The Potential for Community Shared Solar in Massachusetts

Expanding Solar Access to Low- and Moderate-Income Households
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EXECUTIVE SUMMARY

In the spring of 2016, following a successful statewide program that integrated home weatherization and green jobs for low- and moderate-income communities, Community Labor United (CLU) and the Green Justice Coalition (GJC) enlisted five Tufts University graduate students (the Field Projects Team) to explore the prospect of community shared solar projects for underserved populations in the Commonwealth. This report concludes a five-month investigation into the feasibility of community shared solar projects that would specifically expand access to the environmental, economic, and employment benefits of solar energy to low- and moderate-income renters, urban populations, and communities of color in Massachusetts.

Community shared solar is a type of shared renewable energy system, meaning a system that allows a single renewable energy facility to serve multiple, dispersed energy consumers, and enables the consumers to receive direct benefits on their utility bill from their investment in renewable energy. Compared to buying electricity from a utility or purchasing rooftop solar panels for individual residences, community shared solar can benefit low- and moderate-income communities in several ways, such as by enabling communities to meet their own energy needs and allowing members to pool their financial resources. Community shared solar projects could also incorporate long-term, well-paying installation and manufacturing jobs within the communities they serve if targets and incentives are in place.

Federal tax incentives and Massachusetts state policies—including loan assistance, net metering benefits, and income from the sale of solar renewable energy credits—have generally increased access to local solar energy since 2008, when Massachusetts enacted its Green Communities Act. Yet H.4173, a bill passed by the General Court and signed by Governor Baker in April of 2016, has raised the caps on net metering while jeopardizing the benefits projects can receive. Other state policies and programs are in flux as well. There remains significant opportunity for political advocacy by CLU and GJC in support of community shared solar and of projects for low- and moderate-income communities in particular.

There are a variety of ways to set up community shared solar projects, though all have a few standard components. These include a project owner/management entity, a site, a contractor to build the project, participants (who may be co-owners of a project and customers who receive the actual electricity), and approval from both the municipality and the local utility. There are also several means of financing a project, including tax incentives, self-financing, leasing and power purchase agreements, as well as newer and more innovative methods, such as cooperatives. Yet financing, credit risk, and barriers to ownership continue to present significant obstacles for members of low- and moderate-income communities. Finding solutions to these impediments is of primary concern to this report and to the goal of ensuring that the clean energy future is accessible to a wider range of citizens.

This report provides significant background on the fast-moving policy field and current development structures and provides case studies to illustrate the variety of configurations available in Massachusetts. Considering the many benefits to—and barriers facing—community shared solar in the Commonwealth, the report culminates with state-level advocacy recommendations and preliminary guidance for Community Labor United and the Green Justice Coalition.
AUTHORS

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The team also extends thanks to the following subject experts and thought leaders who provided critical insights, information, and countless recommendations in support of the project:

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Please note that the recommendations provided in this report, while informed by input from numerous sources, are those of the Field Projects Team alone. The subject experts listed above were consulted for their expert insight, but their participation in this regard should not be construed as endorsement in any way.
Community Labor United (CLU) is a nonprofit organization in Boston, MA that combines community organizing and labor unions to advance the interests of low- and moderate-income working households in the Greater Boston Area. The organization focuses its efforts on affordable housing and climate justice, as well as campaigns for quality jobs and healthcare. The Green Justice Coalition (GJC) is a partnership convened by CLU of numerous community organizations, labor unions, environmental groups, and other members that advocates for clean energy and for the inclusion of low- and moderate-income workers in the burgeoning green economy.

After the Commonwealth of Massachusetts passed the Green Communities Act, the Green Jobs Act, and the Global Warming Solutions Act in 2008, the Green Justice Coalition and Community Labor United convened to create a model for energy efficiency (Grant, n.d.). Their aim was to bring weatherization to low- and moderate-income communities and to create high-quality green jobs and reduce household energy costs in the process (Chen 2014). Community Labor United saw the weatherization program as a great success in advocacy and coalition building.
They seek to build on that success and advance the decentralization and democratization of energy. To pursue this goal, Community Labor United and the Green Justice Coalition decided to gather research regarding community shared solar, including existing case studies, relevant policy, financing structures, and model recommendations.

A group of five Tufts University graduate students (The Field Projects Team) in the Department of Urban and Environmental Policy and Planning came together to work with Community Labor United and the Green Justice Coalition to explore the potential for community shared solar in Massachusetts. The primary aim of the Field Projects Team was to provide their partners with a set of recommendations regarding how to develop community shared solar to serve their constituents. The first goal of this project was to determine the feasibility of expanding community shared solar in Massachusetts given the existing federal and state legislative and regulatory landscape. A crucial element of this project has been a focus on how to expand access to the environmental, economic, and employment benefits of solar energy to more people in the state, including low- and moderate-income households, urban populations, and communities of color. Throughout the project, the team has monitored policy changes to determine how they might support or fail to support community shared solar initiatives in the Commonwealth.

The Team’s recommendations to CLU and GJC draw from community shared solar case studies across the country. Community Labor United and the Green Justice Coalition have a commitment to providing quality green jobs to low- and moderate-income workers and to advocate for their constituents. As such, the recommendations provided have been tailored toward considerations of environmental and social justice, labor opportunities, and models and financing that would allow for the participation of low- and moderate-income households.

The Field Projects Team completed a review of existing literature about community shared solar, including its environmental and social benefits, opportunities for labor, relevant legislation and regulations, and potential organizational and financial models. Through research and interviews, the Field Projects team has also produced case studies describing several existing community shared solar models and projects. The following report is a synthesis of the information gathered through research and interviews. After providing this background information, the report lays out some potential strategies for expanding community shared solar in Massachusetts to a broader range of residents, including promising models and associated challenges, potential avenues for advocacy, and innovative financing models. Finally, the team put together a list of recommendations specific to Community Labor United and the Green Justice Coalition and their aims of bringing community shared solar to low- and moderate-income communities and the constituents whom they represent.
GLOSSARY

CLU: Community Labor United

Data Acquisition System (DAS): a system installed at a solar project that will automatically record and report the system’s generation to the Massachusetts Clean Energy Center’s (MassCEC) Production Tracking System (PTS) on a monthly basis

Data Acquisition System Service Provider (DASSP): an organization with which a project owner may contract to install and maintain a Data Acquisition System (DAS). By using a DASSP, the project owner does not have to purchase and install the DAS herself

DOER: Massachusetts Department of Energy Resources, the executive agency that governs energy related policies in the Commonwealth

DPU: Massachusetts Department of Public Utilities, the executive agency that regulates the transportation and prices of electricity and natural gas in the Commonwealth

GJC: Green Justice Coalition

Interconnection: the process of physically linking a solar project (or another electricity generation project) to the local utility’s distribution grid. Each local utility has rules for interconnection, and project owners must apply for the ability to connect to the grid

ISO-NE: New England Independent System Operator, an independent organization that manages the wholesale electricity markets for the six New England states. ISO-NE manages eight separate “load zones,” which are regions with their own electric markets. There are three “load zones” in Massachusetts

Kilowatt (kW): electric generation capacity equal to one thousand watts

Kilowatt-hour (kWh): the amount of electricity generated in one hour by a facility with a capacity of one kilowatt

Local Utility: the primary investor-owned utility in the project area, including Eversource, National Grid, and Unitil (Fitchburg Gas and Electric Light Company). This term does not include municipal utilities

Megawatt (MW): electric generation capacity equal to one million watts, or one thousand kilowatts

Megawatt-hour (MWh): the amount of electricity equal generated in one hour by a facility with a capacity of one megawatt

Net Metering: an incentive system in which an electric customer, who is generating and using solar electricity on site, can “bank” excess electricity with the utility. This allows the customer’s meter to run backwards and to receive the equivalent amount of electricity from the utility at a later time, nearly free of charge. Also see “Virtual Net Metering”

New England Power Pool Generation Tracking System (NEPOOL GIS): the system through which the New England Power Pool (NEPOOL) tracks the creation and sale of all renewable energy credits (including SRECs) in Massachusetts and other New England states. The Massachusetts Clean Energy Center (MassCEC) reports SREC data in its Production Tracking System to NEPOOL GIS on a quarterly basis, and NEPOOL then administers the auctions in which SRECs are sold

Photovoltaic (PV): photovoltaic systems convert the energy in light into electricity. Within the photovoltaic systems – or solar panels – used in rooftop and community shared solar projects, sunlight causes chemical reactions that release electrons, which then flow out of the panel and, eventually, to an end consumer

Power Purchase Agreement (PPA): an agreement through which a purchaser of electricity (generally a commercial or industrial facility, a group of residential consumers, or a utility) signs a contract with an electricity provider, generally for a certain amount of power over a certain timeframe

Production Tracking System (PTS): the system through which the MassCEC independently tracks and verifies all SRECs produced in the Commonwealth

Solar Renewable Energy Certificate (SREC): SRECs represent the environmental benefits inherent in renewable energy. Solar facilities produce one SREC for each megawatt-hour of electricity they produce, which can then be sold to entities (such as utilities) that require them for environmental compliance, thereby generating
funds that can be used for a variety of project-related purposes

**Virtual Net Metering:** In Massachusetts, customers who are eligible to receive net metering credits for their solar electricity production can transfer those credits to other customers within the same local utility service territory and ISO-NE load zone. “Virtual” means that the customers who receive net metering credits are treated as though they produce the solar electricity themselves, even if they do not actually produce it or use it.
WHAT IS COMMUNITY SHARED SOLAR?

In 2006, community shared solar began due to newly established federal policy that allowed electricity from solar installations to be distributed to multiple and remote users, who could purchase a stake in the solar energy production system. Community shared solar is a type of shared renewable energy system that allows a single renewable energy facility to serve multiple, dispersed energy consumers and enables the consumers to receive direct benefits on their utility bill from their investment in renewable energy (Interstate Renewable Energy Council 2013). This enables people to buy into a solar installation not sited on their residential property and earn credits on their electricity bills for the energy produced, a form of photovoltaic (PV) ownership different from having one’s own rooftop solar array (Spector 2016).

To understand the innovation of community shared solar, it is helpful to understand how rooftop solar works and the differences between rooftop solar and community shared solar. In all solar electric PV projects, solar panels are used to capture the sun’s rays and convert energy from the sun into electricity.
The most straightforward solar projects, residential rooftop installations, are typically initiated by a homeowner, who installs panels on their roof and utilizes the electricity generated by the panels. The homeowner can either finance and own the project—with considerable upfront cost and maximum potential financial benefit—or the homeowner can enter into an agreement to lease their roof rights to a contractor, who will technically own the array and sell the power produced to the homeowner. This requires less (if any) upfront investment and transfers risk to the contractor; however, this arrangement offers fewer financial benefits to the homeowner.

Community shared solar projects can operate with a similar structure but with different inputs. The host site is secured (purchased or leased) by an entity owned by or representing a group of participants. The entity will bring together a group of participants and enter into an agreement with a contractor to build the project. Participants will typically receive benefits through a Power Purchase Agreement (PPA), whereby the contractor owns and operates the site and delivers benefits to participants. Participants can be partial owners/investors, and/or customers who receive net metering credits or financial benefits established through an agreement (Beavers, McGuckin, and Sweet 2013).

Community shared solar has grown significantly in the US since 2010 (see Figure 2) and has significantly expanded the pool of potential customers who may benefit from solar energy generation. Impediments such as poor access to direct sunlight, transiency (renters changing their residence), renting versus owning a home, and upfront costs have prevented much of the U.S. population from installing solar panels and benefitting from generation of solar energy under a more traditional, individual ownership model. Now, community shared solar creates opportunity for more widespread solar buy-in (Mullendore et al. 2015). However, as this report will outline, there remain significant regulatory and financial barriers that limit the expansion of solar access in Massachusetts.
There are several environmental and health benefits associated with solar energy. Like other renewable energy sources, solar energy generation produces very low amounts of carbon dioxide in comparison to other fuel sources ("Benefits of Renewable Energy Use" 2016). Replacing the use of fossil fuels with renewable energy, including solar, is one effective way for the U.S. to reduce its greenhouse gas emissions. A reduction in fossil fuel usage improves public health by reducing air and water pollution that can lead to heart problems, asthma, and cancer (Sanders and Milford 2014; “Benefits of Renewable Energy Use” 2016).

Additionally, after initial installation and start-up costs, solar generation has low operating costs ("Benefits of Renewable Energy Use” 2016). While fossil fuel prices fluctuate, solar offers price stability for electricity (Sanders and Milford 2014). Currently, there are multiple federal and state incentives available for customers to reduce their energy bills and receive credits for energy produced.
Since 2010, there has been a substantial increase in the number of solar installations in the United States (Rogers and Wisland 2014). However, purchasing solar panels for one’s home has typically required homeownership, good credit, and a roof that can accommodate the panels (“National Community Solar Partnership,” n.d.). These requirements have made rooftop solar models largely out of reach for low- and moderate-income households. People with lower incomes are more likely to rent their homes, meaning that they do not own the property necessary for installing rooftop panels (Mueller and Ronen 2015; “Energy Democracy: Community-Scale Green Energy Solutions” 2010).

Furthermore, lower-income households typically have less access to financing due to having less savings and lower credit scores, which make it difficult to meet upfront costs or receive affordable loans (“Energy Democracy: Community-Scale Green Energy Solutions” 2010; Mueller and Ronen 2015). Older homes, predominantly occupied by lower-income households, also often require significant maintenance that would be of a higher priority than installing rooftop solar. In order for low- and moderate-income communities to reap the benefits associated with solar energy, it is necessary to look beyond traditional ownership models that require upfront capital (“Energy Democracy: Community-Scale Green Energy Solutions” 2010).

Community shared solar can benefit low- and moderate-income communities in several ways. Firstly, large-scale projects are larger and more cost-effective than individual rooftop installations (Mueller and Ronen 2015). Because community shared solar allows for partial ownership or third-party ownership, it can offer a lower-cost investment because many investors can pool their funds. Furthermore, participation in energy generation allows low- and moderate-income communities and communities of color to meet their own energy needs, as well as contribute to the national supply of sustainable and renewable energy (“Energy Democracy: Community-Scale Green Energy Solutions” 2010).

Renewable energy can help consumers lower their energy costs. Low- and moderate-income households spend a larger portion of their budgets on necessities, including food and energy, than households with higher incomes (Morello-Frosch et al. 2009). In other words, they bear a greater “energy burden,” which the Department of Energy defines as “the burden placed on household incomes by the cost of energy, or more simply, the ratio of energy expenditures to household income” (U.S. Department of Energy 2012). In 2010, the U.S. Department of Health and Human Services reported that the average annual electricity costs for all households in the U.S. was $1,908 (Administration for Children and Families, Office of Community Services, Division of Energy Assistance 2010). For the subset of all households that were categorized as low-income, the average annual cost of electricity was $1,653 (Administration for Children and Families, Office of Community Services, Division of Energy Assistance 2010). The energy burden for low-income households is, on average, 4.5% higher than the national average.²

In the Boston Metropolitan Area in 2013, the median monthly expenditures for electricity was $89 for all households (U.S. Census Bureau and Department of Housing and Urban Development 2015). For Black households, the median was $84 and for Hispanic households, it was $95. For elderly households, the median cost was $79 (U.S. Census Bureau and Department of Housing and Urban Development 2015). For households below the poverty line, the median monthly energy cost was $78. This data suggests that monthly energy costs for households living in poverty are only $11 lower than the overall median costs for all households; thus, the energy burden is much higher for households living in poverty. Because low- and moderate-income communities suffer from very high energy

² There are various definitions of “low- or moderate-income income” at the state and federal levels for various programs. Perhaps the most applicable definition in Massachusetts is the one used by utilities to determine eligibility for a discounted electric rate: (1) a household’s income does not exceed 60% of the state median, and (2) the household is currently eligible to receive fuel assistance benefits or is participating in one of the following programs: EAEDC, SNAP, WIC, Head Start, Mass Health, National School Lunch Program, Public Housing, School Breakfast Program, Supplemental Security Program, TAFDC, or Veterans Programs (115 benefits, DIC surviving parent, non-service pension).

burdens, they have a clear interest in reducing their expenditures on electricity, and participating in community shared solar is one avenue for reducing energy bills.

Many of the impacts of climate change disproportionately affect disadvantaged populations, including low-income communities and communities of color (Morello-Frosch et al. 2009; Intergovernmental Panel on Climate Change 2014; Sanders and Milford 2014). Climate change can have detrimental effects on human populations, including impacts on human health, undermined food security, economic losses, and displacement (Intergovernmental Panel on Climate Change 2014). Low- and moderate-income people tend to live in sub-optimal housing, which leaves them more exposed to flooding and extreme heat (Kelly and Ross 2014). Dense urban neighborhoods, often populated by people with lower incomes and communities of color, are more vulnerable to heat waves because of the heat island effect (Kelly and Ross 2014; Morello-Frosch et al. 2009).

Additionally, these communities are less likely to have access to air conditioning or cars, both of which reduce exposure to extreme heat (Morello-Frosch et al. 2009). Low- and moderate-income communities tend to rely more on public transit than others, and transportation, along with other infrastructure, may be damaged in the event of a storm (Kelly and Ross 2014). Finally, low- and moderate-income households may be disproportionately burdened by the financial costs of climate change. As previously stated, they already spend a higher portion of their budgets on necessities, including food and energy, than households with higher incomes; climate change has the potential to widen this spending gap across income groups (Morello-Frosch et al. 2009).

While climate change will certainly affect all people, it is clear that it will not affect them evenly. Everyone has an interest in reducing greenhouse gas emissions to mitigate climate change, but perhaps no one has more interest in halting climate change than the already disadvantaged communities that will be hit the hardest. Though a single solar generation facility may not measurably impact health or the environment in one locality, there are cumulative benefits that come with increasing community shared solar across the state or the nation (Interstate Renewable Energy Council 2016). Implementing community shared solar is a part of a greater movement for “energy democracy.” As described by the Center for Social Inclusion, energy democracy is community residents becoming involved in managing and making decisions about the creation and use of energy (“Energy Democracy in a Nutshell,” n.d.). This concept ties together the environmental benefits of renewable energy and the goal of empowering marginalized communities through participation in the green economy (“Energy Democracy: Community-Scale Green Energy Solutions” 2010).

In the renewable energy industry, there has been unequal participation by higher income individuals and low- and moderate-income communities. People with financial resources have received greater access to clean energy technologies and have benefitted from public policy that provides incentives for using renewable energy; these opportunities have simply not been readily available to low-income communities (Sanders and Milford 2014). Community shared solar can allow historically disadvantaged communities greater access to and inclusion within the green economy (Outka 2012). Community-based projects are unique among renewable energy models in their ability to provide local jobs, keep wealth within a particular community, and give local residents positions as owners and decision-makers (Giancatarino 2013). Locating community shared solar within low- and moderate-income communities and communities of color may improve the economic wellbeing of these communities through “providing pathways for residents to more directly participate in and benefit from the clean energy economy,” including the creation of employment opportunities (Interstate Renewable Energy Council 2016).
Green Jobs

The Bureau of Labor Statistics describes green jobs as jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources (U.S. Bureau of Labor Statistics 2016). Green jobs include positions in industries that produce green goods and services such as energy from renewable sources, energy efficiency, pollution reduction and removal, greenhouse gas reduction, and recycling and reuse. Green jobs may also include work in natural resources conservation, environmental compliance, education and training, and public awareness. Nationwide, the solar industry continues to outpace most other sectors of the economy, adding workers at a rate nearly 12 times faster than the overall economy and accounting for 1.2% of all jobs created in the U.S. over the past year (The Solar Foundation 2016). Solar industry employment has grown by 123% since 2010, resulting in over 115,000 new domestic living-wage jobs. Massachusetts has the second highest number of solar jobs among U.S. states.

![Figure 3: U.S. Solar Employment Growth by Sector, 2010-2015. Source: (The Solar Foundation 2016)]
National wages paid to solar workers remain competitive with similar industries and provide many living-wage opportunities. In 2015, solar installers earned a median wage of $21 per hour, a 5% increase over the $20 per hour wage in 2014. Manufacturers pay assemblers a median of $18 per hour. Sales representatives and solar designers earn the highest median wages of $28.85 and $26.92 per hour respectively. All of these are above the national median wage of $17.04 per hour (The Solar Foundation 2016).

Several articles and reports have detailed the implications of green jobs and the industries surrounding sustainability and renewable energy, highlighting the unique benefits of green jobs. The renewable energy and low-carbon sectors generate more jobs per unit of energy delivered than the fossil fuel sector. Among the common renewable portfolio standard (RPS) technologies, solar PV creates the most jobs per unit of electricity output (Bowen 2012).

While the solar industry provides a growing number of competitively paid jobs, it is important to consider which demographic groups in the population are being represented within the industry. When looking to bring equity to low-income communities, employment is a large part of that equation. The demographic makeup of the solar industry is similar to that of the U.S. workforce as a whole. In some cases, the solar industry is less diverse than others (The Solar Foundation 2016). This should be considered in an effort to make Massachusetts’ solar industry accessible to a diverse group of residents. The tables below include the employment rates of select minority groups, showing that women, African Americans, and Latino/a Americans are underrepresented in solar industry employment. In an effort to increase solar access to a more diverse group it is important to attempt the same in the industry. At the moment, the solar industry is in some cases less diverse than the rest of the job market on a national level.
## 2015 Installation Sector Demographic Breakdown

<table>
<thead>
<tr>
<th></th>
<th>2015 Solar Employment</th>
<th>% of Solar Installation Employment</th>
<th>% of Total U.S. Workforce</th>
<th>% of Construction Industry Employment</th>
<th>% of Oil and Gas Extraction Industry Employment</th>
<th>% of Coal Industry Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>25,305</td>
<td>21.1%</td>
<td>46.9%</td>
<td>8.9%</td>
<td>17.9%</td>
<td>7.4%</td>
</tr>
<tr>
<td>African American</td>
<td>5,877</td>
<td>4.9%</td>
<td>11.4%</td>
<td>5.9%</td>
<td>5.8%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>8,395</td>
<td>7.0%</td>
<td>6.1%</td>
<td>1.8%</td>
<td>2.1%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Latino/a or Hispanic</td>
<td>16,191</td>
<td>13.5%</td>
<td>16.1%</td>
<td>27.3%</td>
<td>12.8%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Veterans of the US Armed Forces</td>
<td>2,874</td>
<td>9.5%</td>
<td>7.0%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Belong to a Union</td>
<td>108</td>
<td>0.4%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>55 and over</td>
<td>7,272</td>
<td>24.0%</td>
<td>22.1%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Table 1: 2015 Installation Sector Demographic Breakdown. Source: (The Solar Foundation 2016)*

## 2015 Manufacturing Demographic Breakdown

<table>
<thead>
<tr>
<th></th>
<th>2015 Solar Employment</th>
<th>% of Solar Manufacturing Employment</th>
<th>% of Total U.S. Workforce</th>
<th>% of US Manufacturing Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>8,635</td>
<td>28.5%</td>
<td>46.9%</td>
<td>29.3%</td>
</tr>
<tr>
<td>African American</td>
<td>2,942</td>
<td>9.7%</td>
<td>11.4%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>4,895</td>
<td>16.2%</td>
<td>6.1%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Latino/a or Hispanic</td>
<td>3,415</td>
<td>11.3%</td>
<td>16.1%</td>
<td>15.8%</td>
</tr>
<tr>
<td>Veterans of the US Armed Forces</td>
<td>2,874</td>
<td>9.5%</td>
<td>7.0%</td>
<td>n/a</td>
</tr>
<tr>
<td>Belong to a Union</td>
<td>108</td>
<td>0.4%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>55 and over</td>
<td>7,272</td>
<td>24.0%</td>
<td>22.1%</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Table 2: 2015 Manufacturing Demographic Breakdown. Source: (The Solar Foundation 2016)*
Employment opportunities in the solar industry can be further subdivided into three tiers of green job growth and longevity. In the short-term, jobs may be lost in directly affected sectors, and new ones are created in replacement industries. In the medium-term, when the impact of climate change policy ripples through the economy, jobs are created and lost along the value chains of affected industries. These are the higher-order, economy-wide effects of climate policy. In the long-term, innovation and the development of new technologies create opportunities for investment and growth. We can call this the dynamic effect of climate policy (Fankhaeser, Sehlleier, and Stern 2008). The following table provides the wages and required education levels for several employment opportunities available in the solar industry, from conception to installation and afterward.

<table>
<thead>
<tr>
<th>Training Opportunity Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is important to consider training opportunities associated with employment in the industry. For many individuals who come from low-income communities, access to a college education is not always possible. However, job training programs are available in the state of Massachusetts and throughout the country.</td>
</tr>
<tr>
<td>Job Corps is a no-cost education and vocational training program administered by the U.S. Department of Labor that helps young people ages 16 through 24 improve the quality of their lives through vocational and academic training. The Westover Job Corps Center, in Chicopee, Massachusetts, worked with local contractors on the construction of approximately 1.5 acres of stationary, ground-based solar PV panels. Once the solar panels were installed, the new system served as an alternative energy source to decrease the center's dependency on outside power sources. The panels have added 150 to 200 kilowatts to the center's existing power system. The center and contractors identified training opportunities for students during the installation of the panels, a prime opportunity for students to learn more about emerging technologies and energy-efficiency in the construction industry. PV and Thermal System Installation Programs are currently located at the Job Corps Centers in Gainesville, Florida and Puerto Rico (Job Corps, n.d.).</td>
</tr>
<tr>
<td>GRID Alternatives is a California-based nonprofit organization whose mission is &quot;to make renewable energy technology and training available to underserved communities&quot; (“Mission and History,” n.d.). The organization manages solar programs and projects across the country, including in Colorado, where it recently received a grant from the Colorado Energy Office to develop community shared solar projects in conjunction with rural electric cooperatives throughout the state. GRID alternatives will develop at least five projects that</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential Solar Project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job</strong></td>
</tr>
<tr>
<td>Canvasser</td>
</tr>
<tr>
<td>Construction Laborer</td>
</tr>
<tr>
<td>Solar Installer</td>
</tr>
<tr>
<td>Electrician</td>
</tr>
<tr>
<td>Maintenance</td>
</tr>
<tr>
<td>System Designer</td>
</tr>
<tr>
<td>Administrative Manager</td>
</tr>
<tr>
<td>Construction Manager</td>
</tr>
<tr>
<td>Operations Engineer</td>
</tr>
</tbody>
</table>

serve at least 300 low-income families, and the projects will specifically incorporate around 2,000 hours of solar industry training for members of the participating communities (“Community Solar Colorado,” n.d.).

It is important to ensure that job opportunities are accessible to communities with high rates of unemployment and underemployment when implementing community shared solar models. In order to do so, manufacturing is often a way to cement long-term jobs for low-skilled workers. An aim to locate shared solar facilities within low-income communities is also typically driven by an interest in improving the economic wellbeing of these communities and providing opportunities for residents to more directly participate in and benefit from a green economy. To accomplish this task, programs often require additional funding (via public-private partnership or state and federal funding) or incentives for community education, job training, and/or local hiring (Interstate Renewable Energy Council 2016).

While some direct, indirect, and induced economic development benefits may result from simply locating facilities within low-income customers’ communities, these positive impacts are not guaranteed without targeted efforts. In addition, there has to be strong advocacy and precise policy for program and economic goals to ensure they are achieved.
Community shared solar programs in the Commonwealth of Massachusetts are supported by a statewide goal to install 1,600 MW of solar energy generating capacity by 2020 ("Patrick-Murray Administration Reaches 2017 Solar Energy Target, Sets New Goal" 2013). As Figure 5 shows, a total of 1,058 MW have been installed as of March 2016.

This goal of solar energy production was announced by the Patrick Administration in 2013 and received subsequent, continued support from the Baker Administration in 2015 (Dumcius 2015; “Patrick-Murray Administration Reaches 2017 Solar Energy Target, Sets New Goal” 2013). Yet many of the more pertinent details for the state’s solar industry—in particular, engineering criteria and available incentives—stem from the Green Communities Act of 2008 and subsequent revisions and appear in Chapter 164, Sections 138-9 of the MA General Laws.
In Massachusetts, like in several other states, the ability to participate in “net metering” has been one of the principal benefits of investing in solar projects. In its simplest form, net metering involves using the electricity from on-site solar generation and “banking” any excess generation with the local utility. Banking allows a customer’s meter to automatically run backwards as excess electricity is sent to the electric grid; the customer receives a credit on her bill and can then draw an equivalent number of kilowatt-hours from the utility at a later time and at a reduced rate. The Massachusetts General Laws define three classes of solar facilities that may participate in net metering (General Court of the Commonwealth of Massachusetts, n.d.). They also define limits to the availability of net metering: as of April 2016, the collective capacity of private solar facilities cannot exceed 7% of a local utility’s historical peak load, and the collective capacity of projects owned by municipalities or other public entities cannot exceed 8% of historical load (Senate, No. 1979, Amended, n.d.).

Importantly for community shared solar initiatives, projects under a certain size (generally, 10 kilowatts for residential rooftop projects and 25 kilowatts for non-residential projects) are exempt from the net metering cap, and the electricity produced by a project does not need to be consumed on site, as long as it is connected to the utility’s distribution grid through a retail electric meter.

3 For a quick guide to current and proposed policies regarding community shared solar and net metering in other states, see the “USA Shared Energy Map” developed by Shared Renewables HQ: http://www.sharedrenewables.org/shared/community-energy-projects/
4 Class I facilities are those with a capacity of 60 kW or less, Class II facilities are those with a capacity more than 60 kW but less than or equal to 1 MW, and Class III facilities are those with a capacity more than 1 MW but less than or equal to 2 MW.
5 These limits exist ostensibly to allow the local utility to manage electric load on its transmission and distribution grid, particularly on sunny summer days when many solar projects may be sending their excess production to the grid. Knowing how much electricity could be sent to the grid helps the utility balance all sources of electricity and prevent blackouts. At the same time, however, the utility has an interest in limiting solar projects so that it can ensure as many people as possible must purchase electricity from the grid.
(General Court of the Commonwealth of Massachusetts, n.d.; “Net Metering Frequently Asked Questions and Answers” 2016). In addition, project owners may allocate their net metering credits to other customers, even those who are not affiliated with that particular project, as long as (1) those customers reside in the same utility service territory and the same load zone for the New England Independent System Operator. (ISO-NE)6,7 and (2) the stipulations of the local utility’s “net metering tariff” are met (General Court of the Commonwealth of Massachusetts, n.d.; Massachusetts Department of Public Utilities, n.d.). Allocating credits to other customers in this way is sometimes referred to as “virtual net metering,” since those who receive the benefits are not the ones actually using the electricity produced. Regardless of where the beneficiaries reside, a project owner must file a “Schedule Z” form with the local utility in order to specify who will receive the credits.

Several other statewide programs and policies in Massachusetts have also bolstered solar projects in recent years. In particular, two consecutive programs coordinated by the Massachusetts Department of Energy Resources (DOER) have allowed solar facilities to access the statewide market for solar renewable energy certificates (SRECs)—the current program is known as "Solar Carve-Out II/SREC II."8 SRECs represent the environmental benefits inherent in renewable energy. The value of an SREC in Massachusetts has ranged from $257 – 470 (up to $.25-.47 per KWh for residential facilities) and represents a major financial mechanism for solar development (SREC Trade 2016). Community shared solar facilities are awarded one SREC for each megawatt-hour of electricity they produce, which can then be sold to entities (such as utilities) that are required to buy them for environmental compliance. SREC sales generate funds that project owners can then use for a variety of project-related purposes (“About the Solar Carve-Out II Program” 2016). Aside from acting as the “Independent Third Party Meter Reader” that verifies SREC generation by all projects across the Commonwealth, the Massachusetts Clean Energy Center (MassCEC) also runs a “Mass Solar Loan” program aimed at enhancing the availability to homeowners of financing for solar projects. (See Appendix III for more information on SRECs and Mass Solar Loan.)

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6 ISO-NE is an independent organization that manages the wholesale electricity markets for the six New England states. ISO-NE manages eight separate “load zones” - regions with their own electric prices – of which there are three in Massachusetts.
7 Given that beneficiaries of net metering credits must live in the same utility service territory and load zone as the project itself, residents of Boston and Chelsea, for example, could be involved in the same project. Residents of Boston and Quincy or of Springfield and Worcester, however, could not be involved in the same project. See Appendix I for a map of the load zones along with local utility service territories.
8 DOER has specific requirements that community shared solar projects must meet in order to participate in the SREC II program. Namely, net metering credits must go to at least three utility customer (member) accounts, no more than two utility customers may receive credits for more than the amount of electricity produced annually by 25 kW of installed solar capacity, and no two customers may hold the net metering rights for more than 50% of the project’s total capacity (Massachusetts Department of Energy Resources, n.d.). Allowing two customers to hold rights for up to 50% of capacity is intended to boost funding opportunities, assuming these two customers have a greater ability to invest in the project than others might.
Recent changes in the state program and policy landscape will reduce—but not eliminate—the incentives and benefits available for community shared solar in the short term. The SREC II program has met its cap for projects with a capacity over 25 kW, though those under 25 kW are still eligible, and DOER is currently designing a successor program to SREC II. More critically, on April 11, 2016, Governor Baker signed a bill, H.4173, that raises the statewide caps on net metering, but simultaneously reduces the net metering benefits available to privately owned projects (those not owned by municipalities). The implications of this new legislation are outlined below.

### Retail Rates

The “retail rate” is “a credit equal to the excess kilowatt-hours by time of use billing period, if applicable, multiplied by the sum of the distribution company’s: (i) default service kilowatt-hour charge in the ISO-NE load zone where the customer is located; (ii) distribution kilowatt-hour charge; (iii) transmission kilowatt-hour charge; and (iv) transition kilowatt-hour charge; provided, however, that this shall not include the demand side management and renewable energy kilowatt-hour charges” (General Court of the Commonwealth of Massachusetts, n.d.). As discussed in the overview for this section, when a project owner sends (“banks”) excess solar energy back to the grid, she receives a credit on her monthly utility bill for the amount banked. She—or whoever she designated to receive the net metering credits for her project—can then draw an equivalent amount of electricity from the utility at a later time. If the net metering beneficiary receives the “retail rate” for this energy, she pays almost nothing to retrieve banked electricity. In essence, the utility is paying her after the fact for the electricity that she banked, which the utility took and sold to another customer at the time that she banked it. The price the utility “pays” her for this electricity is the typical price it charges customers, minus the standard charges all customers pay to fund statewide energy efficiency and renewable energy programs. The definition of “retail rate” above is technically for Class II Net Metering Credits; “retail rate” is a colloquial term that does not appear in the Massachusetts General Laws but means this particular benefit structure. As indicated in Table 4, this benefit structure also appears in H.4173 in relation to the credits available to municipal solar projects.

### Table 4: Comparison of Previous Policy and New Policy under H.4173

<table>
<thead>
<tr>
<th>Net Metering Credit</th>
<th>Private (Non Municipal) Projects</th>
<th>Previous Policy</th>
<th>H.4173</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Retail rate (minus distribution charge if a Class III facility)</td>
<td>60% of retail rate</td>
<td></td>
</tr>
<tr>
<td>Municipal Projects</td>
<td>Retail rate</td>
<td>Retail rate</td>
<td></td>
</tr>
<tr>
<td>Grandfathering for Existing Projects</td>
<td>-</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

| Net Metering Cap    | Private (Non Municipal Projects) | 4% of utility’s historical peak | 7% of utility’s historical peak |
|                     | Municipal Projects               | 5% of utility’s historical peak | 8% of utility’s historical peak |
| Exemption for Small Projects (under 10 kW for residential; under 25 kW for non-residential) | Yes | Yes |

<table>
<thead>
<tr>
<th>Minimum Bills</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
</table>

| Additional Programs to Support Net Metering | SREC II Program | DOER must develop program to replace SREC II |

*Table 4: Comparison of Previous Policy and New Policy under H.4173*
H.4173: New State Policy and Implications for Community Shared Solar

Table 4 above provides a brief overview of legislative and regulatory policy regarding community shared solar (and other solar) programs, both before and after H.4173 passed.

Implications of H.4173

- **NET METERING CREDIT REDUCED**: After the Commonwealth meets its 1600 MW goal for solar installations, the net metering credit for private projects will be reduced to 60% of the retail rate. (The new rate is referred to as a “market based net metering credit.”) Municipal projects will continue to receive the retail rate, however.

**Neighborhood Net Metering**

Aside from Class I, Class II, and Class III net metering facilities, the Massachusetts General Laws also define “neighborhood net metering facilities,” which are projects of any class that are located in a particular neighborhood and serve – or are owned by – ten or more residential customers in that same neighborhood (M.G.L. ch.164 § 138). The General Laws also define the term “neighborhood” for this purpose (M.G.L. ch.164 § 138). Prior to H.4173, these facilities received a net metering credit equal to that of Class III facilities (retail minus the distribution charge). It appears that, under the new legislation, they will receive the same “market net metering credits” as any other private project.

- **GRANDFATHERING OF PREVIOUS NET METERING CREDITS**: Any private projects built and approved for net metering before the 1600 MW goal is reached will continue to receive their Class I, Class II, or Class III credits (see M.G.L. ch.164 § 138) for 25 years once they are connected to the grid. After that time, private projects will receive the market based net metering credit. Whereas this provision is good for existing projects, it does mean that existing small projects – generally, those undertaken by wealthy individual homeowners – will continue to receive the retail rate while new, larger projects for low- and moderate-income residents will receive a much lower credit.

- **NET METERING CAP RAISED**: The overall capacity cap for projects receiving net metering credits was raised from 9% of the local utility’s historic peak load (5% allocated for municipal projects plus 4% for private projects) to 15% of the local utility’s historical peak load (8% allocated for municipal projects plus 7% for private projects). The exemption for private residential projects with a capacity less than or equal to 10 kW and for private non-residential projects with capacity less than or equal to 25 kW will remain in effect.

- **MINIMUM BILLS**: Utilities will be allowed to propose “monthly minimum reliability contributions,” which would take effect after the 1600 MW solar goal is reached, but no later than December 31, 2018. These “contributions” are meant to charge solar energy consumers for using the electric grid, regardless of how much electricity they purchase from the utility and regardless of the benefits they provide through the solar energy they send to the grid. DOER may exempt low-income customers or revise their contributions and may also exempt – for any amount of time through the year 2020 – solar projects that are in service before December 31, 2016. In April 2015, a state Net Metering and Solar Task Force provided several recommendations regarding changes to Massachusetts’ solar programs and incentives; its report provides additional insight into utilities’ push for minimum bills (see the Political Advocacy section for more detail) (Massachusetts Net Metering and Solar Task Force 2015).

- **NEW SOLAR INCENTIVE PROGRAM**: DOER is instructed to design a new program that would replace SREC II after the 1600 MW goal is met. The text is vague, though it suggests “differentiate[d] incentive levels to support diverse installation types that provide unique benefits including, but not limited to, community shared solar facilities [and] low-income solar facilities…” Conversations with subject matter experts suggest that this new program is intended to be the primary means for low- and moderate-income communities to benefit from solar power in the future, in addition to a reduced net metering benefit. (There are no guarantees, however - with regard to community shared solar, this language could just be a way of doing nothing while appearing to do something.)
Current Status of the SREC II Program

DOER has been considering how to phase out the SREC II program as the Commonwealth approaches its target of 1600 MW of installed solar capacity. On April 8, 2016, DOER filed an Emergency Regulation to outline the future process for providing Statements of Qualification. Projects with a capacity of greater than 25 kW must receive approval to interconnect from the utility within nine months of April 8, 2016, but projects with a capacity of 25 kW or lower can continue to apply and receive Statements of Qualification until a successor program to SREC II is announced (“Regulatory Proceedings for RPS and APS” 2016). Thus, small projects that are currently exempted from the net metering cap may also continue to apply for SRECs until a successor program is announced. DOER has contracted with Sustainable Energy Advantage, LLC to design the successor program to SREC II (“Massachusetts SREC-II Emergency RegulationFiled: April 8, 2016” 2016). DOER continues to provide updates on the status of SREC II on its website.

SREC Tips from Industry Experts

- When selecting a contractor to design and install a project, project owners should always ask what a potential contractor can offer in terms of technical assistance throughout the SREC registration process.
- All project owners should work with an aggregator. The SREC tracking system is designed for industry professionals, not necessarily for the average person, and an aggregator can help register a project and manage all SREC procedures.
- Project owners shouldn’t worry if the process is taking a while. DOER and the MassCEC’s Production Tracking System (PTS) register a couple thousand systems per month. Once the application is in the system, it’s in the system.
- Given H.4173 and recent developments at DOER, SREC II is here to stay for a while – at least for projects with a capacity under 25 kW. That said, at least one industry expert said their organization is treating SREC as a program that won’t be around forever, especially as the solar industry in Massachusetts matures. It makes sense for project owners to at least consider whether a project could stand financially without SRECs.
Models and Project Components

There are a few standard models of organization that most community shared solar projects use. The basic components of any community shared solar project are as follows:

- A suitable site to host an installation
- A contractor to install and connect the array
- The finances to pay for the installation
- Two or more participants to purchase the electricity as customers (“ratepayers” as demonstrated in Figure 6, below) and/or invest in and become partial owners of the project
- A management entity to manage project operations and administer the distribution of benefits
- Approval from the utility to connect to the grid and transmit benefits, and permission to construct the project from municipal governments or other regulatory entities

- **Characteristics:** A community shared solar project can be installed on a rooftop or on open land. The location must also be clear of shade and obstruction. The size of the site must be able to accommodate the system and panel design. For example, a 1-MW community shared solar project would require four to five acres of land, or a square of roughly 416-466 feet, and would meet the electrical needs of roughly 200 households (“The Guide to Developing Solar Photovoltaics at Massachusetts Landfills,” n.d.). We can visualize this as three to four football fields. A 25-kW solar array may fulfill the electricity needs of approximately five households, depending on family size and average energy use.

- **Ownership:** The site owner may be a public entity, such as a municipality, or a private entity. There must be clear ownership or lease arrangement, so that the project can have certainty that it will retain long-term rights to use the land.

- **Geographic Constraints:** If located at a remote location, it must be sited within two geographic boundary constraints: it must be within the same ISO load zone as its customers, and its customers must be served by the same utility. For our specific purposes, most of the metro-Boston area is served by Eversource, and is within the Boston/Northeast MA ISO load zone. A project serving customers in Boston could only provide electricity to customers falling within both of these constraints (see Appendix I: Reference Maps).

**Contractor**

The project must be built by a licensed contractor. The contractor will survey the site and verify site-control, and will construct and maintain the installation. In a lease and PPA agreement, the contractor may be awarded lease rights to the site, and may serve to secure and aggregate finances, and manage and distribute the net metering credits produced by the project.

**Secured Financing**

Site

All solar projects need a host site, where solar electric (or photovoltaic) panels are installed and create energy from the sun. Rooftop projects nearly always need to be sited on roofs with clear ownership or development rights, and the electricity produced by the installation typically must be run through the homeowner’s electricity meter (which must be a net meter, allowing for electricity to be monitored as it flows in both directions). Sites for community shared solar projects also have additional factors that need to be taken into consideration.

- **Characteristics:** A community shared solar project can be installed on a rooftop or on open land. The location must also be clear of shade and obstruction. The size of the site must be able to accommodate the system and panel design. For example, a 1-MW community shared solar project would require four to five acres of land, or a square of roughly 416-466 feet, and would meet the electrical needs of roughly 200 households (“The Guide to Developing Solar Photovoltaics at Massachusetts Landfills,” n.d.). We can visualize this as three to four football fields. A 25-kW solar array may fulfill the electricity needs of approximately five households, depending on family size and average energy use.

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Since the investments of any solar project are front-loaded, with high upfront costs and returns and benefits extending for decades, significant capital must be secured in order to finance any project. Rooftop projects owned by the homeowner are typically financed through home equity, or by financing (Beavers, McGuckin, and Sweet 2013). Financing for most community shared solar projects can be secured by the developer or a tax equity partner, with the lease rights, PPA agreement and the credit ratings of the participants as the instruments to secure the debt (Mendelsohn, Urdanick, and Joshi 2015). The tax equity partner is an investor(s) with taxable passive income that is allowed to take advantage of the 30% Investment Tax Credit (ITC)9 and other tax benefits available to investors in PV systems (Beavers, McGuckin, and Sweet 2013).

In Massachusetts, the Mass Solar Loan Program became available in January 2016 (Interstate Renewable Energy Council 2016), allowing lenders to offer financing for rooftop solar projects at subsidized rates. While it was designed to benefit homeowners with small rooftop projects, there is a potential for loan funds to be used to purchase participation in a community shared solar project (Judge and Krause 2015).10 (See Appendix III for more information.) Some public benefit projects have been built by a combination of funding sources, from public or private grant awards to state and federal loans, to individual financing, donations, crowd-funding and bank financing (Heeter 2014a).

Participants

With community shared solar, the participants can be a set of individuals and/or groups or businesses. Participants can purchase shares of the system, and are granted the corresponding fraction of benefits of the system. In turn, these customers receive that fraction of the system's energy production as a credit on their utility bill, made possible through virtual net metering (Mock 2015). In an LLC or “energy collective” model, a developer pays up front. Later, participants buy in to receive a fraction of the energy produced, and receive benefits for the lifetime of the project. They are part owners, owning a portion of the system and receiving a corresponding portion of the project’s benefits, which also makes them customers. The developer typically partners with a tax equity investor to monetize the 30% Investment Tax Credit and other available tax incentives.

### Participants: Who are we talking about again?

The term “participant” may seem confusing, as it can have different meanings in the context of different projects. Generally participants can be either:

- **Owner** - a person or entity that pays a share of the startup costs as an investor, or
- **Customer** - a person or entity that receives electricity from a community shared solar project via net metering (or virtual net metering).

Or both Owner and Customer – a person or entity that owns part of the project as an investor and receives electricity from the project as a customer.

A community shared solar project with no outside financier beyond the customers who provide upfront costs and receive the net metering benefits typically makes up a consumer-owned co-op model. The investors are the direct customers, providing all project financing, though customers can purchase different portions of the project, and receive corresponding financial benefits. In these consumer-owned models, the tax credits and incentives are delivered directly to the consumer owners. If there are ten or more investor-owners who live in the same neighborhood, the project may constitute a “neighborhood net metering” designation. Neighborhood net metering projects are eligible for exemptions from net metering caps and other favorable policies, described in the previous section.

In another model, participant “owners” provide upfront investment in a community solar array on a non-profit or community building (e.g., church, school, or small business). The energy produced offsets the energy used

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9 The Investment Tax Credit (ITC) is a federal 30% tax credit for solar systems on residential and commercial properties. It was created with the Energy Policy Act of 2005 and has been recently been extended so that it will remain available at least until 2023 (Solar Energy Industries Association, n.d.).

10 While reports reference this program as offering access to community shared solar, it is not clear whether the program has been used for such purposes. The program is in its first year, and use of Mass Solar Loan financing for these purposes deserves further scrutiny.
on that site, and money saved by the site on their utility bills is paid back to participants who have bought into the community solar array (Giancatarino 2013). In this model, the owners are not customers.

In 2014, Massachusetts DOER amended the Commonwealth’s definition of community shared solar, allowing for “anchor participants.” This means that up to two participants can receive in excess of 25 kW each of energy from the community solar array, up to 50% of the total electricity produced, but the project requires that there be other participants. Prior to this change, no participant could receive more than 25 kW on a community solar project. Anchor participants may be able to bring good credit and certainty to a project, allowing a smaller pool of potentially low- and moderate-income customers, to buy in to the remainder of the project’s capacity (Wade 2014).

Management Entity

The manager of a community shared solar project is often the contractor who builds, owns, and administers the project. Alternative models, including non-profit and consumer co-op models, offer different ways to manage and distribute the project’s benefits. One commonality shared by projects with different management entities is the need to register customers on a Schedule Z for the project (see Appendix III) which has the limitation of only being able to be updated once every six months.

Project Approval

While small rooftop projects typically utilize net metering and are exempt from caps, an off-site community shared solar project must be approved for “virtual net metering”, which is governed by state regulation and subject to a cap. (See Appendix III for information on the approval process for interconnection and receipt of net metering benefits.) Before a project is pursued, the local authority (zoning board, building department, Historical District Commission, other local/regional regulatory agencies, etc., where applicable) must also grant project approval.

Case Studies

Case studies are an important tool to examine what has been possible with community shared solar thus far and what might be possible. There is no silver bullet—each study has some promising innovations, and some challenges. Using case studies, Community Labor United and the Green Justice Coalition can get a better sense of how community shared solar projects have been designed and see how other organizations and entities have approached making community shared solar more accessible. There will be specific attention paid to whether or not the community shared solar project engages low- and moderate-income (LMI) consumers, and the level to which they are served. (See Appendix II for detailed narrative descriptions of select case studies.)
<table>
<thead>
<tr>
<th>Entity</th>
<th>Description</th>
<th>Creative Financing</th>
<th>Management Entity</th>
<th>Serves LMI customers?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cape &amp; Vineyard Electric Coop (CVEC)</td>
<td>An energy cooperative, CVEC, has built 32 solar arrays generating 28 MW of solar power. The clients are towns of Barnstable County and Martha’s Vineyard. Projects constructed supply electricity needs for municipal and other government buildings. Benefits: Use of underutilized land; municipal budget relief; stabilization of rates for the Cape &amp; Island, a place that’s vulnerable to impacts and destruction of the energy grid from weather events.</td>
<td>Considered a municipal project, the projects get the highest rate, or price for net-metering credits. Municipalities involved are a very low credit-risk, and the projects are financed “off-budget”.</td>
<td>Energy Coop, with municipalities as the participants.</td>
<td>No. These projects primarily provide relief to municipal budgets. However the success and proliferation of this model highlights the potential for project development should LMI ratepayers be afforded the same net-metering and SREC benefits as municipal projects.</td>
</tr>
<tr>
<td>Community Development Partnership (CDP)</td>
<td>A community development corporation, CDP, manages 5 community solar arrays of roughly 55 kW generation capacity, producing over 68 MWh/year. The electricity offsets electricity needs that CDP is responsible to pay (common spaces on residential buildings, and electricity of administrative buildings), through net-metering. It provides electricity and SREC revenue to the CDP, who has leveraged some of those funds to finance efficiency efforts for their LMI tenants.</td>
<td>Seed money was provided via a private grant from the TD Charitable Foundation. A local bank extended financing since they had a revenue source and reduced financial liability from their solar projects.</td>
<td>Project benefits a non-profit community development corporation. Some of the financial benefits are passed on to tenants via building upgrades and efficiency.</td>
<td>Yes and no. This project does not provide direct relief to LMI customers, but energy cost savings by CDP from the solar project was used on resident energy efficiency measures. Energy efficiency translates to savings on utility bills.</td>
</tr>
</tbody>
</table>
| University Park Community Solar, LLC | A 22 kW solar array was installed on the roof of a Maryland church. Participants invested in a fraction of the project and receive the corresponding portion of revenue from electricity generated and used by the church, federal tax incentives, and auction of SREC sale. The electricity generated directly serves the church building’s load. | The LLC received a $10,000 grant from the state of Maryland. Project development process benefitted from free help from the Maryland Intellectual Property Legal Resource Center. | An LLC, which was founded to run and manage this sole project. | Not specified. The model does not provide electricity to participants, but pays a portion of the project revenue corresponding to buy-in amount. 
This allows participants to move out of the area, helping navigate challenges of transiency. |
| Co-op Power                    | Co-op Power is developing a 600kW project for construction in Greenfield, MA. It will be available to customers in Western Massachusetts who are served by the utility Eversource. Participants will get the virtual net metering credits from their share of the project they’ve invested in up front, estimated at 25 years. | Co-op Power can offer shares at $2/w (compared to $3.50 to $4.50 of most community solar projects) because they use the SREC income to pay off a loan, in effect, giving participants no risk access to the tax credits. The consumer cooperative model allows them to count share purchase as a pre-payment for good or service, not an equity investment, changing the tax credit implications. | Co-op Power is a consumer owned cooperative, though relies on an LLC, Co-op Power, to manage contracts. | Yes. Low-income participants can buy in at a lower rate, financed more heavily by higher income owners of the project. In turn, they receive a lesser return on investment. |
Financing

By nature, solar projects front-load the cost of energy and thus require significant startup capital. A 6-kW rooftop solar array that provides the bulk of the electrical needs for a single household requires an upfront investment of $22,000-27,000, with the funds for such an investment typically financed through home equity (Bahirwani 2016). Though these costs are partly mitigated in the long run by robust federal and state tax incentives, including a 30% federal tax credit (ITC) and up to $1,000 in state credits, individuals seeking to pursue a solar project must pay for the project upfront, either through borrowing or savings.

Third-party ownership, whereby a company builds and owns the array, and sells energy at a discounted rate to the homeowner through a Power Purchase Agreement (PPA) is a common mechanism to avoid large upfront costs. However, such an arrangement transfers much of the financial benefit (including significant SREC value) to the project owner, and this arrangement is available only to homeowners who have the rights to lease their roof space to the project owner. Low-interest loans backed by the Commonwealth are available to homeowners with certain income constraints, but again, such assistance is not available to renters (Massachusetts Clean Energy Center and Massachusetts Department of Energy Resources, n.d.).

Solar Project Costs

Steady advances in solar technology have resulted in a reduction of hard costs (costs of panels and other hardware). In 2013, it was estimated that hard costs make up less than one-third of total project costs (Morris et al. 2013). In the U.S., installation labor represents only 11% of total costs, with customer acquisition, administration, financing costs, developer profits, and other soft costs accounting for nearly half of overall project costs (Morris et al. 2013). ¹¹

Debt interest is also a significant driver of overall costs to the consumer, and there is a significant reluctance on the part of commercial banks to bring potential financial returns of solar installations into their consideration of risk (Heeter 2014a). This cost breakdown indicates that customer acquisition and administrative costs present potential areas for significant cost savings.

Financing Options

Examination of the financing options available to traditional rooftop solar projects gives us a sense of the structure and financing hurdles for community shared solar. In 2014, over ¾ of residential solar projects constructed in the U.S. were third-party owned, meaning that an entity, usually a developer, secured financing for the project and entered into an agreement with the homeowner to receive the rights to build on the rooftop. They also likely entered into a second agreement (PPA) that the homeowner will purchase the power produced by the solar array (Litvak 2015).

There are trade-offs involved in the decision to lease rather than own a solar project. There is a financial risk to the project owner, but a greater potential for benefits. Through lease arrangements, the homeowner does not have to pay upfront costs, and pays the developer a reduced rate for the energy they receive from the installation. Additionally, since the developer owns the array, the tax credits received for the project can directly offset project costs: the company builds those tax credits into the project, rather than to force the homeowner to pay the full cost and to potentially receive a tax abatement in following years. However, the developer receives a return on their investment, partially through the benefits of the sale of SRECs.

Community Shared Solar Financing Options

There are several mechanisms through which groups can fund community shared solar projects. Groups can self-finance, but this arrangement often requires “accredited investors.” Essentially, the U.S. Securities and Exchange Commission limits participation in these types of financial investments to high-net worth individuals with substantial liquid assets (over $1 million in non-real estate financial resources). Additionally, there may be legal limits to the amount of capital that can be

¹¹ However, the steady decline in hard costs of solar installations, coupled with the rapid growth in the industry and the changing regulatory landscape means that these cost projections, and indeed any cost projections without the most recently acquired data, will be somewhat outdated, and actual project costs must be assessed on a case-by-case basis
aggregated, and limits on how a group can recruit participants (Beavers, McGuigin, and Sweet 2013).

Similarly to rooftop solar, groups can enter into a lease and Power Purchase Agreement (PPA) whereby the developer is the owner and financier of the project, leases the site, builds and manages the project, sells the energy to participants, and receives a portion of the SREC profits.

**Community Shared Solar Financing Using Pension Funds**

While there may be substantial regulatory hurdles in establishing an investment mechanism using pension funds, there is precedent for this kind of arrangement, the most notable of which is the AFL-CIO Housing Investment Trust (HIT).

The HIT program is much like traditional a mutual fund, and it invests pension capital in housing projects and earns returns via mortgage-backed securities (AFL-CIO Housing Investment Trust 2015). HIT has invested over $7 billion to finance the construction of over 100,000 union-built housing units since 1984 (AFL-CIO Housing Investment Trust 2015). HIT offers a model for linkage between quality union employment, community investment, and the construction of a reliable investment mechanism.

There is no precedent for using this mechanism to fund community shared solar projects. While HIT prioritizes union-constructed projects, they have a fiduciary responsibility to mitigate risk and may assess the financing of a community shared solar project in the same way as other financing institutions. Such a project may need to provide risk guarantees offered above regardless of the potential financing source.

**Financing Using a Consumer Cooperative Model**

It appears that there is a large void in financing between self-financed or debt-financed projects pursued by groups of affluent consumers, who take on risk but capture significant benefits, and a leasing model that is third-party financed, but offers limited financial benefits to participants. A consumer cooperative model has been proposed to allow a project to be anchored by a non-profit institution, and funded by a mix of wealthier and lower-income participants.

Co-Op Power, a New England collective with several branches throughout Massachusetts, has proposed that a community-owned model may acquire resources from non-profit institutions and community members with a range of incomes and distribute both the electrical resources and financial benefits to those members (Green 2016). By creating an entity that provides tax, financial, and energy benefits to its members, such a model would allow participants other than wealthy "accredited investors" to participate. Resources that members contribute to a project under this model would be considered pre-payments for future goods and services, instead of investment instruments. This model shows considerable promise in finding alternative structures to expand access to solar energy, but it has little case history and remains at the pilot-project level.

**Low-Income Consumers and Credit Risk**

While there are numerous well-documented state and federal programs and non-profit efforts that bring solar energy to low-income homeowners, access to the benefits of solar energy to low- and moderate-income renters presents a significant hurdle, for which there are limited public supports (Valentine 2013). The Obama administration has made significant financial commitments to increase access to solar energy, with a particular emphasis on low-income households (Office of the Press Secretary 2015).

Additionally, the Massachusetts legislative leadership has indicated support for expanding solar access to low-income residents; however, recent legislative developments in Massachusetts indicate that incentives for expanded solar access to low-income residents remain uncertain, with a lower incentive offered to future community shared solar projects (Schoenberg 2016). Though pending solar legislation directs DOER to increase incentives to low-income residents via the SREC program, the benefit structure remains unclear (Schoenberg 2016).
Low-Income Participants: Financial Barriers and Opportunities

Targeting low- and moderate-income customers represents a unique opportunity to expand the base of renewable energy customers. Improved solar access to low- and moderate-income consumers could also increase financial stability for a group that is underserved in renewable energy, and for whom electrical bills are a significantly larger portion of their income (Bovarnick and Banks 2014).

However, any project serving low- and moderate-income consumers, and especially renters, has significant financial and administrative hurdles to overcome. Firstly, these consumers may be considered a credit risk, potentially having higher default rates, which will present a challenge to securing financing for a project (Bovarnick and Banks 2014). Low- and moderate-income renters have a higher rate of transiency (van Ham et al. 2013). However, the recipients of net metering credits for a community shared solar project can only be changed twice per year, and there are significant administrative delays during these transitions.

Under current conditions, a bank may assess a proposal to build community shared solar and supply low- and moderate-income renters as prohibitively risky because of the inefficiency of moving benefits around and the potential for default by low-income ratepayers. If it were easy and quick to transfer benefits, the inefficiency would be removed. Additionally, if the administrator were able to remove the discounted net metering benefits from a customer who could not pay, and transfer those benefits to an individual on a waiting list, concerns about risk of default would be reduced.
It is unlikely that H.4173 will represent the final word on net metering and community shared solar in Massachusetts, even in the short term. State Representative Frank Smizik (D – Brookline) has noted, for example, that the relatively small increase to the net metering cap authorized by H.4173 will likely require a further increase in the next couple years (Schoenberg 2016). In addition, the General Court is currently developing an omnibus energy bill that will ideally reach the floor in 2016. Given the continuing debate and CLU and GJC’s extensive experience with community organizing and advocacy, there are several avenues through which the organizations can exert political pressure to support the interests of their constituent communities within the community shared solar framework. This discussion is meant to stand separately from project development, with the understanding that CLU and GJC may choose to focus solely on advocacy in the short term, or to pursue advocacy in the following areas at the same time as they consider projects.
The concept of minimum bills is meant to address the T&D issue, as well. Both utility representatives and non-utility representatives on the Task Force agreed that “everyone who is connected to the distribution system should contribute towards their use of it . . . [and that] a fair compensation mechanism should be applied to all customers, should be cost based, and should be set in accordance with the customer’s use of the distribution system” (Massachusetts Net Metering and Solar Task Force 2015). Yet the eventual outcome, H.4173, is less concerned with how much a particular customer actually uses the grid, stating that “minimum contributions shall ensure that all distribution company customers contribute to the fixed costs of ensuring the reliability, proper maintenance and safety of the electric distribution system” (Senate, No. 1979, Amended, n.d.). DOER is free to consider a mechanism that “does not unreasonably inhibit the development of Class I, Class II, Class III facilities” though it is not required to do so (Senate, No. 1979, Amended, n.d.).

In sum, it appears that concerns about recouping infrastructure costs and burdening customers who do not participate in solar projects are behind the 40% reduction of net metering benefits in H.4173. Utilities urge caution – they are suggesting that solar customers should not receive further benefits until new mechanisms to ensure cost recovery and equitable distribution are set. There is merit to the utilities' argument, particularly since low- and moderate-income customers who cannot access solar programs are among those who must foot the bill for transmission and distribution investments. (H.4173 does allow DOER to exempt low- and moderate-income customers from minimum bills, or to reduce their payments relative to other customers.) Yet even under current discounted electric rates, low- and moderate-income customers are still paying for renewable energy programs that they may not otherwise be able to access.12 Why should utilities and the General Court choose to reduce the benefits of solar programs rather than devise innovative ways13 to

12 For example, see National Grid’s low-income rate: https://www9.nationalgridus.com/masselectric/home/rates/4_lowincome.asp. Customers receive a 25% discount, but this is a discount on all components of a usual bill, including the renewables charge of 0.05 cents per kWh.

13 One example is New York, where a group of utilities and solar providers have jointly proposed a system through which recipients of net metering benefits continue to receive the retail rate while project owners make payments to utilities to cover the difference between the retail rate and a newly proposed valuation (Vercheak et al. 2016). Though the suggestion is somewhat specific to New
ensure that low- and moderate-income customers can access these programs in the first place?

As noted in the Regulatory Landscape section above, H.4173 allows projects owned by municipalities or other government agencies to continue receiving the retail net metering rate. A previous version of H.4173 included both community shared solar and solar projects serving low- and moderate-income communities in this exemption, as well (Downing, n.d.). There is no reason that municipalities should receive an exemption from the cut while low- and moderate-income communities do not. Although municipal projects may benefit a town's residents by reducing costs that they eventually pay through taxes, private community shared solar projects allow their low- and moderate-income members to receive benefits directly. In addition, it is unconscionable that existing small projects—generally those on individual household rooftops—will continue to receive the retail net metering rate under the grandfathering provisions of H.4173, while new community shared solar projects will not. This amounts to a subsidy for those who can afford to finance their own projects, at the expense of models that would be more likely to benefit low- and moderate-income residents of the Commonwealth. The Field Projects Team recommends that CLU and GJC advocate for a return to at least the retail net metering rate and abolishing net metering caps for all community shared solar projects. If the organizations decide to limit their advocacy to low- and moderate-income communities in particular, then the Field Projects Team recommends advocating for a return to the retail rate and abolishing net metering caps for community shared solar projects that specifically incorporate members of low- and moderate-income communities. The Commonwealth should also conduct a comprehensive cost-benefit analysis of the value of solar electricity – specifically accounting for the benefits achieved by and for low- and moderate-income communities through community shared solar models – to settle the compensation question once and for all. The primary target for this advocacy should be the Joint Committee on Telecommunications, Utilities and Energy in the Massachusetts General Court.

**Schedule Z**

As noted in the Financing section above, the "twice per year" limit of updates to Schedule Z is untenable. If the Commonwealth is truly committed to expanding access to solar energy, then its policies must reflect the realities and necessities of life – including transiency – often faced by low- and moderate-income communities. The Field Projects team recommends that in advocating for a return to retail net metering benefits, CLU and GJC propose an amendment to the Schedule Z process that allows for more timely changes to net metering allocations. For example, even if utilities do not agree to add new net metering accounts more than twice per year, the Schedule Z form could designate a single account to immediately receive credits when the project owner reports someone with rights to net metering benefits has moved. The project's internal contracts and agreements would describe how benefits are allocated amongst the remaining rights holders, without any utility involvement until the next Schedule Z update cycle. Again, the primary target for this advocacy should be the Joint Committee on Telecommunications, Utilities and Energy in the Massachusetts General Court.

**Involvement with DOER Proceedings**

DOER proceedings are public processes, and there will be several opportunities for involvement in the near future as H.4173 is implemented. First, as DOER devises a program to replace SREC II, proposals will be vetted in public meetings around the Commonwealth. Similarly, utilities' proposals for minimum bills will undergo public comment periods in either (or both) DOER or the Department of Public Utilities (DPU).

The Commonwealth has also begun a general overhaul of the electric sector—aside from solar programs in particular—through its grid modernization and time of use pricing proceedings (The Commonwealth of Massachusetts Department of Public Utilities 2012; The Commonwealth of Massachusetts Department of Public Utilities 2014). The first of these requires the utilities to

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York’s current overhaul of utility regulation, it is certainly a development to monitor, particularly given the agreement between utilities and solar providers.
develop ten-year plans for enhancing the effectiveness of their distribution systems, including through incorporation of more "distributed energy resources" like solar. The second requires the utilities to submit plans for time of use pricing schemes, under which the price of electricity would fluctuate throughout the day based on demand, rather than having customers face a flat rate for each kWh they consume (that is, the current system). The Net Metering and Solar Task Force suggested in 2015 that minimum bills could be considered as part of the grid modernization proceeding and Eversource has noted that time of use pricing would likely necessitate a new pricing scheme to replace net metering (Massachusetts Net Metering and Solar Task Force 2015; Eversource Energy 2015). The grid modernization and time of use pricing dockets are currently open – the utilities filed initial plans over the summer of 2015.

To ensure that community shared solar projects—and those for low- and moderate-income communities in particular—are supported and enhanced, the Field Projects team recommends that CLU and GJC monitor and participate (as appropriate) in the DOER and DPU proceedings regarding the SREC II successor program, minimum bills, grid modernization, and time of use pricing.

**Example Pilot Project Proposal**

Every community shared solar project comes with two major sources of risk: solar financing risk, where changes in incentive programs or regulations can jeopardize the profitability of a project, and the development risk, where permitting, zoning, or management difficulties can end the prospects for a project after significant resources have already been invested.

Legislative delays and regulatory uncertainty have created roadblocks for pending projects, with developers seeing significant delays until state government provided at least short-term predictability in regulations. With respect to development risk, projects may take two years to break ground and hundreds of thousands of dollars spent upfront in soft costs, all of which could be lost if a permit is rejected or a municipality passes an ordinance that makes the site unsuitable.

As community shared solar rapidly spreads, it is clear that these risks are manageable for projects that serve affluent customers. Indeed, solar developers do not face a lack of opportunities to build community shared solar; they are instead seeking out the most lucrative opportunities from a range of prospective projects.

A project to serve low- and moderate-income renters adds a third layer of risk: the risk of loss of revenue, either through administrative issues in delivering benefits, or the perception of high defaults by the customer pool.

**Pilot Project Proposal**

The numbers and structure provided below offer a hypothetical project based on precedent projects, the current regulatory environment, and rough costs provided by developers. It should be stressed that the numbers and processes outlined below are subject to a fluid business, financial, regulatory, and even technological environment. Clearer process and cost estimates should be vetted with experienced solar development professionals.

Suppose the Coalition wants enter into a partnership to build a 1-MW array that will serve the electrical needs of 200 low- and moderate-income customers. This project will need roughly five acres of site space, and will have a project cost of roughly $3 million, with administrative costs to sign up customers at an additional $300,000. The total project cost will be roughly $3.3 million. (While there is a wide variation in costs and a dynamic regulatory and technological environment for solar development, these numbers are presented as consensus estimates from developers on a hypothetical, generic project.)

Core support can come from the tax equity structure, where an institution will act as a tax equity partner and will finance roughly 30% of the project cost, or $1 million. $2.3 million in capital startup costs are remaining. The two main sources for this remainder will be both debt and equity financing. If we assume that debt and equity will each make up half of the remainder, each pool will provide $1.15 million. The debt provider will be secured based on the income coming into the project—bill payments from customers and any income associated with SRECs for which the project is eligible. Debt
financing consists of regular payments made to the debt provider based on a regular schedule, similar to a home mortgage.

The equity financer will be an investor partner in the project, accepting a higher risk than the debt financer and the potential for higher returns from the project: this partner is essentially betting based on the uncertainty of the returns of the project. If the project is less successful or experiences losses, the equity partner will lose some or all of their investment. However, if the project is more successful than projected, the equity partner will receive a higher return. The equity partner also brings their good credit to the project to give the debt partner confidence in the project.

Finally, we get to the difficulties surrounding credit risks of potential customers: who are these people, and will they pay their bills on time? Most low- and moderate-income customers will present an unworkable credit risk to financing partners: their assets and credit ratings will be lower than the traditional customers of community shared solar projects. Additionally, as discussed throughout this report, renters present the unique problem that regardless of their ability to pay their bills on time, their housing instability (relative to homeowners) and the delays and complications in transferring community shared solar benefits, they present both an intrinsic and extrinsic risk to potential financiers: their ability to pay is in question, and the project’s ability to consistently deliver resources is complicated by the administrative difficulties inherent to the Schedule Z process.

Firstly, changes to the Schedule Z regulations allowing more responsive modification of net metering distribution would help to limit loss in the project: if the list of project recipients can be changed on a weekly or monthly basis, rather than just twice a year, and changes can be made by the utility in a matter of days, with less processing time, project administrators will experience far less loss associated with customers changing residence. Instead, the benefits will be able to follow customers easily and at low cost.

But uncertainty still remains because there is little precedent in providing these services to low- and moderate-income renters—rather than a risky investment, the risk of default among low- and moderate-income customers and renters receiving affordable, predictably priced solar electricity is unknown. This unsettling question will result in skepticism from any potential partner, perhaps even civic-minded organizations. But there are several ways to mitigate this risk (in addition to changing Schedule Z rules), in order to provide a proof-of-concept for such projects, and perhaps compelling evidence that this type of financial arrangement comes with considerably less risk.

Risk Mitigation

A set of anchor-customers could be significant off-takers, for example coalition partners. If several of the organizations within the Coalition became partners they could collectively take half of the project benefits, and thus half the risk associated with 200 low- and moderate-income customers would be replaced by the likely more conservative risk estimates of the various partners.

In a more direct way of mitigating risk, a philanthropic organization could provide a measure of credit enhancement as a backstop guarantee to cover some portion of payment defaults by customers. If grant support has been pledged, for example as a reserve account to cover a portion of potential losses, it could offer security to a potential financial partner that they will be insulated from some losses. The philanthropist would be in a better position to invest in low- and moderate-income consumers’ ability to pay promptly for a service that offers reduced payments for electricity.

Finally, innovative methods of choosing potential customers could offer more security to investors: perhaps these customers are lower income, with limited assets and lower credit scores. But what about the subset of these individuals who have good payment histories with their electricity provider? The Coalition could request that potential customers make available their electricity accounts to the project administrator, and only those with a certain level of prompt bill payment would be eligible. (This can be complicated because it is not clear what constitutes prompt bill payment. Perhaps it is a history of no late payments, or perhaps some late payments are acceptable, with chronic late-payment or defaults being a greater
concern.) The method for evaluating payment histories will be subject of greater scrutiny, and perhaps a collaboration with a service provider.

It is important to note that this type of project, if properly executed, can present an appealing financial opportunity for a potential financer. With several hundred customers, there will be a rate of default and a portion of loss. However, unlike projects that serve a smaller number of large customers, a single default presents a lesser threat. With 200 customers, 10-20 defaults may be manageable because 90-95% of the revenue for the project is still intact. However, for a project with just five larger off-takers, a single default or bankruptcy could result in a 20% loss in revenue and put the entire project at risk.

The single unknown in this proposal is as follows: can we develop a method to find a subset of low- and moderate-income customers with reliable bill payment histories, transmit the discount benefits of solar electricity, and thus vastly expand the pool of potential green energy consumers? Since we do not know, a pilot project involving the spreading of risk among philanthropic organizations, coalition partners, and public-minded developers may show us how to expand solar energy to a large portion of the population to whom access is nearly impossible.
Although Massachusetts remains a leader in solar energy, the current regulatory structure provides unequal access to solar energy across income levels, with a fundamental lack of access among low-income renters. The legislative landscape in Massachusetts remains fluid, and the Commonwealth’s long-term solar energy policy remains unsettled. There are still many challenges to grant community shared solar access to all residents in the state of Massachusetts regardless of income, class, or racial background. Community Labor United and the Green Justice Coalition are in a unique position to pursue a two-fold strategy: promote and advocate for expansion of community shared solar access at the state level, and begin a wholesale examination of the range of possibilities for CLU and GJC to become partners in a community shared solar project in Massachusetts. Our advocacy and project recommendations are on the following page.
# Recommendations

In summary, the Field Projects team makes the following recommendations, based on the results of its research and considering the mission, history, and capacity of Community Labor United and the Green Justice Coalition:

### Political Advocacy

- Advocate to the state legislature for (1) a return to at least the retail net metering rate and (2) abolishing net metering caps for all community shared solar projects or. Otherwise, advocate for these two policy measures in community shared solar projects that specifically incorporate members of low- and moderate-income communities.
- Advocate in the state legislature for a comprehensive cost-benefit analysis of the value of solar energy, specifically accounting for the benefits achieved by and for low- and moderate-income communities through community shared solar models.
- Advocate in the state legislature for an amendment to the Schedule Z process that allows for more timely changes to net metering allocations.
- Participate in the DOER and DPU proceedings regarding the SREC II successor program, minimum bills, grid modernization, and time of use pricing.

### Community Shared Solar Projects

- Pursue one or more of the following options:
  - Small projects (<25 kW), which are exempt from net metering caps and can still serve multiple customers. This would likely involve pooling and distributing the net metering benefits from a network of smaller projects. It would be logistically complex, but it is an innovative possibility.
  - Large projects, which can be more cost effective through economies of scale. This would require seeking significant funding sources including grants or investors. Seeking a developer with community shared solar experience is recommended.
  - Co-op model projects, which have the potential to be the most financially inclusive to low- and moderate-income participants. Involving anchor participants can reduce perceived financial risk. Identifying entities with experience managing solar co-op projects is recommended.
- The Coalition should evaluate each option’s specific component requirements; larger projects will likely only become viable after regulatory changes.
- Stipulate that contracts with developers require a percentage of union or apprenticeship jobs.
Next Steps

Pursuing a project depends in part on the legal incentive structure available. Changes in regulation around Schedule Z, offering a higher net metering rate to low- and moderate-income projects, and increased incentives offered to low- and moderate-income customers through a future iteration of the SREC program will help facilitate a project. However, those changes are part of a legislative advocacy campaign. In conjunction with advocacy efforts, a number of preliminary steps can be taken by Community Labor United and the Green Justice Coalition.

Evaluate Institutional Resources

A great deal of administrative and research leg-work is associated with any community shared solar project, and this project comes with additional challenges. Coalition members can play an instrumental role in reducing costs (or adding value) by doing the outreach for potential customers that is costly and inefficient when done by private developers. Additionally, a survey should be conducted of coalition member organizations to see which may be able to play a role as anchor customers. If member organizations participate in a project, they may provide a lower credit-risk participant(s), and a portion of the project can be financed directly by funds from those organizations.

Find a Solar Partner

Much of the work planning, building and gathering the financing for a project is going to be done by a project administrator. There are several civic-minded companies that are experts in this type of work, and designated coalition members should reach out to these groups to have preliminary discussions about forming a partnership. The following are examples of solar developers that operate in Massachusetts:

- American Capital Energy
- Borrego Solar
- BlueWave Capital
- Citizens Energy
- EMI Electrical

Community Labor United and the Green Justice Coalition are encouraged to reach out to these and other developers to discuss the pursuit of community shared solar.

Explore Site Locations

The development partner may be able to provide significant assistance here, as many of them actively seek locations to present to partners. The site location would need to be properly sized and zoned, and either clear for development, or able to be legally cleared. It must be available for acquisition or long-term lease (20+ years). The site must be in the same load zone and utility service territory as all potential customers. Most of metro-Boston is within Eversource’s coverage area and is in the Boston/NE Mass ISO load zone; however, there are some exceptions. (See Appendix I: Reference Maps.)

Seek Grant Opportunities to Support the Project

Since a model to provide community shared solar to low- and moderate-income renters has not been pursued in Massachusetts, any proposal may be met with skepticism around the risk of potential customers. Backstop support by a philanthropic organization to act as a guarantor for a portion of potential losses due to higher-than-expected losses or administrative inefficiencies may provide potential lenders or financial partners with a level of comfort to help finance the project. Grants may be available for core support as well.
Future Work

The Field Projects team recognizes that energy policies in the state can change at a moment’s notice. These last recommendations are a look at future work and partnerships to explore in the event that policies present significant barriers. At the same time, notwithstanding the political landscape these are areas worth approaching in tandem with community shared solar models.

Community Land Trust Partnerships

Partnering with a Community Land Trust (CLT) may present a great opportunity to locate a site for solar arrays within the city of Boston. There are instances in the U.S. and worldwide where communities are using land trusts as a hub for clean technology (Hopkins 2008). CLTs come in a variety of forms, as expressed in the following list (Davis 2010):

- Title to multiple parcels of land, scattered across a targeted geographic area, is held by a single nonprofit corporation.
- Any buildings are sold off to homeowners, cooperatives, nonprofits, or other corporations or individuals.
- A ground lease knits together – and equitably balances – the interests of the nonprofit landowner and the interests of the buildings’ owners. This ground lease lasts for a very long time, typically 99 years; it is also inheritable and mortgage-able, allowing the owners of residential or commercial buildings to obtain private financing to construct or to improve their structures.

In the Boston area, the Greater Boston Community Land Trust network consists of: Mattapan United, The Coalition of Occupied Homes in Foreclosure, City Life/Vida Urbana, Somerville Community Corporation, Chinese Progressive Association and the Chinatown Community Land Trust, Right to the City, Alternatives for Community and Environment, and Dudley Street Neighborhood Initiative.

Solar Energy and Microgrids

CLU and GJC may explore the development of microgrids in connection to solar power. A microgrid is an electrical distribution network that serves two or more buildings in a local area. Microgrids can enter into “island mode” and separate from the larger electrical grid when there is a major outage and can produce electricity with locally generated energy. Energy from microgrids is stored is through thermal and electric systems such as hot- and cold-water storage and batteries. These technologies allow users to store excess energy and use it during times of peak demand. Storage technologies allow greater economic utilization of energy produced onsite and outside of peak hours (“Boston Community Energy Study: Exploring the Potential for Local Energy Generation, District Energy, and Microgrids” 2016). While typical microgrids rely on diesel or natural gas generators, there are models that use a photovoltaic-battery backup to generate the emergency power (Maity and Rao 2010).

In relation to Community Labor United and the Green Justice Coalition, microgrid efforts would best focus on environmental justice communities. They are suitable in locations of dense, affordable housing. Because energy costs represent a significant portion of annual household income for lower-income residents, the Energy Justice Microgrid scenarios, according to the Boston Community Energy Study, a microgrid in a lower-income community facing energy and environmental issues, aim to reduce costs for Boston’s lower-income residents while reducing the impact on the environment. Vulnerable populations located in affordable housing, particularly the elderly, are significantly affected by grid outage and thus are well served by resilient power systems. Additionally, Energy Justice Microgrids power critical facilities such as health centers and shelters that become places of refuge when neighborhoods lose power. Much like the multi-user microgrids, these community energy designs aim to achieve a balanced energy demand throughout the day and throughout the year (“Boston Community Energy Study: Exploring the Potential for Local Energy Generation, District Energy, and Microgrids” 2016).
APPENDIX I: Reference Maps

The following maps lay out potential areas in the Greater Boston Area that may be subject to exploring community shared solar models. The first map covers environmental justice communities. According to the Massachusetts Department of Environmental Protection, a community is recognized as an environmental justice community if any of the following are true:

- Block group whose annual median household income is equal to or less than 65 percent of the statewide median ($62,072 in 2010); or
- 25% or more of the residents identifying as minority; or
- 25% or more of households having no one over the age of 14 who speaks English only or very well - Limited English Proficiency (LEP)

The second map covers median household income according to the American Community Survey and the third covers renters per household according to the US Census. The fourth map shows the ISO-NE load zones and the electric utility service territories for the state of Massachusetts.
Figure 7: Environmental Justice Communities Map of Greater Boston Area
Figure 8: Median Household Income Map of Greater Boston Area

Median Household Income (USD) (By Census Tract)

GREATER BOSTON AREA, MASSACHUSETTS

Median Household Income

Figure 9: Percentage Population of Renters per Occupied Household Map of Greater Boston Area

GREATER BOSTON AREA, MASSACHUSETTS

RENTERS

Includes Suffolk, Norfolk, and Middlesex Counties.
Data Sources: US Census American FactFinder, TIGER, 2010 Decennial Census.
Massachusetts Electric Utility Service Territories and ISO New England Load Zones

Figure 10: Load Zones and Service Areas Map. Source: Adapted from maps and information available from the Massachusetts Executive Office for Administration and Finance (utility service territories) and the Massachusetts Department of Energy Resources (ISO-NE load zones)

This map presents the ISO-NE load zones (outlined and labeled in red) superimposed over utility service territories for each municipality in Massachusetts. As noted in the Regulatory Landscape section above, net metering benefit recipients must reside in the same utility service territory and load zone as the associated project. Blue dots indicate towns that are served by the three investor-owned utilities but are split between two load zones - contact the local utility for more information regarding the relevant load zone in these cases.

Note that municipal utilities (in pink) are small, independent utilities that are not regulated by the state in the same way as investor-owned utilities. Municipal utilities have their own rules and regulations, if any, regarding solar power.
Community Development Partnership; Eastham, MA

The Community Development Partnership (CDP) is a multi-service community organization serving parts of Cape Cod, MA. CDP specializes in economic development, small business assistance and affordable housing assistance for low- and moderate-income residents. In connection with their affordable housing efforts, CDP began pursuing solar projects in 2013, with the intent of saving electrical costs, and passing the financial benefits of solar to their affordable housing residents. They have now developed five projects on different properties owned by CDP with an annual electrical production of over 68,000 kWh.

Some “seed money” came from a private grant offered through a grant from the TD Charitable foundation. Institutional resources and financing from a local bank provided the remainder. CDP entered into a contract that included a lease and power-purchase agreement (PPA) with the contractor as technical owner. This arrangement allowed the capture of the tax credits available for the project, since CDP, a non-profit, has limited tax liability. Through this arrangement, the tax credits are captured within the project by the developer, and no tax equity partnership is necessary.

CDP became the aggregator of the credits for their properties and intended to apply net metering credits to their tenants' accounts and provide them with reduced electrical bills; however, that arrangement posed prohibitive administrative challenges.

In order to apply the credits directly to tenants, they were required to file a “schedule Z” with the utility company, designating a percentage of their generation to be applied to each ratepayer’s bill. This distribution of benefits is adjustable only twice per year, and must be done in bulk across all of CDP’s properties. There is also significant processing time with each filing. Since CDP’s units experience a significant turnover, with tenants changing residence sometimes within a year, the slow transfer time to apply credits meant that tenants sometimes would have moved out before their accounts began to receive credits.

The regulatory structure around allocating net metering credits proved unworkable for renters, especially those who change residence regularly. Since the process of managing net metering credits was so cumbersome and inefficient, managing these resources proved to be a strain on the manpower at CDP, and they were forced to develop a different strategy.

Including their administrative offices, CDP manages over 40 properties across the region. The organization now applies their net metering credits to those meters which CDP is responsible for paying: those that supply electricity to common-areas, such as hallways, basements, laundry rooms, and external electricity needs, and to their administrative offices. Over the three years of the program’s operation, CDP has generated nearly $100,000 in returns from net metering credits, reduced electrical bills and SRECs. Their projects generate over 68,000 kWh annually.

This program has been a success for CDP not only in terms of cost savings on their utility bills. Though allocation of power generation to CDP's residents was not successful, the organization found an alternative way to transfer some of the benefits of the program directly to their tenants: they leveraged the value of their Solar Renewable Energy Credits (SRECs) to finance weatherization projects at their facilities, including upgrading their heating systems with new and more efficient equipment.
efficient equipment, and installing insulation in residences. These projects have resulted in significant and direct reductions in tenants’ heating bills.

CDP had hoped to create a scalable model for non-profits. They anticipated the main challenges to the project would be maintenance, contracts, financing, and zoning. However, the single largest burden on the organization was regulatory hurdles and the management of their net metering credits. The process required so much work that it has strained their staff, and procedural limitations of the Schedule Z process limited ability to serve low- and moderate-income customers.

**Takeaways:**
- This project was grant funded, and has resulted in nearly $100,000 in revenue so far.
- The energy produced was not used for direct rate relief for residents. CDP receives the power and portions it out to meters in the residential buildings’ common spaces and to their administrative buildings.
- SRECs helped pay for energy efficiency renovations of residential units, but the financing was not direct payment to residents.
- Utility requirements, delays and excessive paperwork were a major administrative burden.
- CDP has had great success with their solar projects, but is administratively strapped.
University Park Community Solar, LLC; University Park, MD

University Park Community Solar, LLC serves as the aggregator for a 22-kW community shared solar project installed on the roof of a Maryland church. In this model, participants invest in University Park Community Solar, LLC, which was created specifically for this project by the organizing participants. Each participant invests in the LLC, but there is no set investment amount or required kWh buy-in. In return, participants earn a corresponding share of the benefits; specifically, revenue from electricity sales to the site owner (the church), federal tax incentives, and the auction of Maryland SRECs.

The project qualified for the 1603 grant program, which allowed certain entities with limited tax exposure to receive a 30% grant instead of a federal tax credit. This “alternative” to the tax benefit was provided to the LLC as a lump sum and passed on to participants. The 1603 grant program expired in 2012.

The University Park project does not rely on virtual net metering. Rather, the system was installed behind the church’s existing utility meter, and the electricity produced by the PV system directly serves the building’s load. The site owner pays the LLC for all of the electricity generated by the PV system. Because this model does not involve virtual net metering (that is, participants do not receive a credit on their utility bill for the energy produced by their share of the system), participants who move out of the local utility’s territory can still receive payments from the project.

The volunteer founders of University Park Community Solar, LLC, spent more than two years developing the legal and financial arrangements for this community shared solar project. In addition to receiving free help from the Maryland Intellectual Property Legal Resource Center, University Park Community Solar paid $12,000 for other legal and accounting services. It also received a $10,000 grant from the State of Maryland. The legal and accounting documents are available for review (Beavers, McGuckin & Sweet 2013).

Takeaways:

- Participant owners can purchase a fraction of the project and receive the corresponding fraction of financial gain from the project.
- The project was supported by a grant program that no longer exists, but allowed entities with tax exemption (a non-profit, university or church) to receive a grant as opposed to tax-exemption (for which they would not be eligible).
- There is no requirement for these participants to live within the same utility service territory or load zone.
- The administrative, legal, and accounting fees to set up and manage this project were not insignificant.
Cape and Vineyard Electric Cooperative; Yarmouth, MA

The Cape and Vineyard Electric Cooperative (CVEC) was formed in 1997 to develop renewable energy sources for member communities in Barnstable and Dukes counties, to stabilize energy prices in their region, and to serve a number of energy procurement, reliability and other purposes for member towns. As of the end of 2015, CVEC has grown a portfolio of 32 municipal solar projects totaling 28 MW.

Formed as an “energy cooperative“ under state law, the organization is empowered to build, own and finance renewable energy projects. At the time of its forming, cities and towns were not legally allowed to own renewable energy generation, but were empowered to do so through CVEC.

The passage of the Green Communities Act in 2008 offered a favorable tax structure and incentives for towns to pursue renewable energy generation. By allowing net metering, it made it possible for renewable energy generation to be allocated to other customers.

Massachusetts law identifies several classes of net metering recipient, each with a rate, or price value of net metering credits, which is connected to commercial electricity rates. Since municipalities and other government entities are offered the highest net metering credit rate, they are attractive partners for renewable energy development.

CVEC enters agreements with member towns to build renewable energy facilities on town lands, and transfer the benefits of those projects to the host town. Technically, the town leases the land to CVEC, who subsequently signs an agreement with a developer who will sub-lease the land, construct, manage and own the project. The contractor also secures the financing, and manages the tax incentive benefits. The benefits transmitted to the town are in the form of a contract for stabilized electric rates, and a cash sum awarded to the town.

Takeaways:

- CVEC works exclusively for the benefit of member towns, providing benefits to municipal budgets and stabilized electric rates for member town ratepayers.
- CVEC’s model is boosted by the robust incentives for municipalities to build renewable energy facilities, namely the high-value net metering credit rate towns are awarded.
- The CVEC model could be applicable to the aims of the Coalition if non-profit entities and services given to low- and moderate-income ratepayers were given the same net metering credit class as municipalities. That would require a legislative change, essentially giving low- and moderate-income consumers the same treatment as municipalities when it comes to renewable energy projects.
Co-op Power; Greenfield, MA

Co-op Power is a consumer-owned energy cooperative operating as several membership-based community Co-ops throughout Massachusetts, Southern Vermont and New York, offering group purchasing discounts for various energy services. The organization has also explored the consumer co-op model for community shared solar, in an attempt to find an alternative method to allow small-scale ownership of solar energy without the financing and capital costs associated with traditional community solar models. Though the project is not finalized or built yet, Co-op Power is recruiting customers for a 600kW consumer-cooperative community owned solar project in Greenfield, MA, available to Eversource customers in Western Massachusetts. It is their second project of this type, with their first having been completed in Brattleboro, VT.

Participants in the project will get the virtual net metering credits for the portion of the community solar project they purchase, with an up-front payment for 25 years. They don’t have other costs to pay for those credits, which are assumed by Co-op Power, a not-for-profit “nexus of contracts.” According to Co-op Power’s website, they can offer the shares at $2/watt compared to $3.50 to $4.50/watt for other ownership models. The community ownership model allows them to use the SREC income to pay off a loan, in effect, giving participants no risk access to the tax credits.

The energy cooperative has been emerging as a community solar aggregator parallel to an energy collective in practice, as they have demonstrated more commitment to low-income consumer buy-in to community solar projects (Green 2016). Utilizing wealthier customers with more available access to capital and higher energy needs as anchor participants allows more participation from low- and moderate-income customers. Green’s report, commissioned by the Center for Social Inclusion, investigates Co-op Power and a financing model they have designed where low-income owners of community solar projects buy in at a lower rate, financed more heavily by higher income owners of the project. While this is a creative strategy to increase the ability of low-income consumers to purchase or buy in to community shared solar arrays, the return on investment still ends up being lower for the low-income purchasers, since they are paying less up-front cost that earns financial gains. This is a step in the right direction, but further demands the question: how do we sustainably finance and allow for low-income participation in community shared solar projects?

Takeaways:

- Co-op Power is looking at a creative financing structure that allows community ownership, and can lower the cost of getting capital, allowing more value to go to the consumer.
- More focus is being placed on the participation of low- and moderate-income customers, with lower costs to buy in, though the trade-off is a lower return on investment.
- This project has not been fully contracted or built yet, though Co-op Power has one successfully installed community solar array (built on a small business, food co-op) and many other consumer energy cooperative endeavors.
APPENDIX III: Detailed Policy Descriptions and Resources

This section provides additional details regarding certain state solar policies and programs, as well as links to web pages and other information that would be useful during the project development process. Note that in general, potential project owners must apply for these programs before construction begins on any project.

Mass Solar Loan

The Mass Solar Loan program (www.masssolarloan.com) provides three avenues through which residential homeowners\textsuperscript{14} can receive assistance for financing their projects: a loan loss reserve (for lenders) that encourages them to provide financing for more "risky" projects, a loan interest rate buy-down, and two tiers of loan principal buy-downs for residents whose annual household income is below $80,240 (Massachusetts Clean Energy Center and Massachusetts Department of Energy Resources, n.d.).

The application process for Mass Solar Loan is fairly straightforward, though there are small deviations from the usual project development process that mainly entail working with program-approved installers (contractors) and lenders. A brief outline is as follows (Massachusetts Clean Energy Center and Massachusetts Department of Energy Resources, n.d.):

1. Before starting a project, homeowners should receive a quote from a pre-qualified installer (see the list on the Mass Solar Loan website).
2. After selecting a pre-qualified installer, the homeowner and installer apply online for the Mass Solar Loan program and write up a project development contract that is dependent upon receiving assistance through the program.
3. Upon receiving approval (via a "Technical Confirmation" document) for participation, the homeowner and installer can take the Technical Confirmation to a participating lender, a list of which is also available on the program website.

4. Some financing is made available upfront, and the rest is made available once the project is built and the lender has filed completion documentation. See the Mass Solar Loan website for general terms of the financing options.

Net Metering and Schedule Z

Utilities are empowered to charge fees (tariffs) specifically for solar projects with net metering, though these tariffs are ultimately subject to regulation by DOER (General Court of the Commonwealth of Massachusetts, n.d.). The fees pay for the utility to perform recurring services such as reading the meter each month. On a higher level, each utility’s net metering tariffs are part of a larger set of rules for "interconnection" – that is, specifications for how to connect renewable energy projects of any type to the grid. During a project’s early planning phase, project owners who are interested in net metering – and therefore in connecting their solar project to the grid – must apply for interconnection and submit a Schedule Z form to the utility that details who will receive net metering benefits. In addition, any projects that are not exempt from the net metering caps (any residential projects with a capacity over 10 kW or non-residential projects with a capacity over 25 kW) must apply for a "cap allocation," which essentially means reserving a portion of the utility’s net metering cap. If the utility’s net metering cap is filled before the project receives an allocation, the project will be put on a waiting list for net metering. (This does not mean the project cannot move forward, but the project cannot participate in net metering until the cap allocation is approved.)

Below is a general outline of the net metering application process. The details are particular to each utility – see below for links to each utility’s net metering page.

\textsuperscript{14} Although the Mass Solar Loan website refers to small projects by individual homeowners, staff at the Massachusetts Clean Energy Center (MassCEC) have indicated that financing may also be available for community shared solar models. This avenue is worth investigating further in the event that CLU and GJC decide to pursue projects.
1. The project owner, in conjunction with a contractor (as applicable), approves a plan for the design, construction, and operation of a project.

2. Before construction, the project owner applies to the utility for interconnection and also files a Schedule Z form with the utility, identifying the eventual recipients of net metering benefits. Based on the utility's review, the project owner may be required to pay for small modifications to the system.

3. Once the interconnection application is approved, the project can be built. This is also when the project owner applies to the Massachusetts System of Assurance of Net Metering Eligibility (MassACA) for a cap allocation. The application fee is $100, and there are three requirements for approval: (1) a signed interconnection agreement with the utility, (2) documentation of site control, and (3) any necessary local permits. The MassACA website, which lists application instructions, is http://www.massaca.org/.

4. Once construction is complete, the project must be inspected, and the customer must file a Certificate of Completion with the utility. The utility may decide to inspect the project once more after receiving the Certificate of Completion. Assuming all needs have been met, the utility will issue an Authorization to Interconnect approving physical connection with the grid and will install the net meter on the project site.

The utilities each provide information regarding the current status of their net metering caps (see links in the next paragraph). However, MassACA also maintains a single webpage with relevant cap information for all utilities: https://app.massaca.org/allocationreport/report.aspx.

Below are links to each of the three investor-owned utilities' net metering pages, which contain utility-specific information regarding interconnection rules, net metering tariffs, and the Schedule Z form.

- Unitil (Fitchburg Gas and Electric Light Company): http://unitil.com/energy-for-residents/electric-information/distributed-energy-resources/net-metering

Solar Renewable Energy Certificates (SRECs)

SRECs are entirely separate from net metering, but the application processes for SRECs and net metering occur within the same timeframe, and SRECs are also a valuable component of a project's balance sheet (see the Financing section for more details). SRECs represent the environmental benefits inherent in renewable energy - they are "created" by renewable energy projects and can then be sold to entities (such as utilities) that require them for environmental compliance.\(^{15}\) The "Solar Carve-Out II / SREC II" program is administered by DOER, which grants approval for projects to create SRECs. Since SRECs are an actual product that can be sold on a statewide market, there is a statewide verification system to corroborate production of renewable energy and to track the ownership and sale of all the SRECs in existence at any given time.

The need for verification boils down to a few requirements that every solar project must meet if it wants to access the benefits of the SREC market. First,

\(^{15}\) Community shared solar projects and projects for low- or moderate-income housing create one SREC for each MWh of electricity produced. Other types of projects create one SREC or less per MWh of electricity produced ("About the Solar Carve-Out II Program" 2016).
project owners must report the total generation\textsuperscript{16} of their solar projects online each month. For projects with a capacity under 10 kW, this can be done manually or automatically; for projects with a capacity over 10 kW, the reporting must be done automatically. Automatic reporting requires installing a Data Acquisition System (DAS) on the project site to monitor and record electricity generation. Several organizations, known as DAS Service Providers (DASSPs), are available to install and monitor the tracking system on a project owner’s behalf, and a project owner is free to contract with a DASSP for this purpose. The MassCEC provides a list of approved DASSPs on its website: 

\url{http://files.masscec.com/innovate-clean-energy/prod-track-system/DataAcquisitionServiceProviders.pdf}

Among other roles, the MassCEC is the third-party, independent verifier of all SRECs created in Massachusetts, and data reported on a monthly basis by project owners and DASSPs filter into the MassCEC’s Production Tracking System (PTS). Once each quarter, SREC data from the PTS are sent to the New England Power Pool Generation Information System (NEPOOL GIS) - NEPOOL is the organization that ultimately oversees auctions for all renewable energy credits (including SRECs) in New England. Sellers in the NEPOOL GIS auctions are often aggregators whose role is to bundle many SRECs together into large packages, which is how buyers such as utilities generally prefer to purchase them. Thus, a solar project owner will usually contract with an aggregator so that her SRECs are more likely to be sold and so that she does not have to manage the selling process herself. Interested project owners will sign a "Renewable Energy Certificates Services Agreement" with the aggregator of their choice and include this agreement in their application for the SREC II Program. DOER maintains a list of qualified aggregators on its website: \url{http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/market-resources-aggregators-retail.html}.

\textbf{DAS? Aggregator?}

As with the general components of a project (see Models and Project Components), there are several specific roles involved in managing SRECs, but one entity can play more than one role. On the reporting side, the System Reporter is the entity that reports SREC production to MassCEC’s Production Tracking System (PTS). The System Reporter could be either the Project Owner or a Data Acquisition System Service Provider (DASSP). On the sales side, project owners generally contract with an Aggregator, who bundles many projects’ SRECs together and sells them in bulk. As a participant in the actual SREC auctions, the aggregator is usually an Account Holder with NEPOOL GIS. Individual project owners generally will not deal with NEPOOL GIS at all, and if they have a DASSP, they may not even interact much with the PTS.

Below is a general outline of the SREC II application process\textsuperscript{17}.

1. Before construction, the project owner applies for an Assurance of Qualification with DOER to secure a portion of the SREC cap. The requirements for an Assurance of Qualification are the same as those for a net metering cap allocation: (1) a signed interconnection agreement with the utility, (2) documentation of site control, and (3) any necessary local permits. If the project owner has selected an aggregator to manage future SREC production and sales, the project owner and aggregator will need to sign a Renewable Energy Credits Services Agreement and submit it with the application (the aggregator can assist with the application process). If applying for net metering, the project owner may also need to submit a copy of her Schedule Z form along with the application for an Assurance of Qualification.

2. Once the project is qualified for the SREC II program, the project owner will have nine months to construct the project. If the project has not been completed and approved for interconnection by the utility within nine months, the project owner must submit another

\textsuperscript{16} Again, SRECs are separate from net metering – projects create SRECs based on the total energy they produce, regardless of whether that energy is used on site or sent to the grid. From a societal perspective, it doesn’t matter who uses the energy. The benefit of solar electricity production is still realized.

\textsuperscript{17} In addition, the MassCEC provides a handout that describes the process: \url{http://files.masscec.com/innovate-clean-energy/prod-track-system/PTSHomeownerGuide.pdf}. All applicable forms are available on the DOER website: \url{http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/sqa-solar-carve-out-ii.html}. 
application for Assurance of Qualification and await approval.

3. At this time, the project owner will also select a DAS if required or preferred.

4. Once the project has been built and the project owner has received an Authorization to interconnect from the local utility, the project owner must return to the online system to upload a copy of the Authorization to Interconnect and to provide the final required information. After the project owner submits the final information, DOER will review the application and, if accepted, will mark it as "Approved" in the online system. This certifies that the project has received a Statement of Qualification and may begin logging SRECs.
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