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Bringing the Benefits of Solar Energy to Low-Income Consumers

A Guide for States & Municipalities

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SUSTAINABLE SOLAR EDUCATION PROJECT





ABOUT THIS GUIDE AND THE SUSTAINABLE SOLAR EDUCATION PROJECT

Bringing the Benefits of Solar Energy to Low-Income Consumers: A Guide for States & Municipalities is one of six program guides produced by the Clean Energy States Alliance (CESA) as part of its Sustainable Solar Education Project. The project aims to provide information and educational resources to help states and municipalities ensure that distributed solar electricity remains consumer friendly and its benefits are accessible to low- and moderate-income households. In addition to publishing program guides, the Sustainable Solar Education Project is producing webinars, an online course, a monthly newsletter, and in-person training on topics related to strengthening solar accessibility and affordability, improving consumer information, and implementing consumer protection measures regarding solar photovoltaic (PV) systems. More information about the project, including a link to sign up to receive notices about the project's activities, can be found at www.cesa.org/projects/sustainable-solar.

ABOUT THE U.S. DEPARTMENT OF ENERGY SUNSHOT INITIATIVE

The U.S. Department of Energy SunShot Initiative is a collaborative national effort that aggressively drives innovation to make solar energy fully cost-competitive with traditional energy sources before the end of the decade. Through SunShot, the Energy Department supports efforts by private companies, universities, and national laboratories to drive down the cost of solar electricity to \$0.06 per kilowatt-hour. Learn more at www.energy.gov/sunshot.

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SECTION 1

Executive Summary

The declining cost of solar energy is creating opportunities for all Americans to save money on their energy bills. And no one benefits from energy savings more than low-income consumers, who pay a much higher portion of their income for energy than middle- and high-income consumers.

But being poor creates barriers to accessing solar power and its economic benefits. Low-income consumers lack sufficient savings that can be used to buy solar systems, and they may have low credit scores or a lack of credit history that may impede their ability to finance a system. They are often renters, or live in multifamily housing, without ownership of their roof.

Many programs and policies that encourage solar deployment rely on leveraging public dollars with private investment, where a small contribution of public funding can trigger



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a larger contribution from the market. A 30 percent tax credit on a solar investment, for example, is matched by a 70 percent investment by a homeowner. But low-income consumers are less able or likely to respond to this kind of offer, so some policy incentives fail to reach low-income populations. One alternative is to provide a greater portion of public funding directed toward low-income consumers, but that means limited public budgets don't yield as much private investment or as many solar projects.

Policymakers have been trying a range of approaches to bring solar to low-income consumers. This guide surveys the field and recent studies to give a sense of what is being tried, and what could be tried. It examines what has and hasn't been working, and what factors determine whether a given policy or program might work in a given circumstance.

There are many existing government programs and policies aimed at reducing poverty, providing housing, and promoting clean energy. These provide a strong starting point for how to bring the benefits of solar power to low-income households. But there are also many new and emerging ideas, including government policies and programs, new business approaches, and philanthropic and volunteer initiatives.

SUMMARY OF SOLUTIONS, BY CATEGORY

Much of the activity around low-income solar access has been aimed at *financing* to solve the first-cost barrier that low-income households face. Financing ideas either adapt existing techniques or develop new approaches. Property Assessed Clean Energy (PACE), Pay As You Save (PAYS), and third-party ownership arrangements are just a few of the many financing ideas discussed in this paper.

There are also many government policies and programs that are being adapted or created for low-income solar to make it more affordable. Some of these are *compensation mechanisms*, which allow customers to capture the full value of their solar investment. The most common examples are net metering for solar generators located on the customer's side of the meter, and virtual net metering, which enables community solar by tracking output from off-site generation. Compensation mechanisms are distinct from *direct incentives*, whereby government policies provide explicit financial or other inducements.

Energy assistance programs are also starting to see the value of low-cost solar as a way to reduce energy burdens, often in combination with energy efficiency measures. The Low-Income Home Energy Assistance Program (LIHEAP) and Weatherization Assistance Program (WAP) are starting to include solar as cost-saving measures. Many states have existing utility rate discount or bill payment programs that could harness solar to generate savings for consumers

While much attention focuses on solar's direct benefits to low-income customers by reducing energy bills, solar can also provide indirect help by cutting costs for *low-income support services*. The U.S. Department of Housing and Urban Development (HUD), especially, is starting to use solar to improve energy security for the millions of low-income Americans it serves, while saving taxpayers some of the \$5 billion HUD spends annually on utility bills. By installing solar technologies, shelters, food kitchens, churches, and service organizations of all kinds could redirect energy savings toward their primary mission.

SUMMARY OF RECOMMENDATIONS

This guide is primarily for policymakers interested in bringing the benefits of solar to low-income consumers and communities. While this guide makes some policy and program recommendations, it recognizes that not all policymakers face the same constraints, policy environments, stakeholders, economics, and opportunities.

To be helpful to all readers, regardless of their specific situation, the guide suggests some design principles for developing a successful low-income solar program. It highlights some options that seem especially relevant, universal, or promising; and it describes a simple segmentation of audiences—homeowner, tenant, and support service—and the implications of reaching each of them. Finally, the guide presents several scenarios that may apply to states in certain situations.

Of course, the recommendations presented in this guide may not be best in any given circumstance. The lengthy discussion of other solutions is intended to help guide possible alternative actions.

In short, successful low-income policies and programs share some design principles: they are tailored to low-income consumers; they are cost-effective and financially sustainable; they have measurable results; and they are flexible enough to adapt to changing conditions and new learning.

The guide offers several suggestions for policies and programs that seek to expand solar to low-income consumers:

- Leverage existing state energy policy to support low-income solar deployment, such as by adapting net metering, portfolio standards, and financial incentives for renewables.



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- Incorporate solar into low-income energy efficiency programs to reduce implementation costs and provide deeper savings for households with very high energy burdens.
- Adapt existing housing and anti-poverty programs to include solar, such as LIHEAP and WAP, public housing, and economic development incentives.
- Set up a financial vehicle that can develop, test, and deploy innovative financial strategies and provide leadership and technical expertise to other agencies.
- Promote volunteerism to provide low-cost solar to low-income communities, such as new solar homes built by Habitat for Humanity—and reinforce it through supportive incentives and policies.
- Partner with trusted allies in reaching out to low-income communities to ensure greater buy-in and program enrollment.
- Ensure any low-income solar policies and programs will actually provide tangible benefits to low-income households and communities.

In choosing which policy approaches to take, it may first be useful to consider the specific solar consumer you are trying to assist, and the current policy and market environment.

Not all low-income solar customers are the same. They face different challenges and may need different solutions or different combinations of solutions to overcome them. For example, low-income homeowners can see clear benefits from owning solar systems, but may face first-cost hurdles. Tenants of apartment buildings may not be able to own a rooftop system, but they may be able to benefit from a flexible community solar program. Low-income housing landlords may be able to benefit from tax credits, energy savings, and increase in property value from going solar but may be unwilling to share those savings with tenants. Groups that provide support to low-income communities face their own hurdles and opportunities. As nonprofit or governmental agencies, they may enjoy low-cost financing, but may not be able to access tax credits and other incentives.

The very definition of “low-income” varies widely, from one government agency or jurisdiction or program to another. Some programs, for example, include all households earning less than 60–80 percent of the area median income as low income, while others use income relative to the federal poverty level. Definitions can have a significant impact on program design and implementation. Being consistent with other programs may be important, or it may be helpful to target particular customer segments within the low-income customer class. “Moderate-income” households may best be served by different programs and policies tailored to fit their needs. This guide largely avoids these definitional complications to provide general guidance that can be adapted to specific situations.

Lastly, to help inform programmatic options, the guide presents a few sample scenarios that state and local agencies may face when thinking about low-income solar program development. These scenarios vary by the state policy environment for renewables, the type of audience to be reached, energy costs, and other low-income energy policies.

SECTION 2

Situation

PROBLEMS

Because energy consumption by households does not vary as widely as household income, the “energy burden,” or percent of income spent on energy, is greatest for low-income households. Simply put, low-income households spend a larger proportion of their income on energy than other Americans do.

In a recent study of the 48 largest U.S. cities, the American Council for an Energy Efficient Economy (ACEEE) found that households with income below 80 percent of median income in that area, minority households, low-income households residing in multifamily buildings, and renting households all experienced higher energy burdens than the average household in the city. The median energy burden across all of the cities was 3.5 percent, while the median low-income household’s energy burden was more than twice as high at 7.2 percent. The poorest of the poor have an even greater energy burden. In 17 of the cities studied, the lowest quarter of low-income households experienced an energy burden greater than 14 percent—led by a staggering 25 percent energy burden in Memphis.¹

Cities in the Southeast had the highest energy burdens for low-income households, with Memphis, New Orleans, Birmingham, and Atlanta all exceeding 10 percent. High energy demand in these cities is largely driven by electricity used for air conditioning. They were closely followed by northern cities like Philadelphia, Pittsburgh, and Providence, where heating bills are a significant factor.

Low-income neighborhoods are also disproportionately and adversely impacted by traditional forms of energy production. According to the National Association for the Advancement of Colored People (NAACP), people of color and low-income households are more likely to live within three miles of a coal power plant, and thus more likely to suffer from higher incidence of poor health, higher medical bills, and lower property values. The per capita income in these neighborhoods is \$18,400, below the poverty threshold, and 15 percent lower than the U.S. average income of \$21,587.²

OPPORTUNITY

Solar power costs have been declining rapidly and are at parity with retail electricity rates in an increasing number of states and utility service territories.³ As a result, distributed solar has been growing rapidly in the United States, at over 50 percent per year from 2011 to 2016.⁴

California has the most distributed solar, but other states and regions are seeing substantial growth.

In addition to innovations in technology and manufacturing techniques, solar is benefiting from new business models and financing mechanisms. Solar developers are offering leases and loans, as well as selling electricity directly to customers through power purchase agreements (PPAs). Marketers are offering “no money down” deals to customers, and at prices that are lower than retail electricity rates, at least initially.

Lower costs and new business models have made it easier for solar to expand into households of all income levels. According to an analysis by Kevala Analytics, 65 percent of residential solar installed in California in 2015 was in zip codes with median household incomes (MHI) of \$70,000 or less, up from 49 percent in 2008. (The statewide MHI for California was \$64,500 in 2015.) Meanwhile, just 6 percent of installations in the state occurred in neighborhoods with an MHI above \$100,000, down from 19 percent in 2008. In fact, as shown in **Figure 1**, there were nearly as many installations in low-income neighborhoods—about 20,000 cumulative by 2015—as in high-income neighborhoods.⁵

This was true even as direct rebates under the California Solar Initiative largely phased out by 2014.⁶ While California’s affordable solar housing programs, Multifamily Affordable Solar Housing (MASH) and Single-Family Affordable Solar Housing (SASH), have continued to provide rebates to low-income households, supporting about 6,500 projects to date, some low-income households are going solar without state subsidies.

“These trends illustrate what makes intuitive sense—the market for solar is strongest among people where a 10–20 percent savings in their electricity costs is meaningful enough to drive investment in alternative electricity supplies,” according to the Kevala analysis.

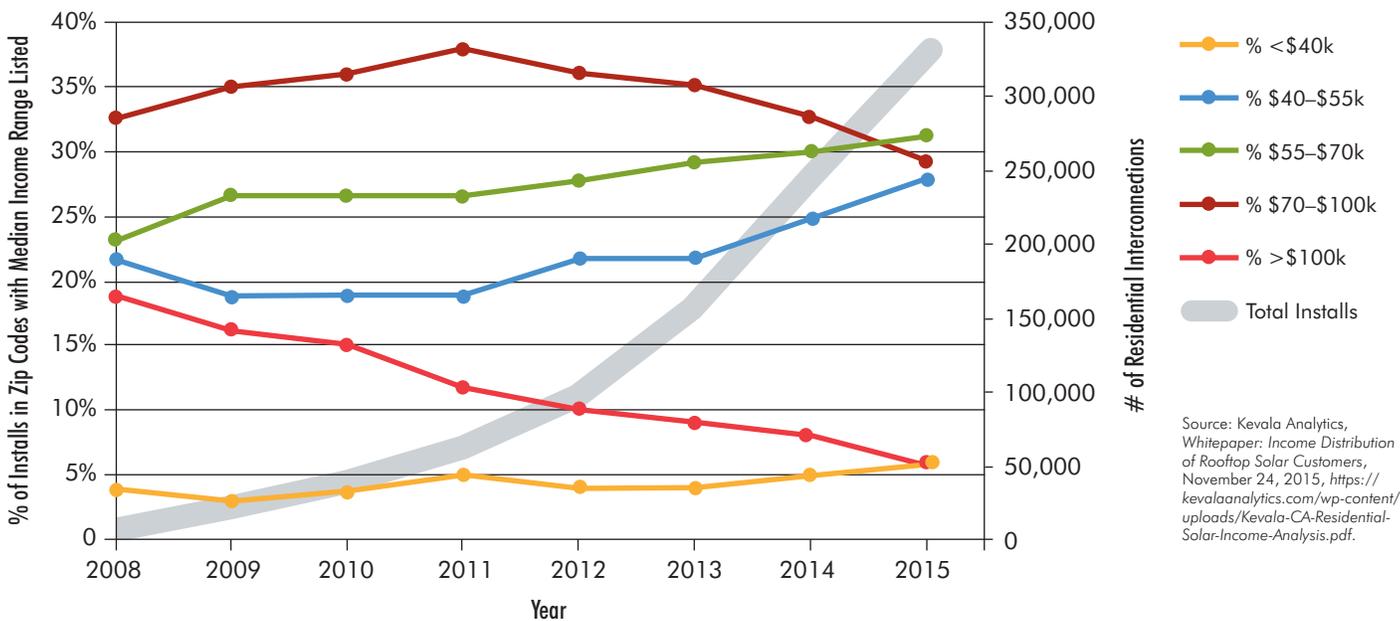
As part of a State Energy Strategies grant funded by the U.S. Department of Energy, Lawrence Berkeley National Laboratory (LBNL) is conducting further research on the demographics of solar adopters.⁷

For customers who can’t or don’t want to put solar on their own property, developers in some places are offering “community solar,” which allows a customer to subscribe to or buy a portion of an offsite solar installation and receive utility bill credit from its output. In Minnesota, for example, over 400 MW of community solar projects will likely be online by 2017.⁸ Community solar enables a wider range of customers—renters, apartment dwellers, and people in homes that are ill-suited for rooftop solar panels—to participate in the solar economy.

By some estimates, at least half of all households in the U.S. are not viable candidates to host a solar PV system on their own property. Community solar offers a way for these utility customers to share the benefits from off-site solar installations. The National Renewable Energy Laboratory (NREL) calculates that community solar could represent between a third and a half of the distributed PV market in 2020.⁹

Although there are many government and private-sector programs and policies to help low-income households with their energy bills, few of them have used solar power to reduce energy costs. Solar power has not been as cost-effective as other measures such as weatherization and lighting. Now, with the decline in the cost of solar, that is changing.

FIGURE 1: Household Income and Solar Adoption in California (2008–2015)



Source: Kevala Analytics, Whitepaper: Income Distribution of Rooftop Solar Customers, November 24, 2015, <https://kevalaanalytics.com/wp-content/uploads/Kevala-CA-Residential-Solar-Income-Analysis.pdf>.

CUSTOMER BARRIERS

A number of barriers impede the adoption of solar by low-income households—intrinsic barriers as well as barriers stemming from policy decisions.

Low-income customers typically don't have enough savings to pay cash or down payments for solar systems. Though U.S. solar prices dropped to an average of \$4.10 per watt in 2015, according to LBNL, that still requires an average investment of \$16,400 for a 4-kW system.¹⁰

In addition, many low-income consumers do not pay enough income tax to take full advantage of federal tax credits for solar power. In fact, 45 percent of American households pay no income tax at all.¹¹ The bottom half of taxpayers represent only 15 percent of total U.S. income.¹² The federal Residential Energy Efficient Property tax credit¹³ offers a 30 percent credit against income tax liability on solar system expenditures, with the ability to carry the credit forward one year. A \$10,000 system, for example, would generate a tax credit of \$3,000, requiring a taxable income of at least \$26,000 a year, assuming there are no other credits or deductions taken. Research has shown that taxpayers with gross income of less than \$40,000—about 60 percent of filers—almost never use the solar tax credit.¹⁴

Credit scores are used by lenders and by third-party solar companies to evaluate the risk of financing a solar system. Credit requirements vary among companies and lending programs, but scores of at least 650–680 are often required. There is a market perception that low-income consumers suffer from low credit scores, which often prevents third-party solar providers from marketing to low-income communities. In truth, the correlation between income and credit quality can vary widely by state and may not be as strong as has sometimes been assumed. (See **Box 1**, “The Correlation between Low Income and Low Credit Scores,” on p. 12.) Nevertheless, some low-income consumers may have insufficient lending activity to generate a credit score, automatically barring them from solar offerings.

BOX 1

The Correlation between Low Income and Low Credit Scores

The conventional wisdom concerning low-income customers is that they may have poor credit scores or a lack of credit history. Because most solar marketers rely on credit scores when they approve financing, solar companies may avoid marketing to low-income customers.

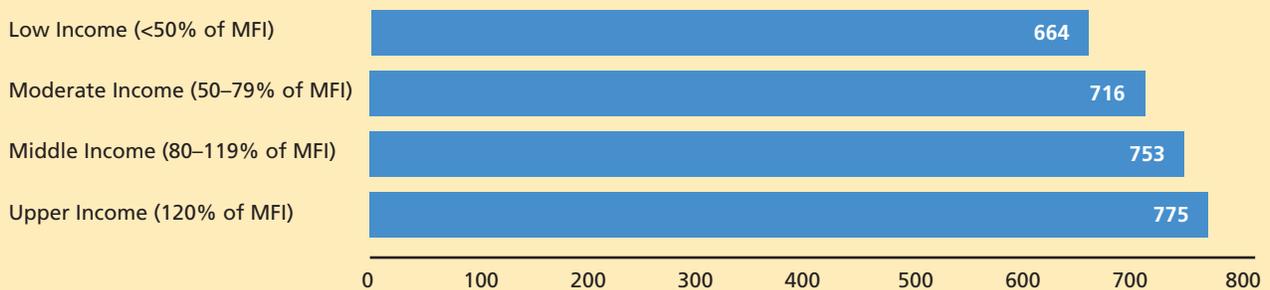
The Minneapolis Federal Reserve Bank found a direct correlation between income levels and credit score, with the lowest quartile (less than half of area median family income) having a FICO credit score 100 points lower than the highest quartile.¹⁵ (See Figure 2.) The Fed’s Board of Governors has reported that “individuals in high-income census tracts have a mean TransRisk Score of 57.9; in low-income census tracts, the mean is 32.5.”¹⁶

Research by the U.S. Consumer Finance Protection Bureau has also found that 26 million low-income Americans are “credit invisible”—that is, one in every ten adults does not have any credit history with one of the three nationwide credit reporting companies. “There is a strong relationship between income and having a scored credit record,” the U.S. Consumer Finance Protection Bureau writes. “Almost 30 percent of consumers in low-income neighborhoods are credit invisible and an additional 15 percent have unscored records. These percentages are notably lower in higher-income neighborhoods. For example, in upper-income neighborhoods, only four percent of adults are credit invisible and another five percent have unscored credit records.”¹⁷

In 2007, the Center for American Progress, using data from the Fed’s Survey of Consumer Finance, found that lower-income consumers were more likely to be denied credit or to not apply for fear of being rejected.¹⁸ The housing crash of 2008–2009 has made lenders even less likely to extend credit to low-income consumers.¹⁹

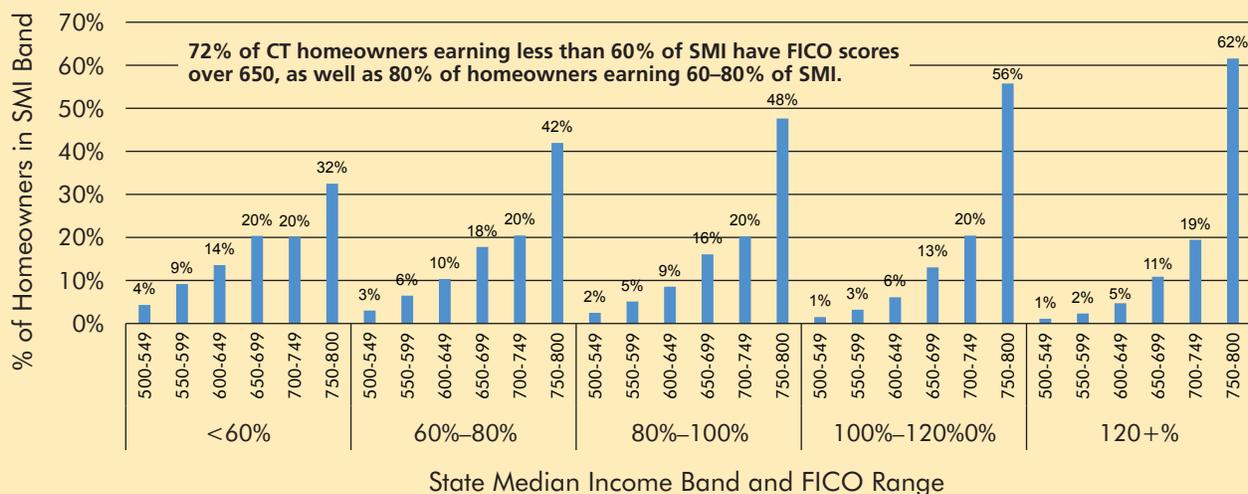
While low-income households may be more likely to be credit-impaired, it does not mean that all of them are. Solar marketers are still doing business in low-income communities. A recent report by GTM Research and Power Scout estimates that there are over 100,000 low-income (<\$45,000 per year) households with solar in the four states of their study, representing over 532 MW of solar capacity.²⁰ Low-income households are less likely to have solar compared to the overall population, but only

FIGURE 2: **Minneapolis Federal Reserve Bank: Credit Score by Income Bracket**



Source: Minneapolis Fed, via Valuepenguin.com.

FIGURE 3: **CT Homeowners 2012 FICO scores by State Median Income (SMI)**



Source: Connecticut Green Bank.

slightly, and it may be diminishing as solar costs fall. In New Jersey and Massachusetts, about 33 percent of solar homes had income levels below the state median, while California and New York had lower representation in low-income communities of 29 percent and 24 percent respectively.

And the perceived link between income and credit score may be overstated. Recent research by the Energy Programs Consortium (EPC) and the Connecticut Green Bank has found a lack of correlation between income and credit levels in some cases. The EPC recently evaluated the Warehouse for Energy Efficiency Loans, or “WHEEL” program, an unsecured residential energy efficiency loan and secondary market program. Using personal income and credit data from Equifax’s Work Number database, EPC found that “52 percent of consumers with incomes at or below \$60,000 have Equifax Risk Scores greater than 640,” and that the income and FICO scores of WHEEL borrowers were not related. However, by including only customers with credit scores of 640 or better, EPC left out the 30 percent of the population who have lower scores—as low as 300. While it may be true that customers with higher credit scores can have any income level, it does not necessarily follow that low-income consumers have high credit scores. “While the data are confined to the WHEEL program and are necessarily skewed towards individuals with higher FICO scores,” EPC noted, “they do provide anecdotal evidence that an individual’s income is not predictive of his creditworthiness.”²¹

Further, proprietary research from the Connecticut Green Bank has found little correlation between income levels and credit scores in their state. The Bank used credit score data from Experian, comparing it with income levels at the city level. As shown in **Figure 3**, while low-income homeowners are less likely to have the highest credit rating, they are otherwise similar to homeowners in other income brackets. Connecticut has seen a rapid increase in solar in low-income areas, including by marketers who rely on credit scores to underwrite finance offerings.

Many low-income consumers who live in multifamily rental property usually do not have access to the roof and have no incentive or ability to invest in the long-term benefits of a solar power system for that property. Often, multifamily buildings have a single “master” electric meter for the building’s common areas (billed to the building owner), and sub-meters for individual apartments (billed to the tenant). In this situation, the tenants pay their utility bills, while landlords are responsible for investing in the appliances, building infrastructure, and other features that affect energy consumption.

This can result in the classic market failure known as “split incentives,” where costs and benefits of a building improvements (such as adding solar) can have differing impacts on who makes the investments and who benefits from them (i.e., the costs of improvements are incurred by the building owner, but the majority of the benefits from the investment go to the renters, or vice versa). A landlord who does not pay the utility bills on a multifamily housing property will not see the full bill savings from an investment in solar power on that building.²² On the other hand, a landlord who does pay utility bills for tenants may be an especially attractive prospect for solar power, as discussed below. While landlords are ineligible to take the residential tax credit for solar, they may be eligible for a 30 percent commercial tax credit on solar expenditures²³ as well as accelerated depreciation or other state and local incentives.

There are other challenges to be considered. Low-income customers who are recent immigrants may have a language barrier to learning about solar power, or to understanding marketing materials. A lack of internet access can be a barrier to solar marketing, much of which takes place through sophisticated online tools. Low-income households may also lack the time and resources to contemplate their energy use and their ability to go solar—since they are simply too busy making ends meet. And they can be suspicious of marketing offers around solar power, which can come from unfamiliar companies or sound too good to be true.²⁴

Finally, solar marketers themselves may not be interested in marketing to low-income households if they are getting enough business from wealthier customers. Many solar companies do not seem to advertise their services in low-income communities or make their marketing materials available in languages other than English.

POLICY BARRIERS

Low-income customers also face policy barriers that prevent them from enjoying the benefits of solar power. Rate design may be the most fundamental policy issue for all solar customers, with distinct implications for low-income customers.

A national debate is underway about how electric utilities should recover their fixed costs, as customers use less energy due to greater efficiency and the cost-effectiveness of self-generation with solar power. A total of 212 state and utility-level distributed solar policy and rate changes were proposed, pending, or enacted in 2016, in 47 states, according to the North Carolina Clean Energy Technology Center.²⁵ Of these, there were 71 utility requests in 35 states plus D.C. to increase monthly fixed charges—paid regardless of how much energy is consumed—while lowering the rates for electricity. For solar customers, higher fixed charges have the effect of lowering the value of solar power and energy efficiency, making both a less attractive investment for customers.

Research by the National Consumer Law Center (NCLC) has shown that low-income consumers would be disproportionately affected by bills that have a greater emphasis on fixed charges. Analysis of a proposal by Madison Gas & Electric to raise fixed charges from \$10 to \$19 per month indicated that high electricity users (usually wealthier households) would have seen bills fall by 2.7 percent, while low-use households would have seen a 5.5 percent increase in utility bills. Since low-income, minority, and elderly households use less electricity than their higher-income counterparts, NCLC concluded that a higher fixed charge “raises profound equity and social justice concerns.”²⁶

Some utilities and regulators have proposed to apply demand charges, commonly used for larger commercial and industrial customers, to the residential sector. The amount of a demand charge is determined by the greatest amount of electricity (kilowatts) demanded by a customer at one time in a month, typically over a 15-minute or one-hour interval.

The Salt River Project (SRP), a utility in Arizona, is one of the few utilities in the country to impose residential demand charges, and they are mandatory only for customers with solar power systems. SRP levies a fixed charge of \$32 per month for solar customers, plus a demand charge ranging from \$8 to \$33 per kilowatt in the summer, combined with an electric rate as low as only 3.9 cents per kWh off-peak.²⁷ Since SRP changed its rate structure, the average savings from solar has declined and the number of new solar installations has fallen dramatically. SRP estimates that only 14 percent of solar customers are saving money under the new rate design.²⁸

NCLC argues that the use of demand charges for residential customers, especially for low-income households, is inappropriate, because demand charges are predicated on the consumer being able to control his or her peak demand and to lower it to avoid higher charges. Residential customers lack the basic information to know when their peak demand occurs, since only about half of households in the U.S. have smart meters capable of measuring real time data, and virtually no customers have a way to track their own household consumption in real time.²⁹ Without knowing when peaks will or have occurred, a household is at a loss to take action to avoid them, making a residential demand charge an arbitrary cost. Moreover, low-income customers may not have the flexibility to avoid usage peaks even if they know when they occur.

A third type of rate design is time-sensitive pricing, where utility rates change according to market conditions and the time of day, season, and system. The most common is time-of-use (TOU) pricing, where rates change to a known amount over a fixed time period—such as peak pricing on summer afternoons when system demand is high, and off-peak prices on spring evenings when demand is low.

TOU rates can be quite beneficial to solar power if peak rates are offered during times of peak solar production since solar homes often produce more power than the household

Low-income customers also face policy barriers that prevent them from enjoying the benefits of solar power. Rate design may be the most fundamental policy issue for all solar customers, with distinct implications for low-income customers.

consumes during sunny peak times. For the solar home, the optimal time-of-use net metering will enable the peak power exported to the grid to be credited at on-peak prices. In the evening, when solar generation ends, the customer buys power from the utility, usually at lower off-peak rates. By “selling high and buying low,” customer-owned solar becomes more valuable to the customer than it would be under flat rates.³⁰ However, advocates for low-income consumers have mixed feelings about time-sensitive rates. Although TOU rates can allow consumers to change behavior to save money by shifting consumption to off-peak periods, they can also result in higher bills for customers who are unable to shift. NCLC encourages regulators to make TOU rates voluntary or to have an opt-out provision for customers unable to benefit from them.³¹ If TOU rates offer peak pricing at times when solar generation is not at its peak, the value of solar can also be diminished, resulting in decreased potential for solar bill savings for the solar consumer.

Another form of rate design for low-income customers may be an inadvertent barrier to solar, even though it benefits those households. Many states require utilities to offer discounted rates to low-income customers, to lower their utility bills. These have the effect of making self-generated solar power less competitive and less attractive by reducing the money a customer can save from going solar. The Interstate Renewable Energy Council (IREC) has proposed revisions to California’s rate program, California Alternate Rates for Energy (CARE), to facilitate the use of solar power in a “CleanCARE” program. This proposal is discussed below in the section on Adapting Current Low-Income Energy Policies to Solar.

In addition to rate design, there are other policy and program barriers. Public agencies have limited budgets for subsidizing solar installations. Because low-income households have a limited ability to assume the costs of a solar system, they typically offer little capital to leverage public funds. As a result, government programs that cover the cost for most of, or an entire, solar installation can only afford to help a relatively few customers.

Washington, D.C.’s Affordable Solar Program is a case in point. In 2015–2016, the program installed almost 300 solar systems on low-income housing, with the costs fully covered through a combination of a federal tax credits, solar renewable energy credits (SRECs), and a rebate of \$2.50 per watt. While the program exceeded goals, it was small compared to the overall demand for low-income energy assistance.

The declining cost of solar will allow limited funds to create greater benefits, but full funding programs like the Affordable Solar Program can only be maintained if they have a sustainable source of funding.

SECTION 3

Recommendations

The falling cost of solar power creates an opportunity to lower the energy burden on low-income households. Low-cost solar power can benefit anyone through potentially lower electricity costs, but low-income households have an especially urgent need to save money.

However, solar for low-income households does not always align with the way policymakers have traditionally thought about energy policy. A standard assumption is that a public-sector incentive will elicit a private-sector reaction. A 30 percent tax credit, for example, will inspire a homeowner to pay the remaining 70 percent for an emerging technology. Policymakers like this leverage because it makes the most of limited public dollars, suggests an exit strategy as the technology matures, and apportions the costs in line with the benefits—some benefits, like clean air, are public while others, like saving money, are private.

In this scenario, however, low-income people would likely be unable to pay a 70 percent share. Nor do they often have the tax appetite to take advantage of tax-based incentives, the ability to afford additional debt, or a credit status that allows them to finance a solar investment from the money saved by going solar.

Low-income customers therefore require different approaches. In this section, we discuss some design principles for developing a successful low-income solar program. We then lay out some options that seem especially relevant to states. Of course, the exact details and policies would need to vary from state to state based on local factors.

DESIGN PRINCIPLES

Successful low-income solar policies and programs will be:

- **Tailored to low-income consumers.** Low-income customers face situations that inhibit many solar-friendly policies from benefiting them directly. They could be renters, live in multifamily housing, and have credit problems, for example. Solar policies must take into account these challenges if the goal is to reach a low-income audience.
- **Cost effective.** Incentives should strive to deliver the maximum return on public investment and maximum impact for the consumer. They should take advantage of the falling cost of solar power and get the most out of limited public funds.

- **Financially sustainable.** Effective programs must be sustained, since it takes time to affect markets and consumer behavior. If a program requires funding, the funding source must be available for a number of years, at a level sufficient to the need.
- **Measurable.** Ongoing support for a policy or program, or changes in direction, will depend on objective evaluation. Performance indicators need to be identified, tracked, and used for future program design.
- **Flexible.** Low-income solar is just starting to get the attention it deserves. It is not necessarily obvious what the right policies and programs are. Moreover, different programs and regions may have different goals. With more experience, agencies will be able to learn from others and from program evaluations. They will need to be flexible enough to change design elements in the face of new information.

STATE OPTIONS

States are in different stages in terms of policy and market development, public support, and funding options for low-income solar. Moreover, federal policies and programs may change, thereby altering what is possible at the state and local level. Although the options that each state has will vary, the following approaches apply to many.

- **Leverage state energy policy to support low-income deployment.** Many states already have policies to encourage renewable energy. State renewable portfolio standards (RPSs), financial incentives, community solar, and net metering policies can all be adapted to support low-income solar. Colorado, for example, experimented with a requirement for community solar programs to include low-income customers, while Washington, D.C. and Massachusetts have used their RPS programs to provide financial incentives for low-income solar.
- **Adapt housing and anti-poverty programs to include low-income solar.** There is currently a vast array of federal and state programs intended to reduce poverty and promote economic development, two things that solar power can help with. Energy assistance programs like LIHEAP and WAP can be or are being adapted to include solar power as cost-effective measures. There are more opportunities in the many public housing programs, economic development incentives for impacted communities, and job training and placement initiatives (See **Box 2**, p. 20.) HUD has been turning to solar to reduce the \$5 billion a year it spends on utility bills in public housing.
- **Set up a financial vehicle.** There are many financial strategies that can increase low-income access to solar. They may require enabling legislation or new regulations and involve working with utilities, solar developers, county agencies, and financial institutions. Because of the diversity of options, legal and regulatory complexity, and potential range of stakeholders, it may be beneficial to establish a lead agency with specialized skills in project finance. The Connecticut Green Bank, for example, does not advance a single “policy,” but it serves as a multifaceted innovator that develops, tests, and deploys new financial strategies, and provides leadership to other stakeholders and agencies. Given the many financing vehicles



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that already exist, the expertise and leadership of an agency steeped in clean energy financing can be just as important as having a substantial endowment.

- **Promote volunteerism.** Using solar power to help low-income consumers can be appealing to the public, at the same time as it helps solve social and environmental problems. Volunteer labor can drive down the cost of installations while providing job training and community service opportunities. Groups like Habitat for Humanity and Grid Alternatives have found success with this approach. It can be encouraged through public policies, including financial and promotional support, preferential permitting, and public recognition.
- **Partner with trusted low-income allies.** In many cases, government officials and program managers may not be best situated to promote programs in low-income communities. Early stakeholder engagement and coalition building can help ensure greater buy in and program enrollment. Partnering with organizations that are trusted within the particular market segments you are trying to reach, such as low-income outreach and advocacy groups, community action agencies, and other service institutions, can reinforce mutual trust and improve outreach and marketing.
- **Ensure programs provide tangible benefits to low-income consumers.** It may seem obvious to say that low-income customers should benefit from low-income solar programs, but in practice it can be difficult to achieve. For example, installing solar on a low-income, multifamily building won't necessarily provide savings for the low-income building tenants. Poorly designed programs could even have unintended, adverse consequences for low-income customers. Low-income solar programs should complement existing programs and provide real financial benefits for the low-income customer they serve.

BOX 2

Solar Workforce Development Programs

This guide specifically focuses on extending the benefits of solar power to low-income consumers. But solar can also help poor people to get good jobs. The United States solar industry employed just over 260,000 workers and accounted for 2 percent of all jobs created in 2016.³² When appropriate opportunities are provided for low-income training and participation, solar industry jobs can offer robust benefits, a decent wage, and a path up the career ladder. According to the Solar Foundation's 2016 National Solar Jobs Census, companies with job postings for solar installers advertised a median wage of \$26 per hour.³³ There are many examples of government and private sector programs to provide workforce development in the solar industry. Here are just a few:

GRID Alternatives, a nonprofit solar developer, provides no- to very-low-cost solar power for low-income families, hands-on installation experience for job seekers and community volunteers, technical assistance and turnkey installation services to multifamily affordable housing developers, and help to utilities to develop community solar projects dedicated to low-income communities.

GRID Alternatives offers several workforce development programs. RISE (Realizing an Inclusive Solar Economy) is a full-service program, with everything from recruitment events to referrals and retention assistance. It delivers training for 4,000 workers in partnership with over 70 job training organizations and community colleges in California, Colorado, New York, New Jersey, the Mid-Atlantic, and New England.

GRID Alternatives also implements the Single-family Affordable Solar Housing (SASH) program in California, with an integrated job development program. GRID dedicates approximately 20 percent of its internal installations for trainees to gain hands-on experience with real-world solar installations. This becomes a double benefit to the low-income community since many solar job trainees come from the same neighborhoods that the SASH Program aims to serve.³⁴ www.gridalternatives.org/what-we-do/workforce-development

Solar1 is a nonprofit in New York City that installs solar and makes energy efficiency improvements for affordable housing projects, in conjunction with workforce development and other programs. It manages the Green Workforce Training Program, a center that trains and certifies unemployed individuals and incumbent building staff in energy efficiency, renewables, and green building operations and maintenance. It has trained over 1,500 unemployed and underemployed individuals since starting in 2004. www.solar1.org/green-workforce

Green City Force is an AmeriCorps program in New York City that engages young adults from low-income communities in national service related to the environment. Since its founding in 2009, it has engaged over 400 18- to 24-year-old residents of the New York City Housing Authority (NYCHA) in its Clean Energy Corps program. Seventy-five percent of the recruits had no income in the year leading up to the program, and of those who did, their average annual income was \$2,000. The Clean Energy Corps is a six- or 10-month, full-time program that involves one day of training and four days in the

field each week performing work such as energy audits in low-income homes, urban agriculture and horticulture, and coating rooftops as part of the NYC-CoolRoofs campaign. The federal AmeriCorps program, with an annual budget of \$1 billion, has supported volunteer and job training activity since 1994, including the GRID Alternatives SolarCorps program since 2006. www.greencityforce.org

GoSolarSF is a City of San Francisco program that provides rebates for solar, explicitly linked to workforce development. To be eligible for a rebate, systems must be installed by companies that participate in the City's Office of Economic and Workforce Development program to employ San Francisco workers. Installers must make "good faith" efforts to hire workers from the First Source Hiring Program, which connects dislocated workers and economically disadvantaged individuals with entry level jobs. Larger rebates are offered for projects in the city's "environmental justice zip codes" and for income-eligible households. <http://sfwater.org/index.aspx?page=133>



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MARKET SEGMENTATION

The obstacles for solar access for low-income consumers differ, depending on household budget, dwelling situation, and location. While definitions vary, HUD defines low-income households as having incomes of less than 80 percent of area median income, while “very low” income households are less than 50 percent.

Households with slightly higher levels of income seem to have fewer constraints to going solar, as shown by the analysis of solar deployment in California cited earlier.³⁵ In recent years, households in zip codes with median household income (MHI) of \$40,000 to \$55,000 have seen rapid growth in solar, making up 28 percent of new residential solar installations in 2015. The statewide MHI for California was \$64,500 in 2015.³⁶ Growth in this segment has persisted even as the California Solar Initiative (CSI) largely phased out residential rebates by 2014.

The Connecticut Green Bank commissioned research on market segmentation in Connecticut to understand solar uptake for different income demographics, and to better target programs for low-income households. The research described the characteristics of past adopters, based on income, education levels, and other factors, as well as of potential solar prospects. Analyzing 66 different consumer profiles, the research identified a class of “Prudent Yankees” in Connecticut who are lower income, older, and less likely to have a college degree, but who are especially interested in saving money with solar.³⁷

Within the low-income category there are sub-sectors that may require different policy and program approaches. The most important split is between homeowners and renters, but there are also significant differences between urban apartment dwellers and households in rural trailer parks, and between seniors on fixed incomes and younger age groups. Moreover, programs can focus on either low-income customers themselves or the institutions that help support them.

Tenants—Low-income customers in apartment buildings or rental housing face significant barriers to solar. They don’t own the roof, they may not be long-term residents, and they experience the split-incentive problem (where landlords don’t invest in energy-saving measures because the tenant pays the utility bill). In some states, the primary solar solution has been to connect renters with off-site community solar through virtual net metering (VNM). But for this to be successful, community solar needs to be combined with policies that solve credit problems and marketing risk for low-income customers.

A different approach is to encourage the landlord to invest in solar, especially for publicly subsidized or publicly-owned housing, where it can deliver long-term savings to taxpayers. Many low-income housing programs and policies can fund solar, including the New Markets Tax Credit, the Low-Income Housing Tax Credit, the Public Welfare Investment authority of banks, “green finance” offerings from FHA and Fannie Mae, and the many offerings of HUD, including the Community Development Block Grant. State energy agencies may want to learn more about these programs, and to collaborate with local implementing agencies. See the section on using solar for low-income support services.

Homeowners—Low-income homeowners don’t have the rooftop access issues that hamper renters from adopting solar, but they may still face financial barriers. They may also face structural and legal barriers, such as roofs in poor condition, electrical code violations,

or property tax liens. The most important policies for enabling homeowners to adopt solar are fair net metering and interconnection rules, but low-income homeowners may need further assistance in the form of rebates, tax credits that can be easily monetized, innovative financing techniques, such as on-bill repayment and PACE financing, strong consumer protection provisions, measures to handle potential credit issues, and policies to reduce risk for third-party providers, such as loan loss reserves.

Low-income support services—Groups that provide support services to low-income communities can often adopt solar more easily than can individual low-income households. Service institutions such as homeless shelters, food banks, and clinics typically have longer-term occupancy, more financing options, and can host larger, more cost-effective solar systems. The money they save on energy expenditures can be redirected toward their primary mission.

Nonprofit organizations and government agencies may not directly be able to monetize state or federal tax credits, but this can be solved by partnering with a third party that can. Government agencies can also tap into forms of financing not available to other sectors, such as bonds, fees, taxes, and the array of federal housing and economic development programs. Nonprofits may be able to raise capital through grants and charitable contributions. State and local energy agencies can help facilitate solar deployment on government and nonprofit buildings by setting up compatible financing mechanisms.

SAMPLE SCENARIOS

The policies or programs a state or municipality should pursue will depend on local conditions, but here are some possible scenarios:

- If a state has a robust renewable energy policy infrastructure, then those policies and associated programs can be adapted to serve low-income solar needs. RPS, net metering, or community solar programs could have low-income quotas or targeted credits. Rebate or incentive programs could provide higher incentives for the low-income market.
- If a jurisdiction has a large number of low-income households in either single-family or multifamily housing, programs should be tailored to reach those two different market sectors. As mentioned above, reaching tenants of multifamily housing may require techniques such as virtual net metering, or it may require focusing programs on the landlord rather than the tenant.
- If a state has relatively high retail electricity prices, then smaller financial incentives may be needed to encourage uptake by low-income households. In that case, the programs may focus more on stimulating the market and directing solar developers toward low-income households, and less on providing subsidies.
- If a state has discounted electricity rates for low-income customers, then solar can be a way to lock in utility program costs while meeting clean energy goals. Community solar can be a flexible way to reach discount-rate customers regardless of location, while solar installed on multifamily public housing can be a way to reach many customers on discounted rates with an on-site solar system.

SECTION 4

Discussion of Solutions

Despite the many barriers to adopting solar PV for low-income households, the declining costs and significant benefits of solar have created strong interest from government agencies, utilities, energy companies, and non-government organizations to expand the benefits of solar in low-income communities. A growing body of research describes and proposes a wide variety of policies and programs. This guide has drawn extensively on these reports, adding some new ideas and exploring some in greater depth. Still, this is a rapidly evolving field, with new programs and policies emerging all the time.

OTHER RESEARCH

A roundup of recent research on public low-income solar programs can be found in, *A Directory of State Clean Energy Programs and Policies for Low-Income Residents*, a report released by the Clean Energy States Alliance (CESA).³⁸ The report catalogs dozens of programs that promote clean energy, especially solar power, as a way to reduce the energy burden of low-income customers. As shown in the **Table 1**, many of these programs offer direct incentives to reduce (or eliminate) solar costs to low-income households, or financing programs that reduce borrowing costs. CESA posts the report on its website and strives to keep the report updated with new program developments.

Nevertheless, with programs being implemented, changed, and phased out regularly, Table 1 is not meant to be a comprehensive catalog of all states' low-income clean energy programs, but instead is designed to illustrate the variety of programmatic approaches states are pursuing.

The declining costs and significant benefits of solar have created strong interest from government agencies, utilities, energy companies, and non-government organizations to expand the benefits of solar in low-income communities.

TABLE 1: **Summary of Low-Income Solar Programs**

State	Program Name	Technology	Direct Incentives	Finance Assistance	Shared Solar	Mandate	High-level and Conceptual	Other / Notes
Alaska	Alaska Affordable Energy Strategy	Unspecified					●	
California	Net Metering Program	Unspecified					●	
California	Single-Family Affordable Solar Housing (SASH) Program	Solar PV	●					Training/Hiring requirements.
California	Multifamily Affordable Solar Housing (MASH) Program	Solar PV	●					Hiring requirements.
California	Multifamily Affordable Housing Solar Roofs (MAHSR) Program	Solar PV	●					Hiring requirements.
California	California New Solar Homes Partnership	Solar PV and energy efficiency	●					
California	California Solar Initiative Thermal Program	Solar hot water	●					
California	Solar For All California	Solar PV	●					
California	Low-Income Weatherization Program	Solar PV, thermal, energy efficiency	●					
Colorado	Rooftop Low-Income Program	Solar PV	●					
Colorado	Colorado Community Solar Gardens	Solar PV			●	●		
Colorado	Low-Income Solar Demonstration Project	Solar PV			●			
Connecticut	Posigen and Efficiency for Low-to-Moderate-Income Homeowner	Solar PV and energy efficiency		●				
Connecticut	Smart-E Loans	Solar PV, energy efficiency, and possibly others		●				
Connecticut	Solarize States-Sponsored Housing Portfolio (SSHP)	Solar PV		●				
Connecticut	Share Clean Energy Facilities	Unspecified			●	●		
Connecticut	Low-Income Multifamily Energy (LIME)	Solar PV and energy efficiency		●				
Connecticut	Kresge Solar+ Storage Initiative Program	Solar PV + battery energy storage		●				
District of Columbia	Affordable Solar	Solar PV	●					

TABLE 1: Summary of Low-Income Solar Programs (CONTINUED)

State	Program Name	Technology	Direct Incentives	Finance Assistance	Shared Solar	Mandate	High-level and Conceptual	Other / Notes
District of Columbia	Solar for All	Solar PV					●	
District of Columbia	Small-Scale Solar Initiative	Solar PV	●					
District of Columbia	Multifamily Housing Energy Efficiency Rebates	Energy efficiency and solar hot water	●					
Hawaii	Green Energy Market Securitization (GEMS) Program	Solar PV		●				
Illinois	Solar for All	Solar PV	●		●	●		
Maryland	Community Solar Pilot Program	Solar PV			●	●		
Massachusetts	Mass Solar Loan	Solar PV		●				
Massachusetts	Affordable Access to Clean and Efficient Energy Initiative	Unspecified					●	
Massachusetts	Community Clean Energy Resiliency Initiative	Unspecified	●					Energy resilience grants to municipalities, favoring low-income communities.
Massachusetts	Solar Massachusetts Renewable Target (SMART)	Solar PV	●					
Minnesota	Housing Fix-up Program	Repairs, remodels and energy improvements, including solar PV		●				
New York	NY-Sun	Solar PV	●					
New York	Affordable Solar Predevelopment and Technical Assistance	Solar PV	●				●	
New York	Low-Income Forum on Energy (LIFE)	Unspecified					●	Interactive exchange of information among programs and resources that assist low-income energy consumers.
New York	Shared Renewables Program	Solar PV, wind, and other renewable energy			●	●		
New York	REVitalize	Solar PV, geothermal, biomass, microgrid and energy efficiency	●					
Oregon	Community Solar Program	Solar PV			●			

TABLE 1: **Summary of Low-Income Solar Programs** (CONTINUED)

State	Program Name	Technology	Direct Incentives	Finance Assistance	Shared Solar	Mandate	High-level and Conceptual	Other / Notes
Washington	Evergreen Sustainable Development Standards (ESDS)	Unspecified					●	Green building performance standard for state-funded affordable housing.
Washington	Ultra-Efficient Affordable Housing Demonstration	Energy efficiency, solar hot water, ground source heat pumps, natural cooling, and solar PV	●	●				

Source: Clean Energy States Alliance, *Directory of State Clean Energy Programs and Policies for Low-Income Residents* (July 2016 edition, with updates).



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In addition to the guides and webinars that CESA has prepared in 2016 on low-income solar under the Sustainable Solar Education Project,³⁹ the following recent reports explore policy options for extending the benefits of solar power to low-income consumers.

- ***Breaking Ground: New Models That Deliver Energy Solutions to Low-Income Customers***, by Rocky Mountain Institute (RMI).⁴⁰ In *Breaking Ground*, RMI explores four business models that can be used to bring the benefits of distributed energy resources (including rooftop solar) to low-income customers. By using cooperative models, tenants of multi-family housing can solve credit barriers, reduce costs, and aggregate their buying power and ability to provide utility services.
- ***Bridging the Solar Income Gap***, by the GW Solar Institute, based on a symposium in 2014.⁴¹ The GW Solar Institute, at George Washington University in Washington, DC, held a symposium on low-income solar in 2014, and prepared a report to capture the findings.
- ***Bringing Community Solar to a Broader Community*** (Working Draft), by Fresh Energy.⁴² Minnesota is seeing substantial growth in community solar, thanks to favorable policies and strong public demand. Fresh Energy, based in Minnesota, rounds up policies, programs, and financing approaches from a number of states that encourage greater participation by low-income consumers, and makes recommendations.

- ***Low- and Moderate-Income Solar Policy Basics***, by National Renewable Energy Laboratory.⁴³ This online policy primer notes some of the key barriers low- and moderate-income consumers face in accessing the benefits of solar energy. It raises promising financing strategies and funding sources for transcending these barriers.
- ***Low Income Solar Policy Guide***, by GRID Alternatives, Vote Solar, and the Center for Social Inclusion.⁴⁴ This policy guide details the barriers that low-income households and people of color face in going solar. It then presents a “policy toolbox” of various options to overcome those barriers, including examples of program models. The guide, which is regularly updated, is available for download and has also been organized into a website at www.lowincomesolar.org.
- ***Shared Renewable Energy for Low- to Moderate-Income Consumers: Policy Guidelines and Model Provisions***, by the Interstate Renewable Energy Council (IREC).⁴⁵ IREC’s *Policy Guidelines and Model Provisions* give detailed guidance to state, local, and utility programs to help them increase access to community solar by low and moderate-income consumers. The report identifies and explains barriers that low- and moderate-income (LMI) customers face in participating in shared renewable energy programs, and suggests approaches to overcome those barriers. The report also discusses IREC’s CleanCARE idea, which proposes a way for low-income energy programs to incorporate renewable energy.
- ***Solar For All: What Utilities Can Do Right Now to Bring Solar Within Reach for Everyday Folks***, by the Southern Environmental Law Center.⁴⁶ This report recommends policies that include innovative finance options, community solar, and incorporating solar into existing energy assistance funds and programs. It draws from examples in the Southeast U.S., especially.
- ***State Policies to Increase Low-Income Communities’ Access to Solar Power***, by the Center for American Progress.⁴⁷ This concise paper explores experience in California, Louisiana, and Colorado, and makes policy and program recommendations.

In addition to the guides and webinars that CESA has prepared in 2016 on low-income solar under the Sustainable Solar Education Project, several recent reports explore policy options for extending the benefits of solar power to low-income consumers.

SECTION 5

Overview of Policy and Program Options

The reports described in Section 4 catalog many options, some of which are being tried already, some that are extensions of existing programs, and others that would be entirely new. Borrowing from these reports and other sources, the following section describes policy and program options in the following categories:

- Compensation mechanisms
- Direct incentives
- Financing and investments
- Adapting current low-income energy policies to solar
- Using solar for low-income support services

More detail is provided on some of these options, with an eye toward implementation issues that local, state, and federal agencies, solar marketers, nonprofit groups, financial institutions, and other stakeholders will face.

COMPENSATION MECHANISMS

Compensation mechanisms include net metering and community (or shared) solar.

Net Metering

Net metering is available in over 40 states, providing a simple way for customers to export solar power to the grid when they have a surplus, and get power back when they need it. Virtual net metering (VNM) enables customers to count the generation of off-site solar generators against their bill, as if it were behind their utility meter. VNM is used to track the value of offsite, shared solar projects that are customer-owned or customer-subscribed, and to credit the value of that solar energy generation against their electricity consumption charges on their utility bills.

Whether or not net metering constitutes a subsidy is a point of much debate currently, as many states are reexamining their net metering policies in the face of rapid solar adoption.⁴⁸ It could be considered an enabling mechanism for any customer-owned solar, rather than a specific support for low-income customers. But without it, any other policy or program support for low-income solar will be less effective.

Net metering can be adapted to provide extra help to low-income households. For example, California currently allows VNM, but only between solar systems located on the roof of a multifamily building and the tenants of that building. A proposal by the California Public Utilities Commission (CPUC) staff would expand VNM to allow credits from a customer-sited solar system to be allocated to any residential customer in the same low-income community.⁴⁹ This is based on a similar policy in Massachusetts that is not limited to low-income communities.

In comments filed in the CPUC case, the Solar Energy Industries Association (SEIA) and Vote Solar pointed out that VNM would enable a developer to “provide solar power through power purchase agreements (PPAs) with a number of participants in a geographical area, and replace them with other participants throughout the lifetime of the project,” thus reducing the risk of contracting with customers with low credit scores.⁵⁰ This would create, in effect, competitive electricity suppliers for low-income households, using solar power valued at retail rates.

Mississippi has a variant on net metering that provides benefits to low-income households. Under its policy, any power exported to the grid in real time is not net metered, but is paid at the avoided generation cost plus a 2.5 cent per kWh premium. The two largest investor-owned utilities in the state, Entergy Mississippi and Mississippi Power, are required to offer an additional 2 cents per kWh adder to the first 1,000 qualifying low-income customers who wish to net meter. To be eligible for this added incentive, the customers must have household income at or below 200 percent of the federal poverty level, or similar requirement approved by the Commission. This adder will stay in place for 15 years from the date the customer begins the service.⁵¹

Community Solar

The design of community or shared solar offerings is still emerging. In some states, community solar is designed to save customers money, relying on virtual net metering to allow consumers to capture the value. In other states, customers pay a premium to participate in community solar owned by a utility, much like a green pricing program.

Policymakers have been seeking ways to increase low-income participation in community solar. In some cases, programs are being adapted to benefit low-income households, while in others, low- and moderate-income customer participation is simply mandated.

In Colorado, the Community Solar Gardens Act of 2010 required developers to allocate a minimum of 5 percent of their output to low-income customers.⁵² While well-intentioned, the requirement proved to be difficult to implement. In many cases, solar developers decided to simply give away subscriptions to low-income customers to fulfill the requirement, with the cost being absorbed by other subscribers. Even marketing free subscriptions to low-income customers came with a host of communication and administrative challenges. The resulting higher cost to other subscribers may have reduced enrollment. Consequently, some viewed the requirement as a restraint on project development.⁵³

In November 2015, the Colorado PUC approved a legal settlement between the state’s largest utility, Xcel Energy, and various stakeholder organizations. Under the terms of the settlement, Xcel agreed to take on the five percent low-income requirement that community solar

garden developers had previously been responsible for. Xcel also agreed to a contract for up to 4 MW of community solar gardens dedicated solely to low-income subscribers.⁵⁴

In Minnesota, the Just Community Solar Coalition, a network of NGOs, is encouraging churches and other customers to act as “anchor tenants,” buying a variable amount of energy each month to make up for the customer churn expected from low-income households. This reduces marketing risk and makes developers more willing to accept customers with low credit scores.⁵⁵

In Massachusetts, Co-op Power, a customer-owned energy cooperative, includes low-income customers in a community solar project as both subscribers and co-owners. Low-income customers’ participation is supported financially through sales of solar renewable energy certifications (SRECs) and virtual net metering credits, and they are eligible for subsidized loans from the Massachusetts Solar Loan Program.⁵⁶

In New York, Brooklyn Power’s Building Co-op model allows members of a building co-op to invest jointly in on-site distributed energy resources, including solar. Lenders consider the credit-worthiness of the co-op rather than of the individual members, so low-income residents are able to participate.⁵⁷

Maryland is undertaking a three-year pilot program for 218 MW of community solar to supply low- and moderate-income customers. Power52, a solar developer cofounded by football star Ray Lewis, is hiring and training local workers to build solar projects in low-income neighborhoods. The projects will supply customers of Baltimore Gas & Electric who receive energy assistance through the Office of Home Energy Programs.⁵⁸

In Hawaii, the Public Utilities Commission has received comments from stakeholders regarding its proposal to include a carve-out for LMI customers in its community-based renewable energy (CBRE) program framework. The Commission’s proposal found that “utilities are well-positioned to identify and reach LMI customers that may be interested in CBRE program participation.” The proposal would require utility-owned CBRE facilities to serve at least 75 percent LMI customers.⁵⁹ The Hawaiian Electric Companies have proposed an alternative to this obligation, asking that a 15 percent carve-out for low- and moderate-income customers be required for all CBRE projects regardless of ownership.⁶⁰

Hosting Solar

While not limited to low-income customers, a number of utilities are offering to rent roof space from homeowners to site utility-owned PV systems, with the electricity flowing into the grid, rather than displacing power used by the home. CPS Energy in San Antonio, Texas, pays a bill credit of 3 cents per kWh in their Solar Host SA program, while Arizona utility APS and the Los Angeles Department of Water and Power pay a fixed \$30 a month to the homeowner.⁶¹ This arrangement delivers fewer benefit to customers, but solves the first cost and financing barriers that low-income homeowners face and may present less risk for the consumer. These programs typically have not had income-eligibility restrictions for participation, but utilities could be encouraged to focus them, at least in part, on low-income neighborhoods.

DIRECT INCENTIVES

Direct incentives include rebates, tax credits, and compliance certificates.

Tax Credits and Rebates

The most common direct incentive for solar is federal tax credits, such as the Residential Energy Efficient tax credit worth 30 percent of the investment cost of a customer-owned PV system.⁶² As mentioned above, because the credit is applied against the federal income tax owed by the filer, it requires a sufficient income and tax burden to be fully captured, which can be a problem for low-income people.⁶³

Many states also offer tax credits or rebates for solar, with some providing extra incentives for low-income households. New York's residential Affordable Solar program doubles the rebates offered under the NY Sun program for homeowners with total household income less than 80 percent of the area or state median income. Launched in October 2015, rebate levels decline as installation landmarks are met, and vary by region.⁶⁴

So far, the program has seen little uptake. New York State Energy Research & Development Authority (NYSERDA) reports that the added incentive supported 102 projects in 2016, with an additional 66 projects in the pipeline at year's end. More than 50 solar installers used the added incentive to serve low- and moderate-income homeowners across the state.⁶⁵ During the same period, over 20,000 projects were completed under the non-low-income incentive program. Solar installers in New York report that a doubling of the regular incentive is insufficient to overcome financing and other barriers they face in serving low-income customers.⁶⁶

Louisiana has offered a tax credit of up to 50 percent of the installed cost of residential solar, with a maximum of \$10,000 per system. This credit began in 2008 and was fully subscribed in 2016, a year and a half ahead of schedule.⁶⁷ While not geared specifically to low-income customers, they have been the primary beneficiary of the credits. Solar installer PosiGen counts more than 8,000 customers in the state, including more than 3,000 in New Orleans, totaling more than 75 MW of capacity. PosiGen notes that 75 percent of all its customers are at or below area median income (AMI). Most of these customers combine solar with energy efficiency offerings.⁶⁸

California has two programs for single-family and multifamily affordable solar housing (known as SASH and MASH). The SASH and MASH rebate programs began in 2008, and were reauthorized in 2013 with \$54 million in new funding for each program.

MASH gives upfront rebates for multifamily solar projects of \$1.10 per watt for projects that serve common areas of a building, and \$1.80 per watt for projects that benefit tenants. To date, the MASH program has funded 25.7 MW of solar capacity across 370 projects, serving over 6,880 tenant units through virtual net metering. An additional 165 MASH projects are reserved, with a capacity of more than 29 MW. More than \$83 million in incentives have been paid to completed projects with an additional \$46 million reserved for pending projects. The program is authorized through 2021 but is currently closed pending new funding sources.⁶⁹

The SASH program provides rebates of \$3 per watt for families with household income of less than 80 percent of the AMI. Just over 6,000 PV systems on low-income single-family

housing, with almost 300 more pending, have been installed and interconnected through the program. These installations are supported by approximately \$100 million in incentives and represent 18.8 MW of solar capacity. The SASH program has also helped enroll 5,826 low-income homeowners to the utilities’ Energy Savings Assistance programs and has trained over 28,800 volunteers. California’s SASH program shares similarities with the Affordable Solar Program in Washington, D.C., described on page 16.

Renewable Energy Certificates (RECs)

Another financial incentive for solar is the use of renewable energy certificates (RECs). About 30 states have renewable portfolio standards (RPSs) that require utilities or electricity retailers to get a portion of their energy from renewable sources. Twenty-two of these (plus the District of Columbia) have set-asides for solar specifically.⁷⁰ Certificates are used to track compliance with RPS programs: RECs for renewables in general, and in those states with a solar carve-out, SRECs. In states with RPSs, utilities must acquire and retire a sufficient number of RECs (and, if applicable, SRECs) to meet their obligations, thus creating a revenue stream for renewable energy generators.

The value of RECs and SRECs is determined by supply and demand, by the cost of renewables relative to wholesale market prices, and through competition among suppliers. As a result, their value can vary dramatically by location and over time. Policymakers have begun using SRECs as a way to provide financial support for low-income solar programs.

Washington, D.C.’s Affordable Solar Program relies on the value of SRECs sold by developers plus the 30 percent federal solar tax credit, and fills the remaining gap with a rebate financed by alternative compliance payments. The rebate plus the tax credit cover about 70 percent of the cost of residential solar installations on low-income properties, while SREC sales create a rapid payback and ongoing savings (see **Table 2**).

The program, originally called Solar Advantage Plus, installed almost 300 systems on low-income homes in 2015 and 2016, with a rebate worth \$2.50 per watt and a maximum of \$10,000 per system.⁷¹ The total program cost was about \$2.5 million over the two years, with funds coming from RPS alternative compliance payments (ACPs) and the Sustainable Energy Trust Fund, a public goods charge collected from all gas and electric customers in Washington, D.C.

As shown in Table 2, the high value of SRECs are an important part of the financial model for solar in Washington, D.C. Utilities buy SRECs to comply with the solar portion of the D.C. Renewables Portfolio

TABLE 2: Example of Solar Pro Forma—Washington, DC (ACTUAL VALUES MAY VARY)

4	kw system size
\$6,000	Cost per kW
\$24,000	System cost
\$7,200	Value of 30% federal tax credit
\$16,800	Cost after tax credit
\$2,500	Value of Affordable Solar rebate per kW
\$10,000	Total rebate value
\$6,800	Cost after rebate and tax credit
5256	Annual output (kWh) at 15% capacity factor
\$0.47	SREC price
\$2,470	Annual SREC value
\$0.15	Electricity price
\$788	Annual electricity value
\$3,259	Annual value to homeowner of SREC and electricity savings
5.155	Simple payback period after federal tax credit (years)
2.087	Simple payback period after federal tax credit and rebate (years)

Standard, recently expanded to five percent from solar power by 2032. If SRECs are in short supply or prices are too high, utilities can make an alternative compliance payment of \$500 per MWh (or 50 cents per kWh).⁷² Utilities paid about \$700,000 in ACPs in 2015, a number that is expected to rise due to the recently raised RPS target.

According to the U.S. Department of Energy, D.C. SREC prices have exceeded \$470 per MWh (47 cents per kWh) for the past three years, more than twice as much as any other state with solar RPS requirements.⁷³

At these prices, SRECs could be worth almost \$2,500 per year for a 4 kilowatt PV system. They are monetized by being sold to utilities by the installer or owner of the solar system. Of course, SREC prices fluctuate according to supply and demand, and may deliver smaller benefits to low-income households in future years.

The federal tax credit is also a significant contributor, worth 30 percent of the installed cost of a system. As noted above, if a low-income homeowner is unable to take the full value of the tax credit, the installer can use a third-party ownership model, leasing the system or selling the power to the customer.

Finally, the rebate for low-income households shortens the payback period considerably and delivers bigger ongoing savings.

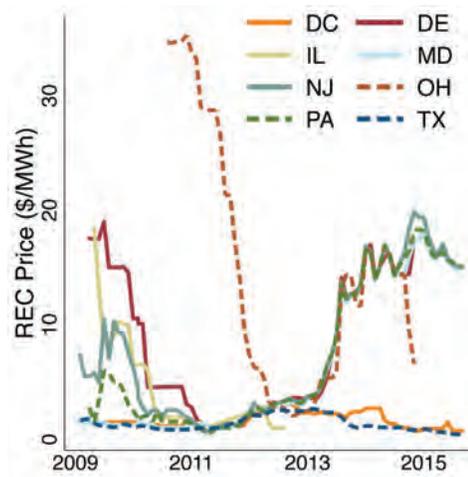
In Massachusetts, the SREC value itself is adjusted to support low-income solar projects. Under the SREC II program, the Massachusetts RPS awarded different levels of SRECs for different kinds of solar projects, based on a variety of factors. Low-income solar projects earned a full SREC, while those sited on brownfields earned 0.8 credits, for example.⁷⁴ SREC prices in Massachusetts have been worth about 20 cents per kWh in recent years.

Massachusetts has developed a new solar incentive program called the Solar Massachusetts Renewable Target (SMART) to replace its SREC II program. Like the SREC II program, the proposed SMART program will include

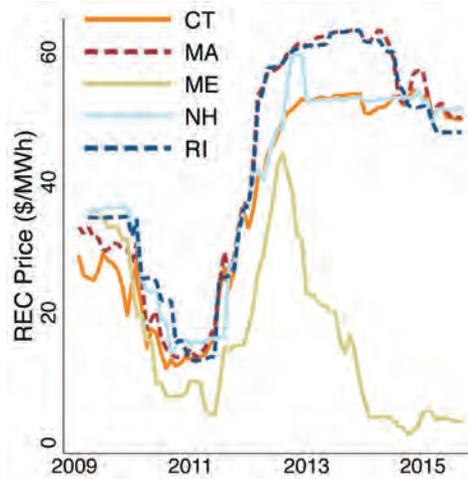
REC prices show wide variation across states and regions, and are highest in the Northeast (Figures 3A and 3B). Solar RECs (Figure 3C) also show a wide range, but are highest in DC and Massachusetts. Voluntary market RECs are selling at less than \$1 per MWh.

Source: NREL, *Status and Trends in the U.S. Voluntary Green Power Market* (2014 Data), <http://www.nrel.gov/docs/fy16osti/65252.pdf>.

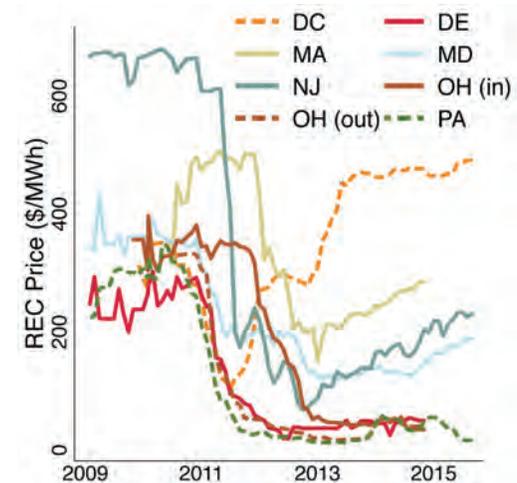
FIGURE 4: **REC and SREC Pricing**



A. Compliance REC pricing in the Midwest, Mid-Atlantic, and Texas

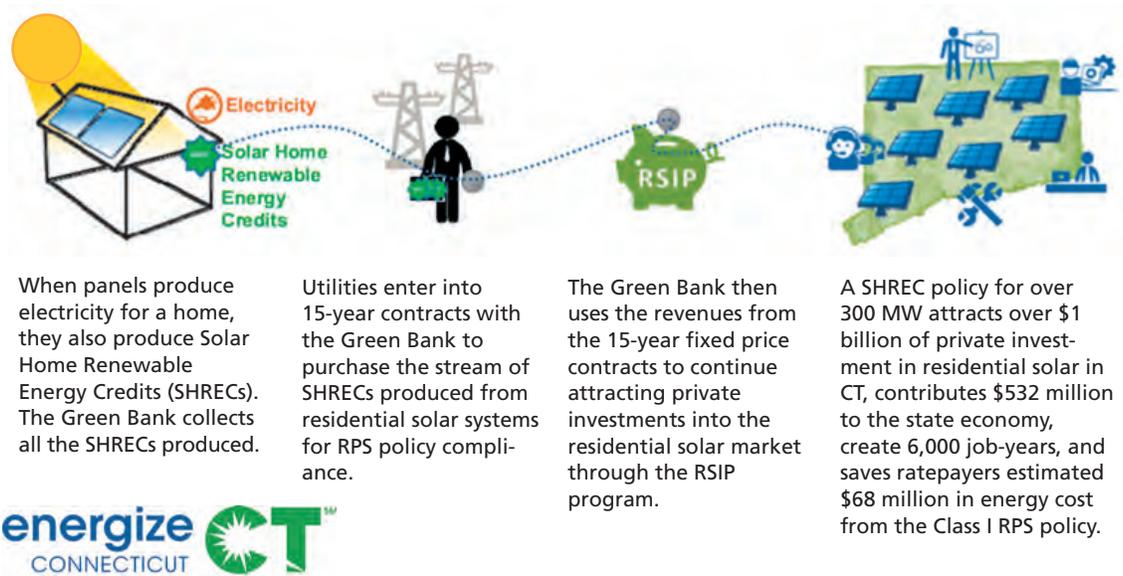


B. Compliance REC pricing in New England



C. SREC Pricing

FIGURE 5: **Connecticut’s Solar Home Renewable Energy Credit Program**



When panels produce electricity for a home, they also produce Solar Home Renewable Energy Credits (SHRECs). The Green Bank collects all the SHRECs produced.

Utilities enter into 15-year contracts with the Green Bank to purchase the stream of SHRECs produced from residential solar systems for RPS policy compliance.

The Green Bank then uses the revenues from the 15-year fixed price contracts to continue attracting private investments into the residential solar market through the RSIP program.

A SHREC policy for over 300 MW attracts over \$1 billion of private investment in residential solar in CT, contributes \$532 million to the state economy, create 6,000 job-years, and saves ratepayers estimated \$68 million in energy cost from the Class I RPS policy.



Sources: Connecticut Center for Economic Analysis at the University of Connecticut (February 10, 2015). Sustainable Energy Advantage (February 10, 2015)—energy cost savings based on IRP assumptions of RPS compliance costs.

additional incentives for low-income customers (defined as those who qualify for reduced utility rates). Systems under 25 kW that serve low-income customers would receive 15 percent higher compensation than other similar-sized systems; and community solar systems serving primarily low-income customers would receive an adder of 6¢ per kWh, compared to other community solar systems, which would receive a 5¢ per kWh adder.⁷⁵

As shown in **Figure 5**, the Connecticut Green Bank takes ownership of the RECs produced by residential solar systems (called Solar Home RECs, or SHRECs) in exchange for the incentives paid to the customer under the Residential Solar Investment Program. The Green Bank then sells the SHRECs to utilities for RPS compliance, and uses the revenues to support further incentives, including solar programs for low-income customers.⁷⁶

EPA’s Clean Energy Incentive Program

The Clean Power Plan (CPP), introduced by the U.S. EPA under the Obama administration, includes the Clean Energy Incentive Program (CEIP) for early-action solar projects “implemented to serve low-income communities that provide direct electricity bill benefits to low-income community ratepayers.”

Under the CEIP, states would issue early action emission rate credits (ERCs) for eligible renewable energy and low-income community projects. For projects in low-income communities, EPA would give a two-for-one match from a pool of credits that EPA would hold in reserve, allocated to states based on their emission reduction targets.⁷⁷

The CPP is undergoing litigation, and the Trump administration opposes the plan, making it highly unlikely that it will be implemented. The concepts, however, may be relevant for regional emission trading systems, like the Regional Greenhouse Gas Initiative and California’s AB32 program.

Prizes and Other Incentives

Some state and local governments and other entities are offering prizes, training, and other incentives for promoting low-income solar housing.

- Through its Green Permits program, the City of Chicago offers expedited permitting and potentially reduced fees for building projects that incorporate green elements like solar power. This could be applied to low-income solar on public housing, for example.⁷⁸
- Nonprofit and quasi-public agencies can support technical assistance and training for low-income solar projects. GRID Alternatives is the most prominent nonprofit provider in this space for low-income solar. With foundation and corporate funding, it offers free assistance for multifamily housing projects across the country. GRID Alternatives also works with NeighborWorks America, a congressionally chartered corporation that receives a direct annual appropriation of about \$200 million to work on affordable housing. NeighborWorks is supporting GRID Alternatives to provide technical assistance for low-income housing projects in nine communities.⁷⁹
- Prizes and commendations can be a low-cost way for governments to encourage and publicize low-income solar projects. New York offers the 76West Clean Energy Business Competition to encourage innovative clean-energy businesses in the state. The most recent round solicited 175 applicants and awarded a total of \$2.5 million to the six finalists.⁸⁰ A Habitat for Humanity solar homes project in Michigan discussed below was awarded the U.S. Department of Energy 2016 Housing Innovation Award, the Zero Energy Hero Award from the GreenHome Institute, and the Midwest Project of Distinction Award for 2016 from the Solar Energy Trade Shows LLC.⁸¹
- In late 2016, the U.S. Department of Energy's SunShot Initiative launched the Solar in Your Community Challenge, a nationwide prize challenge to develop new models for low-income solar and for solar to serve nonprofit institutions.⁸² Teams were invited to submit proposals to compete for up to \$60,000 in seed money and up to \$10,000 in technical assistance. After the projects are completed, prizes will be awarded to the most successful and scalable projects and programs, including a \$500,000 grand prize. The U.S. Department of Energy hopes to elicit creative ideas and new models, and to give a boost to local innovations in low-income solar.
- NYSERDA offers grants of up to \$200,000 under its Affordable Solar Predevelopment and Technical Assistance fund.⁸³ This program is intended "to address resource gaps and solve market barriers preventing the development of solar installations serving LMI income households." Grants can be used to solve legal and financial barriers, for example, but not to pay for engineering or construction.

In late 2016, the U.S. Department of Energy's SunShot Initiative launched the Solar in Your Community Challenge, a nationwide prize challenge to develop new models for low-income solar and for solar to serve nonprofit institutions.

FINANCING POLICIES

Most ideas being tried or proposed for low-income solar expansion involve finance. Governments and other entities are trying a variety of finance tools to lower purchase prices for solar, to make financing less costly and more streamlined for consumers, and to overcome the problem of low or no credit scores for low-income consumers.

One set of options is to set up a method of repayment that lowers risk for the lender, and thereby lowers the cost of financing. This can include repayments on utility bills, on property tax bills, or embedded in utility tariffs.

On-Bill Repayment

On-bill repayment (also called on-bill recovery or on-bill financing) lets customers pay for energy improvements in installments on their utility bill. The savings from the improvement, such as from energy efficiency or solar, offset the cost of the measure, so utility bills that include the repayment may be similar to or lower than what they were before the improvements were made.

On-bill repayment has been offered since the 1970s, facilitating over \$1.83 billion in loans, according to LBNL.⁸⁴ There are about 45 programs currently active in 32 states. Cumulative default rates are low, ranging from zero to three percent. In 2014, over 20,000 on-bill loans were made, including \$76 million in residential loans, \$89 million in commercial and industrial loans, and \$14 million in institutional loans.

BOX 3

Advantages and Disadvantages of On-Bill Finance

Advantages

- Savings are paired directly with repayment on the same bill.
- Can be structured to meet the needs of different markets.
- Provides a relatively secure revenue stream because failure to pay can be tied to disconnection.
- Can use past bill replacement as a proxy for credit.

Disadvantages

- Utilities are often reluctant to take on the role of financing entity; potential exposure to consumer lending laws and alterations to billing systems are required.
- Can be costly and complicated to set up.
- If transferability is not allowed, homeowners or businesses must pay off entire loan upon sale of property, which could result in not all of the energy savings being realized.

Source: U.S. Department of Energy. <http://energy.gov/eere/sls/bill-financing-and-repayment-programs>

Still, as noted in **Box 3** on the advantages and disadvantages of on-bill finance, utilities may be reluctant to play such an active role in financing, since lending laws can vary by state. Rules must be established around whether and how utilities can disconnect service in the case of customer default and the transferability of loan obligations between customers.

Currently, over 90 percent of the total volume comes from just five programs. As experience grows with on-bill repayment, and if default rates stay low, lenders and utilities may become more comfortable with it.

On-bill repayment has been used by the Green Jobs–Green New York program since 2009. Administered by NYSEERDA, the on-bill repayment program has approved 7,144 loans to residential customers, worth almost \$38 million. Almost 2,200 of these included solar installations.⁸⁵

While on-bill repayment makes it more convenient for any customer to finance energy improvements, there are some adjustments that can be made for low-income customers. For example, New York is using bill payment history as a proxy for credit scores, for customers who lack sufficient credit history. The New York program is currently offering loans of up to \$25,000 at a rate of 3.49 percent. It takes credit scores as low as 540, as long as customers have low debt compared to their income (known as a debt-to-income ratio, or DTI).⁸⁶

Loans can also be obligated to utility meters, rather than to the customers themselves. This can make it easier for landlords to take a loan to make property improvements, knowing that tenants will be repaying the loan on their utility bills. There are little data on how common or popular this feature is, but Midwest Energy's How\$mart Kansas program has had 120 renters (out of 989 residential projects) use it as of 2013.⁸⁷

EEtility, an energy services company, worked with the Ouachita Electric Cooperative in Arkansas to develop the Home Energy Lending Program (HELP) to finance energy efficiency improvements through loans that are paid back on utility bills. Of the 300 retrofits performed in 2015, 80 percent were for low-income households. The coop recently switched over to a similar product, called HELP PAYS (Pay As You Save), as described below.⁸⁸

Property-Assessed Clean Energy (PACE)

PACE enables property owners to finance energy improvements through a special assessment on their property taxes, with funding provided by local and state governments, or by private sector lenders. It can be used for commercial properties (such as multifamily housing) as well as for single-family homes. PACE offers some advantages over traditional financing tools, but some disadvantages as well (see **Box 4**, p. 40).⁸⁹

PACE financing for residential projects was delayed for many years due to the concern of federal mortgage finance agencies about its impact on mortgages. Different types of debt have a ranking of priority for payment, in event of a default. PACE finance is typically senior to mortgages, making lenders more confident that the money will be paid back, and potentially making them willing to offer better terms.⁹⁰ But HUD and the Federal Housing Finance Administration (FHFA) refused to insure mortgages that were subordinate to PACE debt. (Lenders can voluntarily make PACE debt subordinate to mortgages, and a few states require it.)

In 2013, California established a \$10 million loan loss reserve fund to compensate mortgage holders for PACE finance losses, in the event of a foreclosure. However, FHFA responded that it “was not prepared to change its position on California’s first-lien PACE program” since it “fails to offer full loss protection.” So far, no claims have been made against the fund, according to Berkeley Lab.⁹¹

On July 19, 2016, the White House and HUD issued guidance outlining the conditions under which the FHFA would insure a PACE-encumbered property, especially in event of foreclosure. The guidelines say that PACE should be treated like any other property tax assessment and not as a traditional loan product. They prohibit lenders from demanding the remaining balance of a PACE assessment be paid off at foreclosure; instead, they require it to stay with the property as it transfers to a new owner.⁹²

According to David Gabrielson, Executive Director of PACE Nation, a PACE advocacy organization,

HUD/FHA accept that because PACE assessments remain with a property upon sale, including foreclosure sales, PACE isn't really senior to their mortgage interests.... Because they

BOX 4

Advantages and Disadvantages of PACE Financing

ADVANTAGES

- Allows for secure financing of comprehensive projects over a longer term, making more projects cash flow positive.
- Spreads repayment over many years and removes the requirement that the debt be paid at sale or refinance.
- Can lead to low interest rates because of the high security of loan repayments attached to the property tax bill.
- Helps some property owners deduct payments from their income tax liability.
- Allows municipalities to encourage energy efficiency and renewable energy without putting general funds at risk.
- Taps into large sources of private capital, such as the municipal bond markets.

DISADVANTAGES

- Available only to property owners.
- Cannot finance portable items (screw-in light bulbs, standard refrigerators, etc.).
- Can require dedicated local government staff time.
- High legal and administrative setup.
- Not appropriate for investments below \$2,500.
- Potential resistance by lenders/mortgage-holders whose claims to the property may be subordinated to the unpaid assessment amount should the property go into foreclosure.
- Default on PACE assessment can lead to loss of property.*

Source: U.S. Department of Energy. <http://energy.gov/leere/scl/property-assessed-clean-energy-programs>, except for *.

*recognize the valid public purpose associated with PACE, they're willing to treat PACE assessments in arrears the same way they treat other property taxes and assessments.*⁹³

Residential PACE interest rates typically range from six to nine percent. The Consumer Action Coalition points out that these interest rates are low compared to credit card or contractor financing, but high compared to a home equity line of credit (HELOC) or second mortgage.⁹⁴

Depending on the particular PACE program, PACE assessments can be made on the same day as application, since they rely on the value of the home rather than on the credit-worthiness of the borrower. The average assessment is over \$20,000, and even though credit checks are not used in underwriting them, the typical FICO score of individuals receiving PACE assessments is between 700 and 720.

As of 2016, over \$3.3 billion had been put toward PACE financing for 132,000 residential energy projects. While 26 states have passed legislation enabling residential PACE, active programs only exist currently in California and Florida and communities in Missouri and New York. Almost 84 percent of the residential activity in the U.S. was generated by the Home Energy Renovation Opportunity (HERO) Program in California, operated by Renovate America. About 37 percent of residential projects included renewable energy.⁹⁵

Commercial PACE has been more widespread, with 46 active programs in 19 states, since it hasn't encountered the same regulatory objection. Enabling legislation has been adopted in 33 states and the District of Columbia, as of Q3 2016. Still, California and Connecticut account for about \$230 million of the \$332 million cumulative total financing since 2009. About 40 percent of the 998 commercial PACE projects included solar power, according to PACE Nation.⁹⁶

PACE financing can be used for low-income solar projects in two ways: 1) commercial PACE can finance solar deployment on multifamily housing or by nonprofits that serve low-income communities, and 2) residential PACE can cover homes owned by low-income residents.

Funding solar for nonprofits can be especially complicated, because they're unable to take advantage of tax credits and other tax benefits. In these cases, it may be useful to combine PACE financing with other financing tools, like the use of tax equity investors. In one example, commercial PACE financing was used to fund energy efficiency improvements and solar power at a HUD-assisted YWCA shelter for homeless women in Washington, D.C.⁹⁷ The project spent \$700,000 on energy improvements, including a 30 kW solar system for about \$120,000. PACE financing was used for \$635,000 while a tax equity investor and other sources supplied the balance.

PACE financing can be used for low-income solar projects in two ways: 1) commercial PACE can finance solar deployment on multifamily housing or by nonprofits that serve low-income communities, and 2) residential PACE can cover homes owned by low-income residents.

TABLE 3: **YWCA Benefits**

Property Owner: Annual Benefit	
Utility Savings	\$73,000
PACE Payments	\$(66,000)
Net Cash Flow	\$7,000
Equity Investor Benefits	
SREC Revenue	\$72,000
ITC	\$36,000
Depreciation	\$35,500
Total Benefit	\$143,500
Tax Equity	-\$65,000
Net Benefit	\$78,500

Source: PACE Nation

The property owner (the YWCA) was able to see utility bill savings that exceeded the PACE payments by \$7,000 per year.

The investor was able to monetize the federal tax credits (ITC) and depreciation over five years that the nonprofit YWCA would not have been able to use. A significant part of the revenue stream was the sale of the solar renewable energy certificates (SRECs), which amounted to \$72,000 over the term of the contract (see **Table 3**).

Ownership of the solar system will be transferred to the YWCA after 15 years.

A significant benefit of using PACE financing was that the property owner did not have to make a capital investment in the project, as shown in **Table 4**. PACE financing allowed a positive cash flow throughout the 15-year term. If the project were self-funded it would have had a payback period of just over 10 years.

A project called CivicPACE is working to bring PACE financing to tax-exempt organizations, such as nonprofits, affordable housing,

faith-based institutions, and schools, with a focus on Cincinnati, Austin, and Washington, D.C. The project is funded by the U.S. Department of Energy SunShot Initiative.⁹⁸

California Governor Brown announced the Multifamily PACE Pilot in 2015, in partnership with the MacArthur Foundation. This pilot will enable PACE financing for certain California multifamily properties, including specific properties within the portfolios of HUD, the California Department of Housing and Community Development, and the California Housing Finance Agency. The \$3 million program of technical assistance and

TABLE 4: **YWCA Finances: Self-Funded v. PACE-Funded**

	Self-Funded	PACE
Investment by Property Owner	\$700,000	\$0.00
Annual Utility Savings	\$77,000*	\$73,000
Annual PACE Payment	\$0.00	\$(66,000)
Net Benefit Year 1	\$(623,000)	\$7,000
Annual Net Benefit Year 2–15	\$77,000	\$7,000
5-year NPV of Cash Flows (@6% discount rate)	\$(305,000)	\$27,000
10-year NPV of Cash Flows (@6% discount rate)	\$(56,000)	\$58,000
5-year IRR	-15%	Infinite
10-year IRR	3%	Infinite

Source: PACE Nation *Includes SREC Income

credit support may include a loan loss reserve and/or a debt-service reserve fund. The pilot is intended “to inform project performance and repayment experience while managing finance risk perception.”⁹⁹

As discussed above, PACE could also be used to finance solar on homes owned by low-income residents. Rather than depend on credit scores or income levels, PACE lenders simply require homeowners to have enough value and equity in their homes to qualify for PACE financing. Underwriting tests typically require that borrowers have at least 10 percent equity in the home, that PACE financing not exceed 15 percent of home value, and that total property-related debt (mortgages plus the PACE assessment) not exceed the home’s value.

Because PACE participants aren’t ordinarily asked what their incomes are, there is little data on low-income customer participation. However, a survey focused on California’s HERO program, the largest residential PACE program in the country, found that PACE customers have similar income and education levels to the general population.¹⁰⁰ Customers that get energy-related rebates, on the other hand, tended to have much higher incomes and slightly more education than average.

For example, 58 percent of rebate participants had an income of \$100,000 or more, compared to 38 percent of HERO respondents and 36 percent of the general population. About 12 percent of PACE customers in the study earned less than \$40,000 per year, which is proportionally less than the general population, where 18 percent are in that income bracket.

The National Consumer Law Center and other low-income advocates argue that PACE financing is not appropriate for low-income homeowners, due to the risk of foreclosure and loss of the home if homeowners default on their payment.¹⁰¹ “Based on our experience with low-income consumers,” they write, “we oppose marketing of PACE loans to low-income households. Rather than encouraging struggling, low-income homeowners to take on additional debt, [agencies] should prioritize these homeowners for access to existing federal and state programs that provide free or low-cost energy efficiency upgrades.”

They point out that PACE interest rates are higher than some other financing options, especially in states with special finance programs for low-income homes, like the no-interest loan offered by the Mass Save HEAT program in Massachusetts. They argue that PACE assessments should be subject to the federal Truth in Lending Act (TILA) and other federal consumer protection laws. These laws require clear disclosure of costs several days before consummation of the transaction, the right to cancel the transaction within three business days, a ban on kickbacks, the right to dispute billing errors during servicing of the loan, and clear rules for enforcement. Legislation to regulate PACE under the TILA was recently introduced in Congress.¹⁰²

The biggest risk of PACE is that it is based on the value of the home, not on the ability of the customer to repay the assessment. NCLC cites this as perhaps the most dangerous aspect of PACE finance for low-income home-owners, and calls it out for special regulatory attention. Consumer protection rules could help make PACE programs more appropriate for low-income homeowners. Specifically, if each project involved an assessment by a trusted third party that the project was likely to be cash-flow positive, saving more money in electric bills than it cost, the risk to homeowners could be significantly reduced. A project that is cash-flow positive should make it easier for homeowners to meet all of their financial obligations.

Pay As You Save

With Pay As You Save (PAYS), the utility rather than the homeowner invests in the energy upgrade. The utility gets paid back through the customer's tariff. There is no loan or lien, and the repayment obligation stays with the property rather than with the customer. The monthly repayment charge is always lower than the money saved from reduced energy, and it remains on the bill for that location until all costs are recovered.

PAYS has been adopted by four rural electric coops to finance energy efficiency improvements, including some regions with severe economic distress. As mentioned earlier, the Ouachita Coop in Arkansas started using an on-bill repayment approach in 2015, but recently switched over to a PAYS approach, to better reach renters and low-income households, with limited capacity to take on debt.

In the first quarter of operation, renters accounted for one-third of the participants. (Renters had been ineligible to participate in the previous loan program.) More than 60 multifamily housing units were assessed in the first quarter and all of those residents accepted the energy efficiency offer by opting into the tariff.¹⁰³

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Compensating for Low or No Credit Scores

Every kind of financing is affected by the perceived ability of the customer to repay it. The most common way to measure a person's ability to pay is through a credit score, which is derived from payment history, debt burden, the length and type of credit used, and

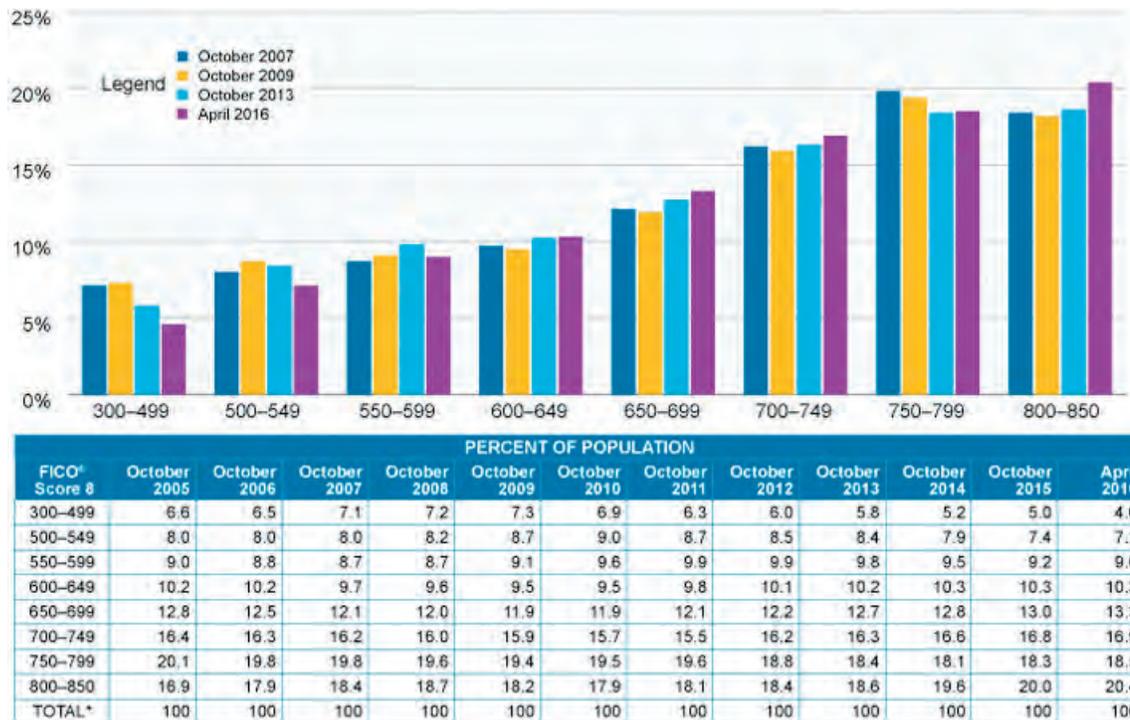
other factors. Credit cards, home and car loans, and student loans are the most common forms of credit history. Low-income customers who don't take loans or use a credit card may have a low credit score, or none. See Box 1 on page 12 on the correlation between low income and low credit scores.

According to the Fair Isaac Corporation (FICO), credit scores have been improving since the housing crash and recession of 2008. The national average FICO score is at an all-time high of 699, while 20.7 percent of consumers have scores less than 600.¹⁰⁴

The Green Jobs–Green New York program has developed two tiers of qualifications for making loans for energy efficiency and solar power. Tier 1 loans use standard underwriting criteria relying primarily on credit scores and debt-to-income ratios. Tier 2 uses mortgage payment history instead of FICO scores, and a sliding debt-to-income ratio requirement to account for reduced household energy costs. These changes address what are “currently the most common cause of loan denials.” Tier 2 loans made up 12 percent of loans made under the program as of June 2015.¹⁰⁵

Additional approaches are being tested by the Solstice Initiative, a nonprofit community solar marketer in Massachusetts. With funding from the U.S. Department of Energy SunShot Initiative, Solstice will use customer data on income, FICO score, and utility, rent, and cell phone repayment history to develop new qualifying metrics for low-income households. They

FIGURE 6: Annual U.S. Consumer Credit FICO Score Ranges Since 2005



All columns may not add up to 100% due to rounding. © 2016 Fair Isaac Corporation

will then enroll customers in community solar programs and compare actual payment.¹⁰⁶

Another way to address the credit problem is through credit enhancement tools, such as loan guarantees or loan-loss reserves, offered by a public agency. These tools reduce the risk of lending to customers with lower credit scores or debt-to-income ratios by either guaranteeing the loan itself or providing a fund that lenders can apply to for repayment of defaulted loans.¹⁰⁷ The \$30 million Mass Solar Loan program, launched in December 2015, is one example of a loan-loss reserve and has additional incentives for low- and moderate-income customers (with thresholds based on household size).¹⁰⁸

For more information on solar loan program design, see CESA’s Sustainable Solar Education Project guide titled *Publicly Supported Solar Loan Programs: A Guide for States and Municipalities*.¹⁰⁹

Third-Party Ownership Models

Many states allow third parties to own rooftop solar systems and provide solar power to a customer through a lease, a power purchase agreement (PPA), an energy service agreement, or a managed energy service agreement. These third-party ownership models are used to develop, fund, and deploy energy improvements.

Nine states specifically prohibit third-party arrangements for solar, while the legality is unclear in another 15 states. These states could stimulate solar deployment for low-income customers by enabling third-party ownership.¹¹⁰

TABLE 5: Green Jobs–Green New York Two-Tiered Loan Underwriting Standards (AS OF JUNE 20, 2015)

Standard	Tier 1 Loans	Tier 2 Loans
Minimum FICO	640 (680 if self-employed for 2 years+) (720 if self-employed <2 years)	540
Mortgage payment history	None	Current on all mortgage payments, if any (as reported on the credit report), for the past 12 months. No mortgage payments more than 60 days late during the past 24 months.
		Up to 70% for FICO 540–599
		Up to 75% for FICO 600–679
		Up to 80% for FICO 680+
		Up to 100% for applicants who are qualified as owner-occupants for Assisted Home Performance with ENERGY STAR Subsidy for the subject property of the loan (\$5,000/50%).
Max Debt-to-Income Ratio	Up to 50%	Up to 70% for FICO 540–599
Bankruptcy	No bankruptcy, foreclosure, or repossession within last 7 years	No bankruptcy, foreclosure, or repossession within last 2 years
Judgments	No combined outstanding collections, judgements, charge-offs, or tax liens >\$2,500	

Source: Green Jobs-Green New York, 2015 Annual Report. https://www.nyserda.ny.gov/_/media/Files/EDPPP/GJGNY/Annual-Report-GJGNY/2015-GJGNY-Annual-Report.pdf.

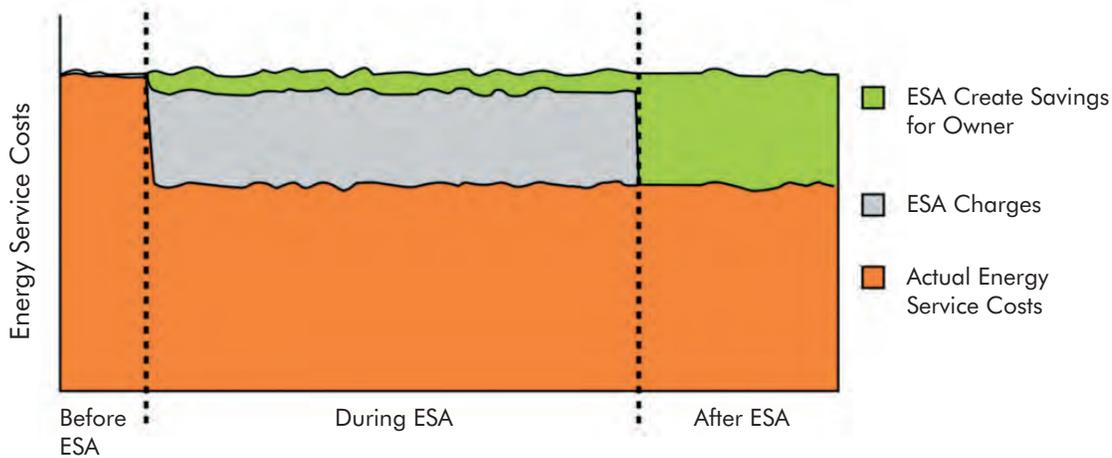
The most common third-party ownership models for solar—PPAs and leases—are used when a developer installs solar on the customer’s property and either leases it to or sells the power to the customer. Third-party models dominated the solar industry for several years, since they allowed customers to go solar with “no money down.” More recently, as the price of solar installations has dropped, customers are increasingly likely to own the system outright.¹¹¹

Under an energy service agreement (ESA), the third-party provider is paid by the energy savings from the project, at a net savings to the customer.¹¹² With a managed energy services agreement (MESA), the third-party takes over paying the customer’s utility bill. The MESA provider then invests in energy efficiency and onsite generation to reduce their expenses.

ESAs and MESAs have been most common for energy efficiency projects with commercial and industrial customers, including low-income multifamily housing. They are less commonly offered to single-family residential customers. One example is Sealed, a company that offers a shared savings deal to homeowners in New York.¹¹³

Third-party solar providers have only rarely served low-income customers. Because credit score is an important factor in determining the financial risk of taking on a customer, low-income customers with perceived poor credit scores have not been attractive to marketers.

FIGURE 7: **Profile of an Owner's Energy Service Costs**



Source: Associated Renewable

Yet third-party ownership may be advantageous to a low-income consumer, since the company maintains the system, is responsible for regulatory and equipment risk, and the service can be transferred to the new owner in event of a home sale. For low-income seniors, especially, having someone else monitor, operate, and maintain the system would be a boon.

At least one solar company, PosiGen, is marketing to low-income communities. Based in New Orleans and currently operating in three states, PosiGen offers the “Solar for All” product, a standardized PV installation in three sizes sold under a 20-year lease for between \$55 and \$99 a month, with no deposit, no credit check and no background check.¹¹⁴ They have sold nearly 1,000 solar leases to Connecticut homeowners, two-thirds of whom were low- or moderate-income.

PosiGen combines solar with energy efficiency, by integrating with state efficiency programs in Connecticut and offers a 20-year energy service agreement for efficiency measures in Louisiana. Because the combined efficiency and solar faithfully delivers savings, they claim to have “very low” default and delinquency rates. PosiGen retains control of the solar systems and can turn them off remotely. This shows the homeowner that they are better off paying for the solar system than reverting to the utility bill.

In Connecticut, PosiGen works closely with the Connecticut Green Bank, which provides subordinated debt into the lease fund, a performance-based solar incentive with elevated rates for qualifying low-to-moderate income customers, and collaborates on community-based outreach campaigns, recruiting low-income customers in four cities. PosiGen has tax equity partners who can take advantage of federal tax credits. They have explored getting discounted financing from banks under their Community Reinvestment Act obligations (as discussed later) but have had limited success due to the relatively complicated structure of transactions.¹¹⁵

States can accommodate third-party ownership models in low-income solar program design. The SASH program in California was recently revised to allow a third-party ownership model. By partnering with the financial services firm Spruce (formerly Clean Power Finance and Kilowatt Financial LLC) the SASH program can better capture federal Investment Tax

Credit (ITC) benefits, plus participating families receive the benefits of a performance guarantee, system monitoring, and a 20-year warranty coverage. SASH continues to offer a rebate of \$3 per watt, which covers a significant portion of system costs. Third-party owned projects have quickly become the method of choice for the program, accounting for over 70 percent of systems installed during the first half of 2016.¹¹⁶

Group Purchase Programs (Solarize)

The cost of solar can be driven down through bulk purchases. “Solarize” programs have implemented intensive short-term marketing and outreach campaigns in specific communities as a way to reduce costs and increase sales.

Solarize initiatives have been run by states, municipalities, and nonprofit organizations across the country, including in large cities such as New York, Portland, and Washington D.C. In some cases, campaigns have also organized around particular affinity groups (businesses, churches, and colleges, for example) rather than by municipality.

Solarize campaigns have been run specifically to attract interest from low-income consumers. PosiGen has worked with the Connecticut Green Bank to do campaigns in low-income communities designated as “distressed” by the state. Their “Solar for All” campaign in Bridgeport has installed over 250 PV systems since 2015.

While not aimed specifically at low-income households, the Solarize Connecticut effort has sold 2,400 systems in 73 municipalities, including in nine of the 25 designated distressed communities. The program has been successful overall, cutting costs as much as 25 percent lower than systems installed outside the campaigns.¹¹⁷ The participation of low-income customers is currently being studied by Yale researchers, with funding from a U.S. Department of Energy SunShot Initiative grant.¹¹⁸

For more information on Solarize program design, see CESA’s guide titled *Planning and Implementing a Solarize Initiative: A Guide for State Program Managers*.¹¹⁹

Crowdfunding

Crowd-sourced funding, where donations or investments are solicited from the public, was initially seen as a major opportunity for low-cost solar financing, especially for “socially worthy” recipients like nonprofit organizations and low-income households.

A hallmark of crowd-sourcing is that it involves investors that are not “accredited;” accredited investors have an income of over \$200,000 per year and a net worth of over \$1 million. Crowd-sourced investors can either be seeking a market rate of return, a less than market rate (so called “mission” investing), or making a charitable donation.

Solar Mosaic, based in Oakland, was a leading early proponent of crowdfunding, organizing about \$5 million in financing for a few dozen projects. In 2014, Mosaic switched to financing residential solar projects through large institutional investors, due to the higher efficiency of raising a large amount of capital from one source rather than from many sources.

The market maturity and declining cost of solar have attracted more conventional funding sources, like investment banks, reducing the need to try alternative pathways. Nevertheless, crowdfunding can still be a good match for certain types of projects that seek to benefit

low-income communities. Moreover, the federal Jumpstart Our Business Startups Act or JOBS Act, may encourage more crowdfunding by easing various securities regulations. Passed in 2012, the implementing rules went into effect in May 2016.¹²⁰ The rules were heavily criticized, however, and legislation to reform them, the Fix Crowdfunding Act (H.R. 4855), passed the House in July 2016 and is pending in the Senate.¹²¹

Over 30 states allow crowdfunding between investors and projects within their state (intrastate), while another eight states have pending legislation.¹²² These states tend to have more flexible rules and higher investment limits, which may encourage more investment.

At least three companies continue to offer crowd-sourcing for nonprofit solar projects: CollectiveSun, RE-volv, and Everybody Solar.

RE-volv has completed only four projects to date, but it aims to raise \$3 million to finance solar energy systems for over 100 nonprofits over the next three years. One of its recent projects was completed in August 2016, putting solar on Serenity House, an outreach ministry of the Arch Street Methodist Church in North Philadelphia. Working with Swarthmore College students, the project raised \$15,000 in donations to cover the cost of the installation. Arch Street will pay RE-volv for the installation over a 20-year lease, with payments 15 percent less than Serenity House's current electricity bill. RE-volv plans to reinvest these lease payments into future solar projects.¹²³



© RE-volv

Another model is Everybody Solar, based in Santa Cruz, California, which accepts donations for specific solar projects that benefit nonprofit groups, such as homeless shelters and job training workshops. The donations pay the full cost of the system, which is given free of charge to the nonprofit. Everybody Solar currently has fully funded four projects and is fundraising for a fifth.¹²⁴

CollectiveSun offers a different model, “crowd lending,” exclusively to nonprofit organizations, such as churches and group homes. While the main benefit that CollectiveSun provides nonprofits is its ability to apply tax credits to reduce any nonprofit solar installers bid by 15 percent, the company also offers assistance to its nonprofit partners in financing the remaining cost of the system.

CollectiveSun works with the nonprofit to recruit individual lenders to finance a solar project. The lending is provided by supporters of the nonprofit, with interest and loan duration set by the nonprofit, but typically around four to five percent for 10–12 years. The loan terms are set so the energy savings are greater than the annual debt service obligations. Crowd lending can be combined with other sources of finance, such as bank loans, PACE, and program-related investments from foundations.

Todd Bluechel, the Vice President of Sales for CollectiveSun, thinks crowd lending works better than a donation model for nonprofits, since it doesn’t compete with other donations.¹²⁵

The nonprofit uses the crowd-lent money to buy a prepaid PPA from CollectiveSun. With a prepaid PPA, the customer pays for the electricity upfront, rather than monthly. The nonprofit then repays the crowd-lenders at a rate less than what it had been paying for electricity.

CollectiveSun owns the project for the first six years to capture the tax benefits and accelerated depreciation. At that point, ownership of the system transfers to the nonprofit. Since the prepaid PPA rate includes the cost of the transfer, there is no additional charge to buy the system. The nonprofit may continue to pay its lenders after the transfer, depending on the duration of the loan.

CollectiveSun has completed about a dozen projects and claims to have about 150 in the pipeline.

Federal Economic Development Programs

There are a host of existing federal policies and programs for low-income people and communities that do or could provide funding for low-income solar energy. As solar becomes more cost effective, it becomes increasingly attractive as a way to reduce living expenses, lower the cost of providing services, promote local economic development, and improve the environmental quality of a community.

State and local governments and quasi-public bodies are often the implementing agencies for these federal programs, through block grants or other means. In other cases, the federal government can be a partner, supporting programs created at the state or local level. Understanding the scope and rules of these programs can help to identify additional pathways for financing low-income solar initiatives.

Given the vast scale of the federal government and the potential for change in the new administration, the discussion of options here is not comprehensive.

Community Development Financial Institutions (CDFI) and **Community Development Entities (CDE)** are institutions designed to encourage economic development in low-income communities. They are typically banks or credit unions with a primary mission of community development, serving a specific target market, providing development services, and with oversight by a community. There are about 1,000 certified CDFIs in the United States, which originated \$3.4 billion in loans and investments in 2015. CDEs primarily serve to implement New Market Tax Credits.¹²⁶

These institutions draw on a variety of federal financial programs, including the Community Development Financial Institutions Fund, Financial Assistance and Technical Assistance Awards, and New Market Tax Credits.

The Community Reinvestment Act (CRA) of 1977 requires banks to do business in low-income communities. It was enacted in response to “redlining” practices, where banks would refuse to finance activity in low-income communities and communities of color. The Act does not require banks to undertake specific or risky or unprofitable measures. Instead, regulators periodically evaluate a bank’s record on meeting CRA obligations, such as making loans to people of different income levels and businesses and farms of different sizes, and the geographic distribution of loans. That evaluation can influence regulatory decisions about expanded operations, mergers, and acquisitions. As a result, banks have created special CRA-related lending programs, adopted more flexible underwriting practices, educated potential borrowers, facilitated government programs for low-income communities, and coordinated with public and private institutions.¹²⁷

CRA activity has already included clean energy. The Solar and Energy Loan Fund (SELF), a CDFI based in Florida, has financed more than \$2 million of energy upgrades since 2011, typically in small loans to households. For example, the fund received a CRA loan of \$300,000 from PNC Bank in 2014 to finance home energy upgrades for low- and moderate-income households.¹²⁸

Federal agencies recently updated their official guidance on the interpretation and application of CRA regulations. In their guidance, they specifically note that clean energy qualifies for community development loans “when the renewable energy or energy-efficiency improvements help reduce operational costs and maintain the affordability of single-family or multifamily housing or community facilities that serve low- and moderate-income individuals.”¹²⁹

Public Welfare Investments are bank investments (as opposed to loans) in community and economic development entities and projects that are designed primarily “to promote the public welfare.” Such investments help the bank meet CRA requirements, and can include affordable housing, homeless shelters, projects to serve disabled and elderly low-income people, and projects qualifying for the Low-Income Housing Tax Credit (LIHTC). Banks

As solar becomes more cost effective, it becomes increasingly attractive as a way to reduce living expenses, lower the cost of providing services, promote local economic development, and improve the environmental quality of a community.

can also invest in economic development and job creation for low-income communities, including renewable energy projects in low-income communities.¹³⁰ US Bank and Bank of America used their Public Welfare Investment authority to support solar projects in California that benefited low-income communities, including 11 rental housing communities in the MASH program.¹³¹

The New Markets Tax Credits (NMTC) program allocates tax credits to CDEs to bring private investment to low-income communities. Between 2003 and 2014, \$38 billion in direct NMTC investments were made in businesses, leveraging nearly \$75 billion in total capital investment to businesses and revitalization projects in communities with high rates of poverty and unemployment. The program was reauthorized in 2015 for five years, at \$3.5 billion annually.¹³²

A number of renewable energy projects have used the NMTC, which can be worth as much as 39 percent of project costs over five years, including solar projects at the Cincinnati Zoo and the Salt Lake County Convention Center.¹³³ Thirteen states have their own state NMTC programs.¹³⁴

The Low-Income Housing Tax Credit (LIHTC) gives investors a federal tax credit for development of low-income units in rental housing projects, over a 10-year period. The credit is permanent under the law, but the amount of the credit fluctuates; new legislation in 2015 creates a minimum value of nine percent of the project investment. States are allocated credits based on population, and give them out following a Qualified Allocation Plan (QAP).¹³⁵ The credits can be used in combination with federal renewable energy tax credits and may qualify as a CRA activity for banks.

State Qualified Allocation Plans often include green building criteria, including energy efficiency and renewable energy, which are used in scoring bids from potential developers. As of 2010, all states had at least one green building criteria in their QAP, while some incorporated third-party certification programs, like Enterprise Green Communities.¹³⁶ (See **Figure 8**.) QAPs can be updated periodically to incorporate new applications, like solar power.

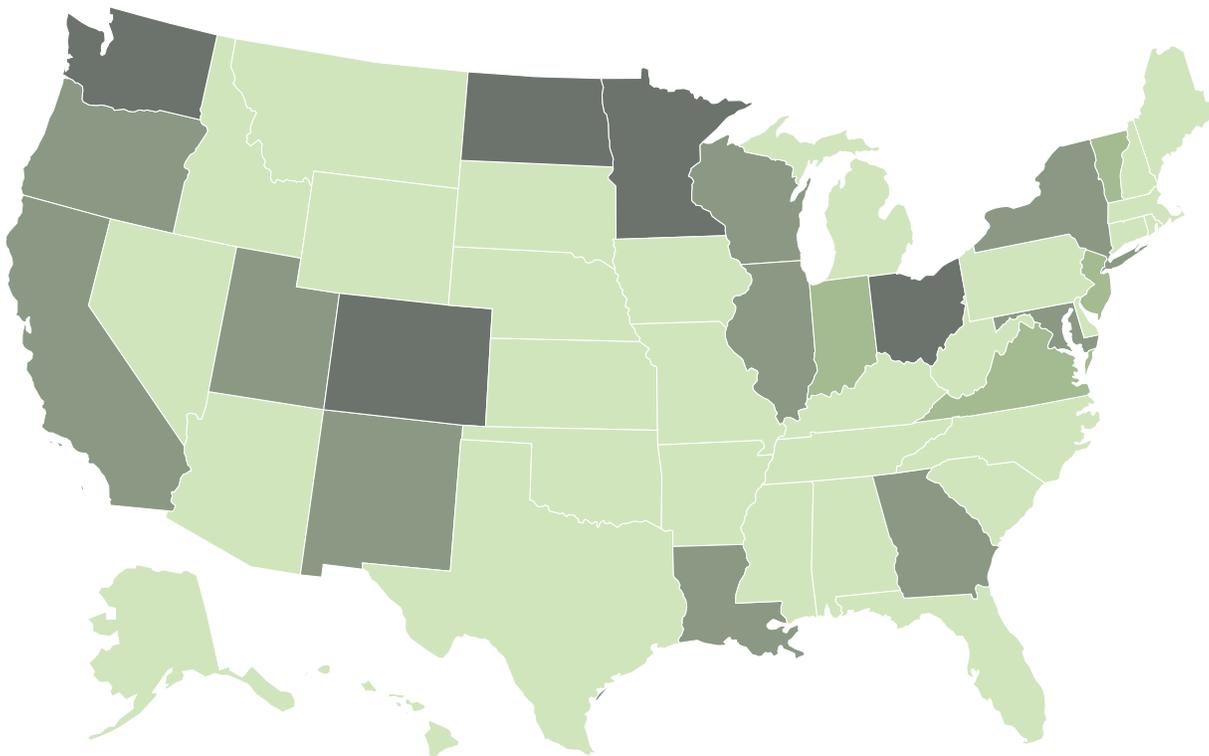
Green building criteria in QAPs can be supplemented with requirements for publicly-owned housing, and with developer incentives, like fast-track permitting or greater density allowances for new construction.

Green financing from federal entities, such as Fannie Mae and Freddie Mac, the government-sponsored enterprises that support mortgage lending, plus the Federal Housing Administration (FHA, part of HUD), all offer “green financing” products and policies to encourage greater energy efficiency in housing. While these offerings are not specifically geared toward low-income homeowners, they can help reduce housing costs through lower energy bills.

Fannie Mae financed \$1.2 billion in Green Rewards loans in the first half of 2016. Freddie Mac rolled out its program in July of 2016. Both offer a similar suite of discounted loans for qualified buildings. They claim to have reserved \$550 million in loans in the first month of operations.¹³⁷

Many programs are aimed at multifamily housing. In 2009, the FHA began offering mortgage insurance premium reductions on green multifamily loans, a program it enhanced earlier this year. Fannie Mae’s Multifamily Green Financing program started in 2012, offering

FIGURE 8: **Green Building Measures in Low-Income Housing Tax Credits**



Green Building Programs Selected as Threshold or Incentive Criteria

- Enterprise Green Communities Criteria
- Enterprise Green Communities & Other Third-Party Green Building Programs
- Other Third-Party Green Building Programs
- QAP incorporated at least one green building measure such as Smart Growth, Health Protection, Energy Efficiency, or Resource Conservation

Source: Enterprise Community Partners, *Green Affordable Housing Policy Toolkit*, 2010

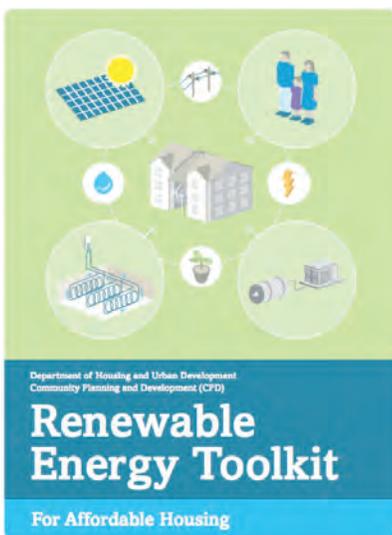
a suite of financing products that encourage energy and water upgrades at existing multi-family housing. Their products, including Green Rewards and Green Preservation Plus, offer lower interest rates and additional loan proceeds, plus free energy and water audits.

Others address single-family homes. Under its PowerSaver program, FHA offers loans for energy improvements, including a second mortgage of up to \$25,000 for energy efficiency, solar PV, solar hot water, geothermal, or other renewable energy projects.¹³⁸ The loans are intended for owner-occupied homes, and require a minimum credit score of 660.

FHA also offers an Energy Efficient Mortgage, under its Solar and Wind Technologies policy, that allows borrowers to get a larger mortgage to pay for a new solar or wind energy system at the time of home purchase or refinance.¹³⁹

Housing and Urban Development offers a suite of programs that provide funding and support for low-income communities and can be used for renewable energy. Altogether, these programs have spent almost \$100 billion since 2003.¹⁴⁰

- **Renew 300: Advancing Renewable Energy in Affordable Housing** is a new program with a goal of deploying 300 MW of solar for federally-supported affordable housing by 2020, and includes rooftop, community, and shared solar installations. HUD provides technical assistance but not funding through this program.¹⁴¹
- **The Community Development Block Grant (CDBG)** program has given block grants to local government for forty years. CDBG funds have supported solar on low-income housing, on water treatment plants in low-income communities, and on institutions that provide services to low-income clients. It also includes a loan guarantee element under Section 108.
- **The Neighborhood Stabilization Program** gave out \$7 billion in federal grants under the CDBG program between 2008 and 2010, for rehabilitating blighted properties.
- **The HOME Investment Partnerships Program (HOME)** provides formula grants to states and localities—often in partnership with local nonprofit groups—to fund a wide range of activities including building, buying, and rehabilitating affordable housing or providing direct rental assistance to low-income people. It is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households.
- **Self-help Homeownership Opportunity Program (SHOP)** awards grant funds to nonprofit organizations that use “sweat equity” and volunteers to build homes for low-income families. This could include the Habitat for Humanity solar projects discussed later.



HUD released the *Renewable Energy Toolkit* report in July 2016 for recipients of HUD Community Planning and Development grants “to make renewable energy and on-site generation systems part of their affordable housing development programs” under the HOME, CDBG, Housing Opportunities for Persons with AIDS (HOPWA) or Emergency Solutions Grant programs.¹⁴²

The toolkit gives specific guidance about renewable energy technologies, assessment, financing, and deployment on affordable housing. One notable financing tool it cites is the Section 108 loan guarantee component of the CDBG Program. It can be used to finance economic development, housing rehabilitation, public facilities and large-scale physical development projects. Its flexibility “makes Section 108 one of the most potent and important public investment tools HUD offers to local governments,” according to the toolkit, including the ability to invest in renewable energy projects.

U.S. Department of Agriculture programs, such as the USDA’s Office of Rural Development (RD) programs that provide rural economic development and support to impoverished rural communities, can provide assistance. Since 2009, USDA has provided financing for more than 14,000 energy projects nationwide through \$2.1 billion in loans, loan guarantees, and grants.

- **The Rural Development Multi-Family Housing Energy Efficiency Initiative** incorporates energy improvements into various pre-existing rural housing programs. The funding guidelines note that on-site generation “will earn additional...points and increase a project’s viability regarding USDA-RD program funding.”¹⁴³
- **The Energy Efficiency and Conservation Loan Program** provides low-interest loans to Rural Electric Coops for energy improvements. It has given out almost \$60 million in loans since inception in 2013.¹⁴⁴
- **The Rural Energy for America Program (REAP)** provides grants and loans for energy efficiency and distributed renewable energy projects in rural areas. It is not earmarked for low-income customers, but can be used for that purpose. REAP was created in 2002, and between 2008 and 2016 helped to finance 10,753 renewable energy and energy efficiency projects with almost \$360 million in grants and \$430 million in loan guarantees.¹⁴⁵

Green Banks

A green bank is a government-supported financial institution—typically a state but also at the local level—that promotes clean energy through financial offerings.¹⁴⁶ A green bank is not a policy, but rather a platform that can implement or facilitate a variety of financial programs. State green banks exist in Connecticut, New York, and Hawaii. The first local green bank was in Montgomery County, Maryland. Mayor Bowser recently proposed starting one in Washington, D.C.,¹⁴⁷ and the Nevada legislature is considering instituting one in its state as well.¹⁴⁸

Green banks can provide affordable financing for low-income solar projects by providing credit enhancement mechanisms, such as loan guarantees or loan-loss reserves, or by providing low-interest loans to project developers.

For example, the Connecticut Green Bank helps multifamily housing owners with third-party PPAs for solar, owning, maintaining, and insuring the system and selling power to the building owner under a 20-year term.¹⁴⁹ It also works with Capital for Change, Inc (C4C) (formerly the Connecticut Housing Investment Fund) to market a Low Income Multifamily Energy (LIME) Loan, an unsecured loan for units with many low-income tenants, and offer gap financing and credit enhancement options.¹⁵⁰

Green banks can provide affordable financing for low-income solar projects by providing credit enhancement mechanisms, such as loan guarantees or loan-loss reserves, or by providing low-interest loans to project developers.

Place-Based Investments

A community can be targeted for special assistance through place-based investments, such as through an Energy Special Improvement District (E-SID). Local governments can authorize a district to be eligible for financing for energy improvements. The project can be funded through sales of revenue or general obligation bonds, with property owners in the E-SID

paying back the improvements through a property assessment. As of 2012, E-SIDs were authorized in 27 states and Washington, D.C.¹⁵¹

The Center for Social Inclusion has proposed a variation on the E-SID concept called Energy Investment Districts, specifically for attracting energy investments to low-income communities. The EID would be managed by a trust and a community board, which could be hosted by a CDFI or other institution. The trust would be responsible for attracting funds from public and private sources that would be invested in clean energy. Unlike an E-SID, the goal is to have greater community input, a focus on low-income communities, and the flexibility to facilitate multiple sources of income.¹⁵²

One example of an Energy Investment District is in Fayetteville, Arkansas. Legislation in 2013, which enabled PACE financing in Arkansas, also allowed cities, counties or the state to create E-SIDs. Fayetteville's Energy Improvement District Number 1 was created in October 2013 to implement and manage PACE for the City of Fayetteville.¹⁵³ The District has the authority to issue municipal bonds to finance the PACE programs, provide loans to interested residents, and create and manage a revolving loan fund that helps make the program sustainable. The only customer so far to use PACE for energy efficiency improvements is Communities Unlimited, a nonprofit whose mission is "to move rural and under-resourced communities in areas of persistent poverty to sustainable prosperity." Four other businesses have applied.¹⁵⁴

Reduced-Cost Solar Development

While falling costs have helped make solar more affordable for all customers, making it even cheaper can increase deployment for low-income customers. Some nonprofit organizations have been tapping volunteer labor and donated equipment to drive down the installation cost for low-income solar projects.

The federal AmeriCorps program, with an annual budget of \$1 billion, has supported volunteer and job training activity since 1994, including the GRID Alternatives SolarCorps program since 2006.¹⁵⁵

PG&E, one of California's major investor-owned electric utilities, has worked with the nonprofit Habitat for Humanity since 2005 to incorporate solar into homes built by Habitat in the PG&E service territory. The company has donated \$10.6 million worth of equipment while PG&E staff have volunteered 12,000 hours to help build over 600 solar homes. Each house is estimated to save the occupant \$500 per year in energy costs.¹⁵⁶

The local Habitat chapter in Traverse City, Michigan, is building a neighborhood of affordable homes that are "net zero," homes that produces as much energy as they consume over a year. The super-efficient, all-electric homes have 7.4 kW solar systems. Habitat plans for 20 housing units when fully built. Volunteers help build the houses, including the homeowner, who puts in "sweat equity" as a condition of ownership.¹⁵⁷

The McKnight Lane Affordable Housing Development in rural Vermont demonstrates how solar, paired with energy efficiency and battery storage systems, can bring economic and energy security benefits to tenants. The project consists of 14 high-efficiency modular homes with solar and battery systems, owned by the Addison County Community Trust and rented to qualifying low-income tenants. The result is net-zero energy costs for the owners plus

backup power for emergencies for the tenants. The batteries also allow the local utility, Green Mountain Power, to manage peak energy demand and reduce costs for all customers.¹⁵⁸

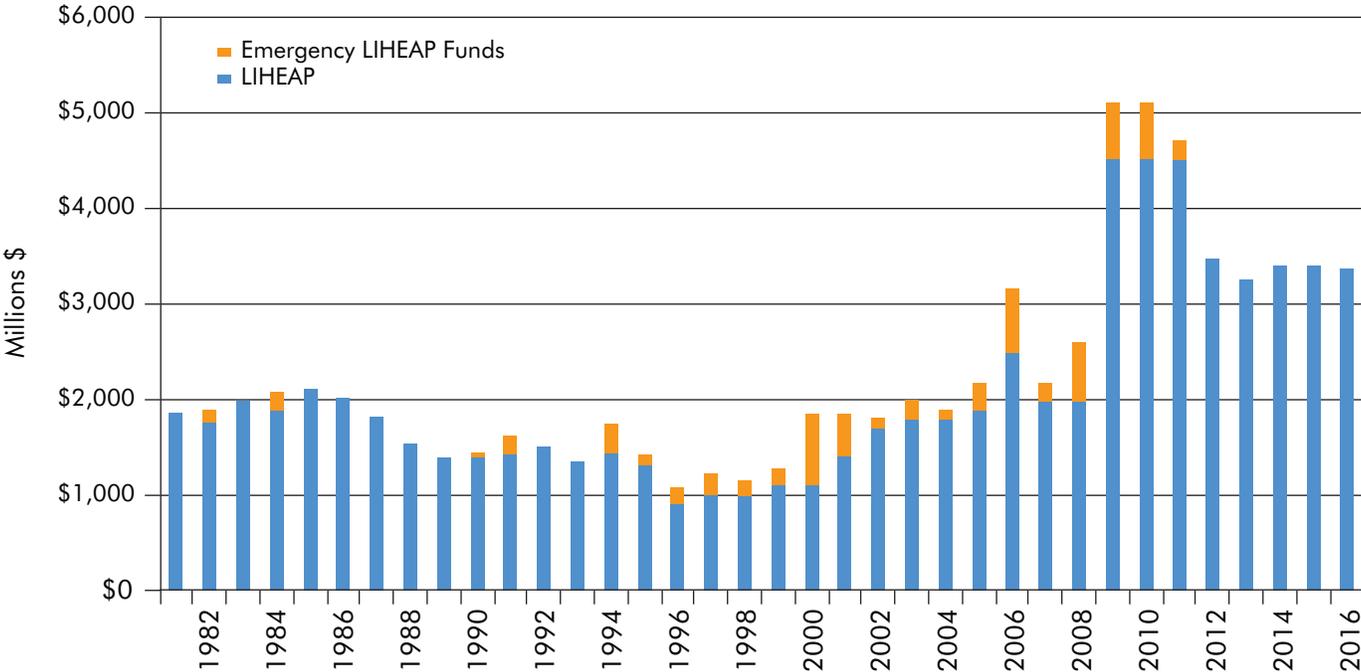
ADAPTING CURRENT LOW-INCOME ENERGY POLICIES TO SOLAR

Federal and state governments have a long history of providing energy support for low-income customers through discounted rates and such programs as the Weatherization Assistance Program (WAP) and the Low-income Home Energy Assistance Program (LIHEAP). These policies and programs are beginning to use solar as another tool to reduce energy burdens for low-income customers.

LIHEAP, administered by the Department of Health and Human Services (HHS), helps pay heating and electricity bills for low-income customers. As shown in **Figure 9**, LIHEAP has been funded at around \$3.4 billion per year in recent years.¹⁵⁹ The much smaller WAP pays to make homes more energy efficient, thus reducing energy burdens in the future. WAP is administered by the U.S. Department of Energy. As shown in **Figure 10** (p. 58), WAP has been funded at over \$200 million per year over the past three years. Both programs are implemented by states.

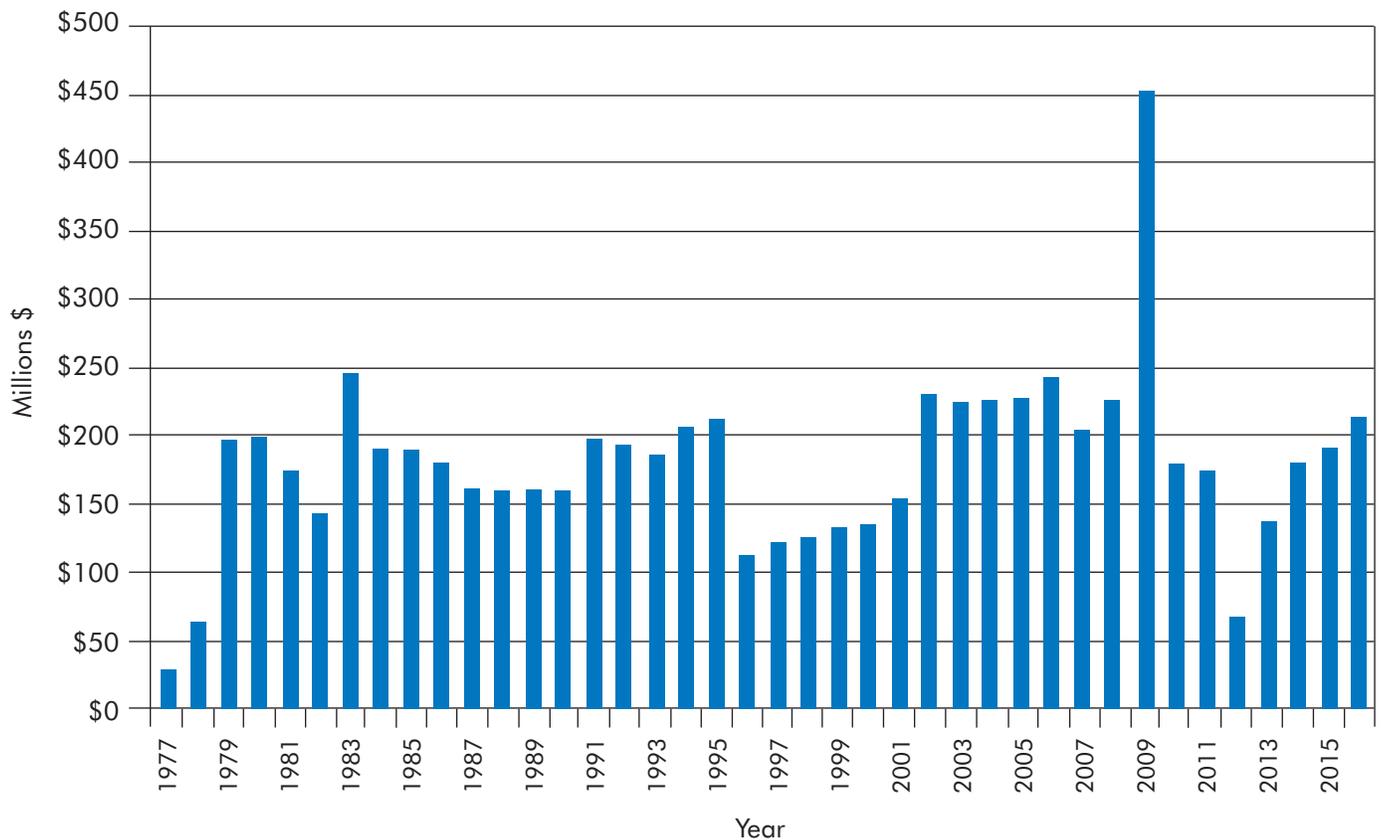
The energy saving measures supported by WAP funds have to pass a cost-effectiveness screen to be eligible, as determined by the U.S. Department of Energy. Solar PV was not an eligible technology until October 2015, when it was added in response to a request by the Colorado Energy Office.¹⁶⁰

FIGURE 9: LIHEAP Federal Funding Levels (1982–2016)



Source: LIHEAP Clearinghouse, https://liheapch.acf.hhs.gov/Funding/energyprogs_gph.htm.

FIGURE 10: **WAP Federal Funding Levels (1977–2016)**



Source: LIHEAP Clearinghouse, <https://liheapch.acf.hhs.gov>.

Colorado did its first weatherization project with rooftop solar in August 2016, along with efficiency measures like insulation, storm windows, low-flow showerheads, and LED bulbs.¹⁶¹ The PV system is expected to net roughly \$6,200 in energy cost savings over 20 years.

“WAP requires that all its home performance services be cost-tested through an approved energy audit to determine that the savings-to-investment ratio is one or greater,” according to the DOE. “The continued decline in the price of solar PV has made it possible for rooftop PV solar to meet this requirement. [The Colorado] project offers a glimpse of what’s next in the field of weatherization and demonstrates what other states can do to expand services.”¹⁶²

While LIHEAP is principally intended to help low-income customers pay energy bills, states are allowed to use some of the funds for energy conservation measures. The California Department of Community Services and Development set aside \$14.7 million from its annual LIHEAP allocation to fund a pilot program that put solar on low-income homes to reduce bills. From 2010 to 2012, the project funded solar systems on 545 single-family homes, plus 14 multifamily apartment building projects with 937 individual units.¹⁶³

The LIHEAP pilot led to California’s Single-family and Multifamily Affordable Solar Housing Programs (SASH and MASH). In 2014 and 2015, the state legislature allocated \$75 million and \$79 million in California Climate Investments (generated by the AB32

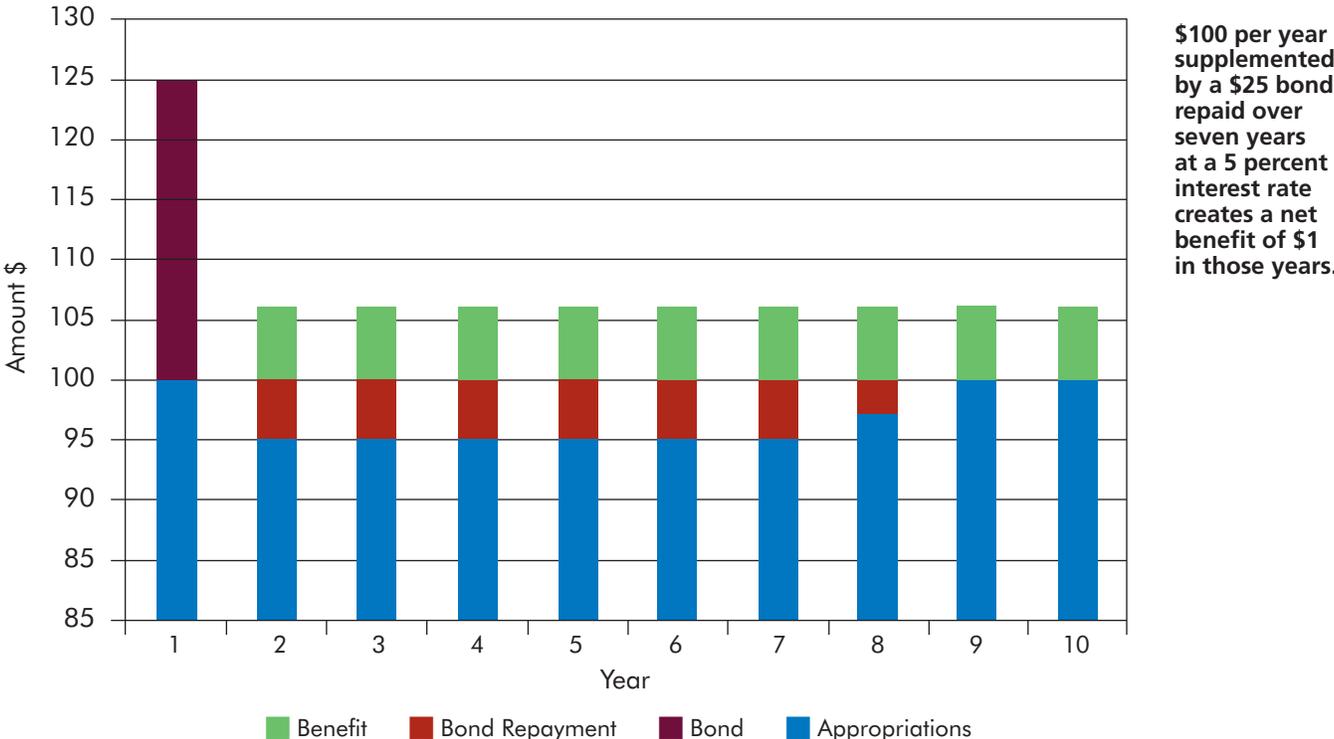
cap-and-trade program) for low-income weatherization projects administered by the Department of Community Services and Development. About one-third of the funds were earmarked for single-family solar projects. As of early 2016, \$6.3 million had been used to fund 582 solar projects.¹⁶⁴

One persistent objection to using LIHEAP funds for long-term investments like solar is that it could create a short-term cash flow problem, given that there is not enough LIHEAP funding to meet all current needs, let alone invest in future cost reductions.

One solution could be to finance solar LIHEAP investments with other investment vehicles, like a green bond, which can be paid back from future payments from LIHEAP that are equal to or less than the benefits they would have acquired. Several state and local governments have developed “green bonds” to finance environmental improvements.¹⁶⁵ For instance, in November 2016, New York announced a \$100 million green bond allowing the New York State Homes and Community Renewal’s Housing Finance Agency to finance over 640 “green and affordable” units for residents in four counties.¹⁶⁶

In the conceptual graph shown in **Figure 11**, LIHEAP appropriations of \$100 per year are supplemented by a \$25 bond in year one that delivers \$6 of annual benefits. The bond is repaid over seven years, at an interest rate of 5 percent, creating a net benefit of \$1 in those years. After the bond is repaid, the total LIHEAP investment will be delivering \$106 of annual benefits.

FIGURE 11: Conceptual Graph of \$100 per Year LIHEAP Appropriation with \$25 Initial Bond



Source: PaulosAnalysis

One risk factor that may deter investors is that LIHEAP funds are appropriated annually by Congress, and appropriations are uncertain.

Many states and utilities offer rate or bill discounts to low-income customers. As part of California's net metering proceeding before the California Public Utilities Commission (CPUC), IREC has proposed using solar as a way to reduce energy burdens for low-income customers in California, financed by the California Alternate Rates for Energy (CARE) program. CARE provides rate discounts worth \$1.3 billion per year to over 4.5 million households.

IREC's CleanCARE pilot program proposal would allow participants in the program "to redirect their share of CARE funds towards the purchase of renewable generation from a third-party owned renewable energy facility located in a disadvantaged community and receive the resulting net energy metering bill credits on their electricity bills." The program would ensure that the bill impact would be the same or greater than under the regular CARE program.¹⁶⁷ CleanCARE is being considered in the context of various CPUC dockets.

USING SOLAR FOR LOW-INCOME SUPPORT SERVICES

While solar programs can directly help low-income customers save money on their utility bills, customers can also benefit indirectly. Solar power can be used to lower the cost of providing support services to low-income communities, helping stretch limited budgets. States can develop solar programs to support providers of services to low-income communities.

Public Housing

Subsidized public housing is provided by state and local governments, as well as by nonprofit and for-profit organizations. As discussed previously, it is supported by a variety of funding mechanisms, many from the federal government.

Public housing agencies are using solar power to lower the long-term cost of providing housing. In Minnesota, the St. Paul Public Housing Agency signed a contract with Geronimo Energy to provide 10 high-rise apartment buildings with 100 percent solar through the state's Community Solar Garden policy. The buildings provide affordable housing to 1,600 low-income seniors and other individuals. The agreement will save the Authority an estimated \$130,000 per year in energy costs and over \$3 million over the life of the contract. The Authority will re-invest the savings to provide residents with affordable housing opportunities.¹⁶⁸

The New York City Housing Authority is planning an even larger solar project, with a goal of 25 MW of PV on city-owned buildings, along with a 20 percent cut in energy intensity.¹⁶⁹

In some cases, pairing solar PV with battery storage can enhance the value proposition for low-income housing developers. For instance, solar+storage can cut bills by reducing demand charges and by generating revenue through the provision of grid services. It also offers resiliency benefits, providing reliable power for essential electric services during outages.

Additionally, pairing battery storage with solar can provide more value to the utility. In the face of changing net metering policies and utility rate tariffs, storage may provide longer-term value than standalone solar systems do.¹⁷⁰ For more information, see the CESA guide for states and municipalities on *Solar+Storage for Low- and Moderate-Income Communities*.¹⁷¹



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Section 8 (Housing Choice Vouchers)

A larger number of low-income households live in privately-owned housing supported by the federal rent subsidy program called Housing Choice Vouchers, previously known as Section 8. There are two types of vouchers: tenant-based vouchers are given to support specific low-income families, and move with the tenant; and project-based vouchers are given to support properties that are dedicated to affordable housing.

HUD provides rental assistance to about three million households each year, including assistance with utility costs. As of 2007, HUD was paying in excess of \$5 billion per year for energy in public and subsidized housing, with over half of that for Section 8 housing.¹⁷²

Solar power could be used to reduce utility expenditures by tenants, landlords, and HUD, saving money for federal taxpayers. Project-based vouchers are more conducive to enabling solar, since the investments are literally attached to the building, rather than moving with tenants.

Depending on state laws, property owners could act as a utility and sell power to the tenants through a third-party PPA. HUD reimburses affordable housing owners for monthly utility costs, not for long-term solar investments. By using a PPA, the cost of solar becomes a regular utility cost.¹⁷³

Public housing agencies (PHAs) can also use energy service performance contract to get access to solar. In HUD's "Rate Reduction Incentive," a PHA that takes extraordinary steps to save energy can keep some or all savings from the contract, rather than passing the savings on to HUD. In some cases, PHAs can use PACE financing if they meet certain requirements, for example, if their FHA loan is in first position for recovery.

One chronic impediment to such ideas depends on who pays the bills, who benefits from the savings, and who owns the property. If the tenant pays the utility bill, the landlord has no incentive to invest in solar; and the tenants can't invest in solar since they don't own the property.

Another impediment for affordable housing is that rent levels are programmatically set. The rent level for affordable housing varies by program, but in many cases, tenants pay no more than 30 percent of their income for rent and utilities. If a solar improvement triggers a utility allowance adjustment, the tenant's rent may be raised to offset the utility cost savings. As a result, utility savings resulting from a solar improvement in an affordable housing project may not be captured by the tenant at all.¹⁷⁴ One workaround idea is to convert the value of community solar generation into a cash payment, rather than a discount on utility bills, and give the check to eligible tenants. Or HUD could source the power supply for tenant-based vouchers from community solar projects, in states that allow such flexibility.

Under its Renew 300 program, HUD is providing technical assistance to landlords, such as education, identifying sources of capital, and standardized legal forms.¹⁷⁵

Solar Infrastructure In Low-Income Communities

Solar can also provide benefits to the many support organizations that provide services to low-income residents and communities, such as nonprofits and government agencies.

Many of the financing strategies already discussed can be used by nonprofits, including power purchase agreements and crowd-funding. CollectiveSun, mentioned earlier, specializes in crowd-lending for solar projects on nonprofit organizations, including group homes and churches.

Soulardarity is a nonprofit group in Highland Park, Michigan, that is seeking to raise \$1.5 million to put solar-powered street lights in a low-income suburb of Detroit. In 2011, DTE Energy repossessed over 1000 streetlights from Highland Park, as part of a debt-forgiveness deal for non-payment of bills.¹⁷⁶ Soulardarity has installed six lights so far, and is raising money through community events, networking and crowd funding efforts. They recently organized a bulk purchase of 50 solar lights for alleys and homes.

The Just Community Solar Coalition in Minneapolis is working with churches and other organizations to help low-income communities benefit from the state Community Solar Garden program. They have recruited Shiloh Temple International Ministries, a Pentecostal church, to host a 200-kilowatt rooftop solar array that will supply community solar to subscribers in the neighborhood.

To reduce the risk of default from low-income customers who may have low credit scores, the Coalition is also recruiting "backup subscribers" who would take over a contract for a short period until a new subscriber is found. For example, a church may buy a 10 percent share of the project, but would agree to buy additional power that would have gone to any customers who default on payment.¹⁷⁷

SECTION 6

Conclusion

Public policy has long sought to reduce the burden of energy costs for low-income households through financial assistance and energy efficiency measures. The declining cost of solar power offers new opportunities to help the poor, while simultaneously reducing pollution, improving energy security and resiliency, and strengthening the economy.

In many ways, solar power is no different than other energy saving measures that can benefit low-income households. As solar begins to meet the cost effectiveness tests of those policies and programs, it can be a powerful new tool, expanding benefits and injecting a new level of interest and excitement.

Efforts to bring the benefits of solar to low-income consumers can benefit from the experience of utility energy efficiency programs, as well as from decades of experience in government programs to provide housing and alleviate poverty. There are many existing and emerging models that can be applied. What works best will depend on programmatic goals and local factors like utility rates, housing stock, income levels, community support, and the policy milieu of each implementing agency.

In this policy guide, we have sought to build on the work of others, as well as to contribute a few new ideas. As experience in the field increases, more insight will be gained as to what does and doesn't work well. This guide should be considered as just a starting point.

The declining cost of solar power offers new opportunities to help the poor, while simultaneously reducing pollution, improving energy security and resiliency, and strengthening the economy.

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Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy. CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

CESA works with state leaders, federal agencies, industry representatives, and other stakeholders to develop and promote clean energy technologies and markets. It supports effective state and local policies, programs, and innovation in the clean energy sector, with an emphasis on renewable energy, power generation, financing strategies, and economic development. CESA facilitates information sharing, provides technical assistance, coordinates multi-state collaborative projects, and communicates the views and achievements of its members.

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