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Credit Enhancements and Capital Markets to Fund Solar Deployment: Leveraging Public Funds to Open Private Sector Investment

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National Renewable Energy Laboratory

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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

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Technical Report
NREL/TP-6A20-62618
February 2015

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Prepared under Task No. SM13.1030

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Executive Summary

Broader penetration of solar energy requires development of consistently-available and lower-cost capital for project finance. This can be achieved by accessing the capital markets and its broad investor base through financial structures such as asset-backed securities (ABS), yieldcos, project bonds, and various other debt products. The transition to such innovative financial structures, however, is not guaranteed. Perceived risks of the solar asset class—including those related to technology, offtaker creditworthiness, and regulatory policy—can increase the required yield, increase probability of investor loss of interest and/or principal, or both. In many cases, this is a cyclical phenomenon: risk perception is fed by lack of historical knowledge, which is in turn fed by risk perception. Therefore, successful access to capital market investment in order to spur low-cost solar deployment depends on the success of this initial fledgling period.

In order to gain wide-scale access to capital markets, the solar industry must first demonstrate that the asset performs as expected and provides the projected investment return for the buyers, issuers, and market-maker handlers of the securities. This can be particularly true for hard-to-reach consumers such as multi-tenant commercial, low or moderate income housing, and non-profit or government sectors. But without any extensive history, it can be very difficult to gain market trust.

To gain the critical initial footing, credit enhancements offer a viable tool to faciliate the transition to frequent and growing access to capital market investment. Credit enhancements can take numerous forms but are generally designed to act as support structures that enable investor confidence in a financial or physical asset—i.e., they enhance the asset's credit quality, thereby reducing its risk profile and thus its cost of capital and even its liquidity. This paper explores the range of credit enhancement mechanisms utilized by both the private and public sectors and delves into mechanisms designed to pool project portfolios called "warehouses."

Credit enhancements for various debt products, whether direct loans or securitized assets, can take on a wide variety of forms but can generally be distinguished by whether they are internal or external to the debt or securitization. Examples of credit enhancements include subordination of credit tranching, excess spread, overcollateralization, and reserve accounts. Overcollateralization was applied in the 2013 and 2014 SolarCity securitizations, or issuances, the details of which are explained in Table ES-1 (Standard & Poor's 2013; Standard & Poor's 2014).

Table ES-1. Details of SolarCity's 2013 and 2014 Issuances ($ millions)

	November 2013	April 2014	July 2014	Improving?
Yield	4.80%	4.59%	4.32%[1]	Yes
Bond Size	$54.4 mm	$70.2 mm	$201.5 mm	Yes
ADSAB (PV of cash flows)	$87.8 mm	$106.2 mm	$276.0 mm	Yes
Overcollateralization	38%	34%	27%	Yes
Advance Rate (Bond size as % of ADSAB)	62%	66%	73%	Yes

[1] July 2014 yield is a weighted average based on the size of two tranches offered.
ADSAB = Aggregated Discounted Solar Asset Balance

Importantly, the various aspects of the SolarCity securitizations have been improving as the market becomes more comfortable with solar as an asset class. ADSAB, or the Aggregated Discounted Solar Asset Balance, represents the present value of the cashflows from the pooled assets in each security. That value has increased steadily along the SolarCity securitizarions. Also, the size of the asset pool, or bond size, has been increasing. And perhaps the metric most valuable, the ratio of debt raised against those bond sizes – known as the *advance rate* – has been increasing. These are valuable trends on the path to wide-scale access to capital market investment.

In order to further expand the accessability of capital market investment to a wider array of solar industry players, the facilitation of "warehouse" vehicles can be a powerful tool to pool projects as they are prepared for eventual securitization. A potential warehouse, for example, may build a portfolio of projects that meet a set of given criteria established by the financier. The warehouse facility plays a crucial role by providing capital liquidity to the developer, allowing further project development activities. Warehouse facilities can be combined with credit enhancements to assist in leveraging public investment. This report offers three examples of warehouse structures and the concept of a partial credit enhancement structures that could possibly open untapped markets, such as: low- and moderate-income households; commercial customers that lack rated credit; and multi-tenant building structures including retail (i.e., strip malls and indoor malls), office complexes, and multi-tenant housing (i.e., apartments and condominiums).

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1 Introduction

In 2011, the U.S. Department of Energy (DOE) launched the SunShot Initiative, designed to lower the cost of solar energy to competitive levels by 2020. In June 2013, the Obama administration outlined three major goals related to climate change in "The President's Climate Action Plan:"

- Cut Carbon Pollution in America
- Prepare the United States for the Impacts of Climate Change
- Lead International Efforts to Combat Global Climate Change and Prepare for its Impacts (Executive Office of the President 2013).

Among the initiatives to cut carbon pollution is to unlock long-term investment in clean energy innovation because meeting these goals will require expanded availability of capital for project deployment through numerous financial innovations. Since 2013, several innovations—particularly yieldcos, green bonds, and securitization—have opened new avenues for investment in renewable energy (RE) projects, a welcome development for the industry.

Distributed RE systems, specifically residential and commercial solar assets, represent a promising means of increasing U.S. clean energy penetration. Distributed systems are, however, currently limited to a narrow band of end-use customers who own their properties (homes and/or commercial real estate) and have demonstrably high credit. For the residential sector, these are customers with high FICO scores;[1] for commercial customers, systems are generally available to those who own or have long-term leases on free-standing buildings and have rated credit (generally, national brands) or can readily provide investors with a reasonable assurance of payback (Lowder and Mendelsohn 2013). The majority of other residential dwellings and commercial properties, including multi-tenant housing (apartments, condominiums), retail, and office properties, are largely untapped markets, even in states where solar deployment is economic and thriving.

Opening these markets to solar deployment will require specific innovations, or credit enhancements, to offset some of the perceived risk of nonpayment. Credit enhancements are available from both the private and public sectors and come in many forms. Importantly, credit enhancements can leverage relatively small levels of public sector investment to open wide-scale private sector capital deployment.

This paper explores the concept of credit enhancement as a means of leveraging private investment in the distributed solar sector. It discusses how these instruments are currently and could be further employed in private sector financings and securitizations, as well as in the public sector. To conclude, the paper overviews "warehouse"structures designed to aggregate solar projects to enable third-party project pooling (typically by large banks) and possibly securitization, which previous NREL work has identified as a means to opening low-cost debt to a wide array of solar deployment (Lowder and Mendelsohn 2013).

[1] FICO stands for Fair Isaac Corporation, which is generally referred to as a credit rating available from one of three primary entities in the U.S. for all individuals in the country.

2 Background

The solar photovoltaic (PV) industry has been growing at a rapid pace. Since 2007, distributed solar—loosely defined as systems deployed "behind the meter" at residential and commercial and industrial buildings—have experienced average annual growth of over 40% (see Figure 1). This relatively strong growth is expected to continue through 2016, after which there is significant uncertainty due to the investment tax credit (ITC) declining from 30% to 10% for commercial and third-party owned systems (and complete termination of the ITC for directly-owned residential systems). In 2013, distributed installations required roughly $7.9 billion in capital (GTM/SEIA 2014).[2]

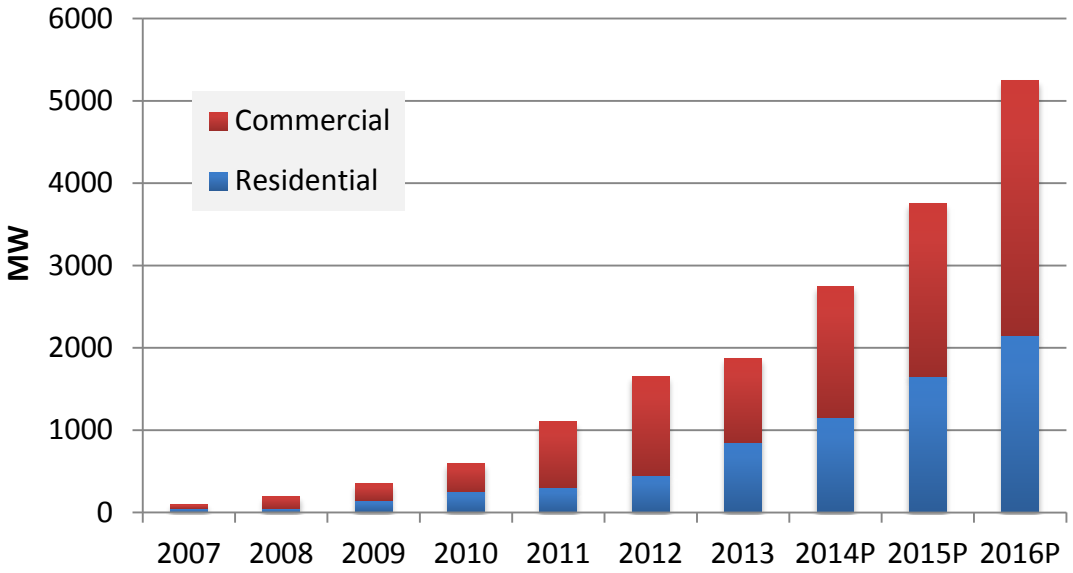

Figure 1. United States PV distributed installations by market sector

Source: Lowder and Feldman 2014

Further deployment growth will require reductions in soft costs, including financing. Unlocking long-term investment in clean energy will, in turn, require access to private investment historically unavailable to RE project finance: pension funds, mutual funds, and private wealth accounts. As shown in Figure 2, of the roughly $100 trillion in global investment assets, the majority is managed by pension funds, insurance companies, mutual funds, and managers of private wealth (TheCityUK 2013). Global assets are primarily invested in debt and equity securities that are liquid, tradable, and priced by the market. Traditionally, renewable energy investment is project-financed and does not have these characteristics, which limits the supply and raises the cost of investment capital.

[2] Calculated as the product of the average system price and the installed capacity by market sector, based on quarterly statistics.

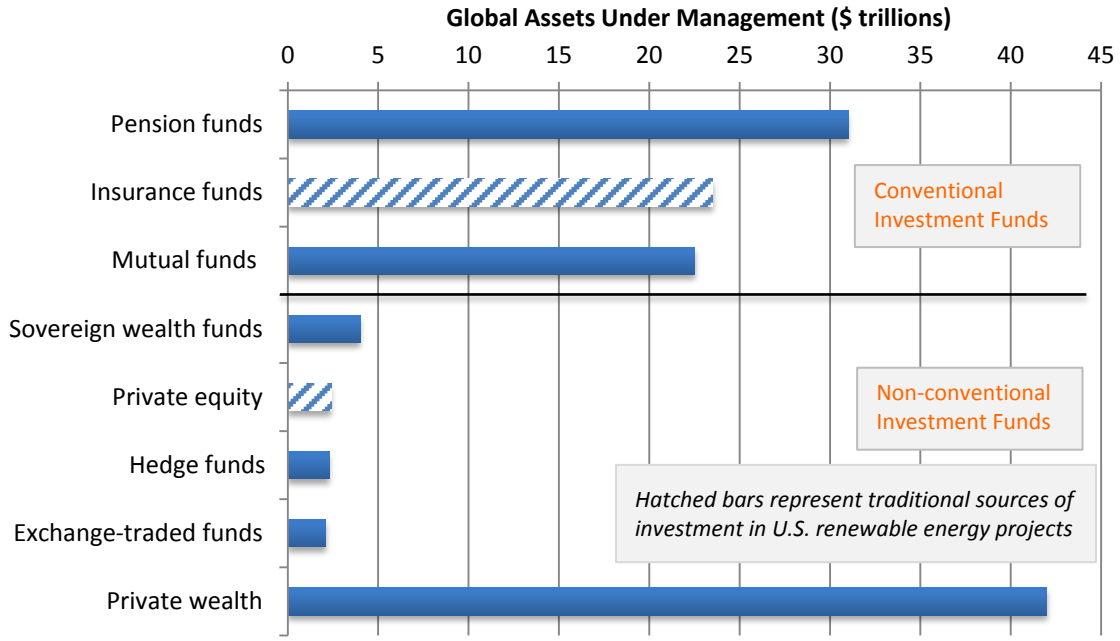

Figure 2. Global capital available for investment

Source: TheCityUK 2013

Access to capital markets—representing the industry that manages and trades such liquid debt and equity securities—would provide a steady and diversified source of investment and allow the solar sector to grow at scale. Laying the foundations for the solar asset class will be increasingly important as the ITC declines to 10% at the end of 2016 for businesses (and terminates completely for homeowners who own systems directly), limiting the need for "tax equity." The reduced utilization of, and demand for, tax equity is viewed as both a positive and a negative: while the ITC represents a 30% direct reduction in the cost of a solar project, tax equity designed to monetize the ITC is both expensive and cumbersome, often negating the opportunity to utilize debt or increasing its cost. Tapping capital market investment requires educating a new set of investors regarding the technology and credit-related risks of solar assets. The financial industry, like many others, is often described as risk-averse and the threshold of investment in a new asset class is not easily overcome without demonstration of its success.

Two critical elements can speed the education process and expand capital market investment (Schwabe et al. 2012):

- **Asset and contractual consistency** – To the extent possible, asset development, documentation, and operation and maintenance (O&M) should be uniform to reduce due diligence (i.e., investor analysis) requirements. That is, standardized procedures and contracts reduce the number of relevant risk factors so investors can model and fully comprehend the potential impact on cash flows and recovery of expected investor returns.

- **Availability of due diligence tools** – Regardless of asset class, investors require data to gain the confidence necessary to invest and/or reduce the required return on such

investment. Solar is a relatively young industry, with the majority of systems only a couple of years old, and risks regarding both technology-performance (i.e., will the system produce energy) and credit-performance (i.e., will the customer pay the bill, even if it is more expensive than utility-based power, etc.) of an investment.

Together, these items feed a virtuous cycle, represented in Figure 3, which facilitates increased liquidity, standardization, a robust market for analytic services, investor confidence, and rating agency feedback.

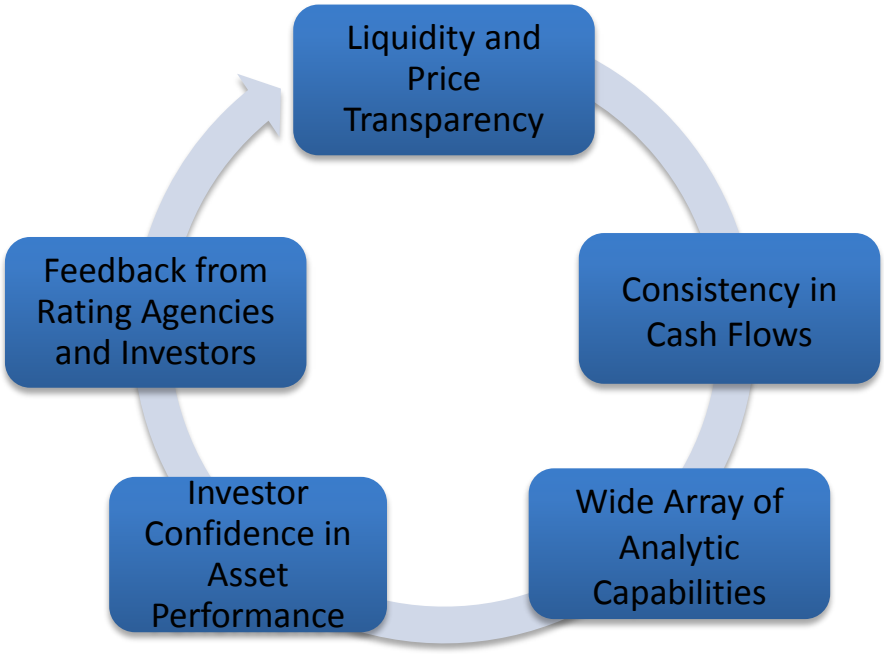

Figure 3. Elements required to build market confidence

Source: Mendelsohn and Joshi 2014

Industry Coordination and Assets to Facilitate Capital Market Investment

As part of the U.S. Department of Energy's SunShot Initiative, NREL was awarded a three-year grant to facilitate access to low-cost capital via securitization and other public capital vehicles. In turn, NREL formed the Solar Access to Public Capital (SAPC) working group, whose members include 450 of the nation's top development, financial, legal, and analytic entities engaged in the solar industry.

SAPC is currently engaged in several initiatives, including:

- Standardizing contracts - The group's suite of contracts, including a residential lease, a residential power purchase agreement (PPA), and a commercial PPA, were diligenced by dozens of law firms engaged in RE development. The list of standard contracts is available at https://financere.nrel.gov/finance/solar_securitization_public_capital_finance.
- Developing best practices in system installation and O&M protocols. These documents are currently in-development, and expected to be issued by early 2015.
- Building robust datasets of technology performance called the Open Solar Performance and Reliability Clearinghouse, or oSPARC. The database is available for stakeholder research at http://sunspec.org/osparc/.
- Filing "mock" securitizations to get a shadow rating from rating agencies to understand their risk perceptions. SAPC's first mock, with detailed term sheets and cash flow analyses, is being reviewed by five agencies. The commercial mock portfolio includes a novel tandem tax equity and securitized debt structure that could enable both forms of capital in the "initial capital stack" could facilitate a lower cost of capital without the need to re-finance. The legal structuring documents, which could save securitization issuers time and expenses to develop, will be available at https://financere.nrel.gov/finance/.

3 Understanding Securitization

Securitization is the transformation of illiquid assets into securities that can provide broader liquidity and reduced risk for investors and easier access to capital for sponsors. Securitization comes in numerous forms and, in a general sense, includes all capital market investments referred to in this paper.

When investors purchase securities, they are essentially buying a claim on the underlying asset or stream of cash flows generated through a contract (Jobst 2008; Lowder and Mendelsohn 2013). Pooling illiquid financial obligations typically reduces risk by diversifying credit of the underlying payments; diversifying geographic and other concentration risks that could impact credit or performance; managing performance and reporting over a larger asset base; and standardizing payment, transfer, and other terms so as to make the resulting collateral pool and securities issued more easily tradable. Traditional securitization assets include consumer loans, leases, mortgages, credit card debt, auto loans, and other esoteric assets.

In its simplest form, securitization is a two-step process. First, a lender, developer, or other entity "originates" loans or leases to homeowners, businesses, or other counterparties. Working with capital market groups, including bankers, legal counsel, and rating agencies, the lender/sponsor can utilize securitization structures to legally and financially insulate the assets that they originated from their own bankruptcy risk (this is critical to the credit quality of the asset pool) into a special purpose vehicle (SPV). This is typically achieved by a "true sale" of the loans by the sponsor to the SPV, an important legal concept.

Second, the lender/sponsor works with rating agencies to add credit enhancements (protecting the investor from the risk of losses on the assets) to the securitization structure, often by retaining a subordinated interest in the pool of securities. The SPV issues various tranches of debt in the capital markets that are structured with different credit ratings and maturities (Lowder and Mendelsohn 2013).

Securitization can offer issuers several benefits over more direct finance of the issuer's corporation (e.g., commercial debt and tax equity). Among these benefits is risk-transfer and the financing opportunities securitization affords by opening a market for illiquid assets that would otherwise remain on owner balance sheets and inhibit a company's ability to originate additional business. Other benefits of securitization include:

- Highly-rated securities can be created at a lower interest rate (coupon) and possibly a longer maturity than other borrowing sources
- Access to increased investor base
- Larger transactions
- Development of capital market history and experience (Lowder and Mendelsohn 2013).

Of course, securitization carries risk, and is often associated with the financial crisis of 2008-2009. According to one expert, "competition between mortgage securitizers led to a race to the bottom on mortgage underwriting standards that ended in the late 2000s financial crisis" (Simkovic 2013). Accordingly, diligent underwriting of solar components and installations is critical to maintain construction quality and operational consistency, and in turn, investor

confidence in the asset class. The solar industry is engaged in numerous activities to facilitate these attributes including Qualification Plus, an NREL-led program to ensure module manufacturing quality (Kurtz et al. 2014) and SAPC's development of installation and O&M best practices designed to improve the probability installations are well built and maintained.

3.1 The Rating Agency Process

Rating agencies represent critical gatekeepers to accessing capital market investment. A poor rating by a rating agency on a given security (perhaps a portfolio of commercial solar projects) can result in far more expensive capital, reduced demand for the security, or both.

Rating agencies assess a wide range of issues including: asset portfolio statistics; legal structure of the transaction; financial performance; experience of the originator; cash flow structure and liquidity; controls and procedures; credit protections, such as guarantors; sovereign and legal risks; and counterparty risks (Mendelsohn 2014b).

Public rating agencies have issued ratings (referred to as pre-sale reports) and published articles regarding securitization of residential and commercial solar leases and PPAs (KBRA 2012; Fitch Ratings 2012; Standard & Poor's 2013; Standard & Poor's 2014). These articles outline the various business and risk factors that need to be addressed to rate a public securitization transaction. The key risk factors identified by the rating agencies include:

- A lack of historical information of both technology and credit performance for solar as an investment asset class.
- A limited number of experienced O&M providers.
- The uncertainty around the future cost of utility-provided electric energy, and the regulations and laws that oversee net metering, demand charges, and other relevant potential factors.
- Solar energy production, which can be unpredictable due to variability in weather, panel degradation, or other inputs, and may cause in variability in cash flows.
- The costs and expenses associated with managing the solar asset portfolio, which may be hard to predict over time.
- Customers that can purchase utility-provided power or lower-cost solar systems may seek renegotiated agreements before the contract term ends that would result in reduced cash flows (Standard & Poor's 2014).

3.2 How Policy Can Support Capital Market Access

Federal, state, and local government support for renewable energy investments comes in a variety of investment incentives:

- Tax credits
- Grants, loans, and guarantees
- Accelerated depreciation
- Nontax environmental incentives
- Renewable portfolio standards (RPS).

Government policy incentives—including the ITC and accelerated depreciation schedule known as Modified Accelerated Cost Recovery Schedule, or MACRS—are designed to encourage investments in renewable energy sources. These incentive structures have encouraged primarily specialized tax equity investment (Mendelsohn and Harper 2012). Looking forward, wider-scale "public" capital will be required to support the scope and scale of investment in renewable energy projects to meaningfully reduce greenhouse gas emissions and garner other benefits. The securitization of cash flows from renewable energy projects is an important tool that can bridge the capital investment gap, and financial policy initiatives which do not require specialized tax equity investment will encourage development of these more flexible financial structures.

However, a securitization solution would require offering credit enhancements to senior investors in the form of loss reserves, subordinate debt, or some other structure to keep default risk (and therefore interest rates on securitization transactions) low enough to attract capital markets debt funding sources for solar energy.

In the United States, many credit enhancements are offered at the local, state, and federal levels to spur energy system manufacturing and deployment. Federal entities that offer credit enhancements to open investment and trade include the Overseas Private Investment Corporation (OPIC), the Export-Import (Ex-Im) Bank, and the Department of Energy.

One recent trend worth noting is state green banks. According to the Coalition for Green Capital, an organizational entity of U.S. green banks, a green bank "is a public or quasi-public financing institution that provides low-cost, long-term financing support to clean, low-carbon projects by leveraging public funds through the use of various financial mechanisms to attract private investment so that each public dollar supports multiple dollars of private investment" (Coalition for Green Capital 2014).

At time of publication, state green banks were in operation in Connecticut, New York, and New Jersey. Connecticut's Clean Energy Finance and Investment Authority (CEFIA), also known as Connecticut Green Bank, was initiated in 2011 and has been written about extensively.[3] The New York Green Bank (NYGB) is a more recent entrant, initiated in 2013 and opened for business in early 2014. Legislation enacting Hawaii's Green Bank passed in 2013 (Center for American Progress 2015).

According to NYGB, the primary objectives of the entity are to:

- "Provide a bridge to self-sustaining, efficient financing markets for clean energy and energy efficiency.
- Leverage private sector capital to develop sustainable clean energy financing markets.
- Increase the amount of clean energy deployed for every dollar of State money spent or invested in the clean energy sector.

[3] See, for example, Berlin, K.; Hundt, R.; Muro, M.; Saha, D. (2012). "State Clean Energy Finance Banks: New Investment Facilities for Clean Energy Deployment." http://www.cleanegroup.org/assets/Uploads/State-Clean-Energy-Banks-Sept2012.pdf

- Animate capital markets for the clean energy sector, so as to reduce the cost of capital and the need for government support.
- Spur economic development and clean energy jobs across the State." (NYGB 2014).

NYGB offers three primary forms of support structures to facilitate investment in renewable energy technologies, which represent the general range of non-tax-related policies available:

1. As a credit enhancement provider (e.g., a reserve account or subordinated debt)
2. As a lender (e.g., senior, mezzanine, or subordinated)
3. As a warehouse provider with the potential to be taken out by third parties upon certain events (e.g., the aggregation of an agreed upon amount of assets) (NYGB 2014).

Note that this analysis focuses primarily on credit enhancements and warehouse facilities because these instruments offer the potential to leverage a relatively small quantity of public investment to garner larger private investment opportunities.

4 Credit Enhancements

Credit enhancement represents a variety of financial support structures that are designed to reduce or transfer risk and improve the terms on debt and debt-like instruments. Credit enhancement typically reduces the required yield/cost of funds of debt, making it more attractive to borrowers. Credit enhancement can also improve the liquidity of a security (i.e., its tradability in a market context), which is attractive to investors (Lin 1999). Section 4.1 evaluates credit enhancements that are *internal* (incorporated within the allocation of cash flows) and *external* to the debt structure, although the designations are not concrete and the credit enhancements described can often fall into either category.

Key considerations in determining or selecting the form and amount of credit enhancement include: the intended investor/purchaser of the security, desired rating level, the credit characteristics of the underlying assets (also known as collateral), the availability of capital for credit enhancement, and the cost of credit enhancement (Mendelsohn 2014b). Other considerations may include the limits or restrictions on the type and amount of credit enhancement available. For example, public sector credit enhancements may be subject to specific risk limitations or design requirements associated with enacting legislation or other statutes.

4.1 Internal Credit Enhancements

Internal credit enhancements are incorporated specifically into the legal structure of the securitization or other investment vehicle. They are generally designed to allocate cash flow from the underlying assets to meet the required debt service coverage levels and protect the noteholders from losses. Internal credit enhancements include:

Subordination or Credit Tranching

Senior/subordinated structures are designed to carve up cash flows from one pool of assets/collateral into multiple classes of securities within one debt offering (Mendelsohn 2014b). The securities issued by the SPV are arranged in a hierarchy of classes (or tranches), which are ranked by risk, tenor, and other qualities (FDIC 2007). Lower seniority (or subordinated) tranches are assigned a lower credit rating and serve as protective layers of the more senior, highest-rated tranche. The cash flows are prioritized to pay the most senior tranches first; the remaining available cash is then paid to next-highest tranche and continues to the most junior tranche or until available cash is exhausted. Losses flow in the opposite direction and applied to the junior tranches first and senior tranches last, based on the specifics of any deal (see Figure 4 below).

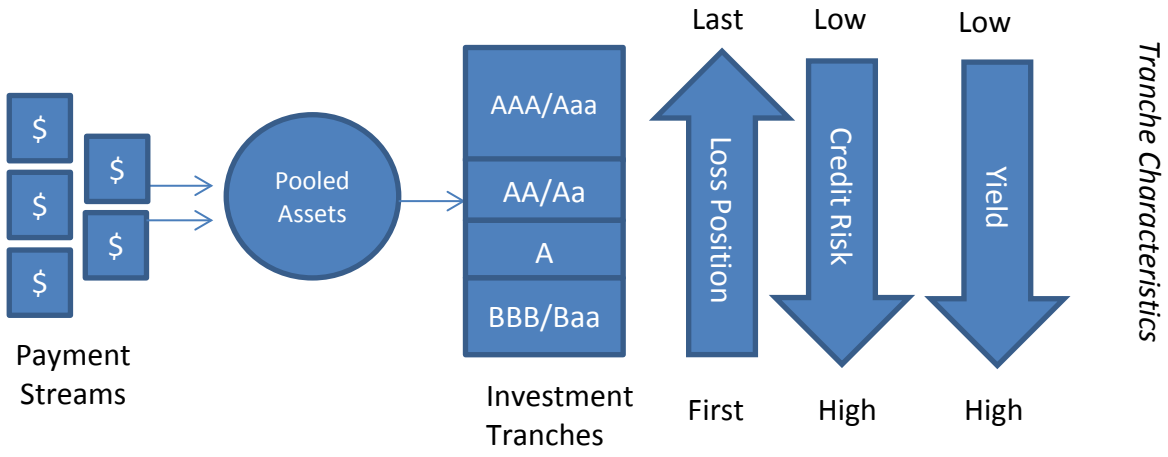

Figure 4. Tranching mechanisms facilitate differentiated asset pools and risk/reward options for buyers of securities.

Excess Spread

Excess spread is the difference between the interest rate received on the underlying assets, also referred to as collateral, and the yield on the issued security. This mechanism is built into a wide array of securitizations, particularly for credit cards (FDIC 2007).

As an example of its use, in February 2014, Riverside County, California issued a securitization of Property Assessed Clean Energy (PACE) loans that fund a portfolio of energy efficiency local projects. The primary credit enhancement of that securitization, known as the HERO Bond,[4] is an excess spread whereby the underlying collateral pays an average yield, or coupon, of nearly 8% and the rate on the securitization note pays 5% to the noteholders.[5] According to Kroll Bond Rating Agency (KBRA), which rated the HERO Bond, the difference in incoming and outgoing yields represents "an excess spread available to cover losses. Any excess interest cash flows from the PACE Bond Portfolio will be available to pay principal should PACE Assessment defaults rise." (KBRA 2014). The HERO Bond pools 5,890 PACE Assessments (i.e., home efficiency improvements) and raised $104.4 million dollars.

PACE Lending

PACE lending, which places a tax lien on the associated property, provides a form of credit enhancement by transferring or substituting the security repayment risk to the likelihood of recovering amounts owed through property tax assessments. Because of the seniority of the tax lien (i.e., by law, taxes are repaid before other types of debt or accounts payable), the HERO Bond received an AA rating (KBRA 2014). KBRA, in assessing the portfolio, was primarily convinced of the creditworthiness (the likelihood that the principal and interest on the bonds would be repaid) based on the ability to tax the underlying real estate value rather than the technical performance of the solar systems or the regulatory environment (i.e., including net metering) that facilitates the system's value to the customer. The rating agency indicated, "[i]n

[4] The HERO Bond is officially referred to as HERO Funding Class A Notes, Series 2014-1.
[5] The HERO Bond also incorporated credit enhancements of a 3% overcollateralization and a 3% reserve margin.

its analysis, KBRA used historical residential real estate tax default data for the County and surrounding counties as a proxy for PACE Assessment defaults. KBRA views this as an acceptable proxy, since PACE assessments are equal in priority to other real estate taxes" (KBRA 2014).

According to KBRA, in providing the loans that comprise the HERO Bond portfolio, Riverside County implemented the following underwriting guidelines to improve the probability of repayment:

- "The property owner(s) must be current on their property taxes
- The property cannot have had more than one 30-day mortgage late payment over the previous twelve months
- Mortgage-related debt on the property must not exceed 90% of the market value of the property
- Proposed improvements must not exceed 15% of the market value of the property and the combined mortgage related debt and amount of the PACE assessment must not exceed 100% of the market value of the property
- The total annual property tax and assessments, including the contractual assessment, on the property must not exceed 5% of the property's market value" (KBRA 2014.)

PACE lending for solar deployment is still in its infancy but is often considered a potentially valuable source of funds. PACE legislation allowing municipalities to create PACE programs has been enacted in 31 states and Washington, D.C. (NCSL 2014). Twelve states and Washington, D.C. have active PACE programs. PACE Assessment is relatively unique to energy and water efficiency and renewable energy projects, and is therefore not widely recognized as a credit enhancement for other asset classes.

Overcollateralization

The expected value of the pooled assets (representing the present value of the remaining cash flows) is larger than the debt raised under the securitization. The overcollateralization provides a reserve to make principal and interest payments if some of the payments from the underlying loans are late or default (FDIC 2007).

In the SolarCity securitizations of November 2013, April 2014, and July 2014, the securitization bond was credit enhanced through overcollateralization (Standard & Poor's 2013; Standard & Poor's 2014). The three issuances represented a present value of cash flows over the remaining life of the contracts (referred to as Aggregated Discounted Solar Asset Balance, or ADSAB) from the underlying collateral of $87.8 million, $106.2 million, and $276 million, respectively. The securitization debt, sold as notes to the noteholders, was sized far smaller, at $54.4 million, $70.2 million, and $201.5 million, respectively. The ratio of the bond size to the total asset cash flows is referred to as the *advance rate*. The overcollateralization equals one minus the advance rate.

Table 2. Details of SolarCity's 2013 and 2014 Issuances

	November 2013	April 2014	July 2014	Improving?
Yield	4.80%	4.59%	4.32%[1]	Yes
Bond Size	$54.4 mm	$70.2 mm	$201.5 mm	Yes
ADSAB (PV of cash flows)	$87.8 mm	$106.2 mm	$276.0 mm	Yes
Overcollateralization	38%	34%	27%	Yes
Advance Rate (Bond size as % of ADSAB)	62%	66%	73%	Yes

[1] July 2014 yield is a weighted average based on the size of two tranches offered.
ADSAB = Aggregated Discounted Solar Asset Balance
Source: Standard & Poor's 2013; Standard & Poor's 2014.

Importantly, the SolarCity transactions show a steadily improving advance rate indicating the increased confidence in solar as an asset class in a very short time frame (roughly 8 months). Relatively mature industries will enjoy an advance rate of 75%-80%. In contrast, the HERO Bond, described above, received a 97% advance rate but – as mentioned – was credit enhanced primarily through security of the tax and the excess spread (i.e., the difference between incoming and outgoing interest rates) incorporated in the structure rather than overcollateralization.

Reserve Accounts

A reserve account is created to reimburse the securitization manager—referred to as the issuing trust—for various types of losses and temporary shortfalls. Solar systems, for example, may require reserve accounts specifically to cover solar-related expenses (e.g., excess O&M and/or replacement of inverters) or non-solar-related expenses (e.g., prepayment, default) over the life of the security. Reserve accounts may be funded at a fixed amount or be replenishable. They may have minimum and maximum levels. If reserves dip below minimum levels because expenses are higher than incoming additions, cash is "swept" away or allocated from investor payments to reserve funds to ensure these primary services are paid for. Cash sweeps may put noteholders' recovery of principal and interest at risk in the near term but ultimately protect the assets and cash flows over the life of the security.

A reserve account can also be external to the debt securitization funded by an entity associated with the debt issuance or an outside party. For example, in March 2014, California established a $10 million loss reserve that will backstop residential PACE programs. In the case of foreclosure or forced sale, the loan loss reserve (LLR) "will reimburse first-mortgage lenders for any losses attributable to PACE loans" (California Office of the Governor 2014). According to the California agency[6] that runs the LLR Program, the goal "is to put first mortgage lenders in the same position they would be in without a PACE lien," thereby placating a concern by the Federal Housing Financing Authority—the federal entity that oversees Fannie Mae and Freddie Mac mortgage insurance programs—that PACE programs place first mortgage holders at additional risk.

[6] The agency is called the California Alternative Energy and Advanced Transportation Financing Authority.

Turboing (Reducing Maturity Risk)

In a turbo structure, excess funds are paid to noteholders as principal, paying down the debt at an expedited rate (SIFMA 2014). Turbo structures can shorten the expected life of the debt from "legal final maturity," or the potential maximum duration of the debt. Shortening the security life greatly reduces risk because it reduces uncertainty. This is particularly true for solar due to limited or no long-term asset production data (particularly as module and inverter designs evolve over time) and ambiguity with respect to regulatory policy (e.g., net metering), fuel prices, technological replacements, and other potential risks perceived by rating agencies and investors (Standard & Poor's 2014).

Additional features internal to securitized assets that may offer additional credit enhancement benefits include:

Amortization Schedule: Amortization schedule represents the rate at which securities return principal to investors. *Full amortization* repays the principal in full over the life of the loan. These loans are designed to closely reflect the repayment characteristics of the underlying loans from scheduled interest and principal payments. A *controlled amortization* repays principal in a series of defined periodic payments after a predetermined period during which only interest payments are made.

Bullet Structures: Securities designed to return principal to investors in a single payment. Bullet structures can be further delineated by whether the bullet will be paid on the expected maturity date ("hard" bullet) or not guaranteed to be paid by that date ("soft" bullet).

Floating Rate Structures: Securities that have had a floating, rather than a fixed, interest rate. The interest rate is or indexed and adjusted periodically. Common indices include the London Inter-Bank Offered Rate (LIBOR) and U.S. Treasury bills, plus a fixed margin. This technique can help avoid an interest rate mismatch between borrowers and investors.

4.2 External Credit Enhancements

External credit enhancements are those that are procured from or provided by a third party and used to protect investors or noteholders ability to recover their expected principal and interest. The addition of external credit enhancement improves the risk profile of the security to attract investors while at the same time lowering the required yield/cost of capital. External credit enhancements include:

Surety Bonds

Surety bonds are insurance policies that reimburse the security for losses related to default or unexpected expenses (FDIC 2007). A surety bond (also called a performance bond) guarantees the contract will be completed according to its terms and conditions. These bonds are different from insurance in that they are constituted by a three-party contract, whereas insurance contracts include only two parties (Lowder et al. 2013). Insurers generally provide guarantees only to securities of investment-grade quality (BBB/Baa) (SIFMA 2014). An asset-backed security (ABS) combined with a surety bond can improve the securities ratings equal to that of the surety bond's issuer. Surety bonds only make economic sense to the effect the reduction in interest

costs on the debt is greater than the cost of the surety bond insurance, i.e., the net effect on the over-all cost of funds is positive (Mendelsohn 2014b).

Security Wraps/Third Party or Parental Guarantees

These products represent forms of external insurance. For example, a third party or the parent company of the ABS issuer can provide a promise to reimburse the trust for losses up to a specified amount. Ex-Im, the United States government's official export credit agency, offers loan guarantees and export credit insurance. The bank's 100% loan guarantees[7] are available to qualified international buyers in the public and private sector for up to ten years, and will finance up to 30% of local costs (Ex-Im n.d.). Ex-Im's access to low-interest debt through the U.S. Treasury and ability to offer 100% loan guarantees allows the bank to achieve narrow interest rate spreads (Chadbourne & Parke 2014). In 2013, Ex-Im approved a $780,000 loan guarantee to finance U.S. solar module exports, supplied by Suniva Inc., to a 500 kW rooftop PV installation at Grupo Metal Intra's main production plant in Queretaro, Mexico (Choudhury 2013).

Letter of Credit (LOC)/Cash Collateral Account (CCA)

A letter of credit is an irrevocable commitment in which a commercial bank or other financial institution is paid a fee to stand by with cash to reimburse the trust for any losses actually incurred, up to the required credit enhancement amount (FDIC 2007). An LOC is usually an alternative to subordinated notes or, if the quality of assets is low, coupled with subordinated notes. Funds from the LOC may be drawn upon by the trust if the losses cannot be covered by excess interest spread or reserve (Lin 1999). In a cash collateral account (CCA), funds from a commercial bank are deposited in an account with the highest available credit quality (e.g., short-term commercial paper) and available for pre-specified expenses to ensure the creditworthiness of the overall security.

Country-Specific Reserves/Currency Protection Mechanisms

Foreign projects, particularly in developing countries, carry additional risks that often must be credit enhanced to garner a high quality credit rating and/or be sellable in the capital markets. Currency risk is of particular concern and can cause a significant increase in the cost of debt in developing countries (Nelson and Gireesh 2014).

[7] Ex-Im provides coverage for medium term and long term transactions, and provides an 85% loan guarantee with a 15% down payment required by the buyer.

Table 3. Selected Credit Enhancement Examples Compared

	Local	State	National	International
	California Governor's Office	Connecticut Clean Energy Finance and Investment Authority	US Department of Energy	U.S. Ex-Im Bank
Credit Enhancement	PACE Loan Loss Reserve	CT Solar Loan Warehouse Facility/LLR	Loan Guarantee	Loan Guarantee
	California Senate Bill 96 authorized a $10 million mortgage loss reserve program to reimburse first-mortgage lenders for PACE payments made during the foreclosure period.	$5 million warehouse facility seeded by (CEFIA), and will be leveraged with debt from Mosaic to originate additional loans. LLR was formed with repurposed ARRA funds, which will pay off the entire default up to $300,000 (Mendelsohn 2014a).	An estimated $4 billion in loan guarantees and "credit subsidy" costs (i.e. essentially insurance premiums) for innovative RE, efficiency, or grid applications. DOE has identified list of eligible projects for consideration (Hansen 2014).	Ex-Im Bank provides an 85% loan guarantee and requires a 15% down payment from buyer. Qualified public and private sector buyers may finance up to 30% of local costs for up to 10 years.

During the financial crisis of 2008 – 2009, an entire private sector industry, referred to as monoline mortgage insurance, was eliminated due to extensive mortgage defaults. This analysis is not meant to review the complex breakdown of the mortgage securities market, but suffice to say, thorough and consistent due diligence of solar project deployment and maintenance is critical to build investor confidence to ensure a high probability the asset will perform as expected from both a technological and credit perspective.

5 Warehouse Facilities

Typical securitizations involve the pooling of assets in "warehouse facilities," sometimes also referred to as "conduit structures," against which securities are issued prior to the securitization being released into the capital markets. These facilities typically feature a "carry/risk-sharing" structure where all parties in the warehouse share interest income (carry) as well as the risk of the underlying asset defaulting or not being acceptable in the final securitization transaction.

Warehouse facilities are commonly provided by an investment bank, conditional upon an agreement with the issuer to securitize the portfolio once the structure has been arranged. Commercial banks have also been active in warehouse finance for other asset classes and it is likely they will become active in the solar asset class. The warehouse provider furnishes capital (cash) to buy (also referred to as "source") the assets. In a solar transaction, the assets in the warehouse can be the cash flows from a lease or PPA, the physical solar systems themselves, or both. Incorporating a credit enhancement from a public entity in this warehouse would spread the risk (and income) amongst a greater range of parties and thus reduce the potential cost to the issuer in setting up the facility.

The Warehouse for Energy Efficiency Loans (WHEEL) program was developed by the Energy Programs Consortium and the National Association of State Energy Officials (NASEO) in partnership with Pennsylvania Treasurer and the banking entity Citi. WHEEL facilitates capital market investment in energy efficiency projects by purchasing unsecured residential energy efficiency loans written, or *originated*, in participating programs. The loans are aggregated into pools, rated, and sold as asset-backed notes. "Proceeds from those note sales will be used to recapitalize WHEEL, allowing it to continue purchasing eligible loans from state and local programs for future rounds of bond issuance" (NASEO n.d.). However, future rounds of bond issuance depend on whether public sector sponsors "recycle" the project cash flows to support more loans. WHEEL is currently active in Pennsylvania, and the program is under consideration in Kentucky, Virginia, Nevada, and other states (Mendelsohn 2014c).

CEFIA also pools project cash-flows into warehouse-like structures. CEFIA offers three products to spur residential solar installations, efficiency and other installations: the CT Solar Lease (targeted to installers), the CT Solar Loan (targeted to homeowners), and the Smart E-Loan (targeted to banks) (Hunter 2014). In total, about $93 million is available for credit enhancement from the state.

In 2014, CEFIA partnered with solar loan originator and master servicer, Sungage Financial, and solar crowdsourcing investment platform, Mosaic, to launch a new residential financing product called the CT Solar Loan (Hunter 2014; Mendelsohn 2014a). To structure this deal, CEFIA seeded an SPV with $5 million to finance residential solar PV projects. CEFIA will leverage this warehouse facility with debt from Mosaic by lending against the cash flow of the residential loans. To re-capitalize the SPV, the loans are pooled into $500,000 tranches and sold to Mosaic at 6% yield and 15 year maturity (the term of the loans). The capital raised remains in the SPV to leverage against tranches as they come in and to buffer against potential defaults. CEFIA retains a first loss position of 20% subordinated debt and Mosaic receives 80% of loan repayment cash streams (Mendelsohn 2014a) (see Figure 5).

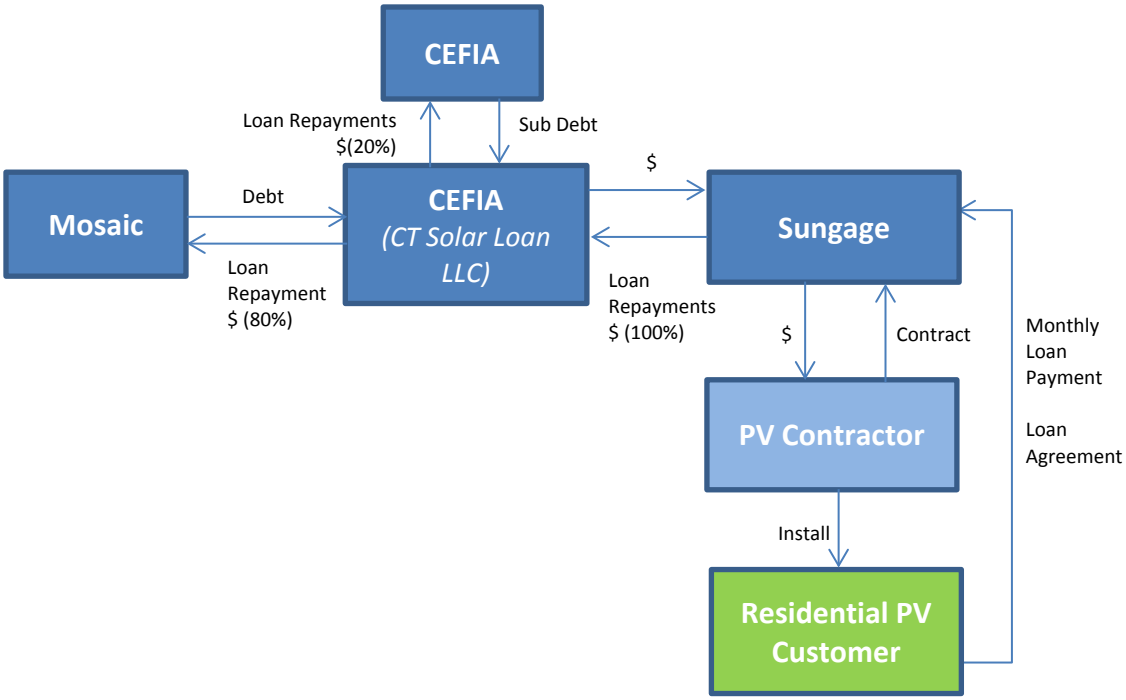

Figure 5. General representation of CT solar loan structure

Source: Hunter 2014

Although the warehouse facility does not necessarily enhance credit directly, it serves to remove transaction costs and pool a portfolio of similar assets to tap debt investment. The warehouse facility can be combined with a wide array of credit enhancement fixtures described above to increase the number of investors interested in the asset class and/or reduce the required yield to garner their investment.

Separately, in May 2014, CEFIA announced the securitization of a $30 million portfolio of commercial projects (CEFIA 2015). The projects were financed by CEFIA via its Commercial PACE program. Connecticut's Public Finance Authority is the issuer of the bonds, which have been purchased by a specialty finance company, the Clean Fund. According to Bert Hunter, CEFIA's Chief Investment Officer, "[t]he sale of this initial portfolio of PACE liens to Clean Fund is the latest step in our effort to attract and deploy private [-sector] capital here in Connecticut supporting energy efficiency and renewable energy opportunities."

6 Example Warehouse/Credit Enhancement Mechanisms

The following example structures, referred to as Partial Credit Enhancement Structures (PCES), combine warehouse conduits, designed to pool the cash flows of similar projects, and credit enhancements to offset risk and induce private sector capital investment. The PCES mechanisms are offered as potential instruments to support the transition from traditional financing mechanisms to the application of public capital vehicles. A PCES can provide valuable support to a securitization transaction not only as an instrument to mitigate project risk but also to provide the necessary additional creditworthiness lenders currently require because of the limited availability of performance and credit data.

The additional credit support of a PCES could substantially improve lending terms, including cost of capital, tenor, and maturity while also encouraging risk sharing and providing additional leverage. As a simple hypothetical example, consider a PCES in the form of a 5% loss reserve that successfully induced private capital 20 times its initial investment. In this example, a 5% PCES of $1 million would leverage up to $20 million of private capital.

As another example, imagine a federal credit enhancement of say 20%, demonstrably less than the current 30% that the government pledges to the solar industry in the form of the ITC. Importantly, the ITC is essentially always paid out for solar system deployment but a credit enhancement is only paid in cases in which noteholders are at risk of recovering scheduled principal and interest due to poor system technical performance or off-taker (i.e., power purchaser) credit performance. However, the comparative effectiveness of the credit enhancement and ITC are not well understood at this time; this analysis assumes that the different policy mechanisms will induce reasonably equivalent investments in renewable energy on a dollar-for-dollar basis, although policymakers would need to better understand if a credit enhancement mechanism would be as effective as the ITC or other policy instruments. Nonetheless, the specified credit enhancement represents the upper limit of potential exposure. The credit enhancement could be far less expensive than that upper limit, or in fact provide a modest return to the public sector entity funding it if cash flows are reasonably consistent with initial projections.

Three potential PCES strategies are:

- **“Warehouse” Reserve.** This credit enhancement product is specifically designed to assist in the formation of the portfolio during warehousing, which is the period in which projects are pooled prior to securitization, perhaps during construction or upon initial commercial operation. As represented in Figure 6, a potential warehouse PCES could lay in a mezzanine position behind the developer’s equity, meaning that the developer’s interest is written off first (consistent with Dodd-Frank regulatory requirements of at least 5% sponsor risk retention), protecting the PCES provider’s position. In the example inFigure 6, the warehouse reserve is sized between 5% and 20% of the total value of the debt. Thus, at 10% reserve, for example, the third-party debt would not incur losses until cash flows limited the first 15% (5% developer, 10% PCES) of total cash available for debt service.

Additional credit enhancement could also be provided to this position through the availability of excess spread between the interest income earned on the assets in the warehouse facility and the actual cost of capital (e.g., in the form of a bank loan in order to pool the assets), operational reserves, or other mechanisms.

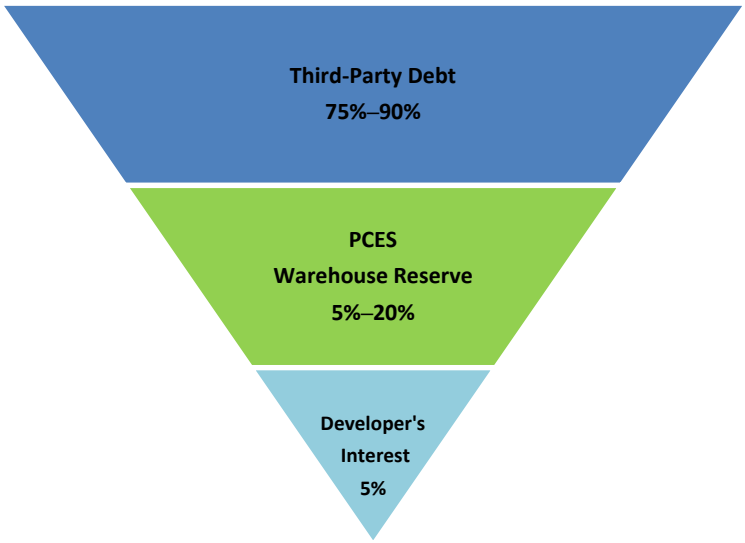

Figure 6. PCES program structure: warehouse facility

(Values are hypothetical percentages of total project investment.)

- **"Securitization" Reserve.** Like a warehouse reserve, this product would be a mezzanine investment, though it would remain in place for the duration of the securitized asset life. The securitization reserve mechanism can be structured in a wide variety of formats based on the allocation of coupon receipts and principal repayment. See Figure 7.

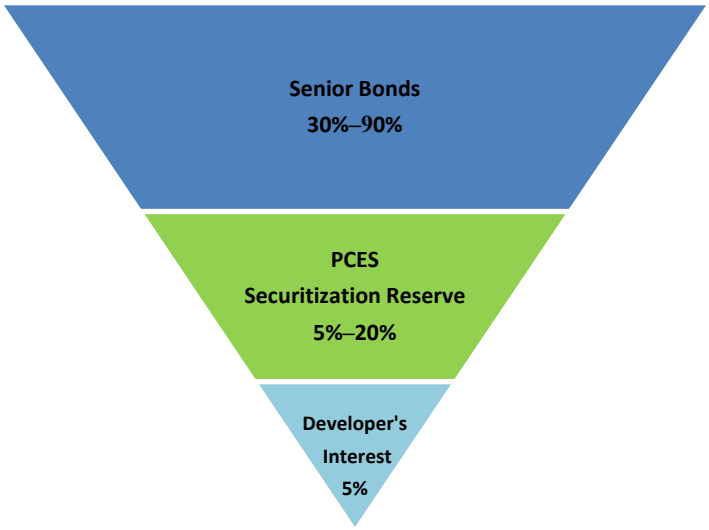

Figure 7. PCES program structure: securitized transaction

(Values are hypothetical percentages of total project investment.)

- **"Warehouse/Securitization Co-Invest" Mezzanine Bond.** This structure represents a combination of the prior two and supports both the creation and long-term operation of the pool. This structure, as pictured in Figure 8, also requires the public credit enhancement and the private sector debt to incur losses at the same rate, thereby slowing losses to the credit enhancement funds but increasing risk to the senior bondholders.

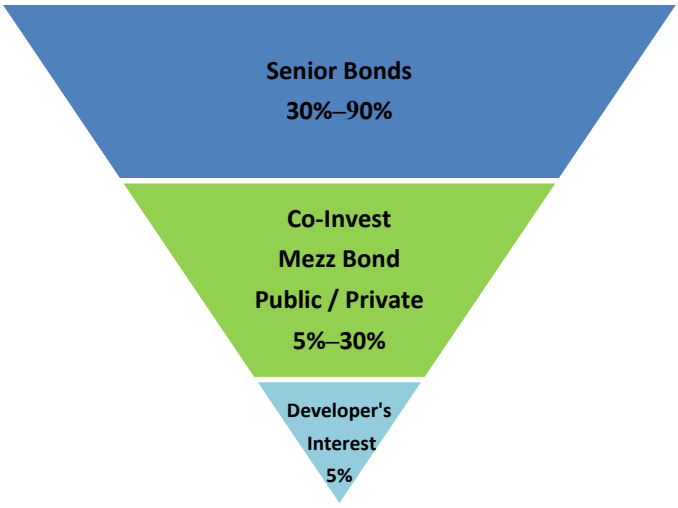

Figure 8. Co-invest PCES program structure: transaction

(Values are hypothetical percentages of total project investment.)

Specific details of these structures can be created in innumerable forms, but are generally designed by both the structuring entity and the potential noteholders as a seller/buyer negotiation. These strategies can greatly reduce the risk perception among investors, reduce yield requirements, and provide valuable experience to nascent forms of securitization. Credit enhancements can also represent a valuable incentive by which to spur adoption of standardized contracts and installation best practices. These might improve a given solar securitization's opportunity for success in the capital markets.

Public investment in securitized vehicles via PCESs can be a low-risk strategy because renewable energy generation projects typically have a contracted revenue stream (e.g., through a PPA or lease). They often also carry other guarantees, such as those from the developer, equipment manufacturers, and construction entity, which could partially or fully indemnify the PCES provider.

7 Conclusion

Credit enhancement represents a variety of financial support structures that are designed to reduce or transfer risk and improve the economics of a debt instrument including debt raised via a securitization process. Credit enhancements can improve both the liquidity of a security and the required yield/cost of funds of the security, thus improving the attractiveness to both investors and borrowers. A wide array of internal and external credit enhancements is available to both private and public sector actors interested in expanding investment in renewable energy assets.

Warehouse facilities facilitate the pooling of assets into portfolios conducive for debt investment. Combined, warehouse structures and credit enhancements, particularly from public sector sources interested in leveraging large quantities of private capital, can potentially be a powerful mechanism to organize solar project cash flows and enable broader access to low-cost debt capital. Importantly, any PCES would need to be carefully assessed and designed to effectively induce private sector investment and to do so at lowest cost to the public sector.

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