WHEREVER THE SUN SHINES

Bringing Solar Power to All Households

Building from recent research testing strategies and messages that are most conducive to solar-adoption in low- and moderate-income (LMI) communities, this guidebook seeks to explain the challenges and opportunities for bringing solar to all communities.

The aim of the research project is the facilitation of creative, effective, and cost-efficient strategies for accelerating the adoption of residential rooftop solar systems by thoughtfully-understanding the barriers and motivators facing potential customers.

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About the Partnership

The project is funded by the DOE's Solar Energy Evolution and Diffusion Studies (SEEDS) program and will involve several partners, including:

- Yale School of the Environment
- New York University
- Tel Aviv University
- Yale Center for Business and the Environment (CBEY)
- Connecticut Green Bank
- SmartPower, a social marketing firm;
- MySunBuddy, an online marketplace that connects solar owners with solar buyers

About the Solar Energy Technologies Office (SETO)

The Solar Energy Technologies Office (SETO) funds early-stage research and development in three technology areas: photovoltaics (PV), concentrating solar-thermal power (CSP), and systems integration with the goal of improving the affordability, performance, and value of solar technologies on the grid. Learn more at https://www.energy.gov/eere/solar/solar-energy-technologies-office

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Executive Summary

America's energy portfolio is cleaner than ever before, in part because many homeowners are taking action into their own hands by installing rooftop solar. However, while low and moderate income (LMI) households often share an interest in generating their own clean, renewable energy, they face significant market barriers and are often overlooked in the development of polices and incentives that support the adoption of residential rooftop solar photovoltaic systems.

This guidebook summarizes some of the key findings from a U.S. Department of Energy-funded research project for relevant stakeholders, including community members, town officials, installers, and policymakers. This Yale-led research program, called the Yale SEEDS2 project, brought together a team of scholars and practitioners to generate knowledge and insights on accelerating solar adoption in LMI communities. This guidebook is intended to complement and expand upon

the information and strategies outlined in previous work on rooftop solar, with a goal of providing a starting point for stakeholders interested in hastening the adoption of rooftop solar in LMI communities.

In this guidebook, we first explore the drivers, motivations, and barriers facing LMI households when considering the adoption of solar energy. For the purposes of this guidebook, we define LMI based on the area median income, as defined by the U.S. Department of Housing and Urban Development; a household or community is LMI if it is below the area median income. Our review of the drivers, motivations, and barriers to solar adoption by LMI households points to significant barriers, including multifamily housing dwellings, potential remediation of asbestos or other renovations required before rooftop solar can be added, and financial barriers. But there are a set of potential solutions, including innovative financing and shared solar options.

Our research program also found that there are many LMI households who could install rooftop solar but are not often being reached. We thus built upon an earlier Yale SEEDS project that demonstrated the effectiveness of community-based grassroots campaigns to encourage the adoption of rooftop solar, called "Solarize" campaigns. Solarize campaigns bring together parties such as a pre-selected solar installer, environmental non-profit groups, community-based volunteers, local officials, and residents to accelerate adoption of rooftop solar systems. Since 2009, more than 25 states have hosted one or more Solarize campaigns. The Solarize Campaigns in all our our SEEDS2 research were implemented by our non-profit outreach and messaging partner, SmartPower.

The research project described in this guidebook demonstrates that Solarize campaigns can work for LMI communities too. Thus, we provide a summary of how Solarize campaigns work, discussing the key ingredients of a campaign and what we have learned about why the campaigns work. On average, these campaigns led to a nearly 1,000% increase in the rate of solar adoptions in a municipality during the campaign and saw a continued increase in adoption even after the campaigns ended (Gillingham & Bollinger 2019). A previous guidebook by the research team goes into more detail summarizing how and why Solarize campaigns work (https://cbey.yale.edu/programs/solar-energy-evolution-and-diffusion-studies-seeds), so we keep our overview of the campaigns concise.

This research also uncovered that the *messaging* used in a Solarize campaign was important. The research program ran field experiments that tested two different messaging strategies in Solarize campaigns. Specifically, one set of campaigns focused on messaging around individual financial benefits of solar ("self-interest"), while the other set of campaigns focused on messaging around the community benefits of solar ("pro-social"). It turns out that for LMI communities, both messaging approaches work about the same—but the community benefits messaging led to households being more satisfied with their solar installations and more likely to recommend solar to their friends and neighbors (although their installations tended to be smaller and less financially lucrative to them). In contrast, for higher income communities, the individual benefits messaging dominated, likely due to the focus on financial benefits resonating more with these communities. These results suggest that for LMI communities, pro-social messaging may be more useful within grassroots campaigns such as Solarize if the goal is to maximize satisfaction among solar adopters.

It's important to note that the research findings discussed in this guidebook are contextualized within the already-established practices of a successful Solarize campaign and do not explore all possible approaches to address the barriers of solar for LMI households. Our intent is that this research provides useful insights to

accelerate the adoption of solar by LMI communities, where families often face a larger-than average energy burden and may live paycheck-to-paycheck or on a fixed income.

We find that proper messaging, creative financing, and community-led campaigns can be powerful approaches for enabling solar as a win-win for families of all socio-economic brackets. By increasing LMI solar adoption through carefully designed approaches based on the insights of our research, we hope to simultaneously help reduce energy costs as well as the negative environmental impacts from building electricity use in Connecticut and across the country.

SUMMARY — BRINGING SOLAR POWER TO LMI HOUSEHOLDS

1. **Seek to assess and remove key barriers.** A starting point is to make sure that the policy environment is conducive to LMI solar adoption. Financing options that are tailored to the needs of these customers is especially important. When capital is available, solar can be much more attractive and accessible to LMI households. Shared community solar options also hold great promise for LMI adoption of solar.
2. **Solarize programs work in LMI communities.** Households in these communities are open to the idea of installing solar, and grassroots campaigns to encourage adoption can succeed. A major reason for this is that trust matters, so community volunteer "solar ambassadors" can be very influential.
3. **Getting the word out is critical.** In LMI communities, customers are equally likely to adopt solar with either a community-based or individual-based message. We find that messaging does not matter for the number of adoptions. This suggests that it is simply most important to be messaging at all.
4. **Messaging matters for who adopts.** Households that install solar after receiving community-based messages are happier with their installations and are more likely to recommend solar to their friends and neighbors, even if the installations tend to be somewhat smaller and less financially lucrative to the household. So, if the goal is happy adopters who continue to tell their peers about solar, community-based messaging is the preferred approach for LMI communities.

Barriers and Opportunities for Solar in Low and Moderate Income Communities

LMI communities are a crucial part of the climate change mitigation puzzle and are imperative to reach for equity reasons. However, they are often over-looked or marginalized in the development of policies and incentives that encourage clean energy programs at the household level, perhaps because of a perception that higher income households will be more receptive to clean energy. Yet despite steep declines in cost of distributed rooftop solar, LMI households continue to face specific barriers and challenges in evaluating clean energy options for their homes.

While there are many possible definitions for LMI, as mentioned above, we focus in this guidebook on a simple definition: whether the community or household is below the area median income, as determined by the U.S. Department of Housing and Urban Development.

POTENTIAL FOR SOLAR IN LMI COMMUNITIES

LMI households live in all types and densities of communities composed of all types of building formats and ownership structures, from high density rental apartments

in urban areas to mixed use developments and owner-occupied mobile home communities in rural areas. Each building typology and neighborhood fabric offers certain opportunities and constraints for the possible installation of rooftop solar systems, such as the availability of rooftop area or the age and structural integrity of the building stock. Cursory knowledge of LMI neighborhoods and building types can sometimes lead policy makers and installers to overlook LMI neighborhoods as viable places for rooftop systems.

However, distributed rooftop solar systems on residential properties in LMI communities have the potential to make significant contributions to a cleaner electricity portfolio and reduced GHG emissions. In 2018, the National Renewable Energy Laboratory (NREL) performed a technical assessment specifically addressing the potential for rooftop solar in LMI communities. This study calculated the overall rooftop solar potential to be nearly 1,000 terawatt-hours (TWh), which is equal to approximately 75% of total residential electricity demand. Of this, LMI households are estimated to have a potential of 415.9 TWh if all LMI households with suitable rooftops adopted. This is equal to approximately 42% of the potential capacity of all residential buildings (Sigrin & Mooney 2018). The technical potential of LMI single family owner-occupied homes alone is 176.8 TWh.

In addition to the technical potential, LMI communities might also be a promising market in many places. It turns out that LMI households can be quite interested in solar. For example, LMI households often show a commitment to having an environmentally responsible household and lifestyle in line with other socio-economic and demographic populations. Wolske (2020) finds that the motivators for installing a rooftop solar system are similar between high and low income communities, and that LMI households have a slightly greater preference for both pro-environmental behaviors and innovative products.

Indeed, while adoption of solar in the overall United States has been primarily by higher income households (Barbose et al, 2018; Borenstein & Davis, 2015), there are places where LMI solar has begun to flourish. In Connecticut, there has been a substantial focus on encouraging LMI solar adoption, both by the Connecticut Green Bank and through the research carried out by the Yale SEEDS2 team. This can be seen clearly in Figure 1, where the rate of growth in solar adoptions in Connecticut from 2013 to 2019 is quite high in several LMI cities or towns (in part due to the work undertaken as part of this project).

Figure 1 below shows that the rate of solar adoptions in Connecticut, high growth rates in solar adoption are by no means restricted to higher income towns but can also occur in LMI communities.

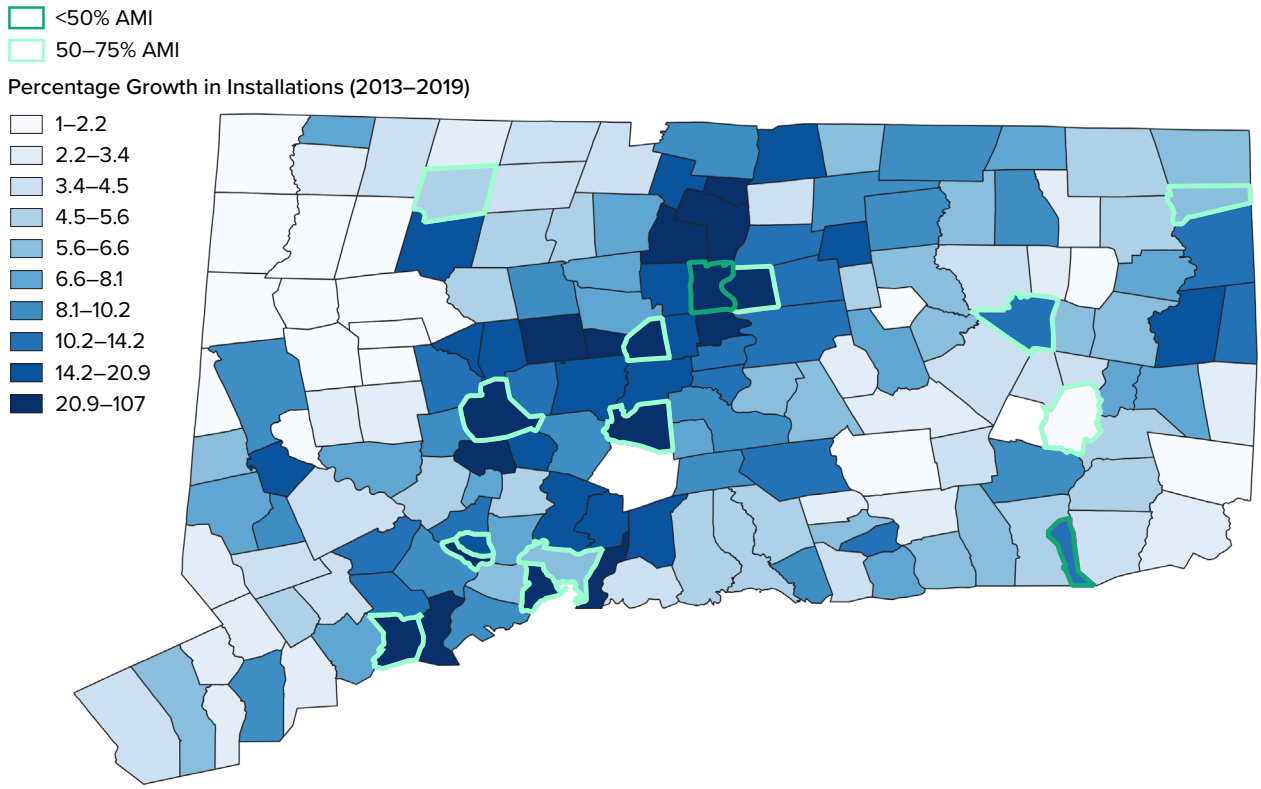


Figure 1: Growth in Installations by Town (2013–2019)

BARRIERS TO ADOPTION OF SOLAR BY LMI COMMUNITIES

But while there are suitable rooftops and interested customers in LMI communities, there are some real challenges to adoption. As part of the Yale SEEDS2 research, we published a comprehensive overview (2017) of the barriers and possible solutions facing potential LMI solar customers. Of course, LMI communities can differ widely in demographic and geographic characteristics in ways that are directly relevant to solar installations, so a first point is that one must be careful in making any generalizations. In our review, we grouped the barriers into three main categories: customer issues, business issues, and government issues.

1. Customer Barriers

One of the biggest hurdles LMI households face in considering a rooftop solar installation is the home ownership barrier. According to the 2017 US Census, 49% of families earning less than the median income own their home, compared with 78% of families with earnings at or above the median income. Of course, there are many different types of leasing and ownership arrangements, from individual private landlords renting a single-family home to multi-family apartment complexes governed by a management company, to federally funded housing communities. Each presents its own unique set of challenges and opportunities. Because of the limited authority tenants have to modify their home, the ownership barrier can be a major hurdle in transitioning to solar. In addition, rental occupants may move frequently, making the long-term investment of rooftop solar hard to justify.

Other customer concerns include budget barriers, specific preferences, and home design complications. For example, because upfront costs are often high, many customers simply cannot afford to make the transition to solar. This can be very relevant to LMI customers, who already devote a greater percentage of their monthly income to home energy costs (Bovarnick & Johnson, 2018). In addition, a 2017 study by the Clean Energy Advisory Council found that approximately two-thirds of LMI households live in homes built before 1970. Depending on the specific date and method of construction and the condition of the home, installing a rooftop solar system may require costly upgrades to the home's roof structure and/or electrical system. One common issue is that homes may need asbestos remediation prior to it being possible to work in the attic to install a solar system.

The challenge of the upfront cost can be further compounded because financing options available to LMI households can also be more limited than those available to families with higher incomes due to low credit scores and less established income histories. In addition, LMI households may have less personal finance knowledge and might also face language barriers which can be challenging in understanding complicated financing contracts and obligations.

2. Business Barriers

Businesses, including solar installers, also face challenges in efficiently and effectively connecting with LMI customers. These challenges include structuring marketing programs to address the specific customer concerns described above and working with lenders to address the income and credit score characteristics that can be limiting factors in obtaining more traditional financing options. The growing trend in personal finance to broaden the ways in which customers are assessed for creditworthiness, such as by including on-time utility payments in credit score calculations, can be applied to solar financing programs. Given the common perception that rooftop solar tends to be primarily for high-income homeowners, many installers are simply not used to working in LMI communities and do not prioritize these homeowners as a viable customer base.

In addition, installers sometimes presume communities are homogenous and thus can inaccurately characterize LMI neighborhoods as being uninterested in solar—for example, by presuming that all residents are short-term tenants or have low credit scores. This can lead installers to bypass large quantities of would-be customers and further, but inaccurately, characterize LMI communities as being uninterested in solar.

3. Government Barriers

One potential barrier to LMI solar adoption from government policies is related to electricity pricing structures. In many states, electricity pricing involves higher prices per kWh of electricity consumed when households consume more electricity—often called "increasing block pricing." While there is substantial variation across households within any income group, on average LMI households have smaller homes and consume less electricity. This implies that with increasing block pricing, the cost of the electricity saved by installed solar is lower for LMI households. When there is net energy metering, such that any excess electricity generated by the solar system and fed into the grid is compensated at the retail electricity rate, the compensation of this excess electricity can again be lower for LMI households. This poses another barrier for LMI solar adoption, in that the economics of a solar system do not look as favorable. Similarly, because there are economies of scale in larger-sized solar installations (Gillingham et al. 2016), the cost per kWh generated is higher for smaller systems, and households with smaller rooftops thus find that solar is less financially attractive. These government barriers likely slow LMI solar adoption.

However, many state and local governments are exploring ways of connecting with LMI communities by expanding their existing solar outreach programs to focus on the LMI market segment. To most effectively connect with LMI households, it is critical that government programs gear their policies in ways that specifically address the benefits or impacts solar provides to LMI households. For example, the Connecticut Green Bank recently completed an analysis of its Residential Solar Investment Program (RISP) and found that LMI communities and communities of color responded positively to incentive programs and led to more than 1,500 new solar installations for LMI homeowners in Connecticut.

Figure 2

BARRIERS	
CUSTOMER	• Budget barriers • Preferences • Home design complications
BUSINESS	• Customer outreach • Cost concerns
GOVERNMENT	• Political • Regulatory • Public Administration

SOME POTENTIAL SOLUTIONS

- Reducing upfront costs
- Financing to spread costs over time
- Improving customer awareness
- Community shared solar
- Other "anchor" institution or business model approaches

Source: Bovarnick and Johnson (2017)

SOME POTENTIAL SOLUTIONS TO THE BARRIERS TO LMI ADOPTION

There is no silver bullet solution that sweeps away all of the barriers to LMI adoption, but our review uncovered valuable insights to help overcome barriers in each of the three categories described above. Indeed, we are beginning to see progress in overcoming these barriers using some of the approaches described here in some parts of the United States.

1. Potential Solutions to Consumer Barriers

To address consumer issues there are a few promising pathways. One is to encourage community shared solar. In the adjacent call-out box, we discuss the promise of community shared solar for households that cannot install solar themselves due to renting or budget constraints. In South Carolina, our work led to 130 sign-ups of interested households in community shared solar options, and many of these households were LMI households. Thus, there is interest in such options.

Another key pathway to address the consumer barriers is through financing. Installing a solar system on one's home requires a significant financial investment. For solar to be an achievable goal for LMI households, financing options are often required, and those financing options need to be well-understood by community representatives spearheading solar campaigns. Other energy agencies have been working to create and communicate the options available to LMI households. In 2018, the NREL published a comprehensive guide on solar financing options specifically for LMI households, with insights on the value of different options for different types of housing units (Cook & Bird 2018). A key figure from that report is shown below in Figure 3, highlighting a variety of financing strategies and how they can help.

A NOTE ON COMMUNITY SHARED SOLAR

Community solar microgrids can be a good way for LMI communities to incorporate solar into their energy portfolios, as they address several of the barriers to individual rooftop systems described above. Community shared solar refers to solar systems that are either jointly owned by the community or owned by a third party and provide solar energy directly to neighborhood customers. Community shared solar systems can be installed in open green space or on shared rooftop space, either on a building roof or on another structure, such as parking lot awnings. Because these systems are not purchased and owned by individual residents, they do not require such a large investment from individuals or require modification to individual units. In cases of rental tenants, it also allows collaboration between landlords and residents and can be better accommodating to more transient populations.

Figure 3: Comparison of Financing Options by Resident, Housing Provider, or Developer

Financing Option	Single-Family Housing (Owner-Occupied)	Multifamily Housing Provider	Manufactured Housing Provider	Any LMI Tenant or Homeowner (Community Solar)	Community Solar Developer
Bulk Purchasing	◖	◖	◖	◖	◖
Capital Refinancing	○	●	○	○	○
Crowdfunding	◖	◖	◖	◖	●
Direct Cash Incentives	●	◖	●	●	●
Solar Hosting	◖	◖	◖	◖	○
Loans	●	◖	◖	●	◖
LIHEAP/WAP[a]	●	●	●	●	○
Net Metering	◖	◖	◖	◖	●
On-bill Financing	●	●	○	●	○
PACE	◖	●	●	◖	○
Production Incentives	○	○	○	○	●
Tax Incentives	○	○	●	●	●
Third-party Leasing/ESA	●	●	●	○	○

[a] Low-Income Home Energy Assistance Program/Weatherization Assistance Program

N/A ○ Second Tier ◖ First Tier ●

Source: Cook & Bird (2018)

Solar leasing is one financing option that can help mitigate the large upfront costs that can sometimes make rooftop systems unaffordable for LMI households. Solar leasing allows for the installation of panels on the roof of an individual home or unit, but much like a car lease, allows the payments to be spread out over the terms of the lease, typically 15–20 years, while the installer retains ownership of the actual panels and equipment. Depending on the terms of the lease, customers have the option of buying the panels outright at the end of the lease or having them removed from the property.

Another financing option is a power-purchase agreement, whereby the solar system is owned by the installer and the household agrees to purchase electricity from the solar system at an agreed-upon rate. While our research has found that overall financial gains from outright purchase in most cases exceed those from a financing arrangement, these financing options can allow those who otherwise would have been able to install solar to do so by making solar a financially feasible option.

In one example of a successful approach, Connecticut has made impressive strides in addressing the economic barriers to solar for LMI customers via creative use of financing options. The state's Residential Solar Investment Program (RISP), led by the Connecticut Green Bank, has helped numerous LMI families and/or families of color collectively install more than 290 MW of rooftop solar systems since 2012, and many of these systems were financed with Green Bank support. Many of these adoptions were facilitated by grassroots Solarize programs, which are another potential solution to help inform LMI customers about the option of solar and overcome any informational barriers that face the consumers. We will discuss the Solarize program in greater depth later in this guidebook.

2. Potential Solutions to Business Barriers

Business barriers can be overcome through a variety of pathways. One of the goals of our guidebook is to overcome any perception that LMI communities are not interested in solar. In addition, there are some successful companies, like Grid Alternatives and Posigen, that focus on underserved communities and demonstrate how such outreach can succeed.

More broadly, marketing programs can be tailored for LMI communities to best ensure that the material is both relevant to LMI families and that it connects with the targeted demographics. Such strategies could include ensuring that materials are available in multiple languages, highlighting the specific barriers with direct messages such as "low monthly payments," or incorporating photos of buildings and families representative of LMI neighborhoods. Grassroots programs like Solarize campaigns can work in LMI communities as a successful outreach approach to help ensure success for the solar installer. And when Solarize campaigns have been run, solar marketers can engage with community members from the previous campaigns to help to ensure the materials are relevant to the targeted populations.

3. Potential Solutions to Government Barriers

Finding solutions to government barriers can be more challenging. Increasing block pricing is difficult to fully address without a major change in regulation that would have other unintended consequences. However, the compensation for excess solar fed into the grid could be the same regardless of consumption, which could improve the financial attractiveness of solar to many LMI customers by raising the compensation rate for these customers (although it might lower it for higher income customers).

When it comes to reaching out to LMI households and communities, some states are leading the way. As mentioned above, some states are providing support through preferred financing for LMI customers. Many local city or town governments are supporting grassroots-based programs, such as the Solarize programs. The Clean Energy States Alliance (CESA) has published some findings on three subsets of the LMI solar market including single-family homes, manufactured homes, and multifamily affordable housing, and has established a working group for state officials in hopes of encouraging other states to continue to find ways of reaching customers across all income brackets. This holds promise to align strategies across states and extend the most successful policies to be used more widely.

Solarize Campaigns: An Overview

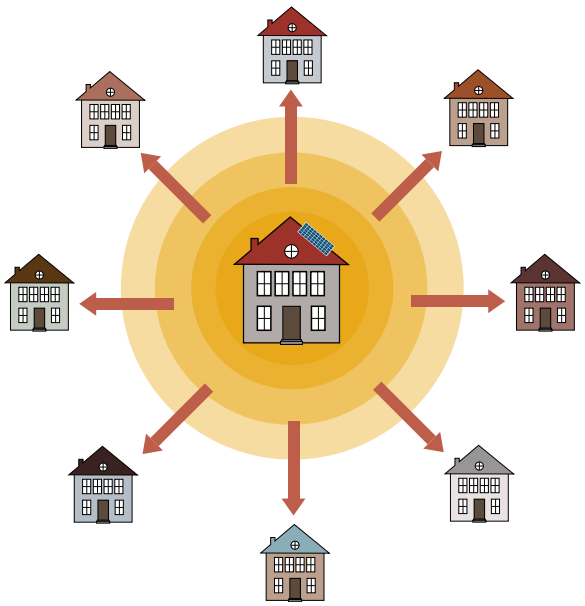
Solarize campaigns are a proven grassroots community-based approach leveraging social interactions between community members to increase solar adoption in their community. Many successful Solarize campaigns have been implemented around the country. In Connecticut alone, Solarize Campaigns implemented by our partner SmartPower, have helped to facilitate the installation of more than 2,600 individual rooftop systems with a generation capacity of over 20 MW since 2012. These campaigns in Connecticut were demonstrated to have a causal effect of increasing adoptions, and to be a cost-effective approach to carbon mitigation (Gillingham & Bollinger 2019).

Sign used in one of the Solarize campaigns in Connecticut to indicate the discount pricing offered by the participating installer.

The starting point notion for the Solarize campaign is based on the idea that 'peer effects' are crucial to solar adoption—if your neighbors install solar, that increases the likelihood that you will install solar (Bollinger & Gillingham 2012, Graziano & Gillingham 2015). Solarize campaigns are explicitly designed around several core elements that, when combined together, result in both increases in installed capacity and in customer satisfaction. During a Solarize campaign, various types of community outreach initiatives, such as town hall meetings, tours of solar homes, and information sessions with pre-approved installers are organized. Solarize campaigns present residents with a bulk-discounted price for a rooftop system, often 20% less than would be otherwise available outside of the campaign. This discount is offered only within a limited-time campaign, typically 20 weeks, creating a time-sensitive urgency for purchase. During these campaigns, homeowners can adopt solar with the assurance that the details of the technology, installer, price, financing options, policies, and other aspects have all been vetted by town-approved program managers. The details of executing a successful Solarize campaign are discussed in detail in the Yale SEEDS1 guidebook, available at https://cbey.yale.edu/programs/solar-energy-evolution-and-diffusion-studies-seeds.

UNDERSTANDING PRODUCT ADOPTION

To more deeply understand why Solarize works, it is helpful to briefly review the broader body of research on the patterns and ways in which populations adopt new and innovative technologies. This is not a new field of exploration; researchers have sought to understand the patterns of new product adoption for generations and have continued to explore this topic within product categories that are classified as "beneficial" behaviors and products. Beneficial products and behaviors are those that provide benefit to the greater population, not just the customer or user. Recent trends of popularizing green and sustainable products aptly fall under this category, as the adoption and use of environmentally friendly products provide benefit to the greater population, future generations, and the physical environment. As such, encouraging the adoption of new green products, or encouraging consumers to switch from traditional products to greener versions, is of interest to economists, policy makers, businesses, environmental organizations, and the general public.

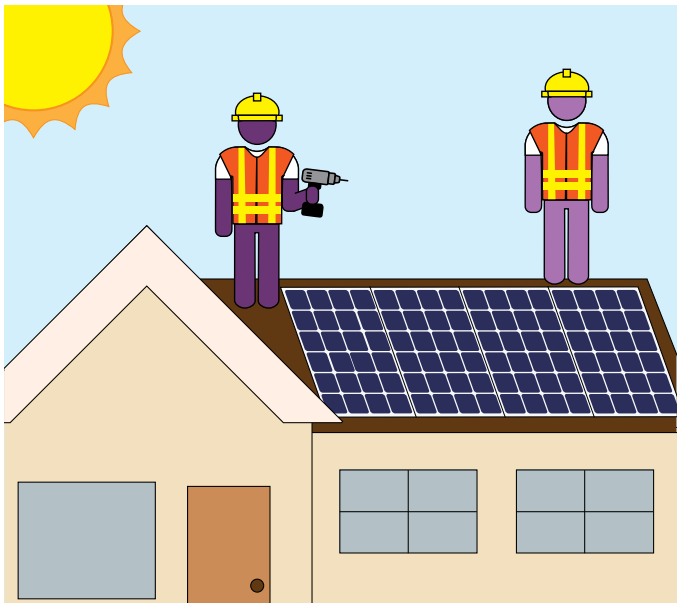


Previous research on solar by the Yale SEEDS2 team has shown the importance of social influence in determining whether a household chooses to purchase solar panels, and Solarize programs aim to leverage this. In short, a family or individual is more likely to purchase solar for their own home if their neighbors or peers have already done so. This is also sometimes called a 'peer effect' or 'neighbor effect,' and it can hold true within LMI communities as well. Having a neighbor who has already made the decision to purchase a rooftop solar system, who understands the process, and can speak to the savings they realize on their monthly utility bills can often be the biggest influence in whether an individual or family decides to purchase solar for themselves. Research on persuasion and social psychology has shown why connections through social networks (real-world or digital) can be such effective forces for change — not only are people more likely to trust advice from peers than from a third party source, but social norms and beliefs about the current level of behavior within a group can have a powerful effect on an individual's own behavior (Wolske et al., 2020).

AMBASSADORS DRIVE ADOPTION

One crucial way that the Solarize program capitalizes on the power of social networks and community-based social interactions is by making use of one or more volunteer solar "ambassadors"—typically a local resident who has already installed a solar system in his or her home and is excited about sharing the benefits of rooftop solar within their neighborhood. Ambassadors serve as point persons within the community and provide information on the process, experience, and cost of purchasing and installing a solar rooftop system. Solar ambassadors humanize the often-intimidating process by sharing their experience first-hand and answering questions from the homeowner perspective. Having a trusted neighbor, friend, or community member who is knowledgeable about the process and trustworthy in their review can often be the deciding factor in committing to purchase a solar system.

In our research, we interviewed solar ambassadors in each city or town that had a Solarize campaign, to glean insights into their motivations and what made them as effective as possible. One key finding of our research is that the most successful solar ambassadors are those who installed solar through the campaigns themselves (Kraft-Todd et al. 2018). A primary explanation for this finding is that those who installed solar through the campaigns themselves are more likely to be seen a credible to other community members and thus are more effective at persuasion. But we derived further insights from the ambassador interviews as well, as is discussed below.



The following lessons are taken from the ambassador interviews:

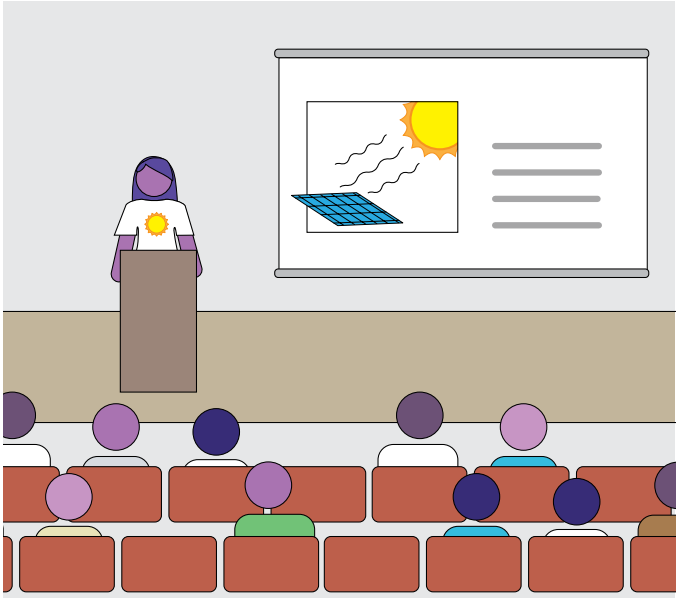
Lessons for Installers: Installers can capitalize on the following 3 strategies to strengthen outreach during the campaigns.

1. **Be a source of knowledge:** provide basic information about how solar works at the beginning of each meeting and make yourself available to answer questions at the end. Surveys show that this technique can help instill trust and spark interest in community members.
2. **Full-belly, open mind:** We have found that the most successful events around solar often are due to something that isn't related to solar at all: good food. Whether it's an ice cream social or lunch spread, having food and snacks provided keeps everyone in a good mood creating a festive environment. While it often serves as a launching pad, these events are typically remembered by many of the townspeople taking part in Solarize.
3. **Be available and follow through:** Some of the most successful campaigns listed their installer's "always available" mentality as a key ingredient of their secret sauce. That said, being available is not enough, as an installer you need to follow-through we whatever you have promised. A good and very successful way to follow-up after an initial inquiry is a satellite survey showing customers what their installation would look like. Customers usually reach very well to this and this strategy can be the turning point between interest and adoption of solar.

QUOTES FROM POST-PROGRAM AMBASSADOR INTERVIEWS:

- *The fact that the town was behind the campaign and really supporting it was helpful. It made people trust the installer.*
- *The most successful messages highlighted economic benefits and how people could save money.*
- *The role of the installer is important too. Friendliness, prompt response, and distance to town are important.*
- *You have to show that solar is a win for the customer, that it makes sense financially and all other is a plus; savings to pass on to your kids and homeowners.*

The ambassadors also had insights for how any community member can be the most successful at telling others about solar:



Lessons for Townspeople: Townspeople can help improve and advance campaigns by capitalizing on the following 3 lessons learned:

1. **Use every tool in your box:** Your network is larger that you may think. In the past, town officials have used their presence across their communities to spread the word about solarize campaigns. Do not limit yourself to the building you work in.

2. **Generate trust:** Regardless of what outreach method, you try to use, make sure you express your support for the installer and campaign. Community members have expressed that this has helped generate trust in them because the town has pre-vetted both the installer, the equipment, and the campaign before it even kicks off.

3. **Find an enthusiastic official:** If your town has someone who is especially enthusiastic about solar, consider giving them leadership responsibilities. Consumers have also felt greater trust when discussing solar with an enthusiastic town official who they already know.

Lessons on Solar Messaging

For communities and policymakers wishing to leverage peer effects to potentially increase solar adoption in LMI communities, a practical consideration is: what type of messaging should be used? This first depends on the degree to which peer influence is due to social norms (i.e., one makes decisions based simply on what everyone else is doing) versus social learning (i.e., one makes decisions after actively learning from their peers). Gillingham & Bollinger (2019) and Kraft-Todd et al. (2018) both demonstrate the extent to which social learning is important in explaining peer influence, but even then, it is still important to determine the type of information that should be highlighted.

As in many marketing settings, one solution to this problem is to experimentally vary the type of messaging used in promotional materials. In the case of the Solarize campaigns, this entails having SmartPower (the administrators of the campaigns) and the solar ambassadors focus on a different value proposition across different communities. To this end, the research team developed two different messaging strategies, one focused on the individual or household benefits of solar ("self-interest"), such as electricity bill cost savings and increases in property value, while the other focused on community and public benefits ("pro-social"), such as a cleaner energy portfolio and a more resilient energy grid.

The different focus of these two types of messaging is motivated by previous research on consumer behavior and psychology. It has been shown that LMI households tend to prioritize community at a higher rate than do upper income individuals (Piff et al. 2010, 2011) and respond more strongly to pro-social messaging campaigns (Whillans 2017). Conversely, research by Mende (2019) concluded that higher income individuals react more strongly to self-interest messaging in the context of financial education. Based on these findings, the research team hypothesized that LMI communities would respond more strongly a community-focused value proposition, rather than focusing on the individual benefits of solar adoption.

To test our hypothesis, the Yale SEEDS2 research team ran a field experiment to test the relative effectiveness of the two types of messaging campaigns. The campaigns in the field experiment took place across 19 municipalities, including a mix of LMI and higher income municipalities. A Solarize campaign was launched in each municipality, including the standard set of public workshops, tours, community meetings, social media campaigns, and the distribution of informational literature via direct mail. All aspects of the campaign were the same except for the messaging content. Of the 19 municipalities, nine focused on individual benefits of solar adoption and ten on community benefits. An additional 10 municipalities were included in the analysis as a control group, receiving no intervention. Duration of the campaign, system pricing, and other aspects of the campaigns were the same across both groups. Figure 4 shows the messages used in the outreach.

Under embargo

Under embargo

Conclusions

The importance of expanding solar adoption within LMI communities continues to grow. Policymakers, community members, national laboratories, and environmental nonprofit groups are all working to develop creative and common-sense solutions to the market barriers that prevent LMI communities from more readily adopting rooftop solar systems.

Some of the potential solutions are straightforward, but challenging, such as changing the financial benefits of adopting. However, there are ways to do this besides the obvious approach of directly subsidizing solar installations. We have seen progress in providing more attractive financing options for LMI households.

Policymakers could also alter the compensation rate for solar generation by changing the electricity pricing structure in some locations where there is increasing block pricing. This could substantially affect the financial attractiveness of systems to LMI households.

In this research, we focus on tools that are likely be easier to implement and yet still have a proven impact, such as the utilization of social learning through peer influence in Solarize campaigns and determining the optimal messaging to be used within Solarize campaigns. Our work demonstrates that Solarize campaigns can work well within LMI communities, despite the preconception that LMI communities are tough to reach. We also find

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that the choice of messaging matters. While either community-based or individual-based messages can reach LMI customers and accelerate adoption, the two messaging strategies bring in different types of consumers. Community-based messaging more often leads to happy solar adopters and more peer recommendations.

The Yale SEEDS2 research contributes to the growing body of work on solar in LMI communities by helping to identify the most relevant and salient ways of connecting with LMI customers to best address the challenging barriers they face to solar adoption. By identifying the best ways to connect with potential LMI customers and understanding their motivations to purchase rooftop solar systems, policymakers can continue to develop programs that make solar attractive for as many customers as possible and communicate the current benefits of these systems in the most impactful way.

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