

WORKING PAPER: STATE GREEN BANKS FOR CLEAN ENERGY

Hallie Kennan

January 2014

EXECUTIVE SUMMARY

The purpose of state green banks is to use public funds and authority to lower the cost and increase the amount of private financing for clean energy technology. State green banks are initially capitalized using existing government sources, such as state programs, federal grants, systems benefit charges, and greenhouse gas allowance proceeds. These funds are then used strategically to lever greater private investment in clean energy and energy efficiency, effectively multiplying the impact of public dollars while making use of private sector expertise.

One of the most useful and flexible structures for state green banks has been as a quasi-governmental state-level financial institution that offers low-cost finance opportunities for clean energy projects. The bank may use a variety of financing tools, such as direct loans and co-investing, on-bill financing, property-assessed clean energy (PACE) programs, credit enhancements, and bonds. One objective of state green banks is to become self-sustaining; for this reason, state green banks intend to prioritize the use of financing tools that will generate returns, rather than offering grants or rebates. State green banks are complementary to federal clean energy incentives, such as tax credits, as these incentives help attract the private investors with which state green banks seek to partner.

State green banks can address gaps in the “finance supply chain” that the private sector cannot easily address on its own. They do not face some of the temporal and financial constraints that may limit private sector investment choices. For example, state green banks have greater flexibility to explore and test untried financing structures than do private investors. Similarly, they can arrange deals whose benefits accrue more to its partners than itself. As a result, state green banks not only improve upon existing financing arrangements, but also create entirely new tools and financing arrangements for clean energy projects.

Several states have already authorized or implemented state green banks. Connecticut established the Clean Energy Finance and Investment Authority (CEFIA) in 2011, making it the longest running state green bank. This paper discusses the goals, structure, and functions of a state green bank, with particular consideration of Connecticut’s CEFIA as a case study. The paper concludes with a list of the strengths and weaknesses of state green banks as a policy tool to accelerate clean energy deployment.

WORKING PAPER: STATE GREEN BANKS FOR CLEAN ENERGY

By Hallie Kennan¹

INTRODUCTION

In recent years, policymakers and think tanks have made several proposals as to how the federal government could establish a financing authority that would provide support for renewable energy. In 2009, the Senate and House each considered bills to create a Clean Energy Deployment Administration, a federal entity that would offer a suite of investment vehicles and credit enhancements to help clean energy technologies bridge the “commercialization gap.”¹ While both bills were passed in their respective congressional houses, neither was eventually signed into law. The following year, the Coalition for Green Capital recommended the establishment of an Energy Independence Trust to act as a federally chartered clean energy finance institution.² Similarly, the American Energy Innovation Council proposed the New Energy Challenge Program in their 2010 report, “The Business Plan,” the aim of which was to accelerate advanced energy technologies to commercial scale through finance opportunities.³ These suggestions also failed to materialize.

Due to the lack of progress at the federal level, policymakers have since turned their attention to the idea of state-level financing authorities, also known as state green banks or clean energy finance banks, as an alternate means of funding the deployment of commercially available clean energy and energy efficiency technologies. This paper discusses the goals, structure, and functions of a state green bank, with particular consideration of Connecticut’s Clean Energy Finance and Investment Authority (CEFIA) as a case study. The paper closes with a list of the strengths and weaknesses of state green banks as a policy tool to accelerate clean energy deployment.

OVERVIEW OF STATE GREEN BANKS

A state green bank can be structured in several ways. One of the most useful and flexible options is to structure the bank as a quasi-governmental state-level financial institution that offers low-cost finance opportunities for clean energy projects. State green banks are initially capitalized using existing government sources, such as state programs, federal grants, systems benefit charges, and greenhouse gas allowance proceeds. These funds are strategically used to lever greater private sector investment in clean energy and energy efficiency, effectively multiplying the impact of public dollars. The bank may use a variety of financing tools, such as direct loans and co-investing, on-bill financing, property-assessed clean energy (PACE) programs, credit enhancements, and bonds.⁴ One objective of state green banks is to become self-sustaining; for this reason, state green banks are intended to prioritize the use of financing tools that will generate returns, rather than offering grants or rebates.⁵ State green banks are complementary to federal clean energy incentives, such as tax credits, since these incentives help attract the private investors with which state green banks seek to partner.

PURPOSE OF STATE GREEN BANKS

The purpose of state green banks is to use public funds and authorities to lower the cost and increase the amount of private financing for clean energy technology. State green banks use a combination of loans and credit enhancements to leverage greater private financing and to multiply the impact of public dollars – essentially leading to more clean energy deployment using less ratepayer or taxpayer resources.

Beyond simply offering loans with advantageous interest rates, state green banks can address gaps in the “finance supply chain” that the private sector cannot easily address on its own. They do not face some of the temporal and financial constraints that may limit private sector investment choices. For example, state green banks have greater flexibility to explore and test untried financing structures than do private investors. Similarly, a state green bank can arrange deals whose benefits accrue more to its partners than to itself. As a result, state green banks not only improve upon existing financing arrangements, but also create entirely new tools and financing arrangements for clean

¹ Hallie Kennan is the Research Associate at [Energy Innovation: Policy and Technology LLC](#). This working paper was funded by the [American Energy Innovation Council](#) and edited by Jason Burwen.

energy projects.

State green banks can also help overcome structural market barriers that impede the widespread commercial deployment of clean energy technologies. The full society-wide benefits of many clean energy technologies (e.g. improved public health from emissions reduction) are not monetized and are thus not represented in market prices. Similarly, the society-wide costs of competing dirty or less-efficient alternatives are not born by producers or consumers and are thus not represented in market prices either. As a result, even proven and commercially available clean energy technologies can remain relatively expensive compared to less clean alternatives, which impedes widespread deployment. A state green bank can provide the necessary support and incentives to help these technologies bridge this ‘diffusion and deployment gap’ and scale up to become competitive in the market (see Figure 1).

Lastly, a state green bank can act as a unified entity that consolidates like-minded, but currently disjointed, clean energy programs. Many states support renewable energy and energy efficiency through a variety of state programs, policies, and funds. By establishing a single, cohesive finance authority that connects existing programs and sources of funding, state green banks take a more holistic approach to the issue of clean energy finance.

State green banks invest in projects according to two economic rules of thumb:

- 1) To permit private firms to offer electricity or energy efficiency deals that benefit consumers – State green banks seek to fund projects that benefit both the economy and the environment. The ratio of environmental to economic benefits varies across projects. Thus, when making a financing decision, a state green bank often must decide between funding projects that offer relatively greater environmental benefits or relatively greater economic benefits. One rule that green banks strive to follow is to only fund projects that provide an economic benefit to energy consumers. Thus, a clean project that increases the net cost of power to consumers, or an efficiency measure that will not pay for itself in energy savings within its lifetime, is unlikely to receive support from a state green bank.
- 2) Use as little public money as is necessary to catalyze private investment – While public funds should always be spent judiciously, the more compelling reason for minimizing public funds is because “there’s no way public capital is going to accomplish the great move to the power platform; it costs too much money.”⁶ Adequate financing to transform the U.S. energy sector will require investment in the range of trillions of dollars, and it is unlikely that federal or state governments will be willing or able to spend and manage this amount of money. Government funds need to strategically maximize the private sector role in offering investment opportunities for clean energy and efficiency programs.

A simple scenario demonstrates the latter point. The Brattle Group developed a model intended to highlight the potential impact of introducing green bank loans to the capital structure of solar photovoltaic (PV) installations.⁷ Under certain assumptions (listed in Table 2 of Appendix A), this model estimates that the levelized cost of solar energy from a typical rooftop PV system in Connecticut would decrease 22 percent (from \$0.21/kWh to \$0.163/kWh) in a scenario where private debt matches green bank debt—that is, under a leverage ratio of 1:1. Using green bank debt would, therefore, make rooftop solar PV energy cost-competitive with Connecticut’s average retail price for electricity in the residential sector (\$0.174/kWh) and nearly cost-competitive in the commercial sector (\$0.146/kWh).⁸ At the same time, green bank funds can enable this technology cost scenario without being the sole provider of support—thereby minimizing the use of public funds. Other scenarios in the model demonstrate that green bank debt can help reduce the cost to government of state incentives, reduce Renewable Energy Credit⁹ prices, and help developers achieve their targeted return values. (See Table 3 in Appendix A for more detail on the model’s scenarios and results.)

CURRENT STATUS OF STATE GREEN BANKS

There is no universal model for state green banks in the United States. Four states have already announced or estab-

lished their own green banks:

- › Connecticut – In 2011, Connecticut created the Clean Energy Finance and Investment Authority (CEFIA), the first state green bank in the U.S. CEFIA is the most well-established and experienced green bank in the country. Therefore, CEFIA is used as a case study in this report.
- › New York – In January 2013, Governor Cuomo announced the establishment of the NY Green Bank with a target capitalization of \$1 billion.¹⁰ New York State Energy Research and Development Authority (NYSERDA), a public benefit corporation designed to help New York achieve its energy goals, is in charge of organizing and managing NY Green Bank. The bank will redirect a portion of its energy efficiency portfolio standards, renewable portfolio standards, and system benefit charges funds to inspire private investment. NY Green Bank aims to focus its activity on bonds, loans, and credit enhancements, decreasing the state’s reliance on subsidies to achieve its clean energy goals. In December 2013, Governor Cuomo announced \$210 in initial funding for the Bank, with \$165 in uncommitted funds that were redirected from other programs, and \$45 million from Regional Greenhouse Gas Initiative (RGGI) auction returns. The Bank plans to open for business in early 2014.¹¹
- › Vermont – In 2013, Governor Shumlin signed into law House Bill H.395 to establish the Vermont Clean Energy Loan Fund (VCELF), which would consolidate clean energy programs that currently exist under the Vermont Economic Development Authority (VEDA). H.395 allows VEDA to establish a credit facility of up to \$10 million from the State Treasury to support sustainable energy loan programs, and an additional \$6.5 million to support residential energy efficiency loans.¹² VCELF will support projects in renewable energy, agricultural energy, energy efficiency, and small business conservation.¹³
- › Hawaii – In July, Governor Abercrombie signed into law Senate Bill 1087, which authorizes the combination of bonds and on-bill repayment to finance clean energy infrastructure in Hawaii.¹⁴ This bill creates a green infrastructure loan fund, which is capitalized by low-interest bonds financed by utility tariffs and purchased by private investors. Funds will be lent to open up opportunities for clean energy, energy efficiency, and demand response technology in homes and businesses.¹⁵

Several other states are considering legislation to establish green banks:

- › California – In February of 2013, Senator De León introduced Senate Bill 798, which would establish the California Green Infrastructure Bank.¹⁶ Lieutenant Governor Gavin Newsom has suggested that this bank could be largely funded by allowances from the state’s cap-and-trade program. Auctions of cap-and-trade permits have already generated \$200 million, which must be reinvested in emissions-reducing activities and programs.¹⁷
- › Maryland, Illinois, Pennsylvania, Washington, and Rhode Island are also at various stages of proposing and approving legislation for green banks.¹⁸

CASE STUDY: CONNECTICUT’S CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY (CEFIA)

ABOUT CEFIA

CEFIA is a quasi-public financing authority that provides financial support to clean energy projects in the state of Connecticut. CEFIA’s goal is to attract and deploy private capital to finance clean energy projects in Connecticut so that clean energy may be affordable and accessible to all consumers. It aims to transition support programs away from grants and rebates, and toward low-cost financing tools that will earn a return for the bank and private investors while helping to scale up deployment of renewable energy resources.¹⁹

HISTORY AND GOVERNANCE

CEFIA's predecessor organization, the Connecticut Clean Energy Fund (CCEF), was established in 2000 as the state's first clean energy funding entity. When CEFIA was created in 2011, it absorbed CCEF to ease its transition and ensure that it would have the staff and resources to begin operations immediately. It also expanded CCEF's clean energy definition and project scope to include financing energy efficiency projects, alternative-fuel vehicles and infrastructure, storage, and other areas. In addition to CCEF, CEFIA has partnered with Connecticut's Department of Energy and Environmental Protection (DEEP), the Connecticut Bankers Association, AFC First Financial Corporation, Smart-Power, and other public, private, and non-profit groups to capitalize on existing sources of talent and resources within the state.²⁰

CEFIA is overseen by a Board of Directors whose members have both public- and private-sector backgrounds and are appointed by the governor and political leaders in the legislature.²¹ The Board's role is to oversee and approve CEFIA's Comprehensive Plan, policies, programs, and funding. Because CEFIA's budget is not controlled by the state of Connecticut, it is the Board's task to determine levels of funding for the projects and programs that CEFIA manages.

Connecticut Innovations, Inc. (CI), a quasi-public economic development bank, provides administrative support and services to CEFIA.²² Although CI's objectives are similar to CEFIA's, CI focuses on providing early-stage funding (i.e. clean tech investing) as well as mentoring, management, and market support to Connecticut's technology companies, as opposed to CEFIA's "green bank" focus on financing the deployment of commercially available technologies. Financing opportunities for energy projects at CI are mainly available through their Eli Whitney Fund and Clean Tech Fund.²³

CEFIA'S SCOPE AND CHARACTERISTICS

CEFIA's programs support projects that focus specifically on clean energy. (See Table 1 in the appendix for a list of qualifying clean energy technologies.)

Types of projects funded: CEFIA generally funds projects that use proven technologies that have existing, yet limited, deployment opportunities, rather than technologies that are still in early development or demonstration stages. Proven technologies are lower-risk, meaning they are less likely to lead to loan defaults by project owners and more likely to generate a return for private investors relative to other pre-commercial clean energy projects. CEFIA is authorized to finance up to 80 percent of clean energy project investments and up to 100 percent of energy efficiency project investments, although the bank aims to provide "a tranche of the debt financing wherever possible and not 100 percent of the loan" for all of its investments.²⁴ As CEFIA programs develop and demonstrate success, private investors are likely to offer increasing proportions of finance to clean energy project deals. In its last fiscal year, CEFIA's efforts have attracted over \$180 million in private investment, establishing a private-to-public capital ratio of approximately 9:1 – meaning every \$1 of the bank's funds has generated about \$9 of private investment.²⁵ CEFIA has reduced the use of its proceeds toward grants from 80 percent to 33 percent. Over 50 percent of funds are now invested in loans and leases, and about 15 percent are invested in credit enhancements (i.e. loan loss reserves). This shift is intended to recover ratepayer (or taxpayer) contributions for further reinvestment in the clean energy economy of the state.

Financing tools offered: Examples of financing tools include direct lending and co-lending, on-bill financing (coming April 1, 2014), credit enhancements, and commercial property-assessed clean energy (C-PACE) programs. Direct lending provides a loan directly to the renewable energy or energy efficiency project. Direct loans may come solely from the state green bank if commercial lenders are unwilling to step in on certain projects, or they may share costs by partnering with private lenders to help finance a project. This second option is known as co-lending and has the advantage of providing opportunities for projects that would not exist if the private bank had to be responsible for providing the entire loan amount. On-bill financing is an example of a lower-risk loan because it is repaid directly through the property's utility bill, which has systematically lower rates of non-payment than other bills. A C-PACE

program provides loans for energy efficiency and renewable energy projects that are repaid over time through a charge on the property tax bills – or a benefit assessment.²⁶ Credit enhancement tools, like loan loss reserves and loan guarantees, help lower the cost of capital and reduce risk for private investors.

BUDGET HIGHLIGHTS

Operating Revenues:²⁷ In 2012, CEFIA received over \$40 million from the following sources:

- › Ratepayer surcharge on utility bills (\$0.001/kWh) –\$27 million
- › Returns from RGGI auctions –\$2 million
- › State grant revenue from federal Department of Energy programs –\$10 million
- › Interest on solar lease notes and short-term investments –\$750,000
- › Other sources –\$250,000

In the future, CEFIA may seek to qualify as a community development financial institution (CDFI) and accept federal CDFI funds. CEFIA may also raise capital by issuing bonds and has access to \$50 million of Connecticut’s special capital reserve fund (SCRF).

The State’s 2014–2015 Biennium Budget, passed by the House and Senate, included a provision that redirects a portion of CEFIA’s net assets to the state’s General Fund to help close Connecticut’s budget deficit. Based on the budget bill’s text, it will transfer \$6.2 million for FY 2014 and \$19.2 million by FY 2015. After talks with the governor, legislature, and industry stakeholders in June 2013, CEFIA’s president and CEO, Bryan Garcia, stated that the bank will receive a larger allocation of the state’s RGGI revenue to compensate for these budget transfers. This revenue will be used to finance energy efficiency projects. Ultimately, CEFIA aims to reduce its reliance on public funds and develop long-term, sustainable capitalization through its portfolio of loans and investments.

RISK MANAGEMENT

CEFIA utilizes a variety of mechanisms, particularly reserves and credit enhancements, to manage and reduce its risk. In doing so, CEFIA attracts private investors to clean energy projects. As CEFIA makes more financial transactions, creating a larger sample and longer track record, it will be able to better estimate how much risk it needs to take and adjust its risk management activities (such as reserve rates or payback timescales) accordingly.

*Interest Rate Buydown (IRB):*²⁸ One tool to better ensure that loan payments are made in full and on time is an interest rate buydown (IRB). CEFIA plans to offer a limited-time promotional IRB with its residential Smart-E Loan program, in which it will pay the interest on loans for up to the first six months. By diverting a portion of funds from the program’s loan loss reserve, CEFIA can provide nearly \$200,000 in promotional IRBs. Because this credit enhancement is a limited-time offer, it incentivizes lenders and borrowers to participate in the Smart-E Loan program early on. In addition to mitigating risk, the IRB serves to ensure that homeowners are cash-flow positive. This means that, from day one, the energy savings accrued from an energy improvement project more than compensate for the debt service payments on a monthly basis.

Liquidity Reserve: CEFIA helps smooth the timing of initial payments to project developers in order to reduce risk and encourage greater investment. For example, repayment schedules of new commercial and industrial PACE (C-PACE) projects are attached to semi-annual property tax collections. As a result, initial C-PACE payments may be delayed, which in turn adversely affect payback to investors. CEFIA is able to consider offering coverage for some of the initial payments of C-PACE projects so that capital providers do not face the financial consequences of these payment losses. Statutorily, CEFIA collects 18 percent on the C-PACE payments that are past due as default interest; as a result, this rate penalty should induce all but the most financially impaired building owners to repay C-PACE obligations, encouraging private capital to fund these projects. Investment risk is reduced by ensuring that first payments are covered on time, which makes investors more likely to get involved in CEFIA programs and finance C-PACE projects.

*Loan Loss Reserve:*²⁹ CEFIA offers loan loss reserves to banks and other lenders through a variety of its programs. For its Smart-E Loan program, CEFIA covers losses amounting to up to 7.5 percent of loans that local credit unions and community banks may encounter on residential clean energy projects. This reserve, however, is not available until the lender has covered losses amounting to up to 1.5 percent of its loans. CEFIA believes these lenders should be able to handle a small percentage of losses, especially because loans are made to those with FICO credit scores above 680 and lenders expect a portion of their loan portfolio to go into default and eventually result in write-offs. This “first-loss” burden encourages banks to perform proper due diligence on their lending model in an effort to minimize portfolio losses. Making the banks responsible for covering small, initial losses keeps them honest in the lending transaction and breaks the habit of turning to government first when a private sector loss occurs. Since government is in the second loss position, rather than the first, this type of risk management tool is more appealing to CEFIA than others such as loan guarantees.

As another example, one of CEFIA’s more recent programs, the Solar Lease II Program, has received \$3.5 million from federal American Reinvestment and Recovery Act funding to go toward a loan loss reserve to cover any residential defaults. This reserve allows CEFIA to tolerate a much higher default rate than is currently experienced (around 0.5 percent), given that the majority of customers approved for Solar Lease loans have FICO credit scores above 700. The form of loan loss reserve in this instance is an example of how CEFIA can engineer a higher debt service coverage ratio for senior debt, which increases the willingness of senior lenders to participate in transactions. The Solar Lease II program demonstrates the first ever leveraged and syndicated residential lease facility.

SELECTED PROGRAMS^{30, 31}

CEFIA has funded a variety of energy efficiency or renewable energy projects. Some examples of its most recent or successful programs are provided below. (A list of CEFIA’s other programs is included in Appendix B.)

- › *Dominion Bridgeport Fuel Cell Park:* CEFIA provided a \$5.8 million working capital loan to support the development of a \$65 million 15-MW fuel cell park on a remediated brownfield in a distressed municipality. The project – the largest fuel cell in the Americas – is a partnership between Dominion Energy Resources and Fuel Cell Energy. The project, part of CEFIA’s Project 150 – an initiative to increase the state’s renewable energy capacity by 150 MW,³² is supported by a long-term power purchase agreement and renewable energy credit purchase agreement.³³
- › *Residential Solar Investment Program (RSIP):* CEFIA subsidizes direct homeowner solar system purchases, as well as the leases offered by third-party solar PV system installers, in order to make PV systems more affordable. Through this program, CEFIA aims to install at least 30 MW of solar PV by 2022 using public dollars for no more than one-third of total investment.³⁴ As of December 2013, over 2,300 projects have been approved, which will produce approximately 18,400 renewable energy credits to help the state fulfill its Renewable Portfolio Standard requirement for 2014.³⁵ Homeowners who choose to purchase a solar PV system may qualify for the Expected Performance-Based Buydown (EPBB) incentive, which provides a rebate based on major design characteristics of the system, such as panel type, tilt, and shading. The incentive is currently offered at \$1.25/W for systems less than 5 kW, and \$0.75/W for systems between 5 and 10 kW. Homeowners may also lease a solar PV system by entering into a contract with a third-party owner. A Performance-Based Incentive (PBI) is paid to the third-party owner based on the performance of their system, and the energy generated by the system reduces the homeowner’s monthly electricity bill. As of January 2014, the incentive offers a 6-year PBI of \$0.180/kWh for systems less than 10 kW.³⁶ Incentives have already declined by 30 percent since they were first established in 2012, and will decline another 20 percent in 2014 as CEFIA’s funding is shifted toward its financing programs. Nearly \$75 million of capital has been invested in residential rooftop solar PV as a result of the RSIP in 22 months, which has led to the deployment of more than 16 MW of clean energy through residential solar PV installations. It should be noted that CEFIA owns the renewable energy credits as a result of the RSIP and intends to sell them into Connecticut’s Class I RPS market.

- › *Commercial & Industrial Property Assessed Clean Energy (C-PACE)*: C-PACE enables businesses to access lower-cost, long-term financing for clean energy and energy efficiency improvements by placing a voluntary assessment on their property tax bill. The energy improvements are paid for over time, and costs are transferred to the new owner if the property is sold. Capital for these improvements can be provided by private third-party entities, which means government financing is not necessarily required.³⁷ Typical projects that qualify for this program include high efficiency lighting, upgrades to heating, ventilation, and air conditioning (HVAC) systems, and renewable energy systems installation. Connecticut's C-PACE program is the first statewide program of its kind in the country. It revolutionizes PACE programs in that it allows third-party leases and power purchase agreements to participate, making it easier for commercial properties to finance the installation of solar power systems.³⁸ C-PACE's first deal, a lighting retrofit and solar project at a shopping plaza, came into fruition in early April 2013.³⁹ Nearly 90 other C-PACE projects, totaling approximately \$40 million in CEFIA support, have been planned.⁴⁰ CEFIA has approved over \$15 million in C-PACE financing since the program began in early 2013.⁴¹ As a result of the unsettled national landscape for residential PACE resulting from policy positions by the Federal Housing Finance Agency, Connecticut's program includes only non-residential properties (i.e., excludes single family homes and structures of four or fewer dwelling units).⁴²
- › *Smart-E Loans*: One of CEFIA's most recent programs, the Smart-E Loan program was created using a credit enhancement (loan loss reserve) to attract low-interest, long-term financing from local credit unions and community banks. These lenders offer loans at rates ranging from 4.49 percent (for a 5-year loan) to 6.99 percent (for a 12-year loan) to homeowners. To fund the program, \$2.5 million was repurposed from the American Recovery and Reinvestment Act State Energy Program, with the intention to attract \$28 million in private investment (for a leverage ratio of 11:1). The Smart-E Loan finances measures that are consistent with Connecticut's Comprehensive Energy Strategy⁴³ – including renewable energy and energy efficiency, as well as natural gas conversions, EV recharging stations, and healthy homes measures like asbestos removal, lead abatement, mold remediation, etc. The goal of the program is to make clean energy financing quick, easy, and accessible to residential customers through streamlining the loan and rebate process and keeping fees to a minimum. The loans are “technology agnostic,” with more than 40 eligible energy technologies from which residential customers can choose to use for an energy efficiency or renewable energy project.⁴⁴ Over 85 percent of Connecticut's residential market can access Smart-E Loans.⁴⁵
- › *Solar Lease II Program*: CEFIA's newest program builds upon the framework originally provided by CCEF's first Solar Lease program, which ran from 2008 until 2011. Solar Lease II provides a public-private leasing option for solar power on residential and commercial properties in Connecticut. US Bank is the tax equity investor, with First Niagara Bank, Webster Bank, Liberty Bank, and Peoples United Bank providing debt capital, and the insurance provider, Assurant, playing a key role in offering an “all-in-one” insurance and warranty management program. Solar Lease II is expected to support 1,500 residential solar PV systems, 400 residential solar thermal systems, and 40 commercial solar systems over the next two years, with an estimated capacity of 14 MW from solar PV systems and 4,600 MMBtu from solar hot water systems.⁴⁶ Due to the structure of its underwriting requirements, the program will be accessible to approximately 85 percent of Connecticut homeowners and is expected to generate a nine percent internal rate of return for ratepayers.⁴⁷ In FY 2013, this program received approximately \$61 million in capital, the majority of which went toward investment in residential solar PV projects.

Since July 2012, CEFIA has transitioned away from programs dealing with technology innovation, workforce development, formal education, and subsidies (other than for residential solar PV). These programs do not fit within the “green bank” model of low-cost financing and credit enhancements that CEFIA has adopted. Instead, the bank intends to focus its efforts toward low-cost financing of the deployment of commercially available technology, per the requirements set forth through Public Act 11-80 when CEFIA was first established.

THE FUTURE OF CEFIA

CEFIA is entering its third year of operation. Having established a framework and developed several initial programs, CEFIA is now emphasizing program execution and attracting more interest from investors and project developers.

As CEFIA's programs continue to develop, it will experience fewer sunk costs (such as initial start-up costs or unsuccessful programs) and will thus be able to direct more money to revenue-generating activities. Gradually, the market will need fewer (or no) incentives or subsidies as new finance tools, private capital, and declining installation costs encourage more private investment. Bert Hunter, CEFIA's Chief Investment Officer, mentions that this is not expected to happen any time in the near future. He believes that it may take up to a decade before CEFIA reaches the point at which clean energy can be effectively deployed entirely by the private sector and without any green bank assistance.⁴⁸

Fundamentally, while state green banks have the opportunity to promote lower cost financing for clean energy, their ultimate goal is to step back and allow the market to become the main actor in these transactions. CEFIA's role is thus likely to evolve over time. Its goal has always been to make clean energy finance an attractive investment for banks and other private sector investors. CEFIA can help the private sector understand new investments and deal types and become acclimated in the clean energy space. Once they are comfortable with these transactions, it is anticipated that private investors will increase their lending, which will presumably lower the yield requirements over time. Similarly, once banks and other private investors fully understand the programs that CEFIA has developed and observe a positive track record, they will presumably take on more of the financial responsibilities initially handled by CEFIA. At that point, CEFIA will be able to let the private sector take over the main financing role using these tools and begin to develop new tools for other clean energy investment opportunities.

Measures of Success: CEFIA has identified a number of metrics that will be used to measure the success of its programs as they develop beyond their first few years. The core list of metrics is as follows:⁴⁹

- › Amount of clean energy produced per dollar of ratepayer funds invested;
- › Amount of energy saved per dollar of ratepayer funds invested;
- › Total dollars of investment in clean energy;
- › Ratio of private capital to public and ratepayer funds;
- › Ratio of public and ratepayer funds invested in subsidies versus financing programs; and
- › Installed and levelized cost of clean energy resources.

During FY 2013, CEFIA attracted more than \$180 million of private finance through its use of \$40 million of ratepayer funds. Half of ratepayer funds were distributed in the form of loans or leases, which are expected to be paid back over time. This investment led to the deployment of nearly 30 MW of clean energy. Through the establishment of CEFIA's programs and activities in FY 2013, nearly 3,000 jobs will be created and approximately 500,000 tons of CO₂ emissions will be avoided over the projects' lifetimes.^{50, 51}

CEFIA aims to be a transparent entity and will continue to report the results of its programs as the data come in from transactions. If private investors can see data that demonstrate CEFIA's success in achieving high returns, low default rates, and increased clean energy installation, they will be more willing to enter a partnership and invest in its programs. In the future, CEFIA aims to attract investment from non-conventional sources, such as donations from foundations or through crowd-funding.

OTHER STATE GREEN BANK MODELS

In addition to the CEFIA model, there are two other green bank models that have been widely discussed and considered for implementation by other states:

1) State Clean Energy Financing Authority⁵²

Under this model, the clean energy investment fund would attach to an already existing state authority. The bank would be a part of state government, rather than being quasi-independent. Since it would act as a not-for-profit entity, it would likely be unable to offer rates of return high enough to attract private investment in its projects. In this case, a separate entity could be established to raise private funds and partners for the bank. California and

Michigan already have environmental and economic development authorities to which a clean energy financing authority could attach.

Because it would build on an existing entity, this bank model would have the ability to start functioning almost immediately using existing staff, funding, and resources. However, establishing two separate entities (one for state government financing, one for private financing) could require more time, money, and bureaucratic involvement than making one financing authority that includes both the public and private sectors.

2) Infrastructure and Clean Energy Finance Bank⁵³

Under this model, a clean energy investment fund would attach to an existing infrastructure bank. Both clean energy projects and general infrastructure projects (e.g. roadways, flood control measures, etc.) would be financed by the combined state bank. The California Infrastructure and Economic Development Bank is an example of the type of entity whose responsibilities could be expanded to encompass clean energy projects.

Similar to the first model, attaching a clean energy financing authority to an existing bank would have a more immediate community impact by being able to draw upon existing staff and resources. However, clean energy projects are different than infrastructure projects. Trying to align one financing authority to fund both types of projects may not be effective. For example, clean energy projects tend to be smaller and generate revenue, while infrastructure projects tend to be larger and provide a public good that is widely distributed. To account for these differences, the bank may need to establish two separate divisions, each with its own balance sheets and management teams. This could lead to challenges when determining how to appropriate funds, resources, and staff for each division.

BENEFITS OF STATE GREEN BANKS

Greatly reduces uncertainty in clean energy support

After initial establishment, a state green bank can eventually become self-supporting, particularly if it prioritizes the use of revenue-generating finance mechanisms such as loans. In contrast, mechanisms that require continual political action can be inconsistent and unreliable. For example, the Production Tax Credit (PTC) requires periodic renewal, and occasionally expires prior to this. Congressional action is required for every renewal, creating uncertainty for clean energy project economics and stifling development. While a state green bank's structure or goals could be changed through legislative action, they need no continuing action or appropriations in order to maintain their operations once they become financially self-sustaining, which greatly reduces any policy-related risk to developers.

State green banks are thus most vulnerable to policy risks in the years prior to becoming financially self-sustaining. As mentioned earlier, in June 2013 the Connecticut legislature passed a budget transferring significant funds from CEFIA, which would have greatly reduced operations.⁵⁴ Although the state has since arranged for alternative sources of funding to make up for these transfers,⁵⁵ such events illustrate the vulnerability of state green banks to policy uncertainty in the early period of their establishment.

Leverages private capital and expertise with limited public funds

By leveraging private investor funds with limited government funds, state green banks are able to increase their scope and lending capability. Several energy finance entities estimate that CEFIA can attract private investment if its programs are able to provide a rate of return between six and ten percent.⁵⁶ Additionally, if both public and private parties involved conduct due diligence, more careful analysis of projects' credit-worthiness may reduce the rate of default. Furthermore, if the green bank uses the private investor as the loan administrator, it would save the green bank from having to perform loan processing and servicing functions itself. A private lender, such as a commercial bank, may be more capable of performing these administrative functions.⁵⁷

Abundance of methods to reduce risk to investors

State green banks help to reduce risk for initial private investors by using a variety of financing mechanisms. In addition, offering a variety of finance tools opens up the opportunity of funding for a diverse set of clean energy projects, each of which may have specific payback characteristics. State green banks have the added advantage of not requiring immediate return on investments in order to continue operating, which means they can experiment with their mechanisms to ensure they implement only effective ones. For example, state green banks can experiment with novel mechanisms such as total return swaps (a contract in which one party makes payments on a set rate, while another party makes payments based on return of an underlying asset, thus transferring the asset's credit risk and market risk)⁵⁸ or standby purchase agreements (an agreement between the issuer of a security and its underwriters in which the underwriters are responsible for any unsold portion of the issue, transferring the risk of the unsold portion from the issuer to the underwriters).⁵⁹

Understanding of states' environments, needs, and goals

States may have a better understanding of their own clean energy industry's requirements and capabilities than the federal government. States vary both environmentally and politically. Resource potentials for renewable energy and energy efficiency differ based on geography. For example, air conditioning energy consumption is far greater in some states than others, and solar resources vary substantially both across and within states. Policies and standards, such as building codes and public utility commission regulations, also differ by state. For these reasons, state green banks may be better able to tailor activities to the specific economic, environmental, and regulatory conditions of their state than equivalent federal programs. By identifying the individual needs of a state, a green bank can apply optimal solutions to resolve unique local issues.

Bipartisan support

The concept of state green banks has received strong bipartisan support. For example, CEFIA was approved almost unanimously, passing 36-0 in the Connecticut Senate and 139-8 in the House.⁶⁰ New York's Green Bank bill was also passed with significant bipartisan support.⁶¹ State green banks may therefore be less subject to legislative gridlock than some of the more partisan financing policies, and they may have more consistent political support once established.

DRAWBACKS TO STATE GREEN BANKS

*Vulnerability to a decline in federal support*⁶²

State green banks can work with or without federal programs to support clean energy, but they are most effective when they build upon what is offered by federal government. For example, many of the potential private investors in clean energy projects are encouraged by tax credits or subsidies, which are provided at the federal level. If these incentives are eliminated, it will reduce the private investor appetite for clean energy investment that state green banks aim to leverage. Furthermore, state governments themselves often receive clean energy funding directly from the federal government, which can affect the feasibility of state green banks. As previously mentioned, the American Recovery and Reinvestment Act (ARRA) of 2009 provided each state with millions (and in some cases, billions) of dollars to support clean energy and energy efficiency programs; CEFIA is making use of such funds to support its program offerings.

Tension between objectives

Typical finance banks focus on achieving economic goals and objectives. However, clean energy banks' objectives include an environmental component. While economic and environmental goals need not be incompatible, often the investment that maximizes environmental benefits will not be the same investment that maximizes economic benefits, and there are trade-offs to be made. When choosing the types of programs to create or projects to fund, the bank must ask itself, "Is it clean enough to merit funding from a clean energy bank?" or alternatively, "Is it cheap enough to attract the necessary private investment?" Private investors place some limit on a green bank's choices, as they only bring to green banks those projects that would not generate a large enough return to be funded wholly by private capital. (If a project offers a high enough return at low enough risk, private investors will wish to capture

100% of that project's benefits for themselves.) Therefore, the projects that green banks fund will typically be ones that would not be economically viable for private investors on their own. However, among those projects that green banks offer to fund, there are still distinctions between those that will be better economically and those that will be better environmentally.

There are two ways a finance authority may handle this tension. It may choose to prioritize one objective over the other, though this could be problematic if private investors or other funding sources (philanthropies, for example) are supportive of the subordinate objective and cut off investment until their goals are prioritized. The finance authority may also attempt to find a 'middle ground' between both objectives, identifying reasonable environmental and economic goals that can work in concert with one another. However, by not choosing a strong set of objectives on which to focus, the bank's activities and programs may end up being less effective than desired.

Insufficient scale

It is unclear what impact state-level finance institutions can make on the energy sector as a whole, given the scale of funds they are able to commit. The four state green banks currently authorized together would offer just over \$1 billion in resources if fully capitalized. Moreover, state efforts will be particular to their own clean energy needs and capabilities, and their activities may not prove replicable across jurisdictions. Ideally, these state-level programs and the projects they fund could catalyze the wider commercialization of clean energy technologies. Without that take up, though, the contribution by the state green bank and its private partners will be insignificant with respect to real transformation of the energy industry.

CONCLUSIONS

One of the greatest benefits of the state green bank model is its ability to leverage investment from and share costs with private investors. This, in addition to offering return-generating financing tools, allows for the most efficient and least risky use of public and private funds. While other state authorities may offer credit enhancements or other measures to lower risk, state green banks set themselves apart by utilizing a revolving fund, meaning that programs aim to eventually be self-sustaining, eventually requiring no additional outside capital. Moreover, because they are able to afford more risk than the private sector, state green banks have the potential to experiment with a variety of finance mechanisms, not only improving upon existing ones, but developing entirely new tools for the market to work to adopt in subsequent years through the green banks' help.

Despite these key characteristics, the effectiveness of state green banks will be hindered without continued government support for clean energy at the federal level. The federal government's policies, incentives, and resources are an existing structure upon which state green banks build their operations. As tailored entities that fit within their own regional contexts, state green banks offer a complement to a larger suite of federal policy efforts, not a substitute. While state green banks have potential to accomplish clean energy goals on a localized level, the U.S. will still need a big picture framework for the transformation of our energy system.

APPENDIX A: FIGURES AND TABLES

FIGURE 1. GRAPHIC OF THE CLEAN ENERGY ‘DEPLOYMENT GAP’

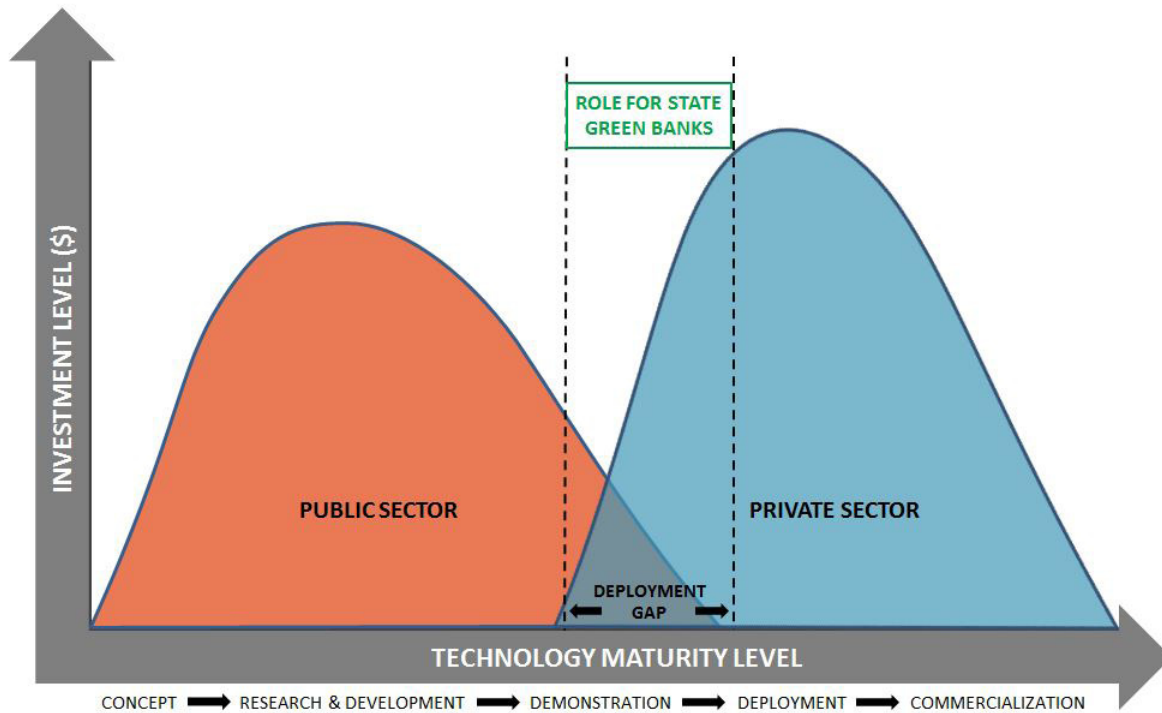


TABLE 1. QUALIFIED CLEAN ENERGY TECHNOLOGIES, AS LISTED IN SECTION 16-245N(A) OF THE CONNECTICUT GENERAL STATUTES⁶³

<ul style="list-style-type: none"> › Solar photovoltaic energy › Solar thermal › Geothermal energy › Wind › Ocean thermal energy › Wave or tidal energy › Fuel cells › Landfill gas › Hydropower › Hydrogen production 	<ul style="list-style-type: none"> › Hydrogen conversion technologies › Biomass conversion technologies › Alternative fuels › Waste heat recovery systems › Thermal storage systems › Financing of energy efficiency projects › Storage technologies › Distribution technologies › Manufacturing technologies › Electric Vehicles, Hybrid Electric Vehicles, and Alternative Fuel Vehicles and infrastructure projects
--	--

Clean energy also includes other energy resources and emerging technologies with commercialization potential and do not involve combustion of coal, petroleum and petroleum products, municipal solid waste, or nuclear fission.

TABLE 2. LIST OF ASSUMPTIONS FOR ROOFTOP SOLAR PV ‘GREEN BANK’ FINANCING MODEL

- › Aggregate portfolio of 20MW
- › Installed cost of \$4.5/Watt

- › 25-year underlying project life
- › Operating costs modeled at \$27/kW-Year
- › Annual degradation modeled at 0.5%
- › State incentives modeled at \$0.225/kWh for 6 years
- › Renewable Energy Credits modeled at \$0.030/kWh under 15-year contract
- › Developer equity return: 15%
- › Tax equity return: 12%
- › Commercial debt interest: 6%
- › Total leverage: 40%

TABLE 3. RETAIL COST (\$/KWH) AS A FUNCTION OF GREEN BANK DEBT AND INSTALLED COST:

System Installed Cost (\$/kW)	% Debt in Capital Structure				
	0% green bank 40% commercial	10% green bank 30% commercial	20% green bank 20% commercial	30% green bank 10% commercial	40% green bank 0% commercial
\$4.50	0.210	0.187	0.163	0.140	0.117
\$4.00	0.174	0.154	0.133	0.112	NA
\$3.50	0.139	0.121	0.103	0.085	NA
\$3.00	0.103	0.088	0.072	0.057	NA

Assumptions:

- › Project investment is 40% debt and 60% equity
- › Commercial debt has 6% interest
- › Tax equity targets a 12% return and developer equity targets a 15% return
- › Aggregate portfolio of 20 MW
- › 25-year project life
- › Regional capacity factors applied per National Renewable Energy Laboratory data
- › Annual degradation modeled at 0.5%
- › State incentives modeled at \$0.225/kWh for 6 years
- › Renewable Energy Credits modeled at \$0.03/kWh under financeable 15-year contract

APPENDIX B: LIST OF CEFIA PROGRAMS

- › *U.S. Department of Energy’s SunShot Initiative Rooftop Solar Challenge* – While the SunShot Initiative Rooftop Solar Challenge program is offered by the Department of Energy (DOE) and not CEFIA, it has been included in this section because it has supported several of CEFIA’s programs. The overall goal of the SunShot Initiative Rooftop Solar Challenge is to help make solar energy cost-competitive with other energy sources by 2020. One of CEFIA’s solar energy programs, Sun Rise New England – Open for Business received \$481,500 in funding from the Rooftop Solar Challenge, and aims to reduce costs associated with solar PV.⁶⁴ In November 2013, CEFIA joined the Clean Energy States Alliance, Massachusetts, New Hampshire, Rhode Island, and Vermont in the New England Solar Cost-Reduction Partnership. The Partnership is funded by \$1.5 million under the second round of DOE’s Sunshot Initiative Rooftop Solar Challenge.

› *Solarize CT*: CEFIA is partnering with Connecticut cities and towns in establishing a pilot program that “encourage[s] the adoption of residential solar photovoltaic (PV) systems by deploying a coordinated education, marketing and outreach effort, combined with a tiered pricing structure that provides increases savings to homeowners as more people in one community go solar.” Solarize CT originally partnered with four municipalities for the program’s pilot phase: Durham, Fairfield, Portland, and Westport. Within these four communities, more solar has been adopted in the first five months of the pilot project than was adopted in the seven years prior. Due to its success, four more communities were added in the program’s second phase: Bridgeport, Canton, Coventry, and Mansfield/Windham.⁶⁵ As of November 2013, the solar installation campaign had been implemented in nine Connecticut towns, with 22 more community campaigns in the process. Through a \$1.8 million grant from the U.S. Department of Energy through the Solar Energy Evolution Diffusion Study (SEEDS) grant, Yale University, New York University, and SmartPower are studying the program.⁶⁶ In total, more than 2,300 residential solar system contracts have been approved within the last 22 months.⁶⁷

REFERENCES

- 1 Clean Energy Deployment Administration: Hearing Before the Committee on Energy and Natural Resources. 112th Congress. 5/3/11. <http://www.gpo.gov/fdsys/pkg/CHRG-112shrg66579/pdf/CHRG-112shrg66579.pdf>
- 2 “Summary of Energy Independence Trust Legislation”. Coalition for Green Capital. <http://bit.ly/1d1ok7t>
- 3 “The Business Plan”. American Energy Innovation Council. 2010. http://americanenergyinnovation.org/wp-content/uploads/2012/04/AEIC_The_Business_Plan_2010.pdf
- 4 Berlin, Ken et al. “State Clean Energy Finance Banks: New Investment Facilities for Clean Energy Deployment”. Brookings-Rockefeller. Sept 2012. <http://www.brookings.edu/~media/research/files/papers/2012/9/12%20state%20energy%20investment%20muro/12%20state%20energy%20investment%20muro.pdf>
- 5 Berlin et al., 2012. p. 3.
- 6 Interview with Reed Hundt. Coalition for Green Capital 6/13/13.
- 7 Mudge, Bob and Murray, Ann. “Overview of Rooftop Solar PV ‘Green Bank’ Financing Model”. Clean Energy Finance and Investment Authority; Coalition for Green Capital. 2011. <http://www.ctcleanenergy.com/Portals/0/Overview%20of%20Rooftop%20Solar%20PV%20Model%2011713v2.pdf>
- 8 “Table 5.6.B. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector”. Energy Information Agency. Nov 2013. http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_06_b
- 9 A Renewable Energy Credit (REC) is a certificate that is issued for each Megawatt-hour of energy generated from renewable sources or for each Megawatt-hour of energy conserved through installation of energy efficiency practices. More information about Connecticut’s (REC) can be found at http://www.ctenergyinfo.com/dpuc_renewable_energy_credits.htm
- 10 “Governor Cuomo Proposes \$1 Billion New York Green Bank”. ENS Newswire. 1/10/13. <http://ens-newswire.com/2013/01/10/governor-cuomo-proposes-1-billion-new-york-green-bank/>
- 11 “Governor Cuomo Announces \$210 Million Initial Capitalization to Jump Start New York Green Bank”. New York State Energy Research and Development Authority. 12/19/13. <http://www.nyserda.ny.gov/About/Newsroom/2013-Announcements/2013-12-19-Governor-Cuomo-Announces-Capitalization-to-Jump-Start-Green-Bank.aspx>
- 12 “No. 87. An act relating to the establishment of the Vermont Clean Energy Fund (H.395)”. LegiScan. 5/13/13. <http://www.leg.state.vt.us/docs/2014/Acts/ACT087.pdf>
- 13 Rothstein, Peter. “Vermont Summit and New Legislation Focus on Financing Clean, Efficient Energy”. New England Clean Energy Council. 6/26/13. <http://www.cleanenergycouncil.org/blog/2013/06/26/vermont-summit-and-new-legislation-focus-on-financing-clean-efficient-energy/>
- 14 “SB 1087: Relating to Green Infrastructure”. OpenStates.org. 2013. <http://openstates.org/hi/bills/2013%20Regular%20Session/SB1087/>
- 15 Friedrich, Kat. “Hawaii Announces New Solar Financing Program”. Clean Energy Finance Center. 5/2/13. <http://www.cleanenergyfinancecenter.org/2013/05/hawaii-announces-new-solar-financing-program/>

- 16 "SB 798: California Green Infrastructure Bank Act". OpenStates.org. 2013. <http://openstates.org/ca/bills/20132014/SB798/>
- 17 Marois, Michael B. "California Cap-and-Trade Funds Proposed for Green Bank". Bloomberg. 3/18/13. <http://www.bloomberg.com/news/2013-03-19/california-cap-and-trade-funds-proposed-for-green-bank.html>
- 18 Private communication with Ken Berlin. Coalition for Green Capital 9/10/13.
- 19 "Progress Through Partnerships: Annual Report Fiscal Year 2012". Clean Energy Finance and Investment Authority. 2012. <http://www.ctcleanenergy.com/annualreport/>
- 20 "Progress Through Partnerships: Annual Report Fiscal Year 2012".
- 21 Hundt, Reed et al. "State Clean Energy Finance Banks: New Investment Facilities for Clean Energy Deployment". Yale Center for Business and the Environment. 1/24/13. <http://cbey.yale.edu/uploads/Blueprint/Jan%2024%20Webinar%20Presentation-FINAL-01-24.pdf><http://cbey.yale.edu/uploads/Blueprint/Jan%2024%20Webinar%20Presentation-FINAL-01-24.pdf>
- 22 "Clean Energy Finance and Investment Authority Financial Statements". Marcum LLP. 6/30/12. <http://www.ctcleanenergy.com/Portals/0/CEFIA%20FY12%20Audited%20Financial%20Statements.pdf>
- 23 "CI Funding". Connecticut Innovations. 2013. <http://www.ctinnovations.com/FundingOpportunities.aspx>.
- 24 Berlin et al., 2012. Private financing is not considered mandatory for energy efficiency projects because CEFIA's board believes that lack of up-front capital is the primary barrier to homeowners and businesses for energy efficiency retrofits and the default risk of such projects is considered low.
- 25 Garcia, Bryan et al. "Memo: Connecticut's "Green Bank" at Work – FY 2013 Results". Clean Energy Finance and Investment Authority. 10/11/13. http://ctcleanenergy.com/Portals/0/board-materials/4_Connecticuts%20Green%20Bank%20at%20Work_FY%202013%20Results_Memo_101113.pdf
- 26 Berlin et al., 2012. p. 13.
- 27 "Clean Energy Finance and Investment Authority Financial Statements". 2012.
- 28 Lieberman, Ali. "Memo: Smart-E Interest Rate Promotion". Clean Energy Finance and Investment Authority. 4/30/13. http://www.ctcleanenergy.com/Portals/0/board-materials/5_Promotional%20IRB_Smart-E%20Loan_Memo_043013.pdf
- 29 Private communication with Bert Hunter and Ben Healey. Clean Energy Finance and Investment Authority. 9/19/13.
- 30 "Comprehensive Plan FY 2013 through FY 2015".
- 31 "Progress Through Partnerships: Annual Report Fiscal Year 2012".
- 32 "Supplying Clean Energy to Electric Distribution Companies". Clean Energy Finance and Investment Authority. 2013. <http://ctcleanenergy.com/default.aspx?tabid=97>

- 33 Burgeson, John. "Largest Fuel Dungeon Era Plant in NA Dedicated in Bridgeport". Connecticut News. 5/5/13. <http://www.ctnewsfeed.com/bridgeport/largest-fuel-cell-generation-plant-in-na-dedicated-in-bridgeport/>
- 34 Velocci, 2012.
- 35 "Market Watch Report: Residential Solar Investment Program". Clean Energy Finance and Investment Authority. 1/3/14. http://www.energizect.com/sites/default/files/uploads/Residential_Solar_Investment_Program_Market_Watch_Report_January_3_2014.pdf
- 36 "Residential Solar Incentives". Clean Energy Finance and Investment Authority. 2013. <http://www.ctcleanenergy.com/YourHome/ResidentialSolarInvestmentProgram/ResidentialSolarIncentives/tabid/617/Default.aspx>
- 37 "About C-PACE". Energize Connecticut. 2013. <http://www.c-pace.com/site/page/view/about>
- 38 Copithorne, Brad. "Combining Solar And PACE In Connecticut: A Potential Game Changer For Commercial Properties". Environmental Defense Fund. 7/19/13. <http://blogs.edf.org/energyexchange/2013/07/19/combining-solar-and-pace-in-connecticut-a-potential-game-changer-for-commercial-properties/>
- 39 Rivard, Nicole. "City celebrates state's first C-PACE clean energy project". Norwalk Citizen. 4/3/13. <http://www.norwalkcitizenonline.com/news/article/City-celebrates-state-s-first-C-PACE-clean-energy-4401588.php>
- 40 Private communication with Bert Hunter and Ben Healey. Clean Energy Finance and Investment Authority. 9/19/13.
- 41 "Connecticut Commercial Property Owner Sets the PACE". Clean Energy Finance and Investment Authority. 11/4/13. http://www.ctcleanenergy.com/NewsEvents/PressRoom/tabid/118/ctl/ViewItem/mid/1364/ItemId/287/Default.aspx?SkinSrc=/Portals/_default/Skins/subpages/subpage_level0
- 42 Private Communication with Bert Hunter and Ben Healey. Clean Energy Finance and Investment Authority. 9/17/13.
- 43 "Connecticut's Comprehensive Energy Strategy". Department of Energy and Environmental Protection. 2/19/13. <http://www.ct.gov/deep/cwp/view.asp?a=4120&q=500752>
- 44 "About Energize Connecticut's Smart-E Loans". Clean Energy Finance and Investment Authority. 10/2/13. <http://www.ctcleanenergy.com/Portals/0/1%20%20Smart-E%20Contractors%20Info%20Sheet%20V10022013.docx>
- 45 Garcia, Bryan. "Memo: EEB Positions, Objectives, and Criteria for Financing – CEFIA Baseline for the Smart-E Loan". Clean Energy Finance and Investment Authority. 4/13/13. http://www.ctcleanenergy.com/Portals/0/board-materials/4_EEB_CEFIA%20Residential%20Financing%20Programs_Smart-E%20Loan_Memo_041013.pdf
- 46 "CEFIA Establishes Solar Leasing Public-Private Partnership Providing Open Access to Private Capital for Clean Energy". Clean Energy State Alliance. 7/1/13. <http://www.cleanenergystates.org/about-us/member-news/newsitem/cefia-establishes-solar-leasing-public-private-partnership-providing-open-access-to-private-capital-for-clean-energy>
- 47 "Clean Energy Finance and Investment Authority Board of Directors: Minutes – Special Meeting". Clean Energy Finance and Investment Authority. 6/26/13. <http://www.ctcleanenergy.com/Portals/0/board-materials/06-26-13%20CEFIA%20Board%20Minutes.pdf>

- 48 Private communication with Bert Hunter and Ben Healey. Clean Energy Finance and Investment Authority. 9/17/13.
- 49 "Comprehensive Plan FY 2013 through FY 2015".
- 50 Garcia et al., 10/11/13.
- 51 Estimate for job gains includes both direct and indirect jobs. Calculations for realized emissions avoided include the Residential Solar Investment Program, Combined Heat and Power Program, and Dominion Fuel Cell Park. Calculations for estimated future emissions avoided include Solar Lease II program, Solar Loan program, and Smart-E Loan program.
- 52 Berlin et al., 2012. p. 11.
- 53 Berlin et al., 2012. p. 11.
- 54 Spiegel, Jan Ellen. "Budget cuts to green bank irk enviros and concern solar industry." The CT Mirror. June 3, 2013. <http://www.ctmirror.org/story/budget-cuts-green-bank-irk-enviros-and-concern-solar-industry>
- 55 "Budget Resolution Will Replenish CEFIA Funds." Press Release. June 6, 2013. <http://www.reeba.org/system/wp-content/uploads/CEFIA-Press-Release.pdf>
- 56 Berlin et al., 2012. p. 10.
- 57 Berlin et al., 2012. p. 14.
- 58 "Total Return Swap". Investopedia. 2013. <http://www.investopedia.com/terms/t/totalreturnswap.asp>
- 59 Farlex Financial Dictionary. "Standby Agreement". The Free Dictionary. 2012. <http://financial-dictionary.thefreedictionary.com/Standby+Agreement>
- 60 Berlin, Ken. "Creating State Green Banks: How New Ways to Finance Clean Energy and Energy Efficiency Projects Can Reduce the Cost of Clean Energy and Replace Expiring Federal Credits and Subsidies". Coalition for Green Capital. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0CEQQFjAD&url=http%3A%2F%2Fwww.stateinnovation.org%2FEvents%2FEvent-Listing%2FPolicy-Directors-Annual-Meeting-2011%2F3-1-4---BERLIN---Creating-State-Green-Banks.aspx&ei=rIBCUCeTN6jgyQHx4oH4AQ&usg=AFQjCNHJvCCYZ7_qhDY60LJxcJvSXDTi-HA
- 61 "Governor Cuomo Proposes \$1 Billion New York Green Bank". 1/10/13.
- 62 Berlin et al., 2012. p. 5.
- 63 "Connecticut General Statutes 16-245n – Renewable Energy Investment Fund created; charge assessed against electric customers to fund Investment Fund; purpose". LawServer Online, Inc. 2013. http://www.lawserver.com/law/state/connecticut/ct-laws/connecticut_statutes_16-245nhttp://www.lawserver.com/law/state/connecticut/ct-laws/connecticut_statutes_16-245n
- 64 "Progress Through Partnerships: Annual Report Fiscal Year 2012".

65 "About Solarize". Solarize Connecticut. 2013. <http://solarizect.com/about-solarize/>

66 "U.S. Department of Energy Grant Award Validates Success of Solarize Connecticut Program". Solarize Connecticut. 7/16/13. <http://solarizect.com/us-department-of-energy-grant-award-validates-success-of-solarize-connecticut-program/>

67 Singer, Stephen. "Solar Power Gets Massive Boost in Connecticut as States Continue to Support Green Energy Push". The Huffington Post. 11/29/13. http://www.huffingtonpost.com/2013/11/29/solar-power-connecticut-green-energy_n_4359785.html?utm_hp_ref=green