CONNECTICUT
GREEN BANK®

Evaluation Framework

Assessing, Monitoring, and Reporting of Program Impacts and Processes

Evaluation Framework

July 2016

Table of Contents

1. Contributors and Acknowledgements

In a Request for Qualifications (RFQ) issued on August 28, 2013, the Connecticut Green Bank ("the Green Bank") sought to identify qualified firms and individuals with expertise in program evaluation, measurement, and verification (EM&V) that could be engaged on an as needed basis to complete certain EM&V projects ranging from researching and developing strategies for EM&V and data collection and analysis to conducting in-depth market, process, or impact evaluations.

For its evaluation framework development and data collection efforts, the Green Bank selected the Opinion Dynamics and Dunsky Energy Consulting team, including:

- Philippe Dunsky, President of Dunsky Energy Consulting
- Antje Flanders, Vice President of Opinion Dynamics
- Alex Hill, Senior Consultant of Dunsky Energy Consulting
- Jake Millette, Project Manager of Opinion Dynamics

The consulting team was selected to assist the Green Bank in developing a strategy for an evaluation framework to assess, monitor and report program impacts and processes. Given their industry leading expertise in the area of financing programs, they were engaged in an effort to assist us in first defining and testing key indicators and associated metrics for impact evaluation with a focus on market transformation, and developing a data collection protocol. This document is the output of the first engagement.

The Green Bank would like to acknowledge the Opinion Dynamics and Dunsky Energy Consulting for contributing to this important work for our organization.

The Green Bank, Opinion Dynamics, and Dunsky Energy Consulting are also grateful for the guidance and feedback from the Board of Directors of the Green Bank and the Joint Committee of the Energy Efficiency Board and the Green Bank.

We also appreciate the feedback and guidance from several individuals and specifically would like to acknowledge:

- Matt Gibbs, former Director of Energy Efficiency at Eversource Energy
- Paul Horowitz, President at PAH Associates
- Chris Kramer, Senior Consultant at Energy Futures Group (and Financing Consultant to the Connecticut Energy Efficiency Board)
- Pat McDonnell, Director of Conservation and Load Management at the United Illuminating Company

As a founding member of the Green Bank Network,[1] we would also like to acknowledge our colleagues who have been advancing best practices for assessing, monitoring, and reporting the impact of public-private partnership models – Australian Clean Energy Finance Corporation,[2] New York Green Bank,[3]

[1] http://greenbanknetwork.org/
[2] http://www.cleanenergyfinancecorp.com.au/reports.aspx
[3] New York Public Service Commission Case 13-M-0412

and the UK Green Investment Bank.[4] We look forward to continuing to collaborate with them – through the Coalition for Green Capital and the Natural Resources Defense Council – to advance public-private partnerships and clean energy investing in our communities and worldwide.

This "Evaluation Framework: Assessing, Monitoring and Reporting on Program Impacts and Processes" document represents an effort by the Green Bank to formalize how we evaluate the societal impacts and benefits we are helping create as a result of our investments. We thank and acknowledge all of the contributors who have helped us produce this evaluation framework.

[4] http://www.greeninvestmentbank.com/green-impact/

2. Introduction

The Green Bank, a quasi-public agency created by state legislation and governed by a Board of Directors, is the first state-level green bank in the United States. The Green Bank uses limited public dollars to attract and deploy private capital to accelerate the deployment of clean energy[5] in Connecticut. Note, the definition of "clean energy" includes "financing energy efficiency projects" and "alternative fuel vehicles and associated infrastructure" – and thus the term "clean energy," when used throughout this document, also includes renewable energy, energy efficiency, and clean fuels for transportation.

The Green Bank's goals are:

1. To attract and deploy private capital investment to finance the clean energy policy goals for Connecticut.

2. To leverage limited public funds to attract multiples of private capital investment while returning and reinvesting public funds in clean energy deployment over time.

3. To develop and implement strategies that bring down the cost of clean energy in order to make it more accessible and affordable to customers.

4. To support affordable and healthy buildings in low-to moderate income and distressed communities by reducing the energy burden and addressing health and safety issues in their homes, businesses, and institutions

By attracting and deploying private capital at leverage ratios of 5, 10, or 20 to 1 of public funds, through public-private partnerships the Green Bank can support the successful implementation of Connecticut's ambitious clean energy policy goals. For example, through statute (i.e. Public Act 15-194), regulation (i.e. Conservation and Load Management Plan), and planning (i.e. Comprehensive Energy Strategy and Integrated Resources Plan), the Comprehensive Plan of the Green Bank seeks to support the clean energy policies of the state.[6]

Beyond the contributions that Green Bank projects and programs can deliver within its near term Comprehensive Plan, to a large extent through the use of private sector capital, we are mindful that significant deployment of clean energy resources and strategies will be required over the coming

[5] Clean energy means solar photovoltaic energy, solar thermal, geothermal energy, wind, ocean thermal energy, wave or tidal energy, fuel cells, landfill gas, hydropower that meets the low-impact standards of the Low-Impact Hydropower Institute, hydrogen production and hydrogen conversion technologies, low emission advanced biomass conversion technologies, alternative fuels, used for electricity generation including ethanol, biodiesel or other fuel produced in Connecticut and derived from agricultural produce, food waste or waste vegetable oil, provided the Commissioner of Energy and Environmental Protection determines that such fuels provide net reductions in greenhouse gas emissions and fossil fuel consumption, usable electricity from combined heat and power systems with waste heat recovery systems, thermal storage systems, other energy resources and emerging technologies which have significant potential for commercialization and which do not involve the combustion of coal, petroleum or petroleum products, municipal solid waste or nuclear fission, financing of energy efficiency projects, projects that seek to deploy electric, electric hybrid, natural gas or alternative fuel vehicles and associated infrastructure, any related storage, distribution, manufacturing technologies or facilities and any Class I renewable energy source, as defined in section 16-1.

[6] FY 2017 and 2018 Comprehensive Plan of the Connecticut Green Bank

decades as the state continues to encourage the successful attainment of its long term greenhouse gas emissions reduction target, of 80 percent below 2001 levels by 2050. The Green Bank's ability to continue to attract and deploy increasing amounts of low-cost and long-term private capital will be an essential element toward attaining this target while helping to mitigate the associated costs that would potentially be recovered from residents, businesses, and industry through electric or gas rates.

In this document, the Green Bank presents a framework through which to evaluate the impacts of its programs. These impacts can broadly be viewed within two categories:

1) Energy savings and clean energy production supported by Green Bank programs and the resulting societal impacts or benefits arising from clean energy investments; and

2) Market transformation impacts from Green Bank programs that lead to new opportunities to support clean energy projects, ultimately through the increase in private capital investment in clean energy.

This evaluation framework focuses primarily on assessing the market transformation impacts of the green bank model. However, it also recognizes the importance of regularly evaluating the program impacts along the way (e.g., of the Residential Solar Investment Program).[7]

The Green Bank currently derives a majority of its capital sources from electric ratepayers,[8] although increasingly it is accessing more and more private capital through various for-profit,[9] non-profit,[10] and public finance[11] sources and transactions. Unlike the State's energy utilities, the Green Bank is not required by statute to evaluate its programs' impacts and thus Green Bank programs are not subject to the evaluation requirements to which the electric and gas utilities who are incentivized to deliver energy efficiency programs to customers are subject. However, many of the Green Bank's programs co-exist in the market alongside ratepayer supported clean energy incentive and other programs; in many cases, they are in a mutually supporting relationship with the utility sponsored programs.

While the Green Bank is not obliged to evaluate its programs in the same manner as are the utilities' energy efficiency programs, the Green Bank is committed to evaluating its programs in order to ensure that the Clean Energy Fund, cap-and-trade allowance proceeds, and other investments are yielding value to the Green Bank's objectives and that the Green Bank's programs effectively and efficiently operate and deliver their services to customers. The Green Bank sees assessing, monitoring and reporting of program impacts and processes as a normal function of operating an organization focused on delivering societal impact. In addition, there are varying degrees of statutorily required auditing and reporting requirements for the Connecticut Green Bank and its programs, including:

---

[7] Cost-Effectiveness Assessment of the Residential Solar Investment Program (March 26, 2016) by Cadmus click here

[8] Through the Clean Energy Fund, a 1 mil surcharge (i.e., $0.001/kWh) is charged to electric ratepayers in Eversource Energy and United Illuminating service territories. This surcharge aggregates to approximately $27 million a year in capital for the Connecticut Green Bank. The Connecticut Green Bank also receives cap-and-trade allowance proceeds of about $5 million a year through the Regional Greenhouse Gas Initiative to support clean energy projects.

[9] Through a public-private partnership with Hannon Armstrong, the Connecticut Green Bank through contract has access to $100 million of private capital to support its C-PACE program.

[10] Through a public-private partnership with the MacArthur Foundation, the Connecticut Green Bank and its partner the Housing Development Fund have access through contract to $5 million of program related investment capital to support their low income and multifamily programs.

[11] Through Sections 159-166 of SB 501 (i.e., 2012 Special Session of the Connecticut General Assembly), the Connecticut Green Bank will begin to issue revenue bonds – or green bonds – to raise private capital to support its programs in 2016.

- **Independent Audit** – Public Act 11-80 requires that the Clean Energy Fund,[12] which is administered by the Connecticut Green Bank be audited annually by independent certified public accountants; and

- **Reporting** – Public Act 15-194 requires the Green Bank to report to the Energy and Technology Committee of the General Assembly on progress toward the goals of the Residential Solar Investment Program (RSIP).

For more details on the statutory reporting requirements of the Green Bank – see Appendix I.

This evaluation framework was developed to assist the Green Bank to present appropriate evaluation approaches to estimate the impacts and benefits of its programs and to help it communicate them to key stakeholders.

2.1 Program Evaluation Objectives

Several objectives guided the development of this evaluation framework, including:

- Identify and estimate quantitative and market impacts resulting from Green Bank financing and Green Bank supported clean energy programs;
- Provide insights into program efficiency and effectiveness that can support program design and process improvements, including coordination with other Energize CT programs;
- Track progress toward Green Bank's market transformation objectives;
- Where appropriate to the program being evaluated, estimate the extent to which the program produced savings or clean energy generation that would not have happened in its absence;
- Provide an assessment, monitoring and reporting mechanism to support the issuance of green bonds that provide increased capitalization to the Green Bank for clean energy investment; and
- Report progress toward objectives and impacts to internal and external stakeholders through the Comprehensive Annual Financial Report (CAFR) of the Green Bank.

2.2 Framework Elements

The evaluation framework presented in this document was developed based on a review of the Green Bank's overall program goals as outlined in the Comprehensive Plan, through discussion with program administrators and Green Bank leadership, and through a review of Green Bank reporting and program documentation, including its audited and unaudited statements.[13] This evaluation framework can be incorporated into the operations of the organization and used as a template for Green Bank programs.

The remainder of this document presents the following framework elements:

- Program Logic Model (PLM)
- Program Impact Indicators
- Evaluation Plan Development
- Net Impact Analysis and Cost-Benefit Analyses

[12] On and after July 1, 2004, the Public Utility Regulatory Authority requires the electric IOU utilities to assess a charge of not less than one mill per kilowatt hour to each end use customer of electric services in Connecticut and that those funds be deposited into the Clean Energy Fund. The Clean Energy Fund is within the Connecticut Green Bank.

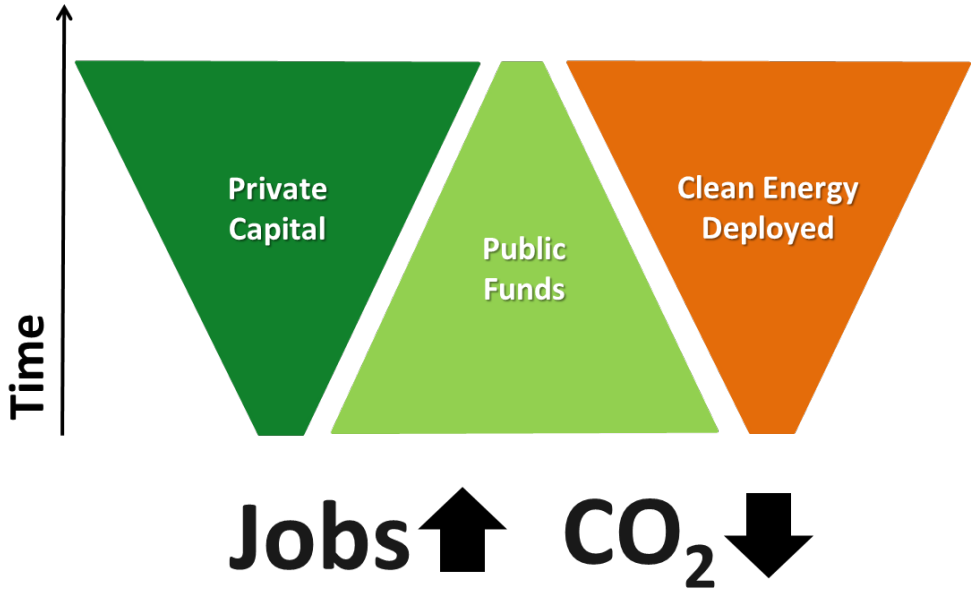
[13] Comprehensive Annual Financial Report for FY 2015 for the Connecticut Green Bank

3. Program Logic Model

A Program Logic Model (PLM) is a "graphical representation of the causal links between program activities, short-term responses to those activities among market actors and longer-term market effects. Logic models flow from decision-makers' hypotheses of how a program intervention strategy addresses barriers or market failures. A logic model can provide the basis for establishing metrics that indicate progress toward program goals and help program administrators, policymakers, and stakeholders assess the likely timeframe within which the theorized transformation might be realized."[14]

The high level, long term Green Bank financial market transformation objective – to rely increasingly on private capital to deploy increasing amounts of clean energy resources, increase jobs and reduce greenhouse gas emissions – can be graphically represented by the following (see Figure 1). The green bank model of public-private partnerships depicts public funds being leveraged more and more over time by private capital – for example, achieving a high leverage ratio for every $1 of public funds invested by the Green Bank by attracting $10 of private capital investment. The Green Bank also expects to recover its investments over time through its financing offerings achieving even greater leverage on the $1 of public funds invested.

Figure 1. Green Bank Model of Public-Private Partnerships for Clean Energy Deployment



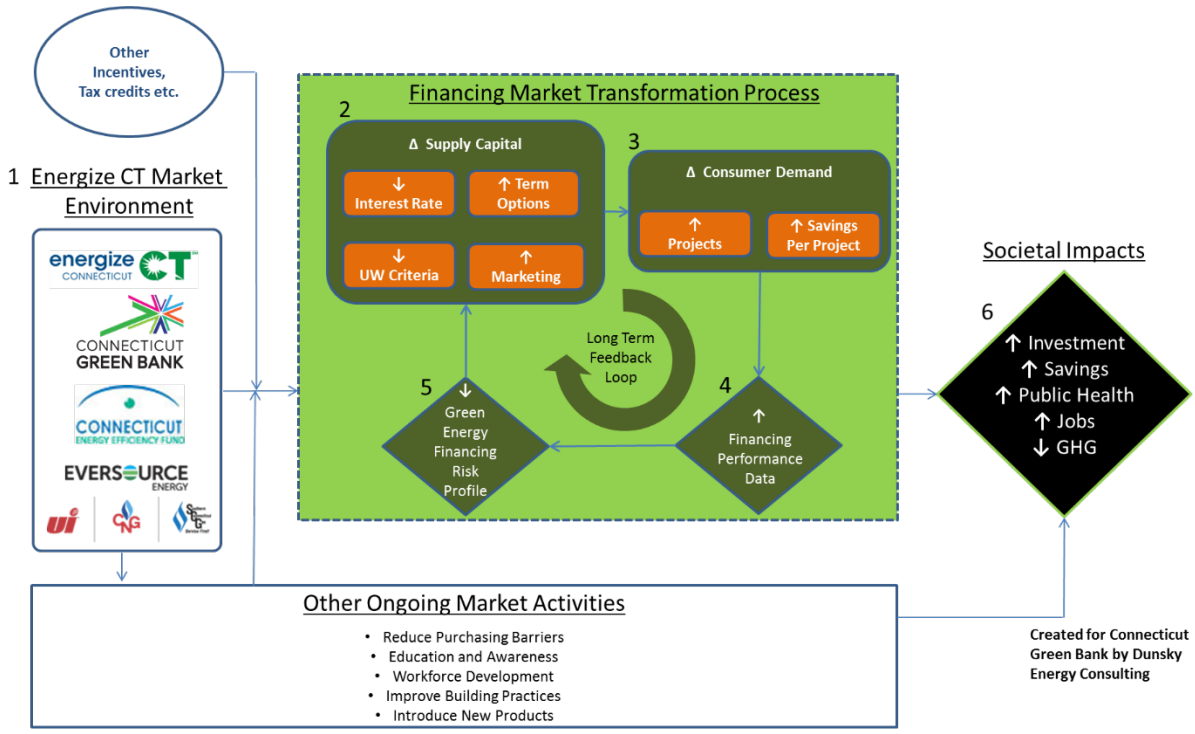
This organizational objective can serve as the general framework within which the PLM for the Green Bank's overall strategy to increase the use of private capital financing to accelerate the deployment of clean energy can be developed and presented. The focus of the Connecticut Green Bank's PLM is on its role in effecting this transformation (see Figure 2).[15] However, as noted above, the Green Bank's programs and associated financing elements are for the most part marketed and deployed in the same

[14] State and Local Energy Efficiency Action Network (2015). *Making it Count: Understanding the Value of Regulated Energy Efficiency Financing Programs*. Prepared by: Chris Kramer, Emily Martin Fadrhonc, Charles Goldman, Steve Schiller, and Lisa Schwartz of Lawrence Berkeley National Laboratory (pp 53). click here

[15] The Green Bank recognizes that a more formalized and detailed structure is typical of industry logic models, and that this is a high level display.

environment as the utilities' energy efficiency and renewable energy (i.e., zero emission renewable energy credit and low emission renewable energy credit) programs, and they often intersect and interact at the Green Bank's individual project level.

Figure 2. Green Bank Program Logic Model



This figure is a generalized market transformation and impact logic model that can be adapted to apply to a specific program of a green bank, as its market transformation strategies and associated evaluation frameworks are developed. An example of the green bank model and the financing market transformation process is the CT Solar Loan.[16]

As the Green Bank's capital availability expands to support further clean energy deployment, one can anticipate that there will be increased coordination between the Green Bank's programs and those administered by the utilities. It is thus important to include the various other key participants in this overall logic model, in order to be able to identify the variety of interactions that can occur between them, that over the short, medium, and long term can lead to the transformation of the funding of clean energy projects. In addition, it is important to identify known interventions in the clean energy environment which can influence the ways in which the Green Bank's financing efforts might play out over time.

The PLM includes three (3) components – Energize CT Market Environment (including Other Ongoing Market Activities), Green Bank Financing Market Transformation Process, and Societal Impacts.

[16] Comprehensive Annual Financial Report for FY 2015 – Market Transformation: Financial Warehouse and Credit Enhancement Structures Case of the CT Solar Loan (pp. 133-136)

3.1 Energize CT Market Environment

Energize CT is an initiative of the Green Bank, the Connecticut Energy Efficiency Fund, the State, and the local electric and gas utilities. It provides Connecticut consumers, businesses and communities the resources and information they need to make it easy to save energy and build a clean energy future for everyone in the state. Under this umbrella, the electric and gas investor owned utilities (IOUs) provide information, marketing, and deliver the energy efficiency programs that have been approved by the State and supported by the Connecticut Energy Efficiency Fund. Operating under a statutory mandate that all cost-effective energy efficiency be acquired, with guidance from the Connecticut Energy Efficiency Board and its consultants, the utilities offer a variety of programs and encouragements for residential, commercial, and industrial customers to make decisions to participate in these cost-reducing opportunities. A range of methods are used to incent customers to participate in the programs, among them targeted information, low cost/no cost measures, financial incentives, discounted retail products, and product and project financing. The Connecticut Green Bank, with a statutorily established residential solar PV target of 300MW by 2022, also markets and delivers its clean energy programs to residential customers. It too relies on information, marketing, direct incentives, and financing opportunities. [17]

Of the Green Bank programs, currently only participants in the Residential Solar Investment Program (RSIP) are required to receive a home energy assessment (i.e., supported by the utility efficiency programs), BPI audit, or equivalent. The program participants in the RSIP, with their individual energy saving projects, may thus receive rebates or incentives from the utilities (which are intended to overcome barriers to customer participation and to encourage increased selection of energy efficient measures), the Green Bank, or other levels of government (e.g., state incentives and Federal tax credits for solar PV and other technologies) as well as opportunities to finance some or all of the remaining portion of their clean energy project. In the context of a PLM, one can anticipate similar links between the Green Bank programs and those of the investor owned utilities (IOU's).

An impetus for coordination between the utility administered energy efficiency programs and the Green Bank programs is threefold: 1) more energy savings, and resulting emissions reductions, could potentially be acquired more economically both to the programs and to the project participants, 2) delivery efficiencies and greater savings could be found in coordinating financing that each entity offers to common customer segments within the sphere of program activities that they offer, and 3) coordination through a Joint Committee of the Energy Efficiency Board and the Connecticut Green Bank is required by statute.[18] It is important to note that there are a number of other ongoing market activities that are occurring through Energize CT or outside of the Green Bank's market transformation process. From introducing new products, reducing purchasing barriers, education and awareness programs to workforce development, and improving building practices – there are a variety of activities that help move the market towards more clean energy deployment.

[17] Per Public Act 15-194 "An Act Concerning the Encouragement of Local Economic Development and Access to Residential Renewable Energy," the Connecticut Green Bank administers a rebate and performance-based incentive program to support solar PV.

[18] Pursuant to Section 15-245m(d)(2) of Connecticut General Statutes, the Joint Committee shall examine opportunities to coordinate the programs and activities contained in the plan developed under Section 16-245n(c) of the General Statutes [Comprehensive Plan of the Connecticut Green Bank] with the programs and activities contained in the plan developed under section 16-245m(d)(1) of the General Statutes [Energy Conservation and Load Management Plan] and to provide financing to increase the benefits of programs funded by the plan developed under section 16-245m(d)(1) of the General Statutes so as to reduce the long-term cost, environmental impacts, and security risks of energy in the state.

3.2 Financing Market Transformation Process

The efforts of the Green Bank are exemplified through the financing market transformation process, which focuses on accelerating the deployment of clean energy – more customers and "deeper" more comprehensive measures being undertaken – by securing increasingly affordable and attractive private capital. The Green Bank can enter the process at a number of points (i.e., from numbers 2 through 4 in the above PLM figure), such as supplying capital through financing offers, marketing clean energy financing, or offsetting clean energy financing risk by backstopping loans, or sharing loan performance data.

Here is a breakdown of each component of the financing market transformation process of the Green Bank:

- **Supply of Capital –** financing programs aim to increase the supply of affordable and attractive capital available to support energy savings and clean energy production in the market place. This is done at the Green Bank by:

    a. Providing financing (loans or leases) to customers using Green Bank capital; and/or
    b. Establishing structures, programs, and public-private partnerships that connect third-party capital to support energy savings projects.

    Beyond ensuring that financing is available for clean energy projects, the benefits of the Green Bank's Supply of Capital interventions can lead to, but are not limited to:

    a. Reduced interest rates, which lower the cost of capital for clean energy projects;
    b. More loan term options to better match savings cash flows (e.g., longer terms for longer payback projects, early repayment, or deferred first year payments);
    c. Less restrictive underwriting criteria to increase eligibility for and expand access to financing; and
    d. Increased marketing by lenders to leverage clean energy investment opportunities.

    Each of these features is intended to increase uptake of clean energy projects, leading to increased energy savings, clean energy production, and other positive societal impacts. The long-term goal of the Green Bank's efforts is to achieve these attractive features in the market with a reduced need for Green Bank intervention, through the provision of performance data that convinces private capital providers to offer such features on their own.

- **Consumer Demand –** in combination with a comprehensive set of clean energy programs under the Energize CT initiative, the Green Bank drives demand for clean energy by marketing financing programs and increasing awareness of the potential benefits stemming from clean energy projects. Green Bank programs that deliver rebates and incentives – or connect with customers to support energy savings projects that are eligible for rebates and incentives – can further help to drive demand for natural gas conversions (e.g., Energize Norwich in partnership with Norwich Public Utilities)[19] as well as reduce the installed costs of and drive demand for solar PV projects (e.g., Solarize Connecticut). It should also be noted that through channel marketing strategies (e.g., contractor channels to the customer) success will be determined by

[19] Section 52 of Public Act 13-298

an increase in demand for financing. The results of the increased demand are expected to, but are not limited to:

a. Increase the number of clean energy projects; and
b. Increase the average savings and/or clean energy production per project.

Increasing affordable and attractive financing offerings in the marketplace is an important component of unlocking consumer demand and driving greater energy savings and clean energy production, and is central to the Green Bank's market transformation efforts.

- **Financing Performance Data** – Green Bank gathers and communicates the performance of clean energy financing either through its own programs or for other financing options in the market place. This increases access to valuable information that can help lenders and customers identify promising clean energy investments. Enabling access to this information (i.e., data transparency) is important to encouraging market competition.

  Ultimately, data on financing performance is expected to play a central part in attracting more private capital investment to offer affordable and attractive financing offerings on their own. As the Green Bank increases the access to affordable and attractive capital, and more customers use financing for their clean energy projects, data demonstrating strong and reliable performance of these projects may indicate lower and more predictable risk.

- **Financing Risk Profile** – Green Bank can help reduce clean energy financing risk profiles in a number of ways. For example, it can absorb a portion or all of the credit risk by providing loan loss reserve (LLR) funds and guarantees or taking the first-loss position on investments (i.e., subordinated debt). It can also channel or attract rebates and incentives to finance energy saving projects thus improving their economic performance and lowering the associated performance risk. In the long run, by making clean energy financing performance data available to the market, Green Bank programs increase lenders' and borrowers' understanding of clean energy investment risk profiles, which may allow them to (1) design more affordable and attractive financing products and (2) select projects for financing to reduce risks.

  This element of the PLM plays the key linking role in the Market Transformation feedback loop, leading to longer term impacts, as the market (1) recognizes the potentially advantageous risk/return profile associated with clean energy investments and (2) takes further steps to increase the supply of affordable and attractive capital with less Green Bank credit enhancement needed to support demand for clean energy investments.

  Ensuring that financing performance and risk profile data are available to the market is important from various perspectives. For a deeper examination and presentation, please see the report by the State Energy Efficiency Action Network.[20]

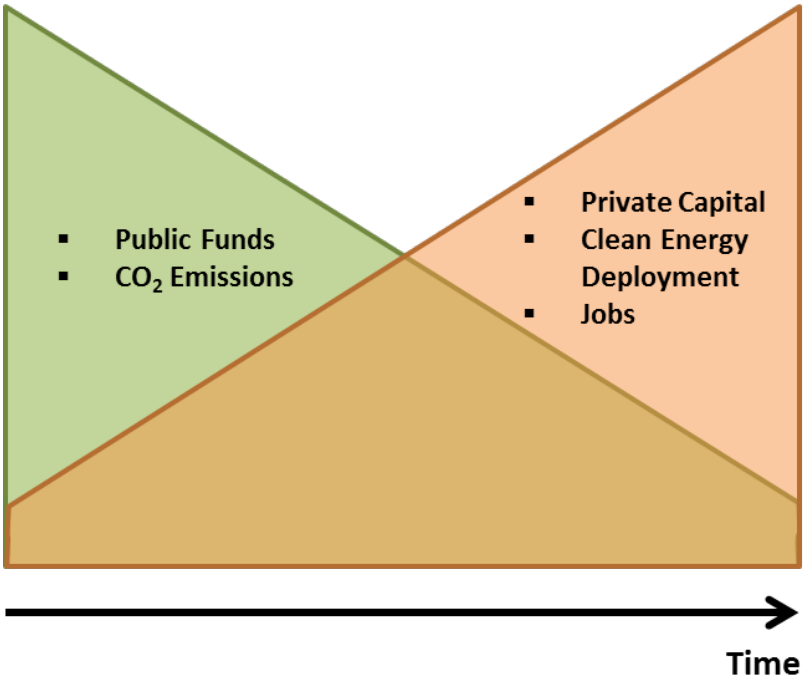
3.3 Societal Impacts

The efforts to accelerate and scale-up investment in clean energy deployment by the Green Bank, lead to a myriad of societal impacts and benefits.

[20] State and Local Energy Efficiency Action Network. (2014). *Energy Efficiency Finance Programs: Use Case Analysis to Define Data Needs and Guidelines.* Prepared by: Peter Thompson, Peter Larsen, Chris Kramer, and Charles Goldman of Lawrence Berkeley National Laboratory. click here

All of the PLM elements ultimately aim to contribute to Green Bank program impacts and benefits. These include the direct impacts resulting from more clean energy investments supported by Green Bank financing that result in an increase in energy savings and improvement of public health (e.g., asbestos remediation, lead abatement, etc.) to the customer,[21] increase in the creation of local in-state jobs,[22] and the reduction of greenhouse gas emissions[23] for society. The impacts may also include consideration of secondary or indirect benefits such as GDP growth and energy savings supported by lenders who have leveraged Green Bank data or marketing efforts. Figure 3 below represents the transition over time of the Green Bank's clean energy impacts and associated creation of societal benefits.

Figure 3. Societal Benefits – Environmental Protection and Economic Development – from Greater Private Capital Investment



As the Green Bank continues to attract more private investment in Connecticut's clean energy economy through the issuance of green bonds, the deployment of clean energy will be accelerated. The more clean energy that is being deployed, the greater the societal benefits will be.

[21] Green Bank will be working with the Connecticut Department of Energy and Environmental Protection and the U.S. Environmental Protection Agency to develop and approve a methodology for estimating public health benefits from the reduction of criteria pollutants as a result of the production of clean energy and reduction of energy consumption through the use of the Co-Benefits Risk Assessment (COBRA) model – https://www.epa.gov/statelocalclimate/co-benefits-risk-assessment-cobra-screening-model

[22] Green Bank is working with the Connecticut Department of Economic and Community Development and Navigant Consulting to update and approve a methodology for estimating economic development benefits from the investment in clean energy projects.

[23] Green Bank is working with the Connecticut Department of Energy and Environmental Protection to develop and approve a methodology for estimating greenhouse gas emission reduction benefits from the production of clean energy and reduction of energy consumption through the use of the AVoided Emissions and geneRation Tool (AVERT) - https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert

4. Program Impact Indicators

For an extensive list of potential program performance indicators that will be used to assess the pace and extent of the movement toward the market transformation objectives, see Appendix II. Each indicator is a numerical value that, in relation both to a stated value for that indicator that would represent success and to previous values that would indicate the extent of progress over time, provides the Green Bank with quantitative feedback on its progress toward transforming the clean energy markets with respect to more customers and deeper energy savings with the use of greater proportions of private financing.

These program impact indicators are organized to correspond to four key impact areas of the PLM (see Figure 3):

1. Capital Supply
2. Consumer Demand
3. Loan Performance / Risk
4. Impacts / Benefits

Figure 4. Key Program Impact Indicators

1. Capital Supply	2. Consumer Demand
o Available private loan pool o Green Bank funds available for credit enhancements o Ratio of public to private capital deployed o Weighted average interest rate o Weighted average loan term	o Awareness of financing options o Total capital deployed (total amount of the loan) o Number of customer applications o Application approval rate o Green Bank customer acquisition costs o Number of active enrolled contractors
3. Loan Performance / Risk	**4. Impacts / Benefits**
o Annual default rate o Average delinquency rate o Early repayment rates o Average and minimum FICO o Average and maximum DTI ratio	o Clean energy capacity installed o Energy savings from clean energy o Jobs created o Improvement in public health o Greenhouse gas emission reductions o Savings-to-investment ratio (SIR) o Total net benefits

The first three categories in blue, present the key market transformation performance impacts of Green Bank programs, following the market transformation process described in Section 3.2. This process involves 1) the provision of capital supply, which facilitates 2) consumer demand, allowing collection of data to improve the 3) risk profile of clean energy investments, improving the capital supply and unlocking greater demand for clean energy, ultimately 4) increasing energy savings, clean energy production, and positive societal impacts. The financing market transformation process can be entered at any point. The category in green, captures the program's ultimate clean energy benefits for economic development and environmental protection. An important step in developing an evaluation plan for any Green Bank program will be to review the lists of indicators and select those that are most relevant to that program and measurable in order to formulate the program's key performance indicators (KPIs) and key risk indicators (KPIs). An associated timeline would also need to be developed

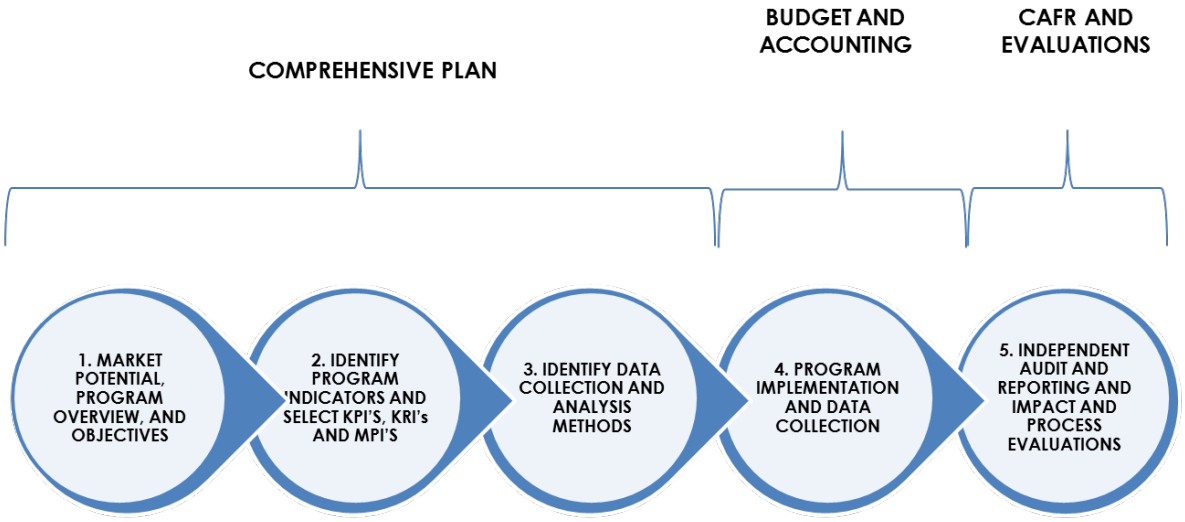
to indicate expected levels of progress toward near-term and long-term metrics at specific points in time.

While this framework focuses on the evaluation of Green Bank program impacts, assessing market transformation effects may best be accomplished by also including some process evaluation. The direct program impacts represent the specific energy savings or economic benefits stemming from the program financing or supported financing (i.e. third-party financing that benefits from program credit enhancements). Aside from measuring the impacts that are supported by the program, it will be important to make some assessment of the portion of the supported clean energy projects and measures that would likely not have happened in the absence of the Green Bank program. Methods for assessing this are addressed in more detail below in the Net Impact Analysis section to follow.

5. Evaluation Plan Development

An important element of applying the evaluation framework is incorporating it within the operations of the organization. This section outlines five steps in the plan development and implementation process. The first three steps can be incorporated into the Green Bank's multi-year Comprehensive Plan, the fourth step is within the annual Budget and ongoing Accounting processes for the organization, and the fifth and final step is through either the independently audited Comprehensive Annual Financial Report (CAFR) or program evaluation, initiated through a statutory requirement, Board of Director requests, or at the discretion of the Green Bank management– see Figure 5.

Figure 5. Evaluation Plan Development and Implementation Process



5.1 Step 1 – Market Potential, Program Overview, and Objectives

Within the Comprehensive Plan of the Green Bank, for each sector programs and products, it is important to clearly state the market in which the program operates – that is, its market potential or Total Available Market (TAM) and the Serviceable Addressable Market (SAM) – how much of the universe is the market for my programs and products?[24] From there, providing an overview of the programs and products as well as the specific targets or objectives will provide a foundation for evaluation. Understanding how the programs and products address market barriers should be part of this first step, in order to then select program KPIs and KRIs and subsequent evaluation methods. A program logic model for each program, typically an implementation tool used by program managers to observe and track performance, should also be prepared. It can also serve as an input into the development of individual program evaluation plans.

[24] The National Action Plan for Energy Efficiency (2007) describes technical potential (i.e., theoretical maximum), economic potential (i.e., cost effective), and achievable potential (i.e., aggressive and effective implementation).

5.1.1 Market and Program Baseline Assessments

As part of its evaluation activities, the Green Bank may conduct baseline assessments to understand current energy savings and clean energy production levels being supported by Green Bank programs and products and to establish baseline values for the key performance and market indicators. These assessments may help establish benchmark values against which to measure the impacts of future activity, while simultaneously serving as near-term assessments of goals achieved through Green Bank programs. Baseline assessments may also characterize current private market practices in providing capital for clean energy, to provide a benchmark for measuring future impacts on the broader market. Some of these baseline characterizations may be conducted collaboratively with the Department of Energy and Environmental Protection, the state's utilities, or other parties.

5.2 Step 2 – Identify Program Indicators, Select KPI's, KRI's and MPI's

The evaluation framework draws from a table of indicators (see Appendix I) which captures various program impacts and market transformation metrics. For each program outlined within the Comprehensive Plan, these indicators are of varying relevance and may be more or less measurable depending on the nature of the financing program's features and available data. The program logic models can serve as a guide on which indicators, key performance indicators (KPIs), key risk indicators (KRI's), and market transformation or market performance indicators (MPIs) to select for each program.

- **Indicator** – A metric of program performance (e.g., the number of loans issued, total estimated energy savings).

- **Key Performance Indicator** – A measure of the program's progress toward its core objectives. KPIs may simply be a single indicator (e.g., annual loan volume) or they may combine multiple indicators to develop a metric that captures a relationship among indicators. For example, the leverage ratio of private to public capital is comprised of the ratio of the total private capital employed to the total public capital invested through the program. In this case, an increasing leverage ratio indicates that the program is making progress toward its core objective of leveraging private capital.

- **Key Risk Indicator** – A measure of risk that could prevent a program or organization from achieving its core objectives. KRIs are meant to be a leading indicator, predictive metric, or warning that targets might not be met (e.g. projects remaining in approved status but not closing, or the number of distributed energy systems not online reporting real-time performance data). Key risk indicators are to be monitored on a regular basis prompting an operational response from the organization to ensure that targets are met.

- **Market Performance Indicator** – a measure of the program's contribution towards the financing market transformation process and program logic model of the Green Bank.

For a given program, the framework can be applied to develop a list of indicators, KPIs, KRIs, and MPIs as follows:

1) Identify the relevant indicators from the provided list and remove indicators that do not apply to the program;
2) Assess the relevance and measurability of each indicator to the program;

3) Select the indicators to be measured in the evaluation; and
4) Identify the indicators that best represent progress toward the program's objectives and green bank model and formulate measurable KPIs, KRIs, and MPIs.

5.3 Step 3 – Identify Data Collection and Analysis Methods

Once the program indicators, KPIs, KRIs, and MPIs have been established, the Comprehensive Plan should outline the data collection and analytical methods that will be used. Selected methods will depend on a number of factors, including the selected KPIs, KRIs, and MPIs, the type of program, the status of projects within the program (i.e., approved, in construction, closed, or completed transactions), the installed measures, the expected magnitude of savings, the level of program participation, and the evaluation timeline. Within the Comprehensive Annual Financial Report process an independent auditor will assess the data collection systems, project status, and project reporting to provide a formal opinion as to whether these data are fair and accurate.

In addition to program materials, evaluations will typically require additional data. Data collection can be broadly grouped into primary and secondary data collection methods. Primary data collection might include in-depth interviews, surveys, real-time metered data, access to utility bill data, and/or on-site measurement and verification. Every effort will be taken to collect customer, contractor, and capital provider data (e.g., through surveys and other means) during the project implementation phase so as to ensure that the information is captured on time as opposed to a future point in time. Examples of secondary data include evaluation plans or reports from other programs/jurisdictions, market reports, or publicly available data (e.g., Census data, EIA data).

5.4 Step 4 – Program Implementation and Data Collection

As programs are being implemented, continuous data collection, analysis, and reporting are being done. With the approval of the Comprehensive Plan and Budget, the accounting department and data collection efforts are constantly tracking and monitoring program performance towards objectives. Lean process improvements are constantly being conducted, and performance is being regularly communicated to staff and the Board of Directors. Having ongoing data collection, analysis, and reporting alongside quarterly communications to stakeholders will lead to continuous improvement of programs and processes.

It should be noted that the Green Bank does require customers that utilize its financing programs (e.g., C-PACE and the Smart-E Loan) to sign data release forms (see examples provided in Appendix III and Appendix IV). The Green Bank anticipates that the use of actual energy consumption data pre (i.e., 1 to 3 years before) and post project completion (i.e., through the life of the financing) will help the Green Bank communicate the value of financing clean energy improvements to existing and prospective customers. The Green Bank is also in the process of establishing an official customer privacy policy that balances the need to protect customer privacy while at the same time providing information that can be used for public disclosure including, but not limited to auditing, reporting, and evaluation. Collecting data through surveys during the financing process should also be pursued. In an effort to support national data standardization and collection efforts, consideration should also be given to the Connecticut Green Bank being a pilot participant in the State Energy Efficiency Action Network

(SEEAction Network) Financing Solution Working Group's residential loan data standardization efforts.[25]

5.5 Step 5 – Independent Audit and Reporting, and Impact and Process Evaluation

Once select indicators and KPIs, and data collection and analysis methods have been established, and various programs and products have been implemented, the independently audited Comprehensive Annual Financial Report (CAFR) will be the mechanism to publicly report on results, and as appropriate independent evaluation of programs will be conducted.

5.5.1 Independent Audit and Reporting

A CAFR is a set of government financing statements comprising the financial report of a state, municipal or other government entity that complies with the accounting requirements promulgated by the Governmental Accounting Standards Board (GASB). GASB provides standards for the content of a CAFR in its annually updated publication *Codification of Governmental Accounting and Financial Reporting Standards*. A CAFR is compiled by a state, municipal or other governmental accounting staff and "audited" by an external American Institute of Certified Public Accountants (AICPA) certified accounting firm utilizing GASB requirements. It is composed of three sections – Introductory, Financial, and Statistical.

- **Introductory** – contains the Letter of Transmittal, Board of Directors, and Organization Chart;
- **Financial (Audited)** – contains the Independent Auditor's Report, Management's Discussion and Analysis (unaudited), Basic Financial Statements (i.e., Statement of Net Position, Statement of Revenues, Expenditures, and Changes in Net Position, State of Cash Flows, and Notes to Financial Statements), and other required supplementary information; and
- **Statistical (Unaudited)** – contains various Financial Statistics (e.g., Financial Trends, Revenue Capacity, Debt Capacity, Demographic and Economic Information, and Operating Information) and Non-Financial Statistics (e.g., Governance, Income, Measures of Success, Market Transformation, etc.).

As the "gold standard" in government reporting, the CAFR is the mechanism the Green Bank uses to report its fiscal year financial and statistical performance to its stakeholders.

5.5.2 Impact Evaluation

With respect to the independent evaluation of programs, some of the work might be done in-house (e.g., data collection, surveys, etc.) as part of the project implementation process, while a majority of the work (e.g., interviews, sampling, etc.) will be done at a later point by an independent evaluation contractor. To ensure quality assurance and quality control given the evaluative use of the data and its implications regarding the assessment of programs, having the ability to retain independent evaluators is important in order to examine the impacts of a particular program. As with financial audits,

[25] State and Local Energy Efficiency Action Network. (2014). *Energy Efficiency Finance Programs: Use Case Analysis to Define Data Needs and Guidelines.* Prepared by: Peter Thompson, Peter Larsen, Chris Kramer, and Charles Goldman of Lawrence Berkeley National Laboratory. click here

independent evaluation of program results can help instill confidence in stakeholder support, insights, and observations of the Green Bank.

5.5.3 Process Evaluation

In the context of the Green Bank programs, a process evaluation is a systematic assessment of a program for the purposes of 1) documenting program operations at the time of the examination and 2) identifying and recommending improvements that can be made to the program to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.[26]

[26] Adopted from New York State Process Evaluation Protocols Dr. Katherine Johnson, April 2013, and California Energy Efficiency Evaluation Protocols The TecMarket Works Team, April 2006

6. Net Impact Analysis

Net impact analysis attempts to identify the impacts (e.g., energy savings, job creation, etc.) that would not have happened in the absence of a program. Net impact analysis thus tries to determine what share of savings can be attributed to a program. For example, Green Bank program participants might have implemented their clean energy project even without the loan for two reasons:

1. They also received a rebate or an incentive, which was equally or more important in their decision to go ahead with the project than the loan; and/or

2. They might have used alternative sources of financing, e.g., through private lenders or equipment vendors, or may have paid for the project using their savings.

In order to have an indication of the Green Bank programs' true impacts, when necessary, efforts should be made to determine what portion of the Green Bank supported projects (and the resulting savings) would not have happened in the absence of the program. Thus, some form of attribution analysis, either quantitative or qualitative, should be included in the Green Bank evaluation plans. The results can be used to inform both program reporting and consideration of program design adjustments.

6.1 Quantitative Assessment: Net-to-Gross Ratio (NTGR)

Rigorous determination of net impacts requires establishing a NTGR that represents the share of the savings that are directly attributable to the program. This typically includes consideration of both free-ridership and spillover. Free-ridership and participant spillover are often assessed through questions in a participant survey; consideration of non-participant spillover is less common in net impact evaluations and would require a non-participant or market actor survey.

Many of the Green Bank programs co-exist with utility administered energy efficiency programs or other government incentives, which creates challenges to establishing a NTGR or its components for the Green Bank's programs. This should not, however, dissuade attempts to consider and implement approaches to estimate these effects.

6.2 Qualitative Assessment

An alternative to establishing a NTGR is to perform a qualitative assessment of the impact of Green Bank financing on the completed projects. This could include asking participants about the relative importance of different factors (e.g., including the loan and any rebates or incentive received) on their decision to complete the clean energy project or asking about the likelihood of completing the project in the absence of the financing.

In the absence of surveys, an expert opinion may provide qualitative assumptions to assign savings. Although this is not an accepted attribution technique, it may provide a framework to assess progress toward increasing the uptake of measures types specifically targeted in the program objectives (e.g., longer payback or non-incented measures).

While these qualitative approaches do not provide a value to be applied to program savings, they provide insights into the importance of the Green Bank financing in completing the clean energy projects.

7. Cost-Benefit Analysis

Assessing the costs and benefits of the Green Bank's programs plays an important role to demonstrate the effectiveness of the Green Bank investments and provides a tool for comparing results among Green Bank programs. These can be assessed from the customers' perspective (i.e., the participant), the program administrator's (i.e., the Green Bank) perspective, or a wider societal perspective. Each perspective provides an important measure of the Green Bank's overall impact, and the cost-benefit ratio for each can be derived and tracked over time for Green Bank's individual programs and overall portfolio.

The three ratios presented below relate the costs borne by each stakeholder to the primary benefit sought:

- **Societal Perspective:** Economic development (e.g., jobs supported) and environmental protection (e.g., GHG emissions reduced) to the associated costs;
- **Green Bank Perspective:** Clean energy production (i.e., energy savings and clean energy production) to the associated investments (e.g., public, private, and total investment); and
- **Participant Perspective:** Project benefits to the associated participant costs.

These three different perspectives on the Green Bank program or portfolio provide a picture of Green Bank's effectiveness in delivering on each key objective – see Appendix V for C-PACE project example results.

7.1 Societal Perspective: Environmental and Economic Objectives

The societal perspective cost-benefit analysis attempts to capture the Green Bank's effectiveness in achieving its overarching goals of supporting economic development and environmental protection.

- **Employment Objective ($ invested / job-year supported)**[27]
  = Green Bank Investments / estimated direct, indirect and induced job-years supported
- **GHG Reduction Objective (tons CO_2 eq. / $1,000 invested)**[28]
  = Estimated GHG reductions resulting from clean energy supported / Green Bank Investments

If Green Bank applies the Carbon Count methodology, then the GHG reductions are attributed simply by the portion of the overall project costs financed by the Green Bank investment. At a minimum, the portion of the overall project implementation costs covered by utility incentives should be calculated, and the corresponding portion of GHG reductions removed from the total. The value of other state and federal incentives (RECs and tax credits) should be noted in the results to support full disclosure, and it

[27] The framework presents the investment value per job-year supported to express the employment cost-benefit – that is, the cost to acquire a unit of the benefit, here one job-year supported by the Green Bank. For some audiences it may be more appropriate to present the result as a benefit-cost ratio – that is, the inverse of the Employment Objective metric as presented above (job-years supported per $1,000 invested)

[28] For cross state and other comparison purposes the equation above presents the metric from the benefit-cost perspective. For other purposes it may be valuable to derive the cost to acquire a ton of CO_2 eq. (i.e., the inverse of the above equation).

should be determined whether the associated portion of GHG reductions should be removed from the total credited to Green Bank.[29]

7.2 Green Bank Perspective: Public Cost of Clean Energy (PCCE)

The PCCE captures the ratio of the present value of public monies invested to the overall savings achieved by Green Bank supported projects.

- **Public Cost of Clean Energy ($ / MMBTU)**
  = Net Present Value of Public Costs / Total Clean Energy Delivered

Public Costs include the Net Present Value (NPV) of Green Bank investments in the program, as well as the NPV of all state incentives (e.g., utility and RECs) and federal incentives (e.g., investment tax credits, depreciation, etc.) received by or assigned to program participants.

Total Clean Energy Delivered includes the total of all financed project lifetime energy saved or clean energy generated

The relationship between public investments and the value of total clean energy delivered (benefits) can also be presented in absolute terms, as net benefits, shown below. This provides a benefit-cost indicator that expresses the magnitude of net economic benefits returned to the public.

- **Public Net Benefits of Clean Energy** = NPV Total Clean Energy Delivered – NPV of Public Costs

In the cases where Green Bank can successfully attribute savings between its programs (i.e., financing), state and federal incentives (e.g., utility efficiency programs, REC's, tax credits etc.), then a more precise measure of Green Bank's own cost per unit of clean energy delivered can be defined as such:

- **Green Bank Cost of Clean Energy ($ / MMBTU)**
  = NPV of Green Bank Investments / Attributable Clean Energy Delivered[30]

The Green Bank Cost of Clean Energy captures just the Green Bank's direct cost (or net return) for delivering clean energy. Comparison between this result and the PCCE result provides a tool to assess the degree to which Green Bank program can deliver clean energy at a reduced public cost. As above, net benefits of the Green Bank investments can be calculated:

- **Green Bank Net Benefits of Clean Energy** = NPV Total Clean Energy Delivered – NPV of Green Bank Investments

These indicators provide a view of the magnitude of economic benefits in relation to the associated costs of public or Green Bank investments.

[29] The inclusion or exclusion of the portion of GHG financed through tax credits and RECs should be determined by following the rules of any third-party green bond assessment methodology applied by Green Bank, such as the Carbon Count method referenced above.

[30] In the absence of savings attribution data, the Green Bank Cost of Clean Energy may be expressed per unit energy *supported.* However, it is essential to note that the Green Bank Cost of Clean Energy (supported) is not directly comparable to the Green Bank Cost of Clean Energy (attributable).

7.3 Participant Perspective: Savings to Investment Ratio (SIR)

The participant's SIR is the ratio of the present value of the savings (benefits) accrued to the participant to the present value of the costs incurred by the participant to implement and finance the project. Benefits may include energy and demand cost savings, as well as state and federal incentives paid to the participant. Some quantifiable non-energy benefits, such as operations and maintenance savings, may also be included. Costs typically include financing repayment costs, any unfinanced portion of the overall investment (not covered by utility incentives) and maintenance costs. In general, a project or program is deemed cost-effective to participants if the SIR is greater than one.

- **Individual Participant SIR** = NPV of Benefits_p / NPV of Costs_p
- **Total Program Participants SIR** = $\sum$NPV of Benefits_n / $\sum$NPV of Costs_n

As in Section 7.2 above, the relationship between individual participant or total program participants benefits and costs can be presented as net benefits, shown below. Here this provides a benefit-cost indicator that expresses the magnitude of net economic benefits returned to the individual participant or the pool of program participants.

- **Individual Participant Net Benefits** = NPV of Benefits – NPV of Costs
- **Total Program Participants Net Benefits** = $\sum$Individual Program Net Benefits

  or

- **Total Program Participants Net Benefits** = $\sum$ NPV of Benefits_n - $\sum$ NPV of Costs_n

An average project SIR, below, can also be a useful indicator for program management and reporting. It should be calculated across the same group of participants as the average project SIR, below (i.e. specific year or years, project type, program lifetime, etc.).

- **Average Project SIR_p** = Total Program Participants SIR / Participants_n

8. Appendix I – Statutorily Required Reporting

Per statute, the Connecticut Green Bank is required to file the following organizational reports:

- **Annual Report** – per C.G.S. Section 1-123(a), an annual report to the Governor, the Auditors of Public Accounts, and two copies to the Legislative Program Review and Investigations Committee.[31] Per C.G.S. Section 245n(f)(1), the Green Bank must also file an annual report to DEEP, the Legislative Commerce Committee, and the Legislative Energy and Technology Committee on its activities including those undertaken in collaboration with the Energy Conservation and Load Management Fund. The Green Bank also provides every chief elected official within Connecticut's cities and towns once a year a cover letter, fact sheet, and annual report.

- **Quarterly Financial Cash Flow Reports** – per C.G.S. Section 1-123(b), a quarterly report to the Office of Fiscal Analysis and shall include, but not be limited to, for each fund and account of the agency:

    1. Beginning fiscal year balance;
    2. All funds expended and all revenue collected by the end of the quarter; and
    3. Total expenditures and revenues estimated at the end of the fiscal year.

- **Quarterly Personnel Status Reports** – per C.G.S. Section 1-123(c), a quarterly report to the Office of Fiscal Analysis and shall include, but not be limited to the total number of employees by the end of the quarter.

Per statute, the Green Bank is required to file the following programmatic reports:

- **Anaerobic Digester and Combined Heat and Power** – per Public Act 15-152, a report on the anaerobic digester pilot program and whether it should continue. This is due on or before January 1, 2018 to the Legislative Energy and Technology Committee, with additional copies to the clerks of the Senate and House, the Office of Legislative Research, and the State Librarian.

- **REEEFA Report** – per C.G.S. Section 16-245aa(d), an annual report on the effectiveness of the Renewable Energy and Efficient Energy Finance Account (REEEFA) to the Legislative Energy and Technology Committee.

- **Residential Solar Investment Program** – per C.G.S. Section 16-245ff, files a report by January 1, 2017 and every two years thereafter to the Legislative Energy and Technology Committee on its progress toward deploying 300 MW of residential solar PV.

Per the Green Bank's enabling statute, the Green Bank:

[31] The annual report includes information detailed in the audited annual Comprehensive Annual Financial Report.

- **Develop Standards** – must develop standards to govern the administration and investments of the Green Bank before providing financing support.[32]

- **Disclosure** – must make information regarding the rates, terms and conditions for all of its financing support transactions and annual reviews available to the public.[33]

- **Clean Energy Expertise** – may expend funds for evaluations that support clean energy technologies and expand the expertise of individuals, businesses and lending institutions with regard to clean energy technologies.[34]

[32] C.G.S. Section 16-245n(d)(B)
[33] C.G.S. Section 16-245n(d)(F)
[34] C.G.S. Section 16-245n(c)

9. Appendix II – Program Performance Indicators

The following program performance indicators were identified through interviews with staff of the Green Bank from various programs and products. These indicators are important from the perspective of the Connecticut Green Bank – the program administrator. There are other actors (e.g., lenders, policy-makers, rating agencies, and investors) and use cases (e.g., program design, eligibility criteria, loan and cash management, loan refinance, and securitization) outside of the Connecticut Green Bank's evaluation framework,[35] but this represents a beginning to data that will be collected, analyzed and reported.

Financing Supply

The following is a list of the program performance indicators for financing supply, including if it is an indicator of market transformation or market performance indicator (MPI), its measurability, and the source of data:

CODE	INDICATOR	MPI	MEASURABILITY	DATA SOURCE
S1	Total Available Program Loan Pool		High	= S2 + S3
S2	Available Public Loan Pool		High	GB Program Data
S3	Available Private Loan Pool	x	High	GB Program Data
S4	Ratio of Available Public to Private Loan Pool	x	High	= S2 / S3
S5	Total Public Funds Invested		High	= S6 + S7 + S8 + S9
S6	Total GB Loans to Participants		High	GB Program Data
S7	Other Public Loans to Participants		Low	Program Data
S8	Total Public Incentives Provided to Program Participants (IOU, RECs etc.)		Medium	GB Program Data, Incentive Program Data
S9	Total Tax Credits Issued to Program Participants (Federal ITCs, etc.)		Low	Program Data
S10	Green Bank Funds Available for Credit Enhancements		High	GB Program and Planning Data
S11	Total Private Funds Invested		High	= S12 + S13
S12	Private Third-Party Loans Delivered		Medium	Lender data and surveys
S13	Participant Funds Leveraged		Medium	GB program data, EM&V (participant survey)
S14	Bond Sales to Support Program Lending		Medium	GB Financial Data
S15	Total Public Loans to Participants		High	= S6 + S7
S16	Ratio of Public to Private Capital Deployed (Leverage Ratio)	x	Medium	= S5 / S11
S17	Ratio of GB Financing to Incentives		High	= S6 / S8
S18	Interest Rate: Weighted Average and Distribution	x	High	GB Program and Lender Data
S19	Loan Term: Weighted Average and Distribution	x	High	GB Program and Lender Data
S20	Customer Cost of Capital through GB		Medium	GB Program and Lender Data
S21	Financing Delivered for Energy Improvements (EE/RE)		Medium	GB Program and Lender Data
S22	Financing Delivered for Non-Energy Improvements		Low	GB Program and Lender Data
S23	Non-Debt Financing Delivered (Participants)		Medium	GB Program Data, EM&V (Participant Survey)
S24	Geographic Coverage of Private Lenders	x	High	GB Program Data
S25	Number of PACE Towns Opting In	x	High	GB Program Data
S26	% of Eligible Population Located in PACE Towns	x	High	GB program Data, Secondary Data

[35] State and Local Energy Efficiency Action Network. (2014). *Energy Efficiency Finance Programs: Use Case Analysis to Define Data Needs and Guidelines.* Prepared by: Peter Thompson, Peter Larsen, Chris Kramer, and Charles Goldman of Lawrence Berkeley National Laboratory.

Financing Demand

The following is a list of the program performance indicators for financing demand, including if it is an indicator of market transformation, its measurability, and the source of data:

CODE	INDICATOR	MPI	MEASURABILITY	DATA SOURCE
D1	Total Value of Loans Issued	x	High	GB Program Data
D2	Number of Loans Issued	x	High	GB Program Data
D3	Loan Amount: Average and Distribution	x	High	GB Program and Lender Data
D4	Number of Customer Applications	x	Medium	GB Program and Lender Data
D5	Application Approval Rate	x	High	Program Data + GB Administration Data
D6	Green Bank Customer Acquisition Cost		High	GB Program Data
D7	Number of Customer Inquiries	x	Medium	GB Program Data
D8	% of Target Customers Aware of EE Loans	x	Medium	EM&V (General Population Survey)
D9	Number of Active Enrolled Contractors	x	High	GB Program Data
D10	Geographic Coverage of Active Contractors	x	High	GB Program Data
D11	% of Active Contractors with > X Applications	x	High	GB Program Data
D12	Number of New Contractors Bringing in Applications	x	High	GB Program Data
D13	% of Eligible Contractors Aware of EE Loans	x	Medium	EM&V (Contractor Survey)
D14	% of Active Contractors Growing their EE Business	x	Medium	EM&V (Contractor Survey)
D15	% of Active Contractors Cooperating with Others to Achieve Deeper Savings	x	Medium	EM&V (Contractor Survey)
D16	Portion of Total Addressable Market (TAM) Reached		Medium	GB Program Data, EM&V, Secondary Data
D17	Portion of Serviceable Addressable Market (SAM) Reached	x	Medium	GB Program Data, EM&V, Secondary Data

Loan Performance and Risk Profile

The following is a list of the program performance indicators for loan performance and risk profile, including if it is an indicator of market transformation, its measurability, and the source of data:

CODE	INDICATOR	MPI	MEASURABILITY	DATA SOURCE
P1	Annual Default Rate		High	GB Program and Lender Data
P2	Average Delinquency Rate (Days Past Due)		Medium	GB Program and Lender Data
P3	Early Repayment Rate		Low	GB Program and Lender Data
P4	FICO Scores: Average and Distribution	x	High	GB Program and Lender Data
P5	Debt-to-Income (DTI) Ratio: Average and Distribution	x	Medium	GB Program and Lender Data
P6	Loan-to-Value (LTV) Ratio: Average and Distribution		Medium	GB Program and Lender Data
P7	Other Borrower Credit Quality Indicators (TBD)		Medium	GB Program and Lender Data
P8	Maximum Loan Term Offered		High	GB Program and Lender Data
P9	Minimum Interest Rate Offered		High	GB Program and Lender Data

Impacts and Benefits

The following is a list of the program performance indicators for impacts and benefits, including if it is an indicator of market transformation, its measurability, and the source of data:

CODE	INDICATOR	MPI	MEASURABILITY	DATA SOURCE
I1	Capacity of Renewable Energy Systems Financed		High	GB Program Data
I2	Verified Demand Reduction from Renewable Energy Systems		Medium	GB Program Data / EM&V
I3	Estimated Energy Generated from Renewable Energy Systems		High	GB Program Data
I4	Verified Energy Generated from Renewable Energy Systems		Medium	GB Program Data / EM&V
I5	Estimated Demand Reduction from Energy Efficiency		High	GB Program Data
I6	Verified Demand Reduction from Energy Efficiency		Medium	GB Program Data / EM&V
I7	Estimated Energy Savings from Energy Efficiency		High	GB Program Data
I8	Verified Energy Savings from Energy Efficiency		Medium	GB Program Data / EM&V
I9	Project Depth: Average Energy Savings		High	GB Program Data
I10	Project Depth: % Projects With Multiple Measures		High	GB Program Data
I11	Jobs Created		Low	GB Program Data and Macro-Economic Factors
I12	Greenhouse Gas Emissions Reductions		Medium	GB Program Data and Energy GHG Intensity Factors
I13	Participant Non-Energy Benefits (TBD)		Low	GB Program Data
I14	Program Attribution		Low	EM&V (Participant survey)
I15	Average Project Savings-to-Investment Ratio (SIR)		High	GB Program Data
I16	Total Program SIR		High	GB Program Data
I17	Public Cost of Energy		High	GB Program Data

10. Appendix III – Example Data Release Form (C-PACE)

CUSTOMER RELEASE OF UTILITY DATA FORM

Utility and Fuel Supplier Information

Customer Name: _____

Electric Utility: _____ Account #:_____

Gas Utility: _____ Account #:_____

Other Fuel Supplier: _____ □ Oil □ Propane Account #:_____

If necessary, attach additional account numbers to this form.

Utility and Fuel Supplier and Program Information Release

Utility Customer Doing Business on the Property ("Company") **(only necessary if different from C-PACE Borrower)**	**C-PACE Borrower ("Borrower")**
Company Name:	**Borrower Name:**
Company Address:	**Borrower Address:**

PROJECT INFORMATION RELEASE – As a participant in the Connecticut Property Assessed Clean Energy (C-PACE) program and pursuant to Section 3.1(g) of the Financing Agreement between the Connecticut Green Bank ("Green Bank") and the Borrower dated _____, 2015 (the "Agreement"), I certify that I am a duly authorized representative of the Company/Borrower that is a customer of the above-named utility and that I hereby authorize and give permission to the utilities and/or fuel suppliers named above to release to the Green Bank and to any of its program partners, for their confidential use in connection with recording and calculating energy savings resulting from clean energy measures made pursuant to the Agreement at the Utility Service Address identified below. This permission is given for the following Data:

1) The monthly and interval usage, charges, and sales for fuels and/or utilities for the Release Period set forth below; and
2) Any supporting project documentation pertaining to calculating energy savings for efficiency measures.

In addition to the use of this Data for the Project, the Data may also be anonymized or aggregated to be used for non-commercial research purposes.

RELEASE PERIOD – This authorization covers Data for the period starting with the completion of the project and ending on the date of the complete repayment of the benefit assessment pursuant to the Agreement.

I hereby release and hold harmless the Green Bank, any Green Bank program partners, the above-named utilities and energy suppliers, and their affiliates and their respective directors, employees, officers and agents from any and all liabilities, damages, losses, penalties, claims, demands, suits and proceedings of any nature whatsoever associated with the dissemination and use of such account and program information and this authorization. An electronic copy of this authorization may be accepted with the same authority as the original.

Customer Signature: _____ Date: _____

Printed Name: _____

Email & Phone Number: _____

Mailing Address (if different)**: _____**

Utility Service Address (if different): _____

11. Appendix IV – Example Data Release Form (Smart-E Loan)

CUSTOMER RELEASE OF UTILITY DATA FORM

WHY WE NEED A RELEASE – For Connecticut Green Bank to offer more Smart-E Loans over time, we need access to utility account and actual energy usage data for your home, energy costs, underwriting and loan repayment records, as well as data on energy saving measures installed in your home (collectively "Data"). This Data will allow us to aggregate and understand estimated and actual savings for home energy improvements provided by participating contractors, ensure that installed measures are delivering the expected energy savings, and understand the performance of these loans. This Data will also be used by the Connecticut Green Bank to evaluate the effectiveness of Smart-E Loans. We take the security and privacy of your information very seriously. The Connecticut Green Bank will protect the confidentiality of your Data in compliance with all applicable laws. Data may be anonymized and released in the aggregate, but we will never release personal data, and we will never sell or rent aggregated data.

ENERGY USAGE, CONSERVATION, UNDERWRITING and REPAYMENT INFORMATION RELEASE – As the holder of the above accounts, I hereby authorize and give permission to the utilities, energy suppliers, and loan providers named above to release the Data to Connecticut Green Bank or its agents for confidential use in connection with calculating estimated and actual energy savings, tracking my loan repayment record, and for evaluating the effectiveness of this financial product. This permission is given for 1) my historic and future energy usage and monthly and total amount of energy used at my utility service address; 2) the total monthly price charged for fuels used by my household; 3) my loan repayment record; and 4) program-related information. In addition to the use of the Data for the evaluation of the Smart-E Loan product, the Data may also be anonymized and released in the aggregate.

PROGRAM DATA RELEASE – As a recipient of financing supported by the Connecticut Green Bank, a quasi-public agency of the State of Connecticut, I hereby authorize Connecticut Green Bank to access my Data and release it to program partners for confidential use in connection with calculating estimated and actual energy savings, evaluation of the effectiveness of this product, and understanding performance of this type of financing in the aggregate; and, in addition, I authorize Connecticut Green Bank to use my anonymized data or anonymized aggregated energy usage data.

RELEASE PERIOD – This authorization covers Data for the period starting 18 months before the date below and ending at the time of repayment of the loan.

I certify that I have read and understand the program requirements and that I must use proceeds I obtain through a Smart-E loan to install energy-related measures based on, or non-materially modified from, the individual contractor(s)' proposal(s), which are submitted with this Proposal Cover Sheet and Data Release Form for eligibility approval. I understand that my contractor must submit this sheet, along with a proposal for energy upgrades to the Connecticut Green Bank for technical approval. A list of Participating Lenders, including a summary of applicable fees and charges, can be obtained at www.EnergizeCT.com/smarte. However, I understand that receipt of a loan is contingent upon the eligibility of the measures proposed for financing, and I must obtain a signed, itemized proposal from an approved contractor.

The actual amount of the Loan will be determined by the actual costs of all approved measures. The loan amount may be net of any additional state rebates from my utility company, the Connecticut Energy Efficiency Fund and/or Connecticut Green Bank.

I understand that completing this Proposal Cover Sheet and Data Release Form does not guarantee approval for a loan or membership in a participating lending institution. Loans must be provided directly by a Participating Lender. I understand that I should not complete any measures listed in my application or otherwise rely on the funds of the Loan until I receive a formal commitment from a Participating Lender.
Connecticut Green Bank is a "public agency" for purposes of the Connecticut Freedom of Information Act ("FOIA"). Information received pursuant to this proposal will be considered public records and will be subject to disclosure

under the FOIA, except for information falling within one of the exemptions in Conn. Gen. Stat. Sections § 1-210(b) and § 16-245n(d), which may be withheld at Connecticut Green Bank's discretion.

HOMEOWNER:

I hereby release and hold harmless the Connecticut Green Bank, the above-named utilities and energy suppliers and loan account holders, and their affiliates, employees, officers and agents from any and all liability associated with the dissemination and use of such account and program information and this authorization.

I have read, understood, and agree to the Terms and Conditions above.

Loan Applicant signature(s): _____ *Date:* _____

Printed Name: _____

Mailing Address: _____

Utility Service Address: _____

CONTRACTOR:

By my signature below, I certify that, to the best of my knowledge, the information listed on this form is correct.

Contractor Signature: _____ *Date:* _____

12. Appendix V – Sample Cost-Benefit Analysis (C-PACE)

Based on the cost-benefit assessment framework presented in the Evaluation Framework, a sample analysis is presented for a C-PACE project that includes energy efficiency, renewable energy, and fuel switching measures within a single financing package. A summary of the results is presented immediately below in Table 1; the calculation details and sources references follow Table 1.

Table 1: Summary of Cost-Benefit Analysis Results for Sample C-PACE Project

Societal Perspective	**Results**		
GHG Reduction Objective	3.07	tons CO_2 eq. per $1,000	(lifetime)
	0.19	tons CO_2 eq. per $1,000	(annual)
Employment Objective	$ 53,363	per job-year	(invested)
Green Bank Perspective	**Results**		
PCCE	$ 10.93	per MMBTU	(net public cost)
GB cost of energy	$ -0.12	per MMBTU (supported)	(net return to GB)
Customer Perspective	**Results**		
Net Present Value	$ 490,927		(lifetime)
SIR	1.08		(financing period)
SIR	1.19		(lifetime)

Calculation Details and Sources

The results summarized above were generated by applying the best available data on the project and C-PACE program, based largely on the *ex-ante* estimates of project performance, and organization-wide program delivery costs.

Table 2: Project Financing Details Provided in the C-PACE Scenario Report

Total project implementation costs		$2,689,570	
Utility incentives		$234,860	
Portion financed		91%	
C-PACE capital (Green Bank investment)		$2,454,710	
C-PACE interest rate		5.60%	
C-PACE financing term		16	years
Estimated project lifetime (longest lasting measure)		25	years
Portion of project financed		100%	
Discount rate applied for present value analysis		6%	
Energy inflation rate		3%	
Employment supported (direct + indirect)	*(lifetime)*	46	job-years
Energy savings	*(lifetime)*	66,327	MMBTU
Estimated GHG reductions	*(lifetime)*	8,266	tons CO_2

1. Societal Perspective: Environmental and Economic Objectives

The societal perspective cost-benefit analysis was performed using data readily available from the C-PACE Scenario report as such:

Employment Objective ($ invested / job-year supported)
= Green Bank Investments / estimated direct, indirect and induced job-years supported

GHG Reduction Objective (tons CO_2 eq. / $1,000)
= Estimated GHG reductions resulting from clean energy supported / Green Bank Investments

The GHG reductions are dependent on the energy performance of the supported systems, and will be influenced by fluctuations in the electrical utility grid intensity throughout the lifespan of the project; thus there is some degree of uncertainty to the GHG reduction estimates. The total GHG reductions delivered was reduced by the portion of the project implementation costs covered by utility incentive (9%).

2. Green Bank Perspective: Public Cost of Clean Energy (PCCE)

The PCCE for the sample project was calculated through a present value analysis of all cash flow streams, including energy savings, C-PACE program costs, ZREC payments, utility incentives and tax credits (including accelerated depreciation). These collectively totaled $725,009. The total clean energy delivered was provided in the Scenario Report, and is stated in Table 1 above.

Public Cost of Clean Energy ($ / MMBTU)
= Present Value of Public Costs / Total Clean Energy Delivered

The analysis assumes the performance of the systems will provide the expected energy cost savings, and that energy prices will increase steadily; in this case a 3% per year assumption was applied in the C-PACE Scenario Report which provided a portion of the input data used in this analysis.

The Green Bank Cost of Clean Energy was assessed based on an estimation of overall C-PACE program costs from the 2013 FY Green Bank Audited Financial Statement, Town Administration Costs, and total C-PACE Program Capital Advanced from 2013-2015 (provided from the C-PACE database). In the absence of attribution results, the results represent the average cost (or return) per MMBTU *supported* by Green Bank financing.

Green Bank Cost of Clean Energy ($ / MMBTU)
= NPV of Green Bank Investments / Total Clean Energy Delivered (Supported)

Table 3: C-PACE and Green Bank Program Cost Data

Net GB commitments June 2014	*Total*	$63,529,051
	C-PACE	$14,294,826
	% for C-PACE	23%
2013 FY GB Administration	*(from audited financial statements)*	$1,811,000
2013 FY GB Organizational Costs	*(from audited financial statements)*	$1,180,000
C-PACE municipal costs 2013-2015		$100,228
GB Capital Advanced for C-PACE Program Financing	*2013-2015*	$33,613,832
Portion of GB Capital Advanced for Sample Project	*(Project's portion of 2013-2015 C-PACE total)*	7%

The data presented in Table 3 above represents available inputs used to determine the C-PACE program costs, which are presented in Table 4 below. With time it is expected that the Green Bank will develop more precise measures of the C-PACE (and other financing program) administrative and running costs, and possibly be able to attribute file management and customer acquisition costs to specific projects. This will support a more accurate assessment of the overall cost/return of individual C-PACE project financing to Green Bank.

Table 4: Estimated Program Costs Attributable to the Project

NPV Loan to Green Bank	*$93,460.53*	(net return for GB)
Attributable Municipal Costs	*-$36,596.51*	
Attributable GB Admin + Org. Costs	- $49,147.91	
Net GB costs/benefit	$7,716.10	(net return for GB)

The results suggest that Green Bank generates a small net return for this project, which helps to slightly lower the overall PCCE result above. However, this result does not account for Green Bank's impact to enable or to increase the scope or size of the project. If attribution studies were performed, it may show that Green Bank's influence to lower the PCCE is much greater than the small net return generated for Green Bank indicates in Table 4.

Participant Perspective: Savings to Investment Ratio (SIR)

The lifetime SIR was calculated for this project based on the ratio of the total present value of the C-PACE assessment repayments, and the present value of the energy bill savings. The project NPV is also presented to show the extent of the participating customer's return for the C-PACE investment over the operating period of the measure with the longest EUL (25 years) for the solar PV system.