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Publicly Supported Solar Loan Programs

A Guide for States and Municipalities

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SUSTAINABLE SOLAR EDUCATION PROJECT

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ABOUT THIS GUIDE AND THE SUSTAINABLE SOLAR EDUCATION PROJECT

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

ABOUT THE U.S. DEPARTMENT OF ENERGY SUNSHOT INITIATIVE

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

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SECTION 1

Introduction

Over the last decade, residential solar has grown from a niche industry to a major economic sector, employing over 130,000 people and installing systems on hundreds of thousands of homes per year (Solar Foundation 2016, GTM/SEIA 2016).

Despite this growth in the residential solar market, concerns over the market's immaturity, its lack of historical data (for both system performance and loan performance), regulatory pressures, and other challenges have tended to keep traditional lenders, such as banks and credit unions, at bay. This has been changing over the last several years, as lenders have begun to find comfort with the residential solar asset class and have begun to offer their customers loan products to finance rooftop system installations. Some of these lenders entered the market without government assistance, though several have benefitted (directly and indirectly) from state and local programs supporting solar lending activity.

The success of lender-support programs demonstrates how states and municipalities can play a critical role in reducing the risks of residential solar investment, spurring local lending to homeowners and businesses for rooftop PV installations. Lenders play a critical intermediary role in the economy, allocating capital from depositors to borrowers; however, they can stymie markets when they are unable or unwilling to underwrite particular asset classes. In such cases, state and local governments can employ certain mechanisms, including credit enhancements, direct support (rebates or grants), mandates, standards, and credit schemes, to jumpstart local lending. Governments have historically done this for asset classes of perceived social or economic value, such as student loans and mortgages.

This guide describes the concepts, methodologies, and applications being used by publicly supported solar loan programs. The guide defines a publicly supported solar loan program as a codified body of rules, platforms, and support mechanisms that facilitate private lending for rooftop solar installation. These support mechanisms, or credit enhancements (see Section 3), are the principal means through which public agencies can drive private lending to this sector. By reducing lenders' risk to an asset class with which they have little familiarity (i.e., solar PV), credit enhancements can stimulate markets and drive sustainable growth by increasing the availability of financing. Publicly supported programs can be administered by a public or semi-public agency (such as a state energy office, green bank, or public benefit

corporation) and are typically designed to be temporary so that private activity can eventually fulfill market demand.

The purpose of this guide is to inform state and municipal officials and loan program administrators (collectively, "administrators") of best practices, lessons learned, structural features, and the relative tradeoffs of various approaches to opening up the lending marketplace for residential solar within their respective jurisdictions. It is organized into following three sections of this guide:

- **Section 2** discusses the general factors state and municipal governments should consider when assessing whether to launch a public solar loan program.
- **Section 3** takes the form of a "how to guide," detailing the design and structural elements that comprise public solar loan programs.
- **Section 4** presents several case studies of state and municipal solar loan programs. The case studies vary in forms of support, degrees of leverage, and agency participation.

The success of lender-support programs demonstrates how states and municipalities can play a critical role in reducing the risks of residential solar investment.

This guide focuses primarily on residential solar loans, but many of the concepts can also apply to commercial and community solar programs. Generally, the program structures discussed herein can apply to the financing of any solar installation that will be purchased, in whole or in part, directly by a consumer or a business. That being said, this guide will not cover on-bill financing/recovery or property assessed clean energy (PACE). Both are certainly relevant to the topic of publicly supported loan programs, though they require different implementation pathways and alternative means of support than the programmatic structures discussed herein. PACE requires state and sometimes local legislation, while on-bill requires statutory approval. Moreover, the administrative organizations required of both are unique and outside the scope of this guide. Readers who are interested in these types of programs will find that there is a wealth of existing literature on both available on the internet.

Lastly, while this guide does contemplate how publicly supported loan programs can facilitate access to solar for low- to moderate-income (LMI) borrowers (Section 3, page 10), low-cost loans alone are insufficient to accelerate solar adoption in this market sector. LMI consumers are reached most effectively through an integrated approach that combines support mechanisms (such as rebates with low-cost loans). Financing is an important pillar in an LMI strategy, but its availability and impact are limited without other support mechanisms.

SECTION 2

Preliminary Assessment

When conducting a market/economic assessment to determine the feasibility of a solar loan program, a state or municipality may find it helpful to seek input from outside consultants. However, for those agencies which do not have the resources to contract with a consultant or would like to conduct an informed check on a consultant's work, the following subsections identify the major elements and key questions that would comprise a market/economic assessment.

EXISTING FINANCING OPTIONS

States and municipalities should understand at the outset of program conception which solar financing products are available within their jurisdiction and the level of access consumers and businesses have to these products. It is important to identify the demand for these products, what the uptake for each is, and where a publicly supported solar loan program would fit into the field. A primary consideration is whether a program would be additive (i.e., it fills a financing gap or supplements existing options in the marketplace) or duplicative (i.e., it crowds out private investment). A related consideration is whether the program would generate benefits—such as local economic activity and higher rates of return for homeowners and businesses—that the current solar market does not produce.

If a particular state or local market already has high penetration of both third-party and traditional loan products, officials may want to consider whether there are benefits that a publicly supported program can offer for residents, or if the market is already well-served by loan providers. In several cases (including Massachusetts and Connecticut), public officials determined that a public program would be complementary to the existing private products (see case studies in Section 4).

For reference, Table 1 presents the full range of financing products currently available in the U.S. market for the purpose of installing a rooftop PV system. Note that many states do not have all of these options available. The most active solar markets have several, if not all, of the listed financing options available.

TABLE 1: **Financing Options for Residential Solar**

	Financing	Description	Lender	Term (years)	Interest Rates for High FiCO Borrowers	Security Interest
Third-Party Ownership	**Solar Lease**	Contract whereby solar company retains ownership of system and host pays a fixed monthly fee for use of the solar equipment	TPO* Provider	Typically, 20	NA	Solar assets (i.e., the system) or unsecured
	Power Purchase Agreement	Contract whereby solar company retains ownership of system and host pays a per kWh charge for energy produced by that system	TPO Provider	Typically, 20	NA	Solar assets (i.e., the system) or unsecured
Public Programs and Private Lenders	**Solar-Secured**	A loan made to a borrower exclusively for the purchase of a solar system	Bank, CU** Other capital provider	5–20	2.99% +	Solar assets (i.e., the system) or unsecured
	Title I (HUD)	90% government-guaranteed loan secured by second lien on home	Program-approved Lenders	10–20	3% +	Lien on real property (second mortgage)
	203(b) & 203(k) Mortgages (HUD)	Federal Housing Authority-Insured mortgage (203[b]) and second mortgage (203[k]) that allow for additional principal amounts to finance energy-related upgrades	Program-approved Lenders	Up to 30	Varies	Real property
	On-Bill Mechanisms	Cost of energy upgrades are amortized via an additional line item on customers' electric bill	Bank, Utility, State	≤15	As low as 0%	Utility bill
	Home Equity	A loan or line of credit against the value of a home-owner's equity. Also called a 2nd mortgage	Bank, CU	≤30	4% +	Lien on real property (second mortgage)
	Fannie Mae HomeStyle Renovation Mortgage	A mortgage issued through approved lenders that allows for a 15% increase in the home's "as-completed" appraisal value for home upgrades, including solar	Bank, CU	15 & 30	Varies; adjustable rates available	Real property
	PACE* **	A loan made via a property tax assessment and amortized through property tax bill	Bank, Municipality, Other capital provider	≤20	8% +	Tax lien

(Note: Interest rates vary by borrower, macro-financial environment, and other factors. The quoted figures are from published rate benchmarks as of this writing, in December 2016.)

* Third-party ownership (TPO)
** Credit union (CU)
*** Property Assessed Clean Energy (PACE)

POLICY AND INCENTIVE FRAMEWORK

Understanding the incentive framework and the potential impact it can have on solar economics is critical for the design of a solar loan program. This information can assist program administrators in selecting the type and amount of credit enhancement to facilitate lending. Additionally, it will help to identify where the appropriate thresholds should be for loan terms (e.g. interest rate, tenor) to ensure that solar loans can be paid off in acceptable timeframes and still offer a compelling value for system owners. A loan program offered as part of a financial incentive framework that does not generate net savings for system owners will likely experience limited uptake.

Solar generation must, at a minimum, be valued at a price that is competitive with the retail rate of electricity in order to achieve wide-scale solar deployment.[1] Especially in states where electricity prices are below the national average, financial incentives are critical in driving the economics of solar.

Below, are three types of policies and incentives commonly used by states to promote solar adoption.

Net Energy Metering

Net energy metering (NEM) laws are a principal driver of solar economics for homeowners and businesses. If NEM is available at the "fully loaded" retail rate (i.e. the electricity rate, plus any riders, distribution charges, etc.), then this will contribute significantly to helping borrowers realize positive economics on their solar loans. If NEM is not available, or is available at a compensation rate that is less than the fully loaded retail rate, or if there are fixed charges and other value deflators to contend with, then it will be critical for administrators to calibrate the loan terms accordingly to offset any lost value. In some cases, a favorable loan product may be an effective counter to a challenging NEM or utility rate environment.

Investment Tax Credit

Solar installations in all states are currently eligible to receive a 30 percent federal investment tax credit (ITC), which can reduce the capital cost of a system by providing its owner with additional tax savings, which can then be applied to system cost.[2]

Section 25D of the Internal Revenue Code provides a personal tax credit for solar equipment purchases, meaning that individuals are eligible to receive it against their income tax liability. This tax credit is set at 30 percent until December 2019, at which time it will decrease by four percentage points per year. In January of 2021, the 25D credit will expire entirely. This reduction could prove a challenge to the residential solar market at that time.

Renewable Portfolio Standards, Renewable Energy Certificates, and Other State Incentives

Renewable Portfolio Standards (RPSs) are state-level policies that require utilities and other electricity suppliers to procure a specified portion of their electricity supply from renewable energy. Utilities and other covered entities under the RPS demonstrate compliance with the RPS through renewable energy certificates (RECs), which are tradable credits that represent the "environmental attributes" of renewable electricity. When a renewable energy system

produces a megawatt hour of electricity, the owner of that system receives one REC, and can sell this to an RPS compliant entity at a market price. Whoever purchases the RECs has the legal right to say that they received the renewable electricity from the system. System owners who want to be able to say that they are using renewable electricity cannot sell the RECs.

Solar system owners can sell the RECs they generate either in an upfront contract (which can reduce the capital cost associated with system installation), or as they are generated during system operation. For residential systems, RECs usually do not play a crucial role in improving system economics. The exception is if RECs are highly valued. (Solar REC prices in Massachusetts, New Jersey, and the District of Columbia range from $195–$480 as of this writing.) (SREC Trade 2016a, 2016b, 2016c)

Assessing market infrastructure includes understanding how many solar installers are in the area and the condition of the supply chain.

States and municipalities may also offer other financial incentives, including production-based and investment-based rebates (direct payments to system owners either for energy generated or as a proportion of capital costs), tax credits and exemptions, grants, and other mechanisms. In addition to financial incentives, states and municipalities may also offer expedited permitting processes, education campaigns, and Solarize programs.[3] Utilities may have their own incentive programs and initiatives.

MARKET INFRASTRUCTURE AND DEMAND

Solar loan programs (and solar markets in general) will be most successful in jurisdictions where:

1. Robust incentives drive solar economics, or the price of electricity is high enough so that state incentives are not required (or play a smaller role) to make a system economic for the owner.

2. Solar/renewables deployment is a policy priority, and regulations exist to facilitate installation, such as expedited permitting, interconnection, and inspection. (Or, conversely, where regulations do not significantly hinder installation or access to financing through such mechanisms as restrictive zoning laws, or disallowance of third party financing.)

3. There is a market infrastructure to support high solar demand.

Assessing market infrastructure includes understanding how many solar installers are in the area and the condition of the supply chain. For instance, if the market does not already host a sufficient solar industry and cost-effective access to equipment/expertise, will a solar loan program drive the development of these elements?

Also consider the financing environment. How is consumer demand for solar being met in the marketplace today? Are third-party ownership (TPO) companies active in the market? Is property assessed clean energy (PACE) available for residential and/or commercial property owners? Or is there a financing gap that a publicly supported program can fill? In such a case, is there pent up demand among the jurisdiction's residents that can be tapped by the introduction of solar-specific financing?

These questions should be addressed with a general demand analysis. Also included in this analysis could be a review of the jurisdiction's financial demographic data. Administrators should have an understanding of the capacity of their residents to take on additional debt burdens (e.g., by identifying the median income and aggregating credit score and debt-to-income data at the county or municipal level).

Additionally, administrators would benefit from an understanding of the solar resource in their geographic area (which drives system production and therefore economics) and the generally available roof space in their jurisdiction. Light Detection and Ranging (LIDAR) analyses and satellite imagery can be useful for determining unshaded and unobstructed roof space. If community solar is the goal, then available land space, costs, access to substations, and transmission and distribution infrastructure will be important considerations.

Reaching Low- to Moderate-Income (LMI) Consumers

Extending the benefits of solar to the LMI community is an express policy priority for some state and municipal governments, and an important goal as solar markets mature and more consideration is given to equitable distribution of the benefits of solar to all ratepayer classes. State and municipally supported loan programs can be an effective way to reduce borrowing costs for this demographic, enabling homeowners who may not otherwise have access to financing to own a solar system. LMI homeowners can experience challenges in accessing financing. Often, incomes or debt-to-income ratios among this demographic do not meet the underwriting criteria for lenders. The same may be true of credit scores. Publicly supported solar loan programs can provide support to lenders so that they will extend credit to borrowers that would otherwise be disqualified based on these factors.

Additionally, states and municipalities can target the LMI demographic by reducing costs specifically for these borrowers. The Mass Solar Loan in Massachusetts, for example, has a distinct credit enhancement available—income based loan support (IBLS)—that alleviates solar equipment costs through direct payments to lenders to buy down principal. This has the effect of not only reducing the debt burden but also the interest burden (the Massachusetts program also has an interest rate buydown, further driving value for low-income borrowers).

However, as mentioned in the Introduction, financing is just one "arrow in the quiver" to open the LMI market. Some states are considering integrated approaches, combining mechanisms to address cost-reduction, multi-tenant property access, and other challenges. Moreover, while low-cost loans can be a means to engage LMI consumers, they may not necessarily be the proper mechanism. For example, LMI homeowners may not have sufficient tax burden to take advantage of the ITC, which would make ownership through loan financing impractical versus hosting a third-party owned solar system. Publicly supported solar loan programs can only reach LMI borrowers who own their homes. If home ownership among the LMI community within a particular jurisdiction is low, then support may be required to engage the owners of LMI multifamily housing in the solar loan program. It can, however, be difficult to convince property owners of the value of a solar investment, particularly if they are not responsible for the electricity payments on the property.

Ultimately, jurisdictions considering a solar loan program as a means of providing LMI residents with access to financing will need to conduct an economic analysis that considers

tax burdens by income levels, local installed costs, and property ownership, among other inputs. Such a model can help determine the levels support required to provide LMI customers an engaging value proposition. From there, the jurisdiction can assess if it has the means necessary to provide such support.

FUNDS

Lastly, the loan program's size, scope, and its effectiveness at driving solar economics will—to a greater or lesser degree—be a function of the credit enhancements that undergird it. In the context of public finance, credit enhancements are governmental funds used for the purpose of improving the creditworthiness of borrowers, asset classes, etc. and thereby catalyzing private investment.

Credit enhancements are the principal mechanism through which publicly supported loan programs operate, as most governmental agencies do not have the expertise, the resources, or even the statutory authorization to do direct lending to consumers and businesses. By providing risk abatement mechanisms, states and municipalities can encourage private sector finance to lend into certain markets and asset classes; governments can use their resources to drive the achievement of policy goals and stimulate local economic activity. Specific credit enhancement mechanisms are discussed in Section 3.

Before a state or municipality decides which mechanism to use, it needs to determine whether there are sources of funds that can be appropriated for launching and operating a solar loan program. The publicly supported solar loan programs in existence today have derived their funds from a variety of sources, including:

- System benefit (e.g., mill) charges on utility ratepayer bills
- Alternative compliance payments from the state's RPS/REC program
- State general funds
- State or local appropriations for specific agencies (i.e., a green bank), or for specific purposes (i.e., for the acceleration of renewable energy deployment) that do not come out of the general fund
- Utility payments resulting from lawsuit settlement
- Federal government funding, such as grants or funds received and since repurposed from the American Recovery and Reinvestment Act (ARRA)

The choice of funding source may affect how the money can be used. Administrators may have more flexibility in designing programs when their funds don't come directly from taxpayers (such as a general fund). Massachusetts, for example, capitalized its solar loan program with utility payments made in lieu of compliance with the state's RPS. Using this discrete fund, the loan program administrator was afforded some latitude in the levels of credit enhancement it applied to facilitate lending (see Section 4, page 20).

If a state is considering development of a green bank to increase the amount of private capital leveraged by public dollars, there are several public resources available. For more information, see the "Green Bank Resources" in the References section (page 29).

SECTION 3

Program Design and Implementation

With a market/economic assessment in hand, administrators will have the necessary information to understand which loan product would best suit their market. If electricity prices are low relative to the national average, then a product that will achieve minimal monthly payments may be the priority. That is, the goal may be to reduce a borrower's monthly principal and interest payments such that they are close to (if not less than) what the borrower would have paid for electricity that month. If electricity prices are high and the availability of incentives is robust, then there may be more flexibility in product offerings. Knowing what type of loan will achieve optimal economics for homeowners and businesses will also inform what type of credit enhancement to use.

The following subsections will discuss design and structural considerations that can underlie a publicly supported solar loan program, and outline some implementation strategies.

CHOOSING THE TYPE OF CREDIT ENHANCEMENT MECHANISM

Credit enhancements can take several forms, each with a specific intended outcome and degree of leverage (i.e., the ratio of public funds to resulting private investment).

This guide focuses on those mechanisms that are best matched to publicly supported solar loan programs. Although the ultimate degree of leverage that these instruments provide will be determined by the specifics of program design and performance, it is possible to describe the general degree of leverage *potential* for each.

- **Loan Loss Reserve (LLR) Fund:** An LLR functions as a guarantee against defaults in a portfolio of loans. This is a common form of credit support that allows lenders to familiarize themselves with new asset classes with the assurance that they are not exposed to the full extent of potential losses. Generally speaking, LLRs have a medium leverage potential, as they are merely temporary holds on capital and not permanent expenditures. That is, any unused portion of the funds can be recouped and repurposed for other governmental programs. The ultimate degree of leverage will depend on the proportion of losses that lenders are expected to shoulder. An LLR fund that stipulates lenders take 20 percent of the losses on a portfolio and the LLR handles the other 80 percent would provide lower leverage than one expecting lenders to take 40 percent of the losses. However, higher loss share proportions may stymie lender participation.

A portfolio of loans that performs well will net very few losses, and the government may receive most of its capital back after the program ends. If, on the other hand, the portfolio experiences a large number of defaults, the full extent of the loss to government is bounded by the size of the fund. If this happens, the government may choose to establish another supporting LLR fund, or may choose to allocate all risk of future defaults to the bank (which may drive up interest rates on loans originated after the funds exhaustion).

- **Interest Rate Buydown (IRBD):** An IRBD is a payment to a lender that equates the difference in future cash payments, generated from reducing the interest rate on a loan, with a present value lump sum. An IRBD compensates the lender for agreeing to accept reduced interest rate payments over time, with the implementation of that reduced interest rate resulting in additional savings to the borrower over the life of the loan. An IRBD rewards the borrower with an effective reduction in interest rate payments over time and is delivered in the form of an upfront payment. This effectively amounts to a reduction in credit risk for the lender and does not result in any change in the actual cash payments it will receive over the life of the loan.

  Knowing what type of loan will achieve optimal economics for homeowners and businesses will also inform what type of credit enhancement to use.

  An IRBD is an upfront, direct expenditure, and while it can be an effective tool to increase borrower eligibility and reduce lifetime costs, benefits can come at considerable cost. Table 2 on page 14 illustrates the potential extent of this cost. It displays hypothetical present value, lump sum IRBD amounts that could be required to bring a $30,000 loan to a target interest rate (listed in the left column). For example, a 12-year loan that would be issued at 7 percent (pre-IRBD) by a lender could be bought down to 4 percent (post-IBRD) with an IRBD of $4,459. As demonstrated in the table, the size of an IRBD fund to credit enhance a loan program can balloon quickly if lower target interest rates are set by the program administrator. This becomes something of an optimization exercise, where administrators must balance the level of interest rate reduction with the level of funds available to achieve such a reduction. In this sense, IRBDs are typically mid- to low-leverage instruments, compared with other options such as LLR funds.

- **Other Direct Payments:** In addition to IRBDs, credit enhancement funds can be paid directly to any of the parties for the purpose of reducing the upfront system price, though not necessarily the interest rate. In this sense, the credit enhancement would function more like a grant or a direct financial incentive. Both IRBDs and direct payments (such as IBLSs) can be effective ways to tap the LMI communities, as they provide direct cost relief on systems that may be too expensive for this demographic to purchase or finance.

  Direct payments are generally low-leverage, though they can be effective in driving markets by surmounting cost barriers and improving solar economics.

- **Warehousing:** Warehousing is a financial intermediary service normally provided by well-capitalized private sector entities, though it was one of the principal features of the Connecticut Green Bank's Solar Loan program. A warehouse facility is a fund that

TABLE 2: **Hypothetical IRBD Amounts to Achieve Target Interest Rates**
$30,000 Loan–IRB "To Lender" Illustrative Cost Table—5-year, 10-year, and 12-year terms

BORROWING RATE (paid by Borrower)—Post-IRBD Rate	FUNDING RATE (paid to Lender)—Pre-IRBD Rate											
	Term A: 5 Years				Term B: 10 Years				Term C: 12 Years			
	7.00%	6.00%	5.00%	4.00%	7.00%	6.00%	5.00%	4.00%	7.00%	6.00%	5.00%	4.00%
4.00%	$2,098	$1,422	$723	$0	$3,840	$2,642	$1,363	$0	$4,459	$3,084	$1,601	$0
3.75%	$2,268	$1,597	$902	$183	$4,146	$2,961	$1,698	$351	$4,812	$3,456	$1,993	$414
3.50%	$2,438	$1,771	$1,080	$366	$4,450	$3,279	$2,031	$699	$5,161	$3,824	$2,382	$825
3.25%	$2,608	$1,944	$1,258	$548	$4,751	$3,594	$2,361	$1,045	$5,508	$4,190	$2,768	$1,232
3.00%	$2,776	$2,117	$1,435	$730	$5,051	$3,907	$2,688	$1,388	$5,852	$4,552	$3,150	$1,636
2.75%	$2,944	$2,289	$1,611	$910	$5,348	$4,218	$3,014	$1,729	$6,192	$4,911	$3,529	$2,036
2.50%	$3,112	$2,460	$1,787	$1,090	$5,643	$4,526	$3,336	$2,067	$6,530	$5,267	$3,904	$2,433
2.25%	$3,278	$2,631	$1,962	$1,269	$5,935	$4,832	$3,657	$2,402	$6,865	$5,620	$4,276	$2,826
2.00%	$3,444	$2,801	$2,136	$1,448	$6,226	$5,136	$3,975	$2,735	$7,197	$5,969	$4,645	$3,216
1.75%	$3,610	$2,970	$2,309	$1,626	$6,514	$5,437	$4,290	$3,066	$7,525	$6,316	$5,011	$3,602
1.50%	$3,774	$3,139	$2,482	$1,803	$6,800	$5,737	$4,603	$3,394	$7,851	$6,659	$5,373	$3,984
1.25%	$3,939	$3,307	$2,654	$1,979	$7,083	$6,033	$4,914	$3,719	$8,174	$6,999	$5,731	$4,363
1.00%	$4,102	$3,474	$2,826	$2,155	$7,365	$6,328	$5,222	$4,042	$8,493	$7,336	$6,087	$4,739
0.75%	$4,265	$3,641	$2,996	$2,330	$7,644	$6,620	$5,527	$4,362	$8,810	$7,669	$6,439	$5,111
0.50%	$4,427	$3,807	$3,167	$2,504	$7,921	$6,909	$5,831	$4,680	$9,124	$8,000	$6,788	$5,479
0.25%	$4,588	$3,973	$3,336	$2,678	$8,196	$7,197	$6,131	$4,995	$9,434	$8,327	$7,133	$5,844
0.00%	$4,749	$4,137	$3,505	$2,850	$8,468	$7,482	$6,430	$5,307	$9,742	$8,651	$7,475	$6,205

This table represents the potential extent of IRBD costs. It displays hypothetical, present value, lump-sum IRBD amounts that could be required to bring a $30,000 loan to a target interest rate. The table is presented as a heat map, with green denoting lower IRBD amounts and red denoting higher amounts. The table is provided for illustrative purposes only; the specific interest rates, terms and IRB amounts are not necessarily consistent with those of a specific, actual loan product. Table courtesy of Connecticut Green Bank.

purchases and pools assets with the intention of "selling them down" to another entity later. The Connecticut Green Bank solar loan program financed loans for the program's originator, Sungage Financial, and later sold tranches (or sections) of this loan portfolio to investors in private securitizations.[4] Warehouses allow originators to use an external balance sheet to originate loans, which can be highly valuable to smaller companies and non-banks that do not have the reserve capital to hold a portfolio of loans. While not a credit enhancement per se, warehousing serves the function of facilitating private investment, and is therefore included in this list.

In terms of leverage, a warehouse can provide governments with a rate of return for "carrying" the assets as well as selling them down to third parties, and could therefore be considered high-leverage instruments. Any defaulted assets in the facility could be treated as would losses in an LLR. One thing to consider in setting up a warehouse is that the legal and financial structuring fees (as well as any additional cost, such as insurance) may be high, and thereby limit the leverage factor.

- **Subordinated Capital:** Governments may protect private capital in perceived risky investments by taking subordinated positions in the capital stack. This means that the government entity either lends capital, or takes an equity stake in a project, special purpose vehicle, or some other investment structure, and then places itself behind the private investor in terms of priority claim on assets and recoverable cash in case of a default. The private investor is thus in a senior position, which reduces its risk, thus improving the outlook of the investment.

  As in the case of a warehouse line, a subordinated investment entails the possibility of a return on capital, but only if the investment performs well—i.e., it meets or exceeds the projections of the financial model. Also like the warehouse model, subordinated capital typically requires government resources and capabilities beyond those required to implement an LLR or IRBD. These can include investment expertise, sizable funds, and authorization to take risks.

Table 3 summarizes types of credit enhancements and ranks them according to leverage potential and complexity. While there are other mechanisms that state and local governments may employ to improve loan terms and reduce solar system costs for borrowers, these five represent the principal foundations on which existing programs have been based. Administrators and officials who are interested in pursuing publicly supported solar loan programs could use the table as a starting point to determine how each instrument could best align with their capabilities and available resources. As will be shown in Section 4, several of the existing programs have made use of two or more credit enhancement instruments to reach different markets and to achieve different program goals.

TABLE 3: **Credit Enhancement Summary Table**

Mechanism*	Leverage	Cost**	Complexity	Examples (see Section 4)
LLR	+++	$–$$	Low	Milwaukee Shines, UVA PowerSaver
IRBD	++	$$–$$$	Mid	Mass Solar Loan, UVA PowerSaver
Direct Payments	+	$$–$$$	Low	Mass Solar Loan
Warehousing	++ – +++	$$$	High	Connecticut Green Bank
Sub. Capital	++ – +++	$$–$$$	Mid–High	Connecticut Green Bank

* All rankings are relative to the selected instruments and do not include mechanisms that have not been discussed here.

** Cost indicates the likely expenditure level at which the program achieves its deployment goals.

ADMINISTRATION AND AGENCY ARCHITECTURE

Other major solar loan program design considerations include the level of program administration that will be required, which government agency (or agencies) will be responsible for that function, and where the funds to pay for administration will come from. Larger programs may find it most efficient to establish a centralized authority to administer the program. For example, the Mass Solar Loan program administrator—the Massachusetts Clean Energy Center (MassCEC)—staffs at least two full-time employees to perform the following tasks: oversee program applications and other documentation; operate a payments clearinghouse between lenders and installers; manage money transfers; operate the web platform; and other functions. Smaller programs with limited staff availability and only one or two lender participants may choose to devolve administrative responsibilities to those lenders, in essence having them manage their own loan programs. This was the case for the University of Virginia (UVA) Community Credit Union's PowerSaver program, for example.

For large programs that may require a more hands-on role from the implementing government, administrators must determine if the existing agency architecture will suffice, or if a new agency is required. Creating a new agency can be a time and resource-intensive process; all of the existing publicly supported solar loan programs have relied on existing departments to take on administrative responsibilities. Some states have nascent green banks that may be well suited to this task, while others may have an energy office or managed energy fund that could fulfill the role. However, an agency could face challenges in tapping existing staff and may have not have the resources to hire additional staff. In that case, administration may become a patchwork of responsibilities that are apportioned to various staff members.

Administrators will also have to determine how to defray the costs of program administration. If the program relies on an existing agency and is delegated to existing staff, then the funds may already be allocated to manage the program. If additional staff, or an additional agency is required, then an allocation request may need to proceed through the legislature and governor's office, unless the funds can be drawn from elsewhere in the government budget. Program costs may also be sourced from the funds that provide the credit enhancement.

Lenders, particularly if they are depository entities such as banks and credit unions, can generally perform underwriting (determining borrower eligibility), origination (executing financial contracts with borrowers), and servicing (collecting payments and communicating with borrowers) functions. However, in some cases the program-approved lender may not be

a depository, but rather a financial services company, as was the case in the Connecticut Green Bank's solar loan program. A financial services company may run a leaner and more efficient operation than a bank, but this may also prevent it from operating a servicing arm. In such a case, it may be in the administrator's interest to select an independent third-party servicer to allow for the participation of companies that do not have this capability in-house.

STAKEHOLDER ENGAGEMENT, PROGRAM PARTNERS, AND PROGRAM VENDORS

Depending on the size and scope of the program, administrators may wish to conduct an outreach and engagement process with local lenders, the solar industry, trade associations, and other stakeholders, such as consumer and/or ratepayer advocates. Through these meetings, administrators can get feedback and guidance on program and product design, the amount and type of credit enhancement that may be required, the particular needs of each group, and other data that can inform the solar loan program.

Depending on the size and scope of the program, administrators may wish to conduct an outreach and engagement process with local lenders, the solar industry, trade associations, and other stakeholders, such as consumer and/or ratepayer advocates.

Stakeholder engagement can also provide a venue to bring lenders on board. A one-on-one process whereby administrators build relationships with program partners may be more fruitful than a depersonalized request for information (RFI) or request for proposals (RFP) process. Lenders may be more amenable to opening their business to a new asset class if they have a direct conduit to voice their concerns. Lenders may be particularly concerned about the extent of pent-up demand for a solar loan product, and in what kind of timeframe they could expect to underwrite a certain number of loans to make the endeavor profitable. The market analysis contemplated in Section 2 will help to address these questions.

Once potential partners have been identified, legal agreements will need to be drawn up and executed so that these partners can access the credit enhancement funds. These agreements will represent another expense that administrators must account for in determining the costs of setting up and operating the solar loan program.

Administrators need not necessarily execute legal agreements with vendors, i.e., solar installers and general contractors. Instead, they may draw up a body of qualifying criteria (which could be based on feedback received during the stakeholder engagement process) that would allow any vendor to participate so long as it is compliant with these standards. Such criteria could relate to operating history, financial health, insurance, certifications, eligible technology, etc.

PRODUCT SPECIFICATIONS

Publicly supported solar loan programs should generally not dictate specific underwriting criteria to lenders, nor enforce the use of a standard loan contract. In this way, administrators can leverage the expertise of their program partners and avoid imposing potentially unworkable and costly requirements that may have been conceived independent of market experience.

Administrators should have some influence on the determination of interest rate (minimum and/or maximum levels, fixed or floating) and tenor (length of the loan), because these have a direct impact on the economics of the underlying solar assets. Massachusetts, for example, chose to peg the maximum interest rate for its loan programs to the *Wall Street Journal* prime rate. It specified that loans that take advantage of the credit enhancements provided through the program cannot exceed this rate by more than 275 basis points, i.e., by more than 2.75 percent. In Massachusetts, lenders are free to offer any number of loan tenors, so long as they offer a product of at least 10 years (and no more than 20 years).

Administrators may also choose to dictate what type of loan securitization the lenders can require. If lenders take a security interest in the real property (the home or building), this could cause issues during a home sale or refinancing. To avoid such complications, administrators may specify that real property is not a valid security interest for the loans, but that the solar system assets are. Lenders may choose to underwrite unsecured loans if the protections afforded through the credit enhancements are deemed sufficient.

Transferability is another consideration. If a homeowner moves before the solar loan tenor is up and there is an outstanding loan balance, will she be able to transfer the loan obligation to the new occupant, provided the occupant fulfills all applicable underwriting criteria? Or, will the balance become due in full at the home sale? *Selling Into the Sun* (Hoen et al. 2016) found that host-owned solar systems increase home value, and it is therefore possible that a homeowner could recoup the outstanding balance of the loan through a higher home sale price. Transferability of the loan, though it may impose some burden on the lender, may be desirable from the property owner's perspective, as it allows for a clean break with the solar loan contract without the potential headache of an accelerated balance due.

Lastly, administrators will need to decide the jurisdictional boundaries of loan program eligibility. In practice, this almost always means that then solar loans are available exclusively to residents of the particular state or city that operates the program. In theory, however, a loan program administered by a state or local government could extend beyond its juris-dictional borders—for instance, through partnerships.

IMPLEMENTATION

Approvals

A publicly supported solar loan program's final design and product specifications will require approval from relevant agencies. In cases of a state-level solar loan program, approval may be required at levels up to and including the governor's office. Even before final approval of the program, signatures and authorizations from various agencies and divisions of government, within both the legislative and executive branches, may be required for items such as budget

approvals, funds appropriation, clearance to sign legal documents, and statutory authorization to expand the scope of a particular agency. Local programs may have a less onerous approval pathway, but still may require sign-off by officials up to and including the mayor. Programs that outsource day-to-day administrative functions to lenders may have fewer requirements.

Accountability and Transparency

It is important to make the process of conceiving, designing, and implementing the solar loan program open to the public for accountability purposes. Administrators may choose to seek public comment at various stages of the process, and to publish meeting proceedings, market/economic assessments, rulemaking, etc. in a document clearinghouse online. After the program is implemented, it is useful to publish a publicly available guidebook that addresses the information needs of each tier of participant (lenders, vendors, and borrowers). Information can be posted on the customer-facing websites of lenders and vendors as well.

Program Duration

Loan program administrators should have an exit plan at the time of program launch. Public support programs that are designed to leverage private investment are usually not intended as permanent subsidies. Accordingly, administrators should consider deployment milestones (metrics could include private capital, MW deployed, or others), the degree and intervals of support phase-out, timetables, and other factors that will influence how the market responds in the face of declining incentives. Some administrators may choose to simply run the funds out, though this could run the risk of creating a market disruption.

Marketing

Administrators must decide how and by whom the marketing of the loan program will be done. Ensuring that homeowners and businesses are aware of the special product offering will be important for uptake and program success. Marketing can come with its own costs, however, so some strategic use of resources will be required. If administrators will be taking on some marketing activities, they may choose to utilize avenues that are available to them at low expense, such as public hearings or a web presence. Participating lenders may also conduct their own marketing efforts.

SECTION 4

Case Studies

The following case studies detail two state-supported and two municipal-supported solar loan programs in the United States. Table 4 below highlights the key features of each program.

MASS SOLAR LOAN

Through a combination of favorable solar renewable energy credit (SREC) prices and other state incentives (including tax credits and direct payments), the Massachusetts residential solar market has grown to 309 MW of cumulative capacity at the beginning of 2016 (while total solar capacity—including commercial and utility-scale projects—topped 1,100 MW) (GTM/SEIA 2016). The majority of this growth has been fueled by third-party ownership (TPO) financing (leases and power purchase agreements). In 2014, the Massachusetts Department of Energy Resource (DOER) undertook the design and implementation of a loan program to provide homeowners with alternative financing options.

TABLE 4: **Publicly Supported Loan Product Case Studies**

Loan Program*	Type of Support	Initial Support Fund	Tenor	Max Interest Rate	Max Principal Amount	Program Administrator	Lender/ Originator
Mass Solar Loan	LLR, direct payments (income-based), IRBD	$30 million	Lenders must offer 10-year term, but otherwise discretionary up to 20 years	WSJ Prime + 2.75% (fixed)**	$60,000	MassCEC	13 partner banks and credit unions
CT Solar Loan	Warehouse LLR, subordinated debt	$5 million	15 years	6.49%		CT Green Bank	Sungage Financial
UVA Community Credit Union PowerSaver	IBRD, FHA-insurance	$100,000	Up to 15 years	4.99%	$35,000	UVA Community Credit Union	UVA Community Credit Union
City of Milwaukee Solar Loan	LLR	$100,000	Up to 15 years	WSJ Prime + 1.50% (fixed)	$20,000	City of Milwaukee	Summit Credit Union

* All loan terms are current as of the publication of this guide except for the CT Loan, which is no longer available.

** This is the maximum "gross" interest rate, though because of the IBRD, the ultimate interest rate to the borrower is less.

DOER manages the commonwealth's alternative compliance payment (ACP) collection and accounting. ACPs are payments made by utilities and other entities subject to the RPS in lieu of procuring the required amount of renewables in a given year. By 2013, DOER had amassed over $30,000,000 of ACPs and was considering innovative ways to leverage this capital to facilitate renewable energy development. DOER officials identified the residential solar financing gap as an area of particular interest.

In 2013, DOER published a study (Cadmus, Meister & SEA, 2013), which provided the basis for pursuing the loan program in earnest. Perceiving that direct ownership of solar assets was lagging in the market, DOER sought to quantify the benefits of loan financing versus the TPO model. The report also benchmarked the local economic benefits that would accrue to the commonwealth were local lenders and installers to provide the financing and installation services in lieu of an out-of-state TPO provider. The authors used two publicly available tools from the National Renewable Energy Laboratory to conduct the analysis: the Cost of Renewable Energy Spreadsheet Tool (CREST), and the Jobs and Economic Development Impact model (JEDI).

The report concluded that loan financing (on a given set of terms) and direct ownership produced economic benefits to both homeowners and the commonwealth at large that outweighed those provided by the TPO businesses. Accordingly, DOER developed a loan program using $30,000,000 of its ACP fund as the basis for a suite of credit enhancement mechanisms.

DOER established several goals for its loan program at the outset:

1. Provide homeowners with a value proposition similar to TPO products (no down payment, positive cash flow, and longer tenors).

2. Open the solar market to the LMI demographic and to homeowners with credit scores below what the TPO companies were underwriting at the time.
3. Provide the Massachusetts lending community with a business opportunity by facilitating their entry into this new asset class and establishing a long-term solar finance market.
4. Brand the loan program as its own entity, independent of DOER and the Massachusetts Clean Energy Center (which partnered with DOER to finalize the program and take on the administration).

Starting in the summer of 2014, DOER convened many stakeholders, including the local solar industry, the Massachusetts Bankers Association, and the Cooperative Credit Union Association, to solicit comments on program design. These comments and the interim program designs were published on the DOER website. Ultimately, DOER decided on three forms of support to facilitate lending on favorable terms, and to target demographics. These were:

- An IRBD available for all borrowers to ensure a competitive maximum interest rate. As of this writing, a loan with a maximum gross interest rate of *Wall Street Journal* prime + 275 basis points (6.25 percent pre-IRBD) would be reduced by 300 basis points, to 3.25 percent (post-IRBD), which is what the borrower will ultimately pay on top of the principal. However, this 300 basis point reduction is in the process of being stepped down as the program progresses.
- An LLR which serves to support customers with lower FICO scores. This reserve sets aside 10 percent of every loan to borrowers with a score of 680 to 720, and allows lenders to recoup up to 80 percent of the principal amount in the case of a default. Loans to borrowers below a score of 680 trigger a 20 percent set-aside, with 90 percent of the principal recoverable.
- An income-based loan support mechanism, which is a direct payment to reduce the loan principal, alleviating a portion of upfront costs for homeowners who earn 120 percent or less of the Massachusetts median household income. Households earning 80–120 percent can be reimbursed for 20 percent of upfront costs, while those earning less than 80 percent can receive 30 percent of upfront costs. Thresholds are based on the borrower's household size and are capped on the first $35,000 of project cost.

The Mass Solar Loan program opened to applications on December 17, 2015. Initially, five lenders signed the participation agreement, but that number has grown to 13. The MassCEC administers the program through an online application portal which serves as a hub for borrowers, lenders, and installers. This platform houses all relevant programmatic information, including project eligibility, funding reservation for the three support mechanisms, and project/loan status.

Program administration requires 2.5 FTEs who oversee day-to-day program operations and maintenance. Their duties include:

- Collecting and reviewing monthly reports from lenders

- Collecting and reviewing technical applications from installers
- Collecting and processing program feedback and executing adjustments
- Processing consumer applications and verifying qualifications (e.g., LMI status)
- Onboarding new installers and lenders
- Paying out loan support to lenders

The loans are structured with 35 percent of the loan disbursed upon closing, with the remaining 65 percent available upon receipt of Project Completion Approval. Loan support funds are reserved at the time of loan closing and are paid out primarily at project completion approval. This is to ensure that any changes in system cost can be accounted for in the final principal amount. Borrowers only pay interest on 35 percent portion of the loan amount until the balance is paid out upon completion. All lender loan disbursements are paid via a two-party check from the lender to the system owner and solar installer.

To date approximately 1,000 loans have been underwritten through the Mass Solar Loan program, totaling more than 8 MW of capacity.

Readers are encouraged to view the Mass Solar Loan Program Manual, which includes comprehensive information on the program including detailed discussion of the credit enhancement instruments, process flow, eligibility, and other programmatic aspects.

CT SOLAR LOAN

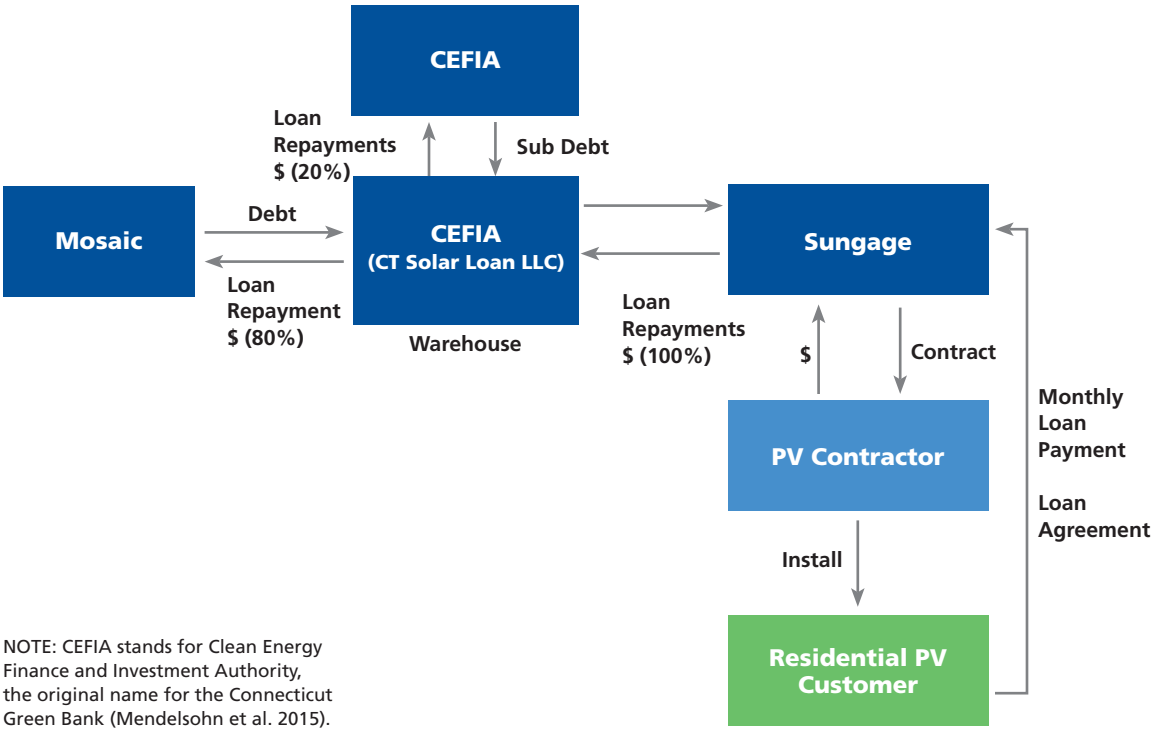
Connecticut became the first state in the U.S. to establish a green bank in 2011. The Connecticut Green Bank (CGB) was formed through a reorganization and expansion of the Connecticut Clean Energy Fund, a ratepayer-funded suite of incentive programs housed within the state's quasi-public venture capital division, Connecticut Innovations (DOE 2015).

CGB rolled out its first broad-based residential solar financing products in 2013: a solar lease, a solar loan, and a general energy upgrade loan (which could be used to install several energy-related technologies, such as HVAC and renewables). Of these programs, only the energy upgrade loan (Smart-E Loan) is still supported by CGB today. The CT Solar Lease and CT Solar Loan programs have fully deployed their investment capital and have achieved, in CGB's estimation, the intended goal of catalyzing private investment, making continued CGB support unnecessary.

CGB took an innovative approach to supporting its CT Solar Loan program. It employed a warehouse facility—a structure not typically seen in public finance—of $5 million in debt capital that it used to originate solar loans through a third-party partner, Sungage. Additionally, CGB put up a $300,000 loan loss reserve (from repurposed American Recovery and Reinvestment Act funds) to cover payments on loans that had been delinquent for up to 90 days, and $1 million of subordinated debt.

On the front, consumer-facing side of this structure, CGB contracted with the Sungage Financial, a solar finance originator. Sungage was, at the time, a startup solar loan provider out of Massachusetts that had won a CGB clean energy financing innovation RFP. Through a collaborative process, Sungage and CGB developed the underwriting criteria for eligible

FIGURE 1: **CT Solar Loan Program Structure**



NOTE: CEFIA stands for Clean Energy Finance and Investment Authority, the original name for the Connecticut Green Bank (Mendelsohn et al. 2015).

borrowers and qualification criteria for installers, and Sungage served as the solar loan program's administrator.

When the program became operational, Sungage underwrote the homeowner solar loans and used the $5 million in the CGB warehouse facility to pool the loans (Sungage was never the lender of record, essentially leaving their balance sheet unburdened by the portfolio of loans.) Sungage serviced the loans (i.e. tracked each contract and collected payments), and CGB held them in its warehouse to be refinanced in tranches and sold to investors as private securitizations. These securitizations were overcollateralized, meaning that investors purchased securities at a price that amounted to less than the full asset value of the tranche. This remaining value remained available in the warehouse to backstop any defaults in the tranche.[6] Solar financier Mosaic was the first entity to invest in tranches of these loans from CGB's warehouse, using its crowdfunding platform to supply the purchase capital. Later, CGB refinanced a secondary pool of loans with the community development finance institution the Reinvestment Fund. See Figure 1 for a schematic of the CT Solar Loan program.

CGB played a meaningful role in marketing the CT Solar Loan, leveraging other efforts such as their Solarize campaigns and the Go Solar CT website. As Sungage grew and further developed its market presence, it played an increasingly large role in driving the program's volume.

In nearly two years, the CT Solar Loan program underwrote nearly $7 million in loans, equating to over 300 residential systems at a total of approximately 2 MW. In late 2014, Sungage Financial announced a $100 million partnership with Digital Credit Union in

Massachusetts, at which time CGB pulled its capital out of the solar loan space and considered the CT Solar Loan successfully "graduated" to the private sector. Today, CGB retains some of the solar loan portfolio as a credit enhancement for its secondary investors (Mosaic and The Reinvestment Fund). If there are defaults in the portfolio of loans to which these investors have purchased the cash flow rights, CGB can provide cover with the cash flows from the portfolio it has retained.

CGB is funded through a mill charge on the utility bills of Connecticut residents. While its investments in the CT Solar Loan and Lease programs are self-sustaining, meaning they will earn all the initial capital back plus a small return, CGB at this point does not seek to cover its operations through its investments alone.

This example demonstrates that, with the right policy frameworks in place, states can supply sustainable capital to agencies and institutions which can effectively spur markets, support private sector confidence in clean energy investment, and accelerate clean energy deployment.

MUNICIPAL LOAN PROGRAMS: CHARLOTTESVILLE AND MILWAUKEE

Municipalities commonly have fewer resources than states to develop, launch, and administer a solar loan program. This has, however, not been a deterrent for several cities, particularly those with their own set of policy priorities for clean energy deployment or carbon reduction. This subsection will overview two municipal loan programs and examine how they creatively leveraged existing programs to maximize the resources they had at their disposal. The first, the UVA Community Credit Union PowerSaver Loan Program (a partnership between the credit union, the City of Charlottesville, Virginia, and the Local Energy Alliance Program or LEAP), made use of an existing, federally insured loan product to obtain beneficial loan terms for participants. The second, the Milwaukee Solar Loan Program, was established to bridge a financing gap in a city that had been selected as a U.S. Department of Energy "Solar City" and which periodically hosted Solarize campaigns. The UVA Community Credit Union's loan program has also been paired with Solarize campaigns in the past.

UVA Community Credit Union PowerSaver Loan Program

The City of Charlottesville has a history of local policy action aimed at sustainability, environmental protection, and energy-related carbon reductions. Milestones in this history include (but are not limited to):

- **2003:** Passage of the Environmental Sustainability Policy
- **2006:** City Council's endorsement of the U.S. Mayors Climate Protection Agreement
- **2007:** Delineating climate goals and objectives in the City's Comprehensive Plan
- **2008:** Completion of its first community greenhouse gas emissions baseline report
- **2009:** City Council issuance of the "Green City" Vision Statement for 2025

Having established an enabling environment, the City of Charlottesville has attempted to spur financing for energy efficiency and distributed renewable energy installations with

a variety of incentives (largely tax-related) for homeowners and businesses. In an effort to engage the lending community, the city granted funds to a local nonprofit, the Local Energy Alliance Program (LEAP),[5] to set up two loan programs with the UVA Community Credit Union. Both have evolved into IRBD programs.

The first, the Clean Energy Loan Fund (CELF), was originally granted by the City of Charlottesville to LEAP for the installation of renewable energy and energy efficiency equipment on commercial and non-profit properties. CELF began as a revolving loan fund (RLF) but was later renegotiated as an LLR and then again as an IRBD. Renegotiations were precipitated by a number of factors, including limited market interest, complexity of product explanation to borrowers, and narrow borrower criteria.

The second, a PowerSaver IBRD, was originally paired with a U.S. Department of Housing and Urban Development (HUD) pilot program for a special energy-related Title I product called PowerSaver. HUD's PowerSaver loans allowed homeowners to borrow up to $7,500 unsecured for energy-related home retrofits, and secured loans for amounts in excess of that up to $25,000. Title I loans are insured up to 90 percent of the principal by the Federal Housing Administration (FHA). The funds for the supplemental IRBD program came to the City through the ARRA Energy Efficiency Conservation Block Grant (EECBG) and were intended to further enhance the HUD PowerSaver loans by bringing borrower interest rates down to as low as zero percent.

Subsequent to the conclusion of the HUD pilot program, the UVA Community Credit Union has continued to offer a PowerSaver loan product and has expanded the list of items eligible for funding, such as fuel efficient vehicles. (The "PowerSaver" name is now trademarked by the Credit Union but is no longer subject to the HUD PowerSaver program requirements.) The IRBD program continues to be offered as a supplement to residential energy efficiency

upgrades or the installation of onsite PV systems. The terms for the IRBD have been renegotiated several times to align with various types of home improvements. For example, the allowable term length has been lengthened to allow for lower monthly principal and interest payments for capital-intensive assets such as PV. The highest volume of loan issuance generally occurs when the PowerSaver product is marketed in concert with rebates for energy efficiency upgrades and Solarize programs.

The UVA Community Credit Union has been one of the most active issuers of PowerSaver loans in the country (second only to AFC First Financial), underwriting over 400 such loans as of 2015. In addition to low interest loans and LEAP's periodic Solarize campaigns, the City of Charlottesville has sought to improve solar economics by granting a property tax credit for property owners who install rooftop or ground-mount solar equipment. The credit is calculated by multiplying the current property tax rate by the system installed cost and it is granted annually over five years. At current tax rates, it equates to a total benefit of 4.75 percent of the system installed cost.

Milwaukee Shines Solar Loan Program

Milwaukee's solar loan grew out of the Milwaukee Shines program, which is a joint project between the city's Environmental Collaboration Office and local partners. The program itself was first launched with a U.S. Department of Energy grant during the Solar America Cities campaign in 2007–2009. Solar America Cities was a national drive to accelerate solar adoption in selected metropolitan areas through financial and technical support. With the resources afforded through this grant, Milwaukee created the Milwaukee Shines office, streamlined permitting, created solar zoning ordinances, and launched several Solarize campaigns.

In 2013, to complement its Solarize initiatives, Milwaukee Shines appropriated $100,000 of capital it received through local utility We Energies to an LLR and issued an RFP to lenders in the city to participate in a solar loan program. Summit Credit Union was the only favorable respondent and eventually became the program partner. The program was largely spearheaded by one staff member in the city's Environmental Collaboration Office (ECO), and did not have additional access to a funding source to allow the office to play an ongoing administrative role. Accordingly, Summit provides the majority of the servicing and administration of the program. However, the majority of the leads and origination of loans has come from marketing through Milwaukee Shines and its neighborhood Solarize campaigns. The program has produced a cumulative portfolio of just under 300 loans to date (around 500 kW of solar capacity).

Following their experience with the City of Milwaukee, Summit Credit Union partnered with the City of Madison in 2016 to roll out the MadiSUN solar loan program. Additionally, Wisconsin currently has a statewide renewable energy loan program called Focus on Energy, established through Section (196.374[2]) of the Wisconsin Statutes that compels state utilities to fund programs for energy efficiency and renewable energy deployment. Focus on Energy also provides direct incentives which can buy down the upfront cost of an installation. Milwaukee-based nonprofit CleanTech Partners administers the loan program on behalf of the larger Focus on Energy consortium.

SECTION 5

Conclusion

The growth of distributed solar in the United States has contributed to diversifying the electricity sector while at the same time affording homeowners and businesses with savings on their electricity bills. States and municipalities that are interested in capturing these benefits can jumpstart their solar markets or accelerate the activity in an existing market with the creation of a publicly supported solar loan program. Access to financing on favorable terms remains a key challenge to the mass deployment of solar in the United States, but public officials can play a part in removing this barrier through the facilitation of financial flows and the improvement of economic benefits for borrowers. Additionally, publicly supported solar loan programs can be a means for states and municipalities to engage their LMI communities and extend the benefits of solar to homeowners who may not otherwise be able to reap them. Solar loan programs can also generate local economic benefits, such as increased business for solar installers, material savings for households, and growth in local bank and credit union loan portfolios.

Access to financing on favorable terms remains a key challenge to the mass deployment of solar in the United States, but public officials can play a part in removing this barrier through the facilitation of financial flows and the improvement of economic benefits for borrowers.

This report has provided examples—both real world and hypothetical—of how a solar loan program could be designed, implemented, and administered in practice. The central concept behind all of them is the credit enhancement. This allows public agencies to engage private investment and stimulate markets without long-term commitments, and by leveraging a limited amount of funds and resources. The type, size, and extent of credit enhancement will depend on the capabilities of the particular state or municipality and the requirements of the lenders in territory. However, as demonstrated in the case studies in this report, when these instruments are designed well with local conditions in mind, the resulting market activity can be appreciable.

SECTION 6

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Green Bank Resources

- Energy Investment Partnerships: *http://energy.gov/epsa/energy-investment-partnerships*

  A report and series of webinars detailing case studies of how public agencies are leveraging private investment in renewable energy projects and programs.

- The Coalition for Green Capital: *www.coalitionforgreencapital.com*

  The Coalition for Green Capital's mission is to accelerate the transition to the clean energy economy by establishing Green Banks at the local, state, federal, and international levels to spur greater private investment in renewables, energy efficiency and clean transportation.

- The Green Bank Academy: *http://greenbankacademy.com*

  A 2014 initiative sponsored by the Coalition for Green Capital, the Brookings Institute, and the Connecticut Green Bank to provide a learning laboratory for state energy and finance officials to engage in peer learning around green bank establish-ment. See the Resources tab for presentations from the event, as well as finance models and other materials.

- The Connecticut Green Bank: *www.ctgreenbank.com*

  This landing page has a number of resources to inform and educate state officials about the operations of the first green bank in the United States.

- The California Alternative Energy and Transportation Finance Authority: *www.treasurer.ca.gov/caeatfa*

  The CAEATFA works collaboratively with public and private partners to provide innovative and effective financing solutions for California's industries.

Endnotes

1 Other factors besides economics are critical for deployment as well. For example: favorable codes and standards, interconnection rules, consumer education, and others.

2 Only individuals that pay federal income tax can take advantage of the credit. LMI customers with small to no tax burdens may not be able to benefit significantly from the federal income tax credit, which may result in more favorable economics with third party ownership for these customers.

3 Solarize campaigns are essentially bulk purchasing, marketing, and education programs organized by cities to reduce the cost of solar equipment for a large segment of buyers within city limits. Combined with other incentives, they can be particularly effective at driving solar economics for homeowners.

4 The Connecticut Green Bank Solar Loan Program also credit enhanced its securitization with an overcollateralization of assets in the warehouse. See Section 4.2 for more information.

5 LEAP was created in 2009 through a cooperative agreement between the City of Charlottesville, Albemarle County, and several local and regional stakeholders. The organization was initially grant-funded with a $500,000 award from the Southeast Energy Efficiency Alliance and operates today as an information and administration hub for local energy programs.

6 Overcollateralization is a credit enhancement commonly found in the securitization markets, but atypical in public finance owing to the limited use of warehouses. The Warehouse for Energy Efficiency Loans (WHEEL) (*www.naseo.org/wheel*) is another example of a public-private partnership that employed a warehouse to enable refinancing of loans, though, in this case, energy efficiency installations were the underlying loan collateral.

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

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