. electricity in 2015.[iii] Hence tremendous potential remains for solar PV's future (see Figure 1, page 2).

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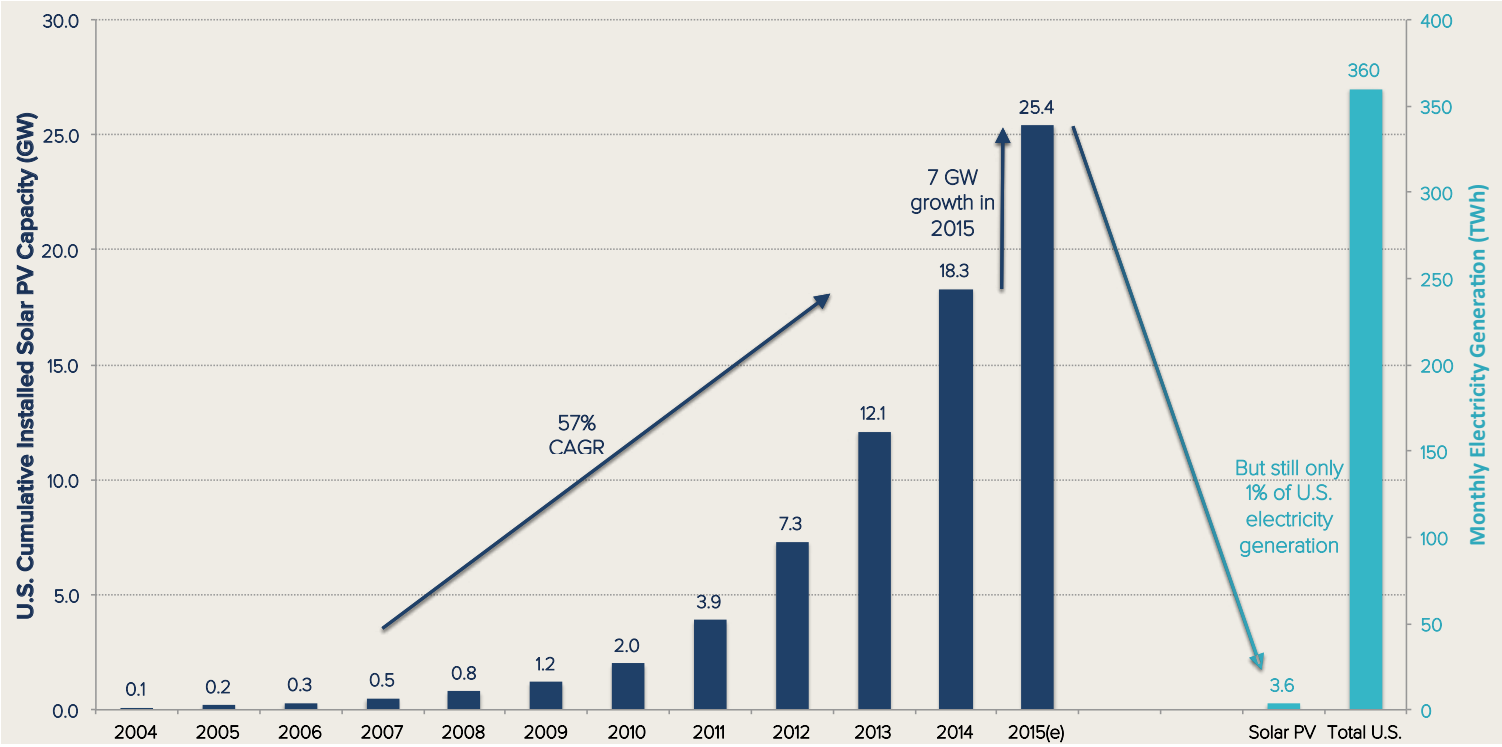
Figure 1: U.S. Solar PV Cumulative Installed Capacity and Monthly Generation

U.S. solar PV cumulative installed capacity has been growing impressively, but still represents only a small fraction of overall U.S. electricity generation.



To date, solar PV's U.S. growth has been concentrated in two markets: utility-scale solar and behind-the-meter solar (i.e., residential rooftop and C&I). Most of solar PV's growth in the residential rooftop segment—which is now a multi-GW annual market—has been confined to middle- and upper-income households.[iv]

Utility-scale and behind-the-meter solar will both play a large role in a high-solar-penetration future, but both solar market segments could face headwinds in the years ahead. Utility-scale solar could face transmission constraints and siting challenges. Behind-the-meter solar, which in most places benefits from retail net energy metering, faces challenges to its economics in places where export compensation is being reduced to avoided cost, wholesale rates, or other terms less than the retail rate (such as in Hawaii and Nevada).

Yet between traditional behind-the-meter (e.g., residential rooftop) and utility-scale solar exists a substantial untapped opportunity, one that can expand the U.S. solar market and provide affordable solar energy access to millions more Americans.

COMMUNITY-SCALE SOLAR REPRESENTS AN UNTAPPED MARKET OF UP TO 30 GW BY 2020

Community-scale solar represents a substantial untapped market that could powerfully complement existing utility-scale and behind-the-meter solar market segments. RMI defines community-scale solar as mid-size (i.e., 0.5–5 MW), distribution-grid-connected, with a variety of potential "customers" (see Table 1).

Table 1: Solar Market Segment Comparisons

	BEHIND-THE-METER	COMMUNITY-SCALE	UTILITY-SCALE
TYPICAL SIZE	5 kW–0.5 MW	0.5–5 MW	20–100 MW
ENERGY USER	Households Businesses	Utility Customers (coops, munis, and IOUs) Residential Subscribers* Business Subscribers*	Utility Customers (primarily IOUs)
INTERCONNECTION	Behind-the-Meter	Distribution Grid	Transmission Grid
DISTRIBUTED BENEFITS?	Yes	Yes	No

** Subscribers to shared solar receive bill credit for community solar production*

Three major types of utilities serve customers: electric cooperatives (coops), municipal utilities (munis), and investor-owned utilities (IOUs). RMI sees munis and coops as especially promising segments for community-scale solar, though any utility could theoretically pursue this opportunity.

Community-scale solar is not yet a market driver. According to GTM Research, the shared solar installed base was ~181 MW through 2015.[v] This is less than 1% of cumulative installed solar PV capacity to date.

The segment's market potential, however, is immense. GTM Research forecasts 1.8 GW of cumulative community solar by 2020.[vi] The National Renewable Energy Laboratory (NREL) forecasts 5.5–11 GW of shared solar by 2020.[vii]

COMMUNITY-SCALE SOLAR VS. COMMUNITY SOLAR

Traditional community solar (also known as shared solar) commonly refers to projects in which output from a solar array is divided among and credited to multiple subscribers or owners. GTM Research and the National Renewable Energy Laboratory (NREL) market assessments referenced in this report pertain to community (shared) solar.

In this report, community-scale solar describes shared solar systems AND other mid-size arrays. This definition includes arrays that are owned by utilities and third-party-owned arrays that sell energy to a utility.

This broader definition emphasizes the potential role of the utility in proactively pursuing community-scale solar. When community-scale solar prices decline and become competitive to wholesale power prices, utilities could increasingly look to community-scale solar as a clean, low-cost power source.

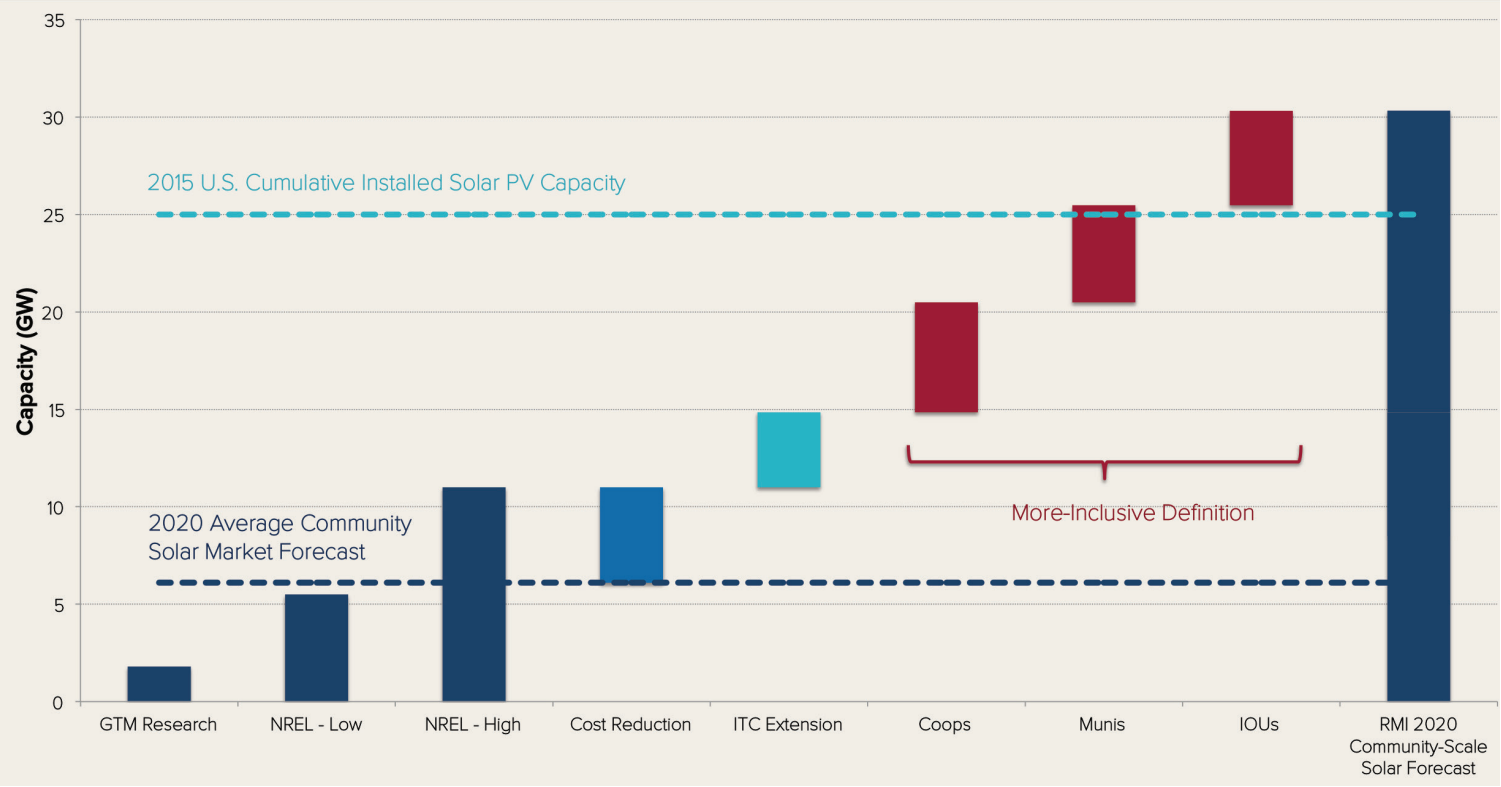
RMI sees an opportunity for even more—an estimated 30 GW of community-scale solar by 2020 under one possible scenario (see Figure 2, page 5). This is comparable to the total amount of installed solar PV in the U.S. through 2015. Beyond the shared solar market identified by GTM Research and NREL, RMI expects growth from the following:

1. **Cost reductions**: RMI has identified cost reduction potential through buyer-focused, seller-focused, and shared cost reduction levers. These cost reductions will enable shared solar to achieve a more bullish projection, comparable to NREL's 11 GW high-growth scenario. Cost reductions are discussed in greater detail later in this report.
2. **Improved economics due to investment tax credit (ITC) extension:** The NREL and GTM Research forecasts were released prior to December 2015's investment tax credit extension. RMI expects shared solar installations will increase 35%[1] due to improved economics from the investment tax credit extension.[viii,ix]
3. **More-inclusive definition of community-scale solar:** Approximately 50% of the 30 GW community-scale solar market will not be shared solar, but rather solar owned by utilities or purchased by coops, munis, or investor-owned utilities through power purchase agreements (PPAs). Among utilities, community-scale uptake and 2020 penetration is expected to be highest among coops, followed by munis, then investor-owned utilities.

[1] *GTM Research and NREL both predict ~35% increase in rooftop installations as a result of ITC extension.*

Figure 2: Community-Scale Solar 2020 Market Potential Scenario

Three factors—system cost reductions, ITC extension, and a more-inclusive definition beyond traditional shared solar—contribute to a potential of up to 30 GW of installed community-scale solar by 2020.



Compared to historical solar PV and especially community solar installation rates, 30 GW is an aggressive target. Yet, the U.S. Energy Information Administration expects 9.5 GW of utility-scale solar capacity to come online in 2016, so substantial numbers leading to 30 GW cumulative by 2020 are certainly possible.[x] This is in part because community-scale solar reaches millions of U.S. customers that so far rooftop solar has not or cannot.

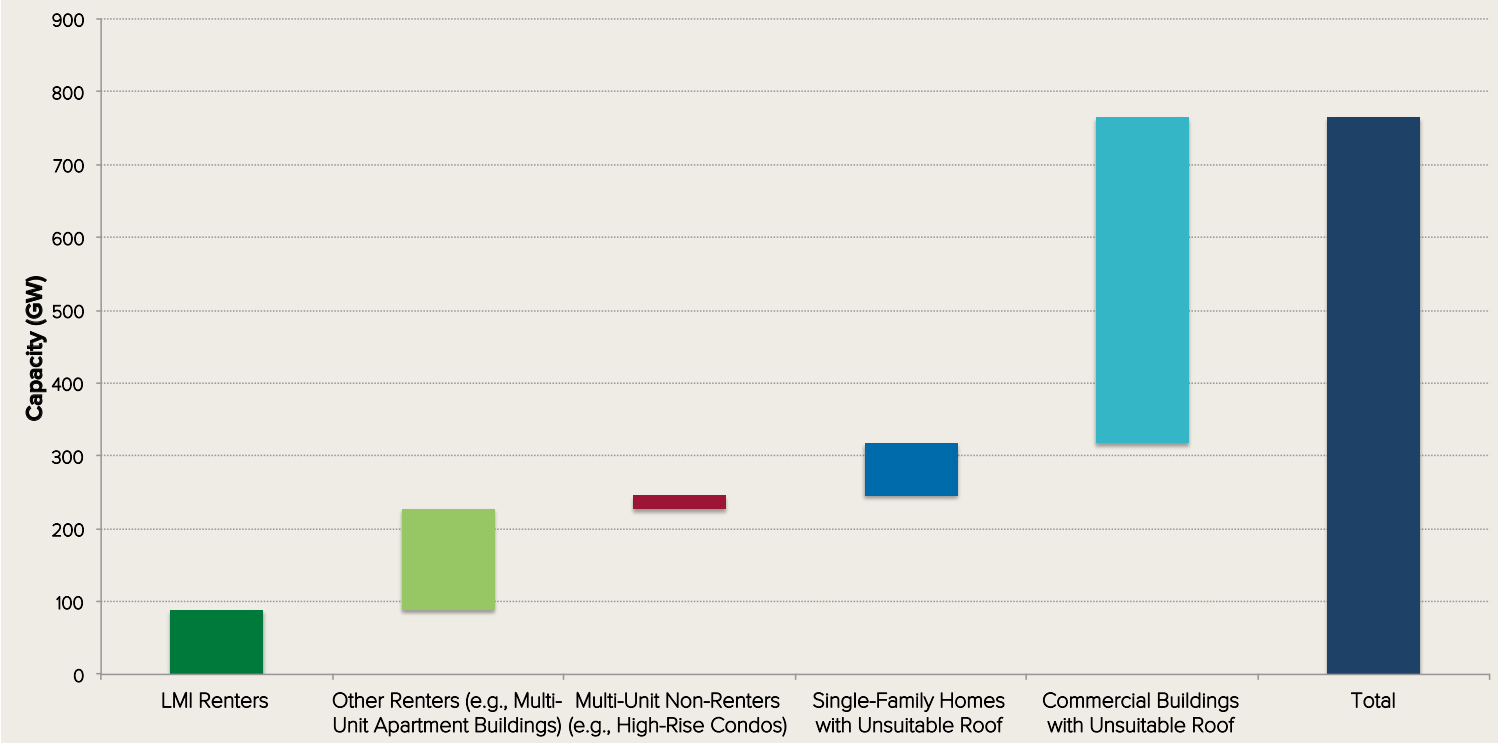
Nearly half of U.S. households and businesses cannot access rooftop solar. According to NREL, 49% of U.S. households are unable to access rooftop solar, because they rent their home, live in dwellings such as a multi-unit apartment building or high-rise condo, or have a roof unsuitable for solar.[xi] NREL also reports that 48% of commercial buildings have roofs too small to host on-site solar PV of any meaningful size (i.e., covering at least 20% of their demand).

RMI used census, NREL, U.S. EIA, and other data to estimate the total electricity demand shared solar could serve across several categories core to the community-scale solar market: a) low- to moderate-income (LMI) renters, b) other renters (e.g., multi-unit apartment buildings), c) multi-unit non-renters (e.g., high-rise condo unit owners), d) single-family homes with unsuitable roofs for rooftop solar, and e) commercial buildings with unsuitable roofs.

Altogether, the long-term community-scale solar market potential for serving these U.S. households and businesses that cannot access rooftop solar is more than 750 GW, according to RMI estimates (see Figure 3, page 6).

Figure 3: Community-Scale Solar Long-Term Market Potential Scenario

The long-term market potential for community-scale solar to serve rooftop-ineligible customers is 750+ GW across five categories of customers.



COMMUNITY-SCALE SOLAR IS INCLUSIVE OF LOW- AND MODERATE-INCOME HOUSEHOLDS

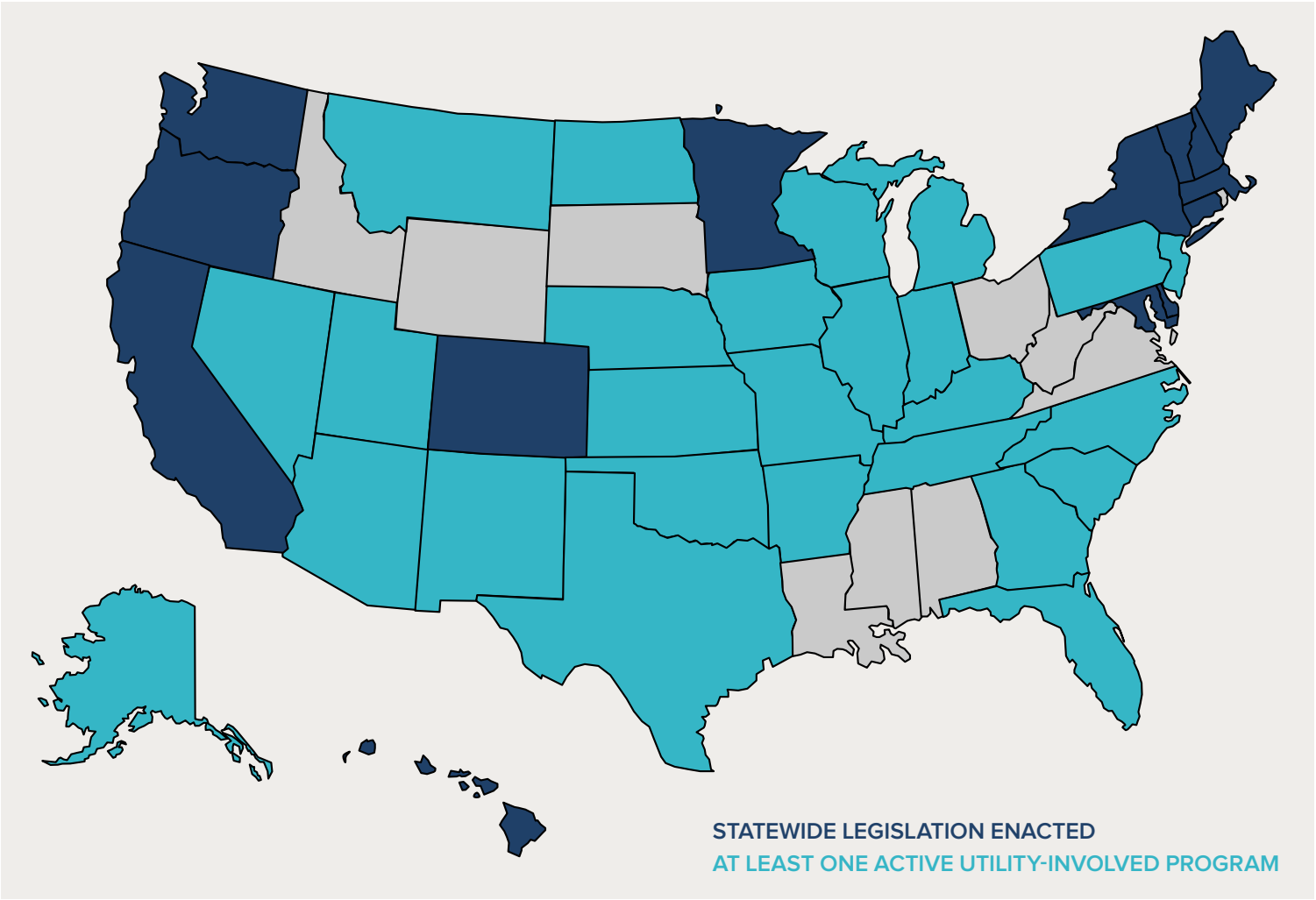
Community-scale solar is inclusive to renters, apartment dwellers, homeowners with no suitable roof, and low- and moderate-income (LMI) households. In states such as Colorado and New York, community solar laws include a carve-out or preference for LMI subscribers. Rural electric cooperatives are using community solar to serve LMI members.

As of February 2016, 14 states and Washington, D.C., have enacted community solar legislation. Five of these states (Connecticut, Maryland, Hawaii, New York, and Oregon) enacted community solar legislation in 2015. In addition to state-mandated community solar programs, utilities—particularly rural electric cooperatives—have initiated voluntary programs (see Figure 4, page 7).

Still, most community solar projects to date have not addressed the key financial, economic, and social barriers to LMI access. Innovative and flexible subscription models will make community-scale solar more inclusive to LMI households.

Figure 4: U.S. Community Solar Programs

Through 2015, 14 states and Washington, D.C., have enacted community solar legislation. In total, at least 30 states have at least one active utility-involved community solar program.



COMMUNITY-SCALE SOLAR AVOIDS CONSTRAINTS FACING OTHER MARKETS AND CAN REACH UTILITY-SCALE ECONOMICS WHILE LEVERAGING DISTRIBUTED BENEFITS

Community-scale solar is at a sweet spot between utility-scale and behind-the-meter solar. It is neither too big nor too small; it is just the right size to capture community and distributed energy benefits on one hand and utility-scale solar's economies of scale on the other (see Figure 5, page 8). Under RMI's broad, inclusive definition, "community-scale solar" does not imply a specific business model. Electricity from community-scale solar systems can be used by rural electric cooperatives (coops) and municipal utilities (munis) or credited to households and businesses through shared solar practices such as virtual net metering.

Figure 5: Benefits of Solar PV by Scale

Community-scale solar is at the sweet spot between utility-scale and behind-the-meter solar. It simultaneously leverages the economies of scale of utility-scale solar and many of the distributed benefits of behind-the-meter solar.

Community-scale solar can avoid siting and transmission constraints that may impede long-term utility-scale growth. Community-scale solar can be flexibly sited on under-utilized land near loads. For example, EPA's RE-Powering America's Land program[xii] helps communities and utilities site projects on contaminated land, and large parking lots can now cost-competitively host community solar. According to industry contacts, canopy systems have decreased costs by over 40% since 2014, and parking lot canopies now cost only an additional $0.35/W compared to similarly-sized ground-mount systems.

Behind-the-meter solar economics are highly sensitive to net energy metering policy. Without net energy metering, most systems in most geographies are not cost-competitive. Sustained behind-the-meter growth, therefore, is subject to policy risk and policy changes could constrain growth (as the market has seen in places where successor tariffs to net energy metering have substantially reduced export compensation for solar PV). Unlike most behind-the-meter solar, community-scale solar can be cost-competitive even in the absence of net metering. In a recent RMI workshop, a group of New Mexico rural electric cooperatives identified community-scale solar as a means to save money compared to wholesale power purchases. In most of the country, community-scale solar prices must decline to be cost-competitive with wholesale power, but those price declines are achievable already with current technologies and regulation.

BUYERS AND SELLERS TOGETHER CAN INNOVATE AND UNLOCK COST REDUCTIONS OF UP TO 40%

Though community-scale solar's market potential is highly promising, growth of community-scale solar has so far been inhibited by cost, access, and demand:

1. **Cost:** The unsubsidized installed price of solar PV needs to decline further to be cost-competitive against other supply options.
2. **Access:** The community-scale segment has not historically been a priority market for PV developers. Developers must provide clear and compelling offerings that get them in the door and expand access to more buyers.
3. **Demand:** In the rapidly evolving solar PV industry, many buyers in the community-scale segment are relying on dated or incorrect view of the value propositions or don't understand the full array of benefits. Demand for compelling and easy-to-understand offerings must be stimulated.

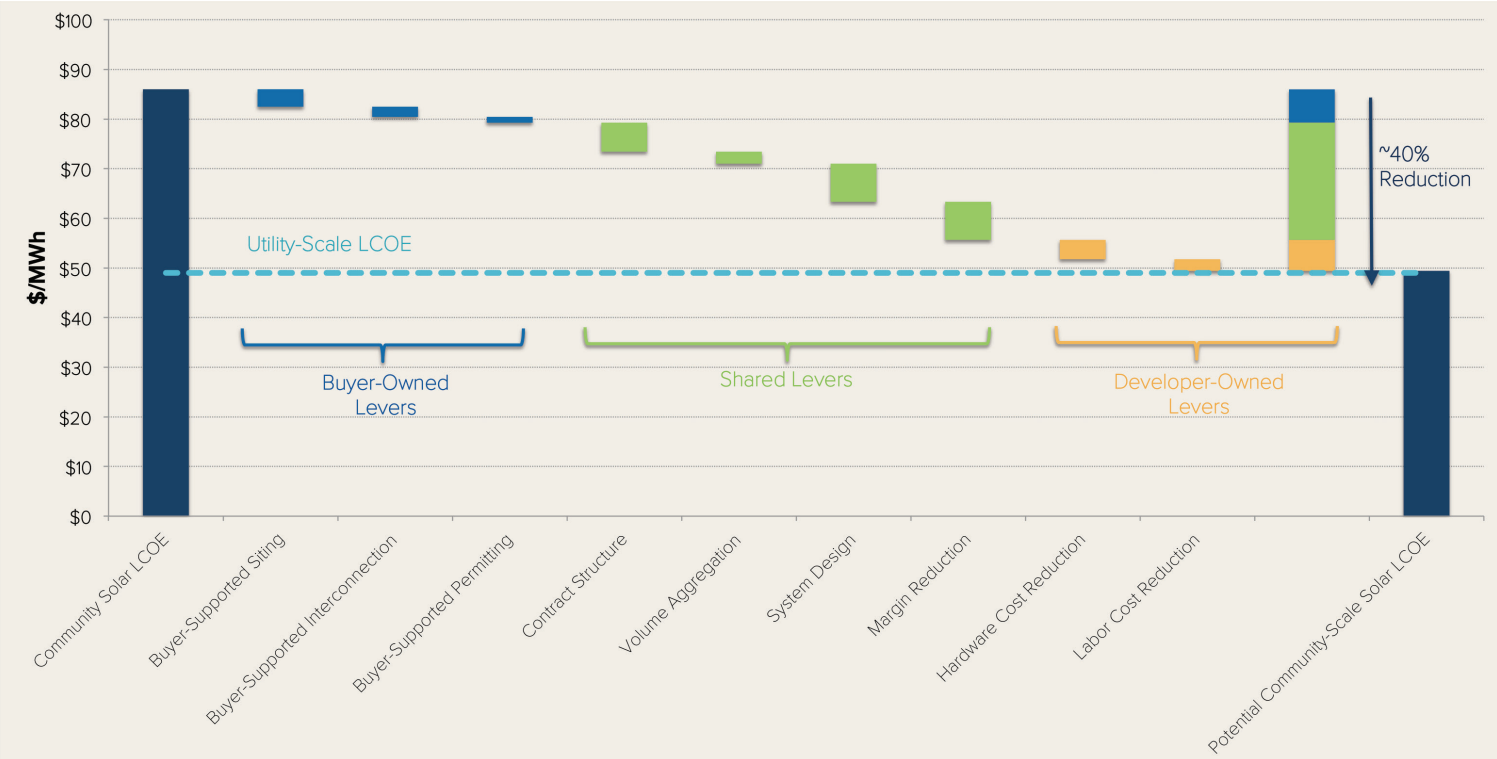
Once growth inhibitors have been addressed, community-scale solar prices can approach utility-scale prices, and buyers and sellers can connect through attractive and easy-to-understand offerings.

Typical community-scale solar prices are currently higher than utility-scale prices (though still well below behind-the-meter prices). Community solar sellers (EPCs and developers) and buyers (utilities and project sponsors) each have access to cost-reduction levers to significantly decrease community solar prices. A further $20/MW cost reduction is available through shared levers owned jointly by buyers and sellers. Together, leveraging buyer-owned, seller-owned (i.e., developer-owned), and shared cost-reduction levers can reduce costs 40% using current technologies (see Figure 6, page 10). Business-as-usual module price and balance-of-system cost reductions are not included in the cost-reduction model.[2]

[2] *Cost-reduction model is based on RMI analysis and developer responses to a request for information.*

Figure 6: Community-Scale Solar at Utility-Scale Prices

A combination of developer-owned, buyer-owned, and shared levers can reduce community-scale solar costs up to 40%.



BUYER-OWNED LEVERS

In some cases, utilities directly develop community-scale projects, but frequently, third parties develop systems and subscribe buyers. Community-scale solar buyers—whether utilities or community-based organizations (CBOs)—can reduce total costs by supporting the development process. Throughout the country, utilities and community-based organizations are decreasing total project costs by supporting the development process.

Buyer-supported siting: Buyers can reduce project cost by providing land or connecting developers to local landowners. For example, coops and munis often own land adjacent to substations, or are closely connected to municipal authorities that own ideal sites in their service territories.

Buyer-supported interconnection: Utility buyers can decrease development cost and risk through efficient interconnection. Lengthy interconnection backlogs delay project timelines and increase costs. This has happened in Minnesota, where a slow community solar interconnection process has frustrated community solar developers and customers.[xiii]

In addition to streamlining the interconnection process, utilities can reduce total costs by identifying regions of the grid that can easily integrate community solar. Utilities can also ensure lowest total cost by covering all tie-in costs on the utility side of the point of interconnection.[3]

[3] Utility will recover increased tie-in expenditure through lower total project cost or through lower PPA price.

Buyer-supported permitting and zoning: Community-scale solar buyers often have relationships with the host community including relationships with permitting and zoning officials. Buyers can complete permitting and zoning, or they can leverage community relationships to facilitate permitting and zoning.

SUBSCRIPTION COSTS

Billing, marketing, and other subscription-related costs contribute approximately 10% to shared solar costs. Community organizations can tap into their existing networks to greatly reduce the costs of customer subscription. Collaborating with specialized subscription service providers, community organizations can engage and activate community members to enroll their neighbors and peers. Utilities can also leverage their customer relationships to reduce total billing and subscription costs.

SHARED LEVERS

The greatest cost-reduction opportunities are associated with levers shared by buyers and sellers. These levers include efficient contract structures, volume aggregation, solution adaption, and margin cost reduction.

CONTRACT STRUCTURE: Low-cost community-scale solar depends on contract structures that effectively utilize tax credits, capture lifetime project value, and reduce cost of capital.

- **Tax Credits:** According to a 2015 National Rural Electric Cooperative Association (NRECA) survey, 47% of coop community solar projects failed to utilize the investment tax credit.[xiv] Costs will decline if nonprofit and community buyers enter contracts that directly or indirectly capture tax benefits.
- **Tenure:** Since community solar projects are distribution-grid-connected, third-party owners cannot access a competitive market for power after a PPA has expired. Full project value can be captured through long-term contracts (e.g., 25 or 30 years) or through ownership flips to the power user.
- **Cost of Capital:** Nonprofit coops, munis, and community organizations often have access to low-cost capital, but are unable to directly capture tax credits. Efficient contracts may use third-party ownership to capture tax credits before transferring ownership to local communities. Communities around the country are also exploring low-cost accredited or crowd-sourced equity financing, community development financial institution (CDFI) participation, and other low-cost financing options. Finally, business models are evolving to control default risk on community solar by allowing a new subscriber to be brought in after the initial subscriber defaults.

VOLUME AGGREGATION: Costs will also decline when volume is aggregated across portfolios of projects. Volume aggregation can increase equipment and personnel utilization, decreasing costs. Developers also incur significant costs responding to multiple requests for proposal (RFPs) for small projects. Similarly, buyers expend resources creating and administering

those procurement processes. Costs will decline when buyers and sellers connect around portfolios of projects aligned around standard terms and conditions.

SYSTEM DESIGN: Costs will decline as solar solutions are adapted to the community-scale segment. Those solutions will be designed to meet customer needs, remove unnecessary features, and add features that reduce LCOE. This is arguably within scope for the suppliers' business development process, but buyers can drive and accelerate the process through procurement processes that provide guidance to the developers.

For example, in an effort to make apples to apples comparisons, buyers are often highly prescriptive in project technical requirements. The buyer may specify module tilt, tracking, or module spacing, but those specifications may limit the developer's ability to offer the system with the best value. Buyers must manage procurement processes in such a way that high-value projects emerge. Sellers must be ready to respond to procurement processes with solar arrays that maximize total value.

EPCs and developers can further reduce costs if they conduct a whole-system redesign of community-scale systems. Developers and EPCs often treat community-scale projects like small utility-scale projects, but opportunities exist to reduce costs through community-solar-focused, whole-system redesign.

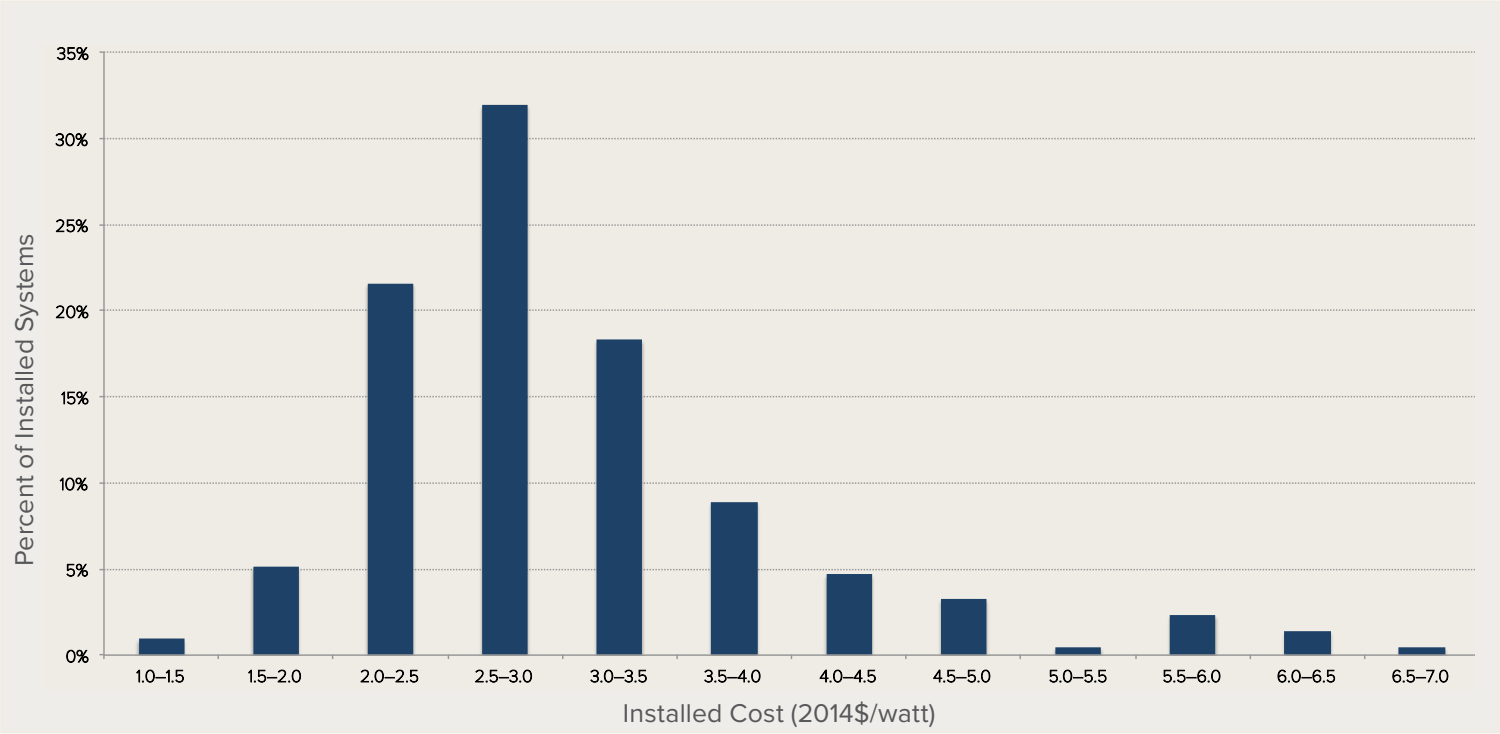
MARGIN REDUCTION: Buyers and sellers both play a role in reducing cost by decreasing margins. Buyers can manage competitive and efficient procurement processes that help manage risk to the seller and result in the selection of reliably low-cost and high-quality vendors.

PROCUREMENT-RELATED PRICE REDUCTIONS

According to Lawrence Berkeley National Laboratory (LBNL) data on large C&I projects, the most expensive quintile of projects cost almost 60% more than the least expensive quintile of projects (see Figure 7, page 13). The wide spread goes far beyond what can be expected from site-specific conditions, indicating an opaque market and ineffective buying processes, as well as a procurement opportunity. Effective procurement will result in buyers accessing desired solar solutions at risk-appropriate margins.

Figure 7: Price Distribution of Large (0.5–5 MW) C&I Solar Systems

A wide price spread suggests an opaque and ineffective market, with opportunities to reduce prices and tighten the spread.



SELLER-OWNED LEVERS

Developers and EPCs can further drive down costs by reducing community-scale solar's non-module hardware costs and labor costs.

Hardware costs: One way to reduce non-module hardware costs is through the use of community-scale power blocks and standard system designs. First Solar[xv] and SunPower[xvi] already use standardized power blocks on utility-scale systems. NRECA's SUNDA promotes a standardized community solar "PV system package." Standard community-scale systems have the potential to reduce non-module hardware costs.

Labor costs: Standard designs and power blocks can also decrease equipment downtime and increase labor productivity, decreasing labor and equipment costs.

HELP US TRANSFORM THE MARKET

Through our Shine initiative, RMI is working with public utilities (i.e., coops and munis), community-based organizations, and developers to unlock this market. RMI is helping coops, munis, and community-based organizations by supporting procurement and business model development. RMI is helping developers and EPCs understand the community-scale opportunity and adapt their designs and business models to best access the market.

CONTACT

To learn more about RMI's Shine initiative for community-scale solar, or to engage with us, please contact ***shine@rmi.org.***

ENDNOTES

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