

EVALUATION FRAMEWORK ENERGY BURDEN REDUCTION FOR SOLAR CUSTOMERS

Savings in Dollars from Commercial & Residential Solar Installations



Overview

The Connecticut Green Bank measures its positive societal impacts across a number of categories, including economic development, environmental impact, and public health. Another area of impact the Green Bank seeks to track is the financial savings achieved by residents and businesses that install solar photovoltaic (PV) systems at their homes or commercial properties. While these systems are helping to create jobs and tax revenues, and decreasing greenhouse gas emissions, there is also often a direct financial benefit in the form of a reduced energy burden to the participating family or business. To those considering going solar, the financial savings can be a key motivator.

Solar Deployment Structures

The Green Bank has used both property-owner (loans) and third-party ownership structures (leases and power purchase agreements) to deploy distributed solar generation in Connecticut in the residential and commercial sectors. Regardless of the structure, these products have a common aim of providing the building owner with clean energy at a price (inclusive of financing) that is less than what they would have paid for electricity from the utilities.



A drone photo of the solar PV system at the SoNo Ice House, a state-of-the-art facility featuring two ice skating rinks, in South Norwalk.

Report Usage

The Connecticut Green Bank proposes to use the Energy Burden Reduction Methodology shown in formula 1 to calculate estimated Savings in Dollars for their residential and commercial solar PV customers. The difference between the cost of electricity for a customer using a Green Bank supported solar PV system and a customer not using such a system is equal to the dollars a customer has saved (i.e., energy burden reduction). Our goal is to make this Energy Burden Reduction for Solar Customers report into the official methodology for calculating actual savings in our Solar Lease and Solar Loan portfolios.

Methodology

This report calculates the Energy Burden Reduction for residential and commercial customers participating in Green Bank Programs in Dollars. Generally, Savings in Dollars is calculated by subtracting the Hypothetical Avoided Utility Expense by Solar Lease or Loan Expense, shown below in Formula 1. The Solar Expense is calculated differently for customers depending on the program in which they participate. For Residential customers, savings is only positive if the hypothetical avoided utility cost of the solar PV generation is greater than the customer's Solar Lease or Loan Payment, shown in Formula 2. For commercial customers, savings is strictly the difference between the utility rate and a customer's contractual PPA rate all multiplied by the Solar PV Generation, shown in Formula 3.

Hypothetical Avoided Utility

Expense: Hypothetical avoided utility expense calculations are the same for UI and Eversource customers, shown in Formula 4. However, various charges differ by rate class and date.

We only consider kWh charges for solar PV because residential electric rates don't have demand charges.

The utility rates used are standard offer rates. The actual rates were recorded off Public Utility Regulatory Authority's (PURA) docket website since

January 1, 2011 for UI's GS, GST, LPT and residential R rate classes, and Eversource's rate classes 1, 5, 30, 35, 37, 40, 55, 56 and 57. Hypothetical Avoided Utility Expense is the Solar PV generation times the kWh Utility Rate for each month, for their respective rate class.

$$(Formula\ 1)\ Savings = Hypothetical\ Avoided\ Utility\ Expense - Solar\ Expense$$

$$(Formula\ 2)\ Posigen/SL1/SL2\ Savings = (Utility\ Rate * Solar\ PV\ Generation) - Solar\ Expense$$

$$(Formula\ 3)\ Commercial\ Savings = (Utility\ Rate - PPA\ Rate) * Solar\ PV\ Generation$$

$$(Formula\ 4)\ Utility\ Rate = (Generation\ Charge + Policy\ and\ Other\ Delivery\ Charges + Transmission\ Charge + Distribution\ Charge + Demand\ Charge + Combined\ Public\ Benefits\ Charges)$$

Solar Expense

PosiGen/Solar Lease 2/Solar Loan 1

Escalating Lease Price: Residential customers with escalating lease prices have a predetermined lease price/kWh that increases at a compounding escalator rate every year on the anniversary of the energize date.

The report calculates the number of anniversaries since the energize date (in the Factor column) then calculates the Adjusted Lease price shown in Formula 5.

$$(Formula\ 5)\ Adjusted\ Lease\ Price = Lease\ Price * (\$1 + Escalator/100)^{Factor}$$

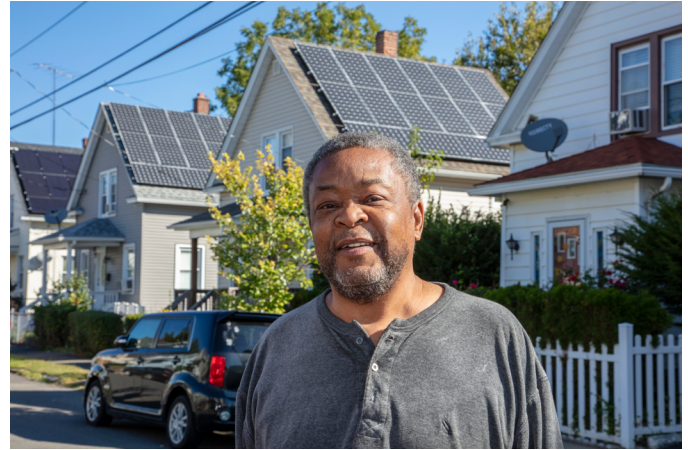
Fixed Lease Price: Residential customers with fixed lease prices will be charged the same amount each month, depending on their respective predetermined lease price, shown in Formula 6.

Repayment is complete: Solar Lease Expenses are structured to be fully repaid before the end of the system's life cycle. If the Solar Lease Expense is fully repaid, naturally there will be no Solar Lease Expense. Savings will be equal to the equation in Formula 7.

Escalating PPA Rate: Customers with an escalating PPA rate see their PPA rates increase by a compounding escalator rate every year on the anniversary of the commercial operation date. The report calculates the number of anniversaries since the commercial operation date (in the Factor column) then calculates the Adjusted PPA price shown in Formula 8. Solar Expense is then calculated by multiplying the adjusted PPA price/kWh by the Solar PV kWh generation shown in Formula 9.

Locus Energy: Our Solar PhotoVoltaic systems continuously upload production data to Locus Energy's web platform on a fifteen minute basis.

Fixed PPA Rate: Customers with fixed PPA rates pay the original PPA rate throughout the term of their agreement. Their Solar Expense is shown in Formula 10.



"Everyone said it was crazy to go solar, now they all want it. People don't realize there are savings. Our bill during the winter was \$460 and now it is \$15." — Melvin, who went solar in June 2015 and convinced three neighbors to also go solar with PosiGen

(Formula 6) Solar Expense = Fixed Lease Price

*(Formula 7) Savings = (Utility Rate*Solar PV Generation)*

(Formula 8) Adjusted PPA Price = Original PPA Rate(1+Escalator/100)^Factor*

*(Formula 9) Solar Expense = Locus kWh Generation*adjusted PPA Rate \$/kWh*

*(Formula 10) Solar Expense=Locus kWh Generation*Original PPA Price \$/kWh*

Controls: The Green Bank has sought feedback from PURA and DEEP. The Green Bank has implemented the following as controls around this and other associated processes:

a. Estimate to Actual Production – Regular review of the estimated production (PowerClerk) vs. the actual production;

b. Staff Performance Review –regular review of fleet performance by senior staff responsible for the programs; and

c. Annual Audit Requirement – independent third party auditor to undertake the following as part of the regular review of Green Bank Impact:

- * Review methodology for reasonableness
- * Assess process for data collection, analysis, and reporting.



With a roof covered with solar panels, the Glenbrook Industrial Park in Stamford is home to a number of artisans, makers and light manufacturers.

Other Considerations

Net Metering Income: The Green Bank has a practice of building our solar PV systems up to 85% of commercial customer's demand. Due to our sizing practice, our solar PV systems were built in such a way where Solar PV generation is not expected to exceed yearly customer kWh demand.

Off peak usage only in Time-of-Day Utility Estimate

Calculation: Utility providers differentiate their prices depending on what time-of-day the energy is consumed. Research shows that peak hour prices are always more expensive than, or equal to, off peak hour prices. Therefore, in an effort to be conservative in the estimate of savings, only use off peak charges in the Hypothetical Avoided Utility Expense calculation. In the future, consideration will be given to adjusting the Hypothetical Avoided Utility Expense calculation to include peak prices.

The only rates that differentiate prices between peak and off peak usage are Eversource's rates 37, 41, 55, 56, 57 and UI's GST and LPT rate; there is no time-of-

day calculation for Eversource rate 1, 5, 30, 35, 40 and UI's R and GS rate.

Automation: This report is almost entirely automated. The Green Bank uses PowerBI for its data analysis. We obtain and record PURA rates quarterly.

Additional Improvements: Incorporate a Peak vs Off-peak kWh model to estimate peak charges for our sites with Time-of-Day rates.

Additional Notes:

1. Commercial customers have the option to purchase supplied energy from third party providers, not just Eversource and UI. However, we are not considering third party utility providers. It is important to note that third-party providers are almost always cheaper for C&I customers than Last Resort.

2. We assume the customer billing month starts on the first day and ends on the last day each month. We assume standard offer rates.

About the Connecticut Green Bank

The Connecticut Green Bank was established by the Connecticut General Assembly in 2011 as a part of Public Act 11-80. As the nation's first full-scale green bank, its mission is to confront climate change and provide all of society a healthier, more prosperous future by increasing and accelerating the flow of private capital into markets that energize the green economy.

This is accomplished by leveraging limited public resources to scale-up and mobilize private capital investment into Connecticut. For more information, visit www.ctgreenbank.com.

