



Ensuring New York Solar Programs Reach Low-Income Residents

Spring 2014

Authors:

Christophe Jospé (Manager), Curtis Probst (Deputy Manager),
Mara Elana Burstein, Tiancheng Deng, Erica Helson, Chanelle Mayer,
Kim Palacios, Igor Valdebenito, Kirstin Verriest, Bora Youn

Faculty Advisor:

Professor Sara Tjossem



COLUMBIA | SIPA

School of International and Public Affairs

Contents

Executive Summary	3
Solar Photovoltaic Programs in General	5
National Growth	5
Advantages of Solar Energy	6
Barriers to Solar Adoption	7
Barriers to Low-income Adoption	9
Solar and Low-Income Programs in Other States	9
States with High Solar PV Adoption	9
States with Low-Income Energy Savings and Solar Programs.....	12
Alternative Financing Models Developed in Other States.....	14
Green Banks: A New Financing Model.....	15
New York Solar Characteristics	15
Insolation Characteristics	15
Electricity Prices.....	16
Energy Usage.....	16
Solar Photovoltaic (PV) Programs in New York.....	17
Renewable Portfolio Standards (RPS) in New York	17
Policy Incentives.....	18
Hindrances to Solar Adoption in New York	22
New York Solar Market Data and Analysis	23
Solar Installation Databases	23
Methodology	26
Data Analysis.....	27
Solar Employment Data.....	32
Policy Recommendations	33
Conclusion	38
Appendix.....	39
Appendix 1: Case Study of Arizona Net Metering Battle.....	39
Appendix 2: Case Study of Opposition to RPS Improvements.....	39
Appendix 3: NYCHA Energy Efficiency/Renewables Discussion	41
Appendix 4: Multifamily Solar Housing Developments in NYC	43
Appendix 5: Selected Green Jobs Providers in New York State	45
Works Cited	47

Executive Summary

Background

Solar energy is an increasingly important component of United States energy generation. Solar photovoltaic (PV) rooftop arrays show particular promise for increasing renewable energy generation. Promoting solar PV requires a tailored approach for each customer segment (e.g., residential, commercial) and income level (low, medium, or high). Low-income households stand to benefit from solar because they spend a high proportion of their income on electricity expenses, yet face the greatest hurdles for adoption. While solar PV has traditionally been seen as a luxury good, for a decade, the not-for-profit organization GRID Alternatives (GRID), has helped lower-income families benefit from solar energy through its expertise, fundraising, outreach, volunteering, and workforce training.

Research Objectives

As GRID expands its operations from California and Colorado to New York State, it faces two questions:

- *Is solar PV reaching lower-income households in New York?*
- *What policies might make solar more accessible to lower-income communities?*

Research Methodology

The Columbia University consulting team evaluated policies and characteristics that impact residential solar adoption in New York and other states. The team also examined data on solar installations in New York. Additionally, almost 30 interviews were conducted with key stakeholders to gather insight into current initiatives.

Solar PV Programs in General

Adoption of solar PV is growing in the United States, albeit from a comparatively small base. Solar offers advantages that should spur further adoption, but the industry also faces barriers. Several incentives exist on state and federal levels to help solar reach cost parity. Many low-income households are not able to directly use the Investment-Tax Credit, however, and face other circumstances that limit their solar adoption.

States with High Solar Adoption and/or with Assistance for Low-Income Households

California, Arizona and New Jersey have the greatest solar capacity because they encourage policies like Renewable Portfolio Standards and offer tax incentives. California, Connecticut, District of Columbia, Hawaii, Montana, Pennsylvania and Washington specifically assist low-income households in adopting solar. Additionally, some states have or are developing “green banks” to finance renewable energy and energy efficiency more generally.

Solar Suitability in New York State

While different policies can reduce the cost of solar systems, several other factors influence solar distributed generation specific to New York. These include low insolation relative to other states, high power prices, and varying energy usage patterns within the state.

Current Status of Solar PV in New York State

Major New York policies that promote solar adoption include a Renewable Portfolio Standard, the New York Sun Initiative, and other incentives such as utility-administered programs, state and local tax credits, and the Green Jobs Green New York program.

Solar adoption in New York is hindered for several reasons including licensing and permitting complexities, no virtual net metering for residential customers, high soft costs, limited solar incentives specifically for low-income residents, and characteristics of the housing stock.

New York Solar Data and Analysis

Sources of solar installation data come from the City University of New York (CUNY), New York Energy and Research Development Authority (NYSERDA), and the National Renewable Energy Laboratory (NREL) through the US Department of Energy. While datasets are somewhat limited, information suggests that overall, solar adoption has been concentrated in moderate- to upper-moderate income levels, with little adoption among low-income communities.

Solar Employment Data

As a nascent industry, data on solar employment is limited; however, studies show that job creation benefits exist. Several organizations in New York provide workforce training similar to GRID's program, offering a potential opportunity for partnership.

Recommendations for GRID

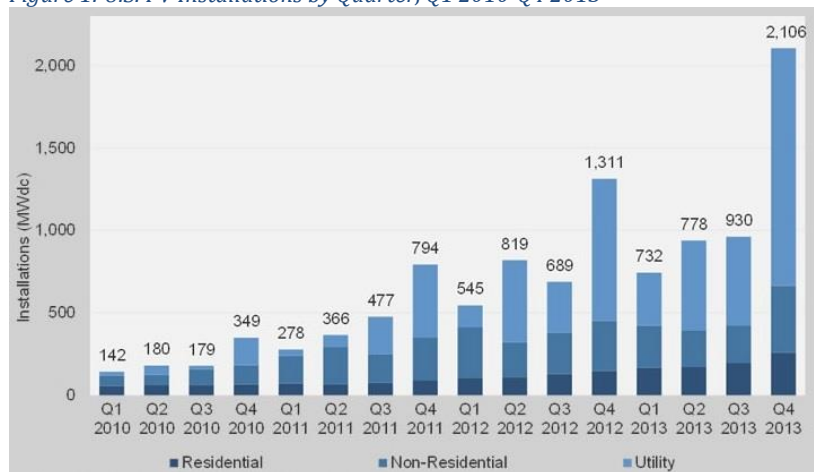
The Columbia University consulting team suggests different areas where actions can positively impact solar adoption for low-income residents in New York.

Solar Photovoltaic Programs in General

National Growth

Solar PV is growing rapidly despite comprising only 0.21% of total U.S. electricity supply for the twelve months ended January 31, 2013.¹ This trend stems from a variety of state and nationwide policies, a reduction of costs, and increased availability of financing. As a result, some expect that solar energy will provide 14% of U.S. electricity by 2030, and 27% by 2050.² In 2013, capacity increased 41% from the previous year (4,751 MW of new PV capacity)³ although only about 20% of new installations were distributed residential (see Figure 1 below).⁴ This year is expected to result in approximately 6,000 MW of new PV capacity, or enough to provide electricity for over 700,000 homes.

Figure 1: U.S. PV Installations by Quarter, Q1 2010-Q4 2013⁵



On a national level, solar PV has grown significantly as a result federal incentives, including the Investment-Tax Credit, the SunShot Initiative, and the American Recovery and Reinvestment Act summarized below.

Investment-Tax Credit

The 30% Investment-Tax Credit (ITC) is the primary federal incentive to increase solar adoption. Enacted as part of the Energy Policy Act of 2005, the ITC significantly reduces the cost of solar for taxpayers and also provides market certainty, which allows increased investment, ultimately lowering consumer costs. However, public sector enterprises, not-for-profits, and low-income consumers have limited ability to take advantage of the credit. Several market participants cite the more recent proliferation of leasing or “power purchase agreement” structures as a way for these customers benefit indirectly from the tax credit. Although the ITC is set to expire in 2016, many believe that it will be extended.

SunShot Initiative

The SunShot Initiative is a nation-wide effort, funded by the U.S. Department of Energy (DOE), to reduce balance-of-system (BOS) costs by driving creation of research, manufacturing, and solar market solutions. BOS costs include soft costs such as marketing, permits, and license fees. The SunShot Initiative's goal to reduce the price of solar to \$0.06 per kWh could lead to 390,000 new solar jobs by 2050.⁶

American Recovery and Reinvestment Act

The American Recovery and Reinvestment Act (2009) allocated \$16.8 billion for the DOE Office of Energy Efficiency and Renewable Energy. Of this amount, funds to lower solar BOS costs included grants for High Penetration Solar Deployment (\$42.05 million) and Photovoltaic Systems Development (\$50.67 million).

Advantages of Solar Energy

Solar power is renewable and relatively clean, offers stable generation costs, and can promote distributed generation.

Clean Domestic Source of Energy

Solar PV produces clean, renewable energy that is not sourced from fossil fuels which lead to climate change. Additionally, solar energy provides more long-term certainty than traditional fossil fuel sources.

Stable Cost Profile

Although installation costs vary by state, the amount spent on solar installations ought to be recouped through monthly utility savings. For example, in New York, the current average cost of a residential solar system is \$9,856, and average monthly savings is \$130 (or \$1,560 per year)⁷ for a payback period of less than seven years. The economics of solar installations will improve as system costs decline further.

Reduced Reliance on the Grid

Distributed solar energy systems produce electricity on site, and often produce the greatest quantity of electricity during times of peak demand. Accordingly, an increase in these systems should reduce overall reliance on the electricity grid. This may reduce the need for increased transmission capacity.

Reduced Need for Utility-Scale Generation

Increasing solar capacity reduces the amount of utility-scale generation required. However, over time, increased use of distributed solar may require additional investment in electricity storage or transmission and distribution infrastructure.

High Scalability of Distributed Generation

Distributed generation (DG) solar can permit net metering, which allows customers to not only purchase from, but also sell power to, the grid. Moreover, adoption is

expedited because only the homeowner needs to decide to go solar, unlike the more complex siting of traditional power generation facilities.

Barriers to Solar Adoption

Barriers that impede market growth include siting issues, cost-effectiveness, incentive uncertainty, licensing and permitting complexities, utility company issues, and landlord/tenant issues.

Siting

Only a certain percentage of housing stock is especially suitable to install rooftop solar due to shading by trees, substandard roofing, and other factors. These factors prevent some building owners from taking advantage of the technology.

Cost Effectiveness

The cost of PV panels is on the decline^a, although high BOS costs contribute to the high price of solar. States like California and New York have reached grid parity for some customers (i.e., the cost of grid-sourced power is equal to the cost of power from on-site generation).⁸ While this may be true for large, commercial solar projects or for homeowners with high electricity bills, solar remains more expensive than grid-sourced power for most Americans.

Incentive Uncertainty

The federal Investment-Tax Credit and state-level incentives significantly reduce the price of solar. Though these incentives help the solar industry by lowering costs and spurring growth, the uncertainty of whether these incentives will continue, and in what form, can harm the market by limiting investment. For example, the 30% federal ITC is set to expire in 2016, so some potential market entrants may hold off until they know it will be renewed.

Licensing Requirements

In other states such as California, there are uniform licensing requirements for contractors that install solar equipment. New York has no uniform licensing standards. This adversely impacts the installation costs and the rate of adoption as licensing requirements can vary across county and city borders.

Inconsistent Permitting

The great variation in permits required by different municipalities drives up costs borne by both solar installers and homeowners. Standardized permit requirements at the state or federal level would streamline processes and produce installer and consumer savings.

^a This is part of a broader and continuing trend. For example, GreenTech Media found that the average price of solar panels dropped by 97.2% between 1975 and 2012.

Utility Company Issues

Utility costs such as maintaining the grid are borne by all customers through electric bills. Utility companies are normally paid per kWh delivered, and have no natural incentive to reduce customer electricity usage. More recently, “decoupling”, which allows utility revenues to be recovered independently from the volume of electricity delivered, may reduce disincentives to solar adoption^b. Nevertheless, even in jurisdictions where there is a decoupling of rates, utilities still have limited incentives to promote distributed generation. Distributed generation may also challenge utility company operations by producing fluctuations in supply that are beyond the control of the utility.

Landlord/Tenant Issues

Another major barrier to the solar industry is its difficulty in reaching the rental market that constitutes about one third of the housing in the U.S.⁹ Renters cannot install solar because they do not own the building and therefore the electric meter, and landlords lack an economic incentive to reduce energy costs borne by tenants. About half of all NYC residents rent, effectively denying them access to distributed solar on their own.

High Upfront Costs

While using the sun for fuel seems free, and solar installations require relatively low operation and maintenance costs, the upfront costs of solar PV are much higher than conventional (fossil fuel-powered) generation. The effective cost of solar is also driven by solar power’s relatively low capacity factor, which is the ratio of actual output versus a theoretical output limit. Due to both the patterns of sunshine and constraints of semiconductor devices, solar PV normally has a capacity factor of 25% or less. Estimates of the levelized cost^c of solar PV and its comparison to other energy sources are listed below in Figure 2.

Figure 2: Major energy sources with capacity factor and levelized cost

Energy form	Capacity factor (%)	Levelized cost (¢/kWh)	Energy form	Capacity factor (%)	Levelized cost (¢/kWh)
Utility solar	25	6~20	Coal	85	7.4~8.8
Dist. Solar	25	15~30	Gas	87	5~7
Wind	34	6~10	Nuclear	90	6~10
Biomass	83	4.7~12	Hydro	52	4.8~8.6

This implies that significant incentives are required to support residential solar growth until the cost structure changes.

^b It is possible that decoupling may produce disincentives for customer adoption if large fixed charges are levied for use of the grid

^c Levelized Cost is the price at which electricity must be generated from a specific source to break even over the lifetime of the project.

Barriers to Low-income Adoption

Low-income households in the U.S. spend a greater proportion of household income on electricity bills, often double that of wealthy households¹⁰ and sometimes as high as 20% of their household income.¹¹ In the northeast U.S., the energy burden for low-to-moderate-income households falls between 7-29%, much higher than the 3% figure for middle-to-high-income households. The energy expenses for New York low-income households exceed \$4 billion annually.¹²

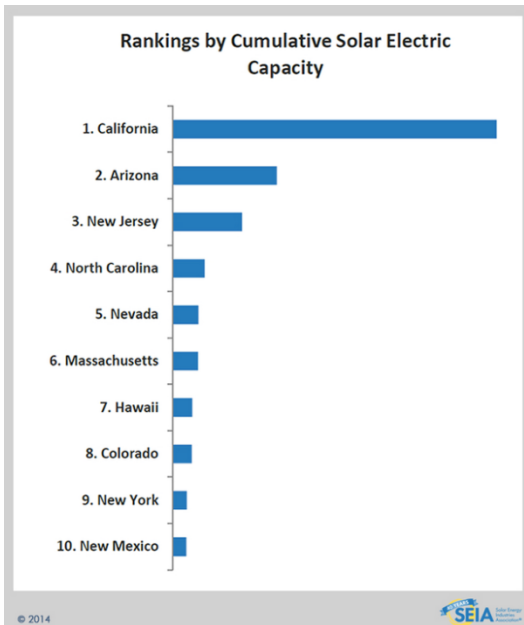
Beyond the factors limiting the adoption of solar in general, low-income homeowners face additional challenges because they (a) are often unable to benefit directly from tax credits, (b) are more likely to be renters, or (c) may lack the creditworthiness to obtain necessary low-cost, long-term financing.

Solar and Low-Income Programs in Other States

States with High Solar PV Adoption

Ten states (see Figure 3 below¹³) account for 85% of installed capacity while accounting for only 28% of U.S. population and 21% of electricity consumption.¹⁴

Figure 3: Rankings by Cumulative Solar Electric Capacity¹⁵



The high level of solar adoption reflects strong public policy initiatives such as:

- Renewable Portfolio Standards (RPS) which requires utilities to produce or procure a certain amount of renewable energy¹⁶

- Net metering which allows solar power system owners to receive the retail rate for excess electricity supplied to the grid, thus improving the cost benefit calculation for homeowners
- Rebates, incentives, and tax exemptions which help defray the upfront or ongoing cost of solar installation
- Creative financing options that help reduce the ongoing costs of solar installation¹⁷

This section focuses on the actions taken by the top three states by installed solar capacity: California, Arizona, and New Jersey.

California

As of April 2014, California leads the nation with more than 5,660 MW of solar capacity, enough to power more than 1,200,000 homes. California reached this level of adoption through a strong RPS, a net metering policy, and diverse rebates and incentives.

California's RPS, established through Senate Bill 1078 (2002), and accelerated by SB 107 (2006), requires retail electric providers to increase renewable energy procurement to 20% by 2010.¹⁸ This goal was increased again through Executive Order S-14-08 (2008) to require 33% of electricity from renewables by 2020.¹⁹ The investor-owned utilities (IOUs) are currently on track to reach the 2020 goal.

California's electric customers also benefit from net-metering, virtual net metering, and co-energy metering which incorporates time-of-use rate schedules.²⁰ California regulators are currently weighing the benefits and drawbacks of ending the net metering program after 2014. Ending this program could significantly reduce the long-term payback of solar installations, thus making it a less attractive investment.²¹

Go Solar California, a joint effort of the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC), aims for the installation of 3,000 MW of solar energy systems on homes and businesses by 2016. With a budget of \$3.4 million (2007-2016), it offers programs such as the California Solar Initiative (CSI), New Solar Homes Partnership, and various programs under the direction of publicly owned utilities.²² These programs offer rebates, incentives, property and sales tax exemptions, loan programs, and/or feed-in tariffs to Californians who install solar.²³ Financing programs like Property Assessed Clean Energy (PACE), which are available nationally but most popular in California, help homeowners take out long-term, low-cost loans from local governments to pay for the upfront costs of solar installation.²⁴

Arizona

Arizona has 1,822 MW of total solar capacity installed, primarily due to the Renewable Energy Standard and Tariff (REST 2006), net metering policies, and utility and tax incentives.²⁵ REST mandates that investor-owned utilities and electric power

cooperatives obtain renewable energy certificates (RECs) and generate 15% of their energy from renewable resources by 2025.²⁶ Additionally, the 15% requirement must include 15% from residential distributed energy renewable sources such as solar.²⁷ To meet REST requirements, electric utilities encourage solar installation through 10 incentive and loan programs, some of which have proved so popular that they have run out of funds. The Arizona Corporation Commission (ACC) is considering what should be done next.²⁸ Arizona's net metering is available to solar customers with systems smaller than 125% of the customer's total connected load.²⁹ More information on Arizona's net metering issue is presented in [Appendix 1](#).

City and state tax incentives, like sales and property tax exemptions, have also made solar installations more attractive in Arizona. In November 2013, after significant controversy, the ACC implemented a \$0.70 per kW fixed fee (not to exceed \$5/month) for solar rooftop owners.³⁰ The fee is meant to address Arizona Public Service's argument that solar customers use the grid without paying utilities for the service. Although the impacts of this decision remain to be seen, there are already reports of reduced interest in solar investment due to this decision.³¹

New Jersey

New Jersey is the third largest state in total installed PV capacity. It has installed more than 1,201 MW almost entirely by policy changes including an aggressive RPS, net metering requirements, rebates and tax incentives, and a Solar Renewable Energy Certificate (SREC) program.³² A 30% rise in electricity rates between 2002 and 2006 also helped to increase residential solar adoption.³³

New Jersey's RPS, established in 1999 and amended in 2008,³⁴ mandates utilities and retail electric suppliers to provide at least 20% of electricity from renewable energy sources by 2020,³⁵ plus 4.1% from solar energy by 2028.³⁶ In addition to the RPS, the state established net metering for distributed generation. The utilities also offer rebates, incentives, and loans to increase residential solar adoption.³⁷

In January 2002, programs funded by ratepayers under the Societal Benefits Charge (SBC) Renewable Energy Program expanded the solar market, especially for PV systems. The SBC was increased in 2004 and established a new rebate program to cover up to 70% of a PV system's installed cost.³⁸ A state sales tax exemption for solar energy equipment and a property tax exemption for the value added by residential renewable energy systems are also available.³⁹

New Jersey's history with Solar Renewable Energy Certificates (SREC) offers insight into a market that allows solar owners to earn and sell credits for each MWh of power generated.⁴⁰ The SREC program helped the state surpass its renewable energy goals. However, there was an outsized response of the market to the availability of generous public subsidies.⁴¹ This outstripped the state's goal for installed capacity and produced an over-supplied SREC market that drove down prices so that PV facility owners received less money per SREC.⁴²

States with Low-Income Energy Savings and Solar Programs

To address issues that negatively affect low-income solar adoption including high upfront costs, poor credit, and requirements for homeownership, several states have adopted specific programs. Based on a national survey, the following states offer interesting programs for low-income residents to invest in solar energy: California, Connecticut, District of Columbia, Hawaii, Montana, Pennsylvania and Washington. Elements from these programs could potentially serve as models to increase low-income solar adoption in New York. Note that some of these states use slightly different definitions of what constitutes “low-income”.

California

The California Solar Initiative’s (CSI) Single-family Affordable Solar Homes (SASH) and Multifamily Affordable Solar Housing (MASH) programs offer upfront rebates for solar systems installed in the most underserved communities. The program’s success is attributed to consistent and reliable funding from electric ratepayers through SB 1 (2006), which allocated \$2.167 billion between 2007 and 2016 to the SASH and MASH programs. Budgets of \$108 million each were established through AB 2723 (2006) by directing at least 10% of CSI funding to low-income solar programs.⁴³ Last year, funding for SASH and MASH was extended until 2021 through the passage of AB 217.⁴⁴

- The SASH program provides fully subsidized 1 kW systems to very low-income single-family homeowners (below 50% of area median income). Highly subsidized systems are available to households at or below 80% of area median income.⁴⁵ To qualify for SASH, applicants must be serviced by an IOU, satisfy income criteria, occupy the home, and be in compliance with California Public Utilities Commission (CPUC) Code 2852 including definitions for low-income housing.⁴⁶ Since SASH’s launch in 2008, applicants have received a total of \$64 million,⁴⁷ facilitating the installation of 3,524 PV systems and training over 12,600 volunteers statewide.⁴⁸
- MASH provides upfront incentives for solar installations on affordable multi-tenant properties to offset energy used in common areas (\$1.90/Watt) and by tenants (\$2.80/Watt). Applicants must satisfy the “low-income residential housing” definition in CPUC Code 2852, hold an occupancy permit of at least two years, and verify that at least 20% of the tenants are low-income. As of March 2013, the MASH program completed 287 projects, accounting for 18.4 MW of electricity generated from solar installations, with an additional 83 projects pending for 11.3 MW.⁴⁹

Connecticut

Residents with low-to-moderate incomes in Fairfield, Litchfield, and New Haven counties can apply to the Cozy Home Loan program that offers a 10-year loan with a 5.99% interest rate for residential projects on one-to-four unit owner-occupied homes. Loans between \$3,000 and \$25,000 (single family) or up to \$50,000

(multifamily) can be repaid at any time without penalty.⁵⁰ To be eligible, applicants must earn 80% or less than the median income in their area, and be a customer of one of the three qualifying utilities. Though the program focuses primarily on energy efficiency, it has a solar component provided that the installation meets certain state standards for rebates.⁵¹

District of Columbia

Established by the Clean and Affordable Energy Act of 2008 (CAEA), Washington DC's Sustainable Energy Utility (DC SEU) is a non-profit dedicated to reducing the economic and environmental costs of energy consumption. In conjunction with the District Department of the Environment (DDOE), DC SEU offers rebates for solar PV and thermal installations on residential properties. Their Renewable Energy Incentive Program (REIP) is available on a first-come, first-served basis and financed through a Public Benefits Fund administered by the Sustainable Energy Trust Fund. The program offers an option for eligible low-income residents. PV incentives are \$3.00/Watt and capped at \$10,000 per applicant. Solar thermal incentives are 30% of installed system costs (up to \$5,000 for water heating systems, \$2,000 for space heating, and \$5,000 for a combination of both).⁵²

DC SEU recently assessed the program and found that low-income communities were not taking advantage of solar incentives. To address this gap, they launched a Small-Scale Solar initiative in 2012 to target specific communities east of the Anacostia River. As a result, solar energy systems were installed without upfront costs through a combination of renewable energy credits, federal tax incentives, DC SEU incentives, and contractor financing. Before this initiative, fewer than a dozen homes had solar panels; they have since installed 87 systems.⁵³

Florida

Florida Power & Light Company (FPL) recently proposed a voluntary, community-based pilot program to advance solar energy, a portion of which may be available for low-income residents or communities. FPL expects that the program could support 2.4 MW of solar over three years. The program allows citizens who may not be able to install it themselves for various reasons, to further solar adoption without increasing electricity rates by donating \$9 a month to support solar. To encourage participation, FPL's parent company will make a matching contribution to the customer's choice of environmental not-for-profits.⁵⁴

Hawaii

To increase low-income solar adoption, and make clean energy more accessible and affordable, Hawaii passed SB 1087(2013) that authorized \$100 million in securitization bonds to finance a renewable energy loan fund. This fund is expected to provide low-cost financing for homeowners, businesses, renters, and nonprofits to invest in solar panels and other clean energy infrastructure.⁵⁵ Act 211, Green Energy Market Securitization (GEMS), has an initial focus on distributed solar and on underserved markets. It aims to increase solar adoption by consumers who

cannot afford high upfront costs or do not qualify for financing due to low credit scores. Participants have no upfront cost and pay over time. The GEMS program has not yet been implemented, but it may be a model for other states to adopt similar financing mechanisms.

Montana

SB 390 (1999) established the Universal System Benefits (USB) charge, which requires all electric distribution utilities to collect approximately \$1.00/month to finance energy conservation, renewable energy projects, and low-income energy assistance.^{56 57} Seventeen percent of funds collected are required to go towards low-income activities.⁵⁸ Financed through the USB charge, residential customers can apply for a fixed solar incentive (\$1.50/Watt) up to a maximum of \$6,000.⁵⁹ In 2013, NorthWestern Energy, the state's largest utility, contracted with the Rural Sustainability Organization to fund the installation of three, 3 kW grid-tied, solar PV systems in high priority, low-income areas. Additionally, USB charge collections have provided partial funding for systems on low-income housing units.⁶⁰

Pennsylvania

The Pennsylvania Sunshine Solar Rebate Program offers fixed rebates (based on watts) for PV and solar thermal projects for homeowners. For low-income customers, the state provides additional rebates (35% of installed costs)⁶¹ and an application fee waiver.⁶²

Washington

In Washington, a low-income residential housing project that intends to apply for state funding must achieve a minimum number of points for green building measures. Solar PVs are one of the measures that provide points, thus creating an incentive for their use.⁶³

Alternative Financing Models Developed in Other States

Posigen, a provider of residential renewable energy and energy efficiency solutions, has piloted a successful affordable lease program in Louisiana. The program leverages incentives to facilitate negotiations with banks to bring these savings to low- and middle-income families. They offer solar lease products that do not require credit checks, guarantee a certain percentage of energy savings, and negotiate lower capital costs.⁶⁴ Since banks are incentivized to participate in community redevelopment projects through a point system, New York could offer additional points for funding projects specifically aimed at low-income solar. The program's success in Louisiana has given Posigen the opportunity to partner with the Connecticut green bank (CEFIA) to expand into the state.

Green Banks: A New Financing Model

A green bank is a quasi-government agency that uses taxpayer or ratepayer capital to leverage private capital investments in renewable energy or energy efficiency investments.⁶⁵ Green banks may use loans, credit enhancement, securitization or other means to attract private capital.⁶⁶ Several states have established or are expected to develop green banks, including California, Hawaii, Illinois, Massachusetts, Maryland, Minnesota, New Hampshire, New Jersey, New York, Vermont, and Washington. In February 2014, Rep. Chris Van Hollen (D-Md.) announced his intention to introduce a bill to create a federal green bank.⁶⁷ If green banks continue to develop and share successful practices, they can increase financing availability for solar adoption.

Connecticut

In 2011, Connecticut established the first green bank, the Clean Energy Finance and Investment Authority (CEFIA). Since then it has grown, leveraging \$180 million of private capital from \$40 million of public funds in 2013.⁶⁸ Over the next 10 years, CEFIA aspires to finance installation of at least 30 MW of solar PV by using public funds for at least one-third of the investment.⁶⁹ Its programs, including Solarize Connecticut and Solar Lease II, improve the flow of capital to clean energy initiatives. Solarize Connecticut uses a tiered price structure with group-buying discounts designed to save homeowners money by dropping prices as more customers sign up. Additionally, it has a marketing, education, and outreach program to increase residential solar installation and investment.⁷⁰

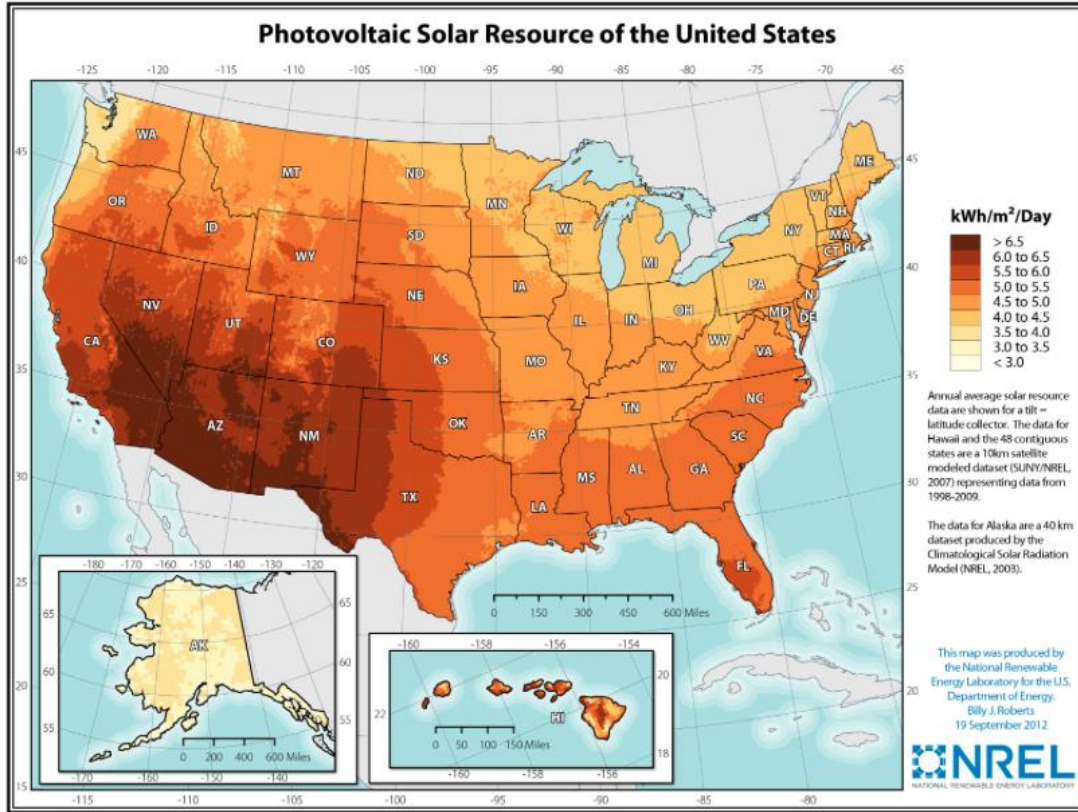
Building on Solar Lease I (a program that used a blend of tax incentives, rebates, and leasing structures), Solar Lease II offers a power purchase agreement (PPA) for customers with lower credit scores. The PPA offers simple monthly payments without a large upfront outlay. It aims to make solar leasing more economically competitive, lower solar energy costs, and increase solar accessibility. The customer saves money by paying for the solar power produced through the PPA, which is less than the avoided power cost.⁷¹ Residential solar customers have the option to choose either an escalating lease or a fixed-price lease. At the end of the 20-year lease, homeowners can buy, return, or extend the lease on equipment.⁷²

New York Solar Characteristics

Insolation Characteristics

According to the National Renewable Energy Laboratory, annual average solar radiation in New York is only about two thirds that of southern California (about 4.2~4.7 kWh/m²/day, see Figure 4).⁷³ Less solar insolation decreases solar PV panel efficiency and thus increases the payback period for installations.⁷⁴

Figure 4: Photovoltaic Solar Resources of the United States⁷⁵



Electricity Prices

According to the U.S. Energy Information Administration's (EIA) annually published average retail electricity prices, New York residential customers pay an average of 19.52¢/kWh. This is 17.3% and 70.3% higher than comparable rates in California and Colorado, respectively.⁷⁶ This favors the installation of solar PV in New York, as the cost of grid-sourced power is comparatively high.

Energy Usage

Many costs of solar installation are relatively fixed (e.g., permitting). Accordingly, large solar systems (designed to displace more grid-sourced energy) will tend to have more favorable economics, all else being equal. Given differences in weather and housing characteristics, solar economics vary within New York. For example, homes upstate generally consume less electricity for cooling than homes downstate. While upstate homes require more energy for heating, it is produced using natural gas, rather than electricity. Therefore, with homes upstate generally consuming less electricity than those downstate, solar PV economics are often less attractive upstate.

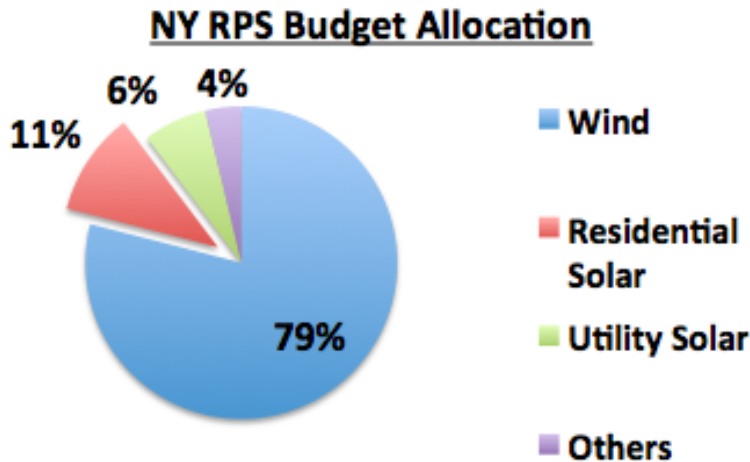
Solar Photovoltaic (PV) Programs in New York

As of June 2013, New York had the 16th largest solar power capacity per capita in the nation, largely due to the NY-Sun Initiative. This helps New York meet its RPS goal of generating 30% of its electricity from renewables by 2015.

Renewable Portfolio Standards (RPS) in New York

When the RPS was mandated in 2004, New York generated 19.3% of its energy from renewable sources (e.g., utility scale hydropower). Less than 12% of current RPS-funded renewable installation capacity is credited to distributed renewable projects (mainly solar). See figure 5 for the amounts allocated to new renewable energy sources in New York State through the RPS fund.⁷⁷

Figure 5 RPS funded allocations in New York State in 2013



The Public Service Commission (PSC) authorized NYSERDA to work with the Department of Public Service (DPS) and allocate \$730.8 million to solar projects from 2012-2015, with \$601.7 million used for solar PV installation. The goal is to raise the actual installed capacity of solar PV from 122 MW as of December 31, 2013 to 409.7 MW in 2015.⁷⁸

NYSERDA offers incentives for distributed solar over 50 kW, “Competitive PV,” as well as “Standard Offer PV” which is under that threshold. Low-income households may only benefit from the latter. According to the 2013 NYS RPS Annual Report, 90% of the Standard Offer PV 2015 target was reached by end of 2013, in contrast to only 54% for Competitive PV. This suggests a greater allocation towards Standard Offer PV could benefit low-income households.

While most residential ratepayers contribute to the RPS fund, low- to moderate-income residents, which are over one-third of the New York population and have significantly contributed to the RPS fund, have not fully participated in the

residential PV incentive programs.⁷⁹ [Appendix 2](#) provides a case study of opposition to RPS improvements in New York, and provides some insight into key participants and their respective issues.

NY-Sun Initiative

In April 2012, Governor Cuomo launched the NY-Sun Initiative. The goal was to install twice as much solar capacity in 2012 than 2011 (from 30 MW to 60 MW), and quadruple the 2011 amount by 2013 (from 30 MW to 120 MW). In 2012, 58.4 MW was installed, falling just short of the stated goal, while the 2013 goal was achieved on time. More than half of this growth is attributable to commercial installations.

The initiative's programs include the expansion of NYSERDA's and Public Service Enterprise Group-Long Island's (PSEG-LI) PV incentive programs, and a BOS cost-reduction program through New York Power Authority (NYPA).⁸⁰ Of the 58.4 MW of customer-sited PV capacity additions in 2012, 34.2 MW were attributable to NYSERDA programs, 23.8 MW to Long Island Power Authority (renamed PSEG-LI) programs, and 0.4 MW to NYPA programs.⁸¹ The NY-Sun Initiative supports both commercial and residential projects, and the statistics cited in this report refer to total combined installations, unless otherwise noted.

Cash incentives are the principal tool used to spur the growth of solar in New York through the NY-Sun Initiative. NYSERDA offers residential (25 kW or less) incentives (PON 2112) to lower the cost of solar installations.⁸² PSEG-LI also offers incentives through its Solar Pioneer Program.^{83d}

In December 2013, Governor Cuomo announced an additional \$108 million in funding through 2015 for the NY-Sun Initiative and extended the initiative through 2023. In 2011, \$24 million went to open enrollment for small- and medium-scale PV and \$30 million to the competitively bid program for large-scale PV projects. New York now has 300 MW of both approved or installed solar capacity and over the next decade it hopes to reach 3,000 MW in installed solar capacity. NYSERDA'S PV incentive targets are projected to hit nearly \$450 million by 2015, up from around \$50 million in 2011. The long-term outlook of the NY-Sun initiative provides a sense of political stability that should ease investor worries.⁸⁴ With continued support for the NY-Sun Initiative, New York is preparing for strong growth in the industry.

Policy Incentives

As summarized in Table 1, and elaborated in the text, New York has adopted a diverse set of policies targeting utilities, municipalities, and consumers to encourage solar production throughout the state.

^d The Solar Pioneer Program for Homeowners is for eligible homeowners in the region to purchase or lease a new solar PV system.

Table 1: Policies or Programs in NYS to promote solar adoption

Utility Targeted	Municipality Targeted	Consumer Targeted
Net Metering	Permit Standardization	NYC Tax Abatement
Utility Rate Structure	Solar Easements	NYS Tax Credit
Feed-in Tariff (Long Island only)	Riverhead Permitting Fee	NYSERDA Incentives
Interconnection Standards		Systems Benefit Charge
Environmental Disclosure Program		Property Assessed Clean Energy (PACE) in some areas
Renewable Energy Portfolio Standards		NY Green Bank
		Green Jobs – Green New York

Utility Targeted Policies and Programs

Net Metering

Net metering allows customers to sell any excess solar energy produced back to the grid. The amount of credit they gain per kWh varies by utility company. The PSC requires net metering benefits be capped at 3% of 2005 peak demand (36 MW). Residential solar systems must be under 25 kW and commercial solar systems must be under 2 MW to be eligible for net metering benefits.

Utility Rate Structure

Utilities and grid operators must be compensated for the use of their goods and services, but there is debate in New York regarding utility rate structure. Decoupling mechanisms disconnect utility revenue generation from the quantity of electricity provided. Without it, utilities are incentivized to sell more electricity and have a disincentive to increase energy efficiency and distributed generation. In April 2007, New York adopted decoupling as a regulatory policy. Decoupling often incentivizes utilities to accept distributed energy generation like solar PV because residential bills increase by 1~2%, mainly from surcharges for electricity distribution and grid infrastructure usage.⁸⁵

PSEG-LI Feed-in Tariff

PSEG-LI offered an initial feed-in tariff program for 50 MW of solar with a second phase (closed on January 31, 2014) adding another 100 MW of solar capacity. The price awarded is determined through a Clearing Price Auction, in which bidders specify a price per kWh for energy delivered to the grid.⁸⁶

Interconnection Standards

In 1999, New York adopted uniform interconnection standards that govern how solar installations are interconnected to the utility grid. There are two sets of standards: expedited process (under 50 kW) and basic process (between 5 kW and 2 MW).⁸⁷ The Solar Foundation gave New York a “B” interconnection policy grade, signaling there is room for improvement.⁸⁸

Environmental Disclosure Program

This PSC policy requires that utility companies and energy service companies disclose their fuel mix and emissions from their suppliers. This provides transparency so that consumers know how much energy comes from renewables versus other forms of energy.⁸⁹

Renewable Energy Portfolio Standards

The PSC mandated that 30% of New York’s electricity consumption come from renewables by 2015. The RPS charge fund, managed by NYSERDA, is separate from the Systems Benefit Charge (SBC).

Municipality Targeted Policies and Programs

Permit Standardization

The Unified Solar Permit for New York was developed by the City University of New York (CUNY) and released on September 20, 2013. Its use is recommended, but not mandated, which creates inconsistencies. Of the nearly 1,600 municipalities in the state, only 20 use the standardized permit and another 19 are in the process of adopting it. In Long Island, 22 municipalities have adopted the Long Island Unified Solar Permit and another 2 are in the process of implementing the unified permit.⁹⁰

According to a CUNY survey, only a quarter of all permit applications received by municipalities are complete and correct on first submission.⁹¹ Standardization of permitting would help to address this problem. NYSERDA offers an incentive of \$2,500 to \$5,000 to help municipalities adopt the Unified Solar Permit. Additionally, CUNY offers support during the transition as part of their work on a DOE Rooftop Solar Challenge II grant.

Solar Easements

These voluntary contracts strive to ensure uninterrupted solar access by requiring nearby new construction not to shade panels. This is a contentious issue, particularly in dense urban areas.

City of Riverhead - Energy Conservation Permitting Fee

This residential incentive allows those with plans to install PV systems a special allowance in building permit fees. There is also a “Fast-Track” process for residential systems that meet minimum technical requirements.⁹²

Consumer Targeted Policies and Programs

NYC Property Tax Credit

This credit offers a tax rebate of 2.5% of PV system expenditures each year for four years (total of 10%) for projects installed between 2013 and 2014.⁹³

Residential Solar Tax Credit

This state tax credit applies to expenditures on PV equipment for single (of 25 kW max) and multi-family (50 kW max) properties. In situations of third-party owned systems, the homeowner may claim a tax credit of 25% of annual lease payments for up to 15 years.⁹⁴

NYSERDA PV Incentive Programs

Customers that pay into the Systems Benefit Charge (SBC)^e can apply for incentives through the following Program Opportunity Notices (PONs):

- PON 2033 – Clean Energy On-the-Job Training: Supports workers in the renewable energy industry by offering training and on-the-job experience.⁹⁵
- PON 2112 – Solar PV Program Financial Incentives: Provides incentives for the installation of grid-connected PV systems. The base incentive is \$1.00/W for the first 50 kW of installed capacity per meter. Larger systems are also eligible for a second tier incentive of \$0.60/W for installed capacity between 50-200 kW per meter. Total incentives may not exceed 40% of installed project costs after tax credits. NYSERDA recently added low-interest financing for small residential units as an option within PON 2112. ⁹⁶
- PON 2156 – RPS Customer-Sited Tier Regional Program: Provides incentives for larger customer-sited PV systems in specified zones.⁹⁷
- PON 2397 – Clean Energy Certifications and Accreditation Incentives: Provides incentives for a number of training programs, including the North American Board of Certified Energy Practitioner’s (NABCEP) program.⁹⁸
- PON 2672 – PV Balance-of-System Cost Reduction: This incentive program is a partnership with NYPA to lower BOS costs.⁹⁹
- PON 2721 – Cleaner Greener Communities: Offers incentives to support the adoption of streamlined permitting for solar PV systems.¹⁰⁰

System Benefits Charge

The SBC was established by the PSC in 1996 to fund programs that focus on energy efficiency, research and development, and low-income sectors. While there are no incentives for solar specifically for low-income residents, there are energy efficiency incentives for low-income residents.¹⁰¹ These programs are only available to customers who pay into the SBC; customers who get their power from PSEG-Long Island or entirely from NYPA do not qualify.

^e Customers of Central Hudson Gas & Electric, Consolidated Edison, New York State Electric and Gas, Niagara Mohawk, Orange and Rockland, and Rochester Gas and Electric utilities.

Property Assessed Clean Energy (PACE)

Property owners can borrow money from selected municipalities for energy improvements to be repaid through property tax assessments. PACE programs are currently administered by Energize New York, and are only available to commercially owned buildings.¹⁰² In other jurisdictions, notably California, residential homeowners have the option to obtain PACE loans.

NY Green Bank

The NY Green Bank, in the early stages of development, is designed to encourage greater private investment in clean energy (see the section on green banks for background information). The NY Green Bank is expected to commence its financing operations in 2014.

Green Jobs - Green New York

NYSERDA established this program, funded in part by the Regional Greenhouse Gas Initiative (RGGI), to offer loans for energy efficiency projects but it is expanding to include loans for renewable energy projects.¹⁰³ The program offers both “Tier I” loans that require customers to meet certain credit scores and other criteria, as well as “Tier II” loans that require, among other things, satisfactory energy bill and mortgage payment history, rather than specific credit scores.¹⁰⁴

Hindrances to Solar Adoption in New York

Apart from barriers to solar adoption discussed above, solar market barriers in New York include complex licensing, high soft costs, and housing stock in New York City.

Licensing Complexities

Unlike California, New York does not issue contractor licenses at the state level.¹⁰⁵ This means that each of New York’s nearly 1,600 municipalities may have different or no licensing requirements for contractors. However, contractor’s licenses are not required in all municipalities; for example, most upstate counties do not require licensing for home improvement contractors.^{106 107}

Licensing is generally viewed as a benefit to both consumers and contractors. License requirements, like passing formal tests and criminal background tests, give consumers confidence that those contractors are qualified for their work.¹⁰⁸ Licensing also provides legal protection to contractors in the event that a contractor needs to make a claim on a contract.¹⁰⁹ Despite the merits of licensing, the lack of unified requirements in New York State is burdensome, time-consuming, and costly for contractors, which could slow the adoption of solar PV in New York.

High Soft Costs

The soft costs for installing solar include non-infrastructure costs like permitting fees, planning and zoning, net metering and interconnection, financing and customer acquisition (e.g., marketing costs for solar developers). Average PV soft

costs in New York were \$5.79/W in 2012 and are expected to decrease as the solar market matures. However, there is high variability in these costs, which in some counties can be 40% above the state average. Certain areas in New York City exceed \$8/W. Growth of the solar market will likely be hindered without a decrease in these costs.¹¹⁰

Housing Stock in New York City

Though the majority of New York State consists of single family homes that could be ideal for solar system installations, New York City poses a particular challenge for solar because of the large number of rental units and multifamily buildings, and the age of the housing stock.

- Rental properties: In 2011, rental units comprised 64.8% of NYC's nearly 3,200,000 residential units.¹¹¹ Renters do not have the authority to install solar panels, which reduces the amount of solar PV installations. Moreover, building owners are not incentivized to install solar because they are often not required to cover the cost of tenant utility bills.
- Multifamily properties: In 2011, 71.3% of NYC housing units was in multifamily buildings versus 28.7% in one or two family houses.¹¹² The economics of solar PV for high-rise multifamily buildings can be poor given the small roof area relative to building energy costs and given rooftop requirements for accessibility that can limit the size of PV installations.
- Age: More than 86% of housing units in NYC were constructed in 1973 or earlier.¹¹³ As a result, the overall age of the building may serve as disincentive for large capital projects more generally.

The New York City Housing Authority (NYCHA) oversees much of the low-income housing within New York City. Some of NYCHA's energy-efficiency activities and its green agenda are discussed further in [Appendix 3](#).

New York Solar Market Data and Analysis

Solar Installation Databases

Analysis of NYSERDA, NREL, and CUNY datasets shows very low adoption of solar PV in low-income communities. The specific locations where solar installations are clustered may provide information for further research. Details of the analysis are provided below.

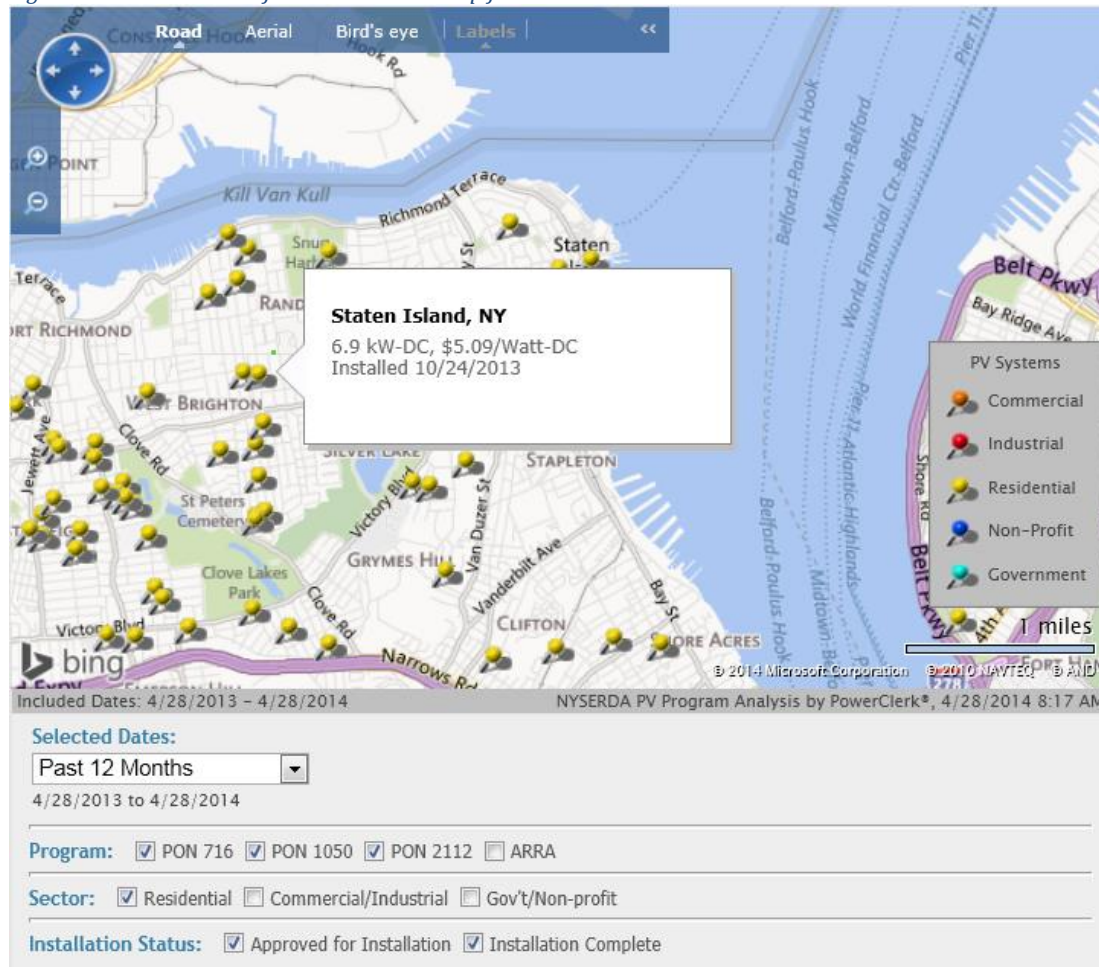
NYSERDA

NYSERDA provides an online report of solar PV installations based on incentive applications, including PON 716 and PON 1050, which have been updated and

included in PON 2112. With NYSEERDA’s data, PowerClerk^f created a real-time interactive heat map of installations by county, by incentive program, or by sector, with each project’s total capacity, price (\$/Watt), and current status. Additionally, PowerClerk provides summaries of the data (e.g., PV fleet energy production, cumulative capacity).

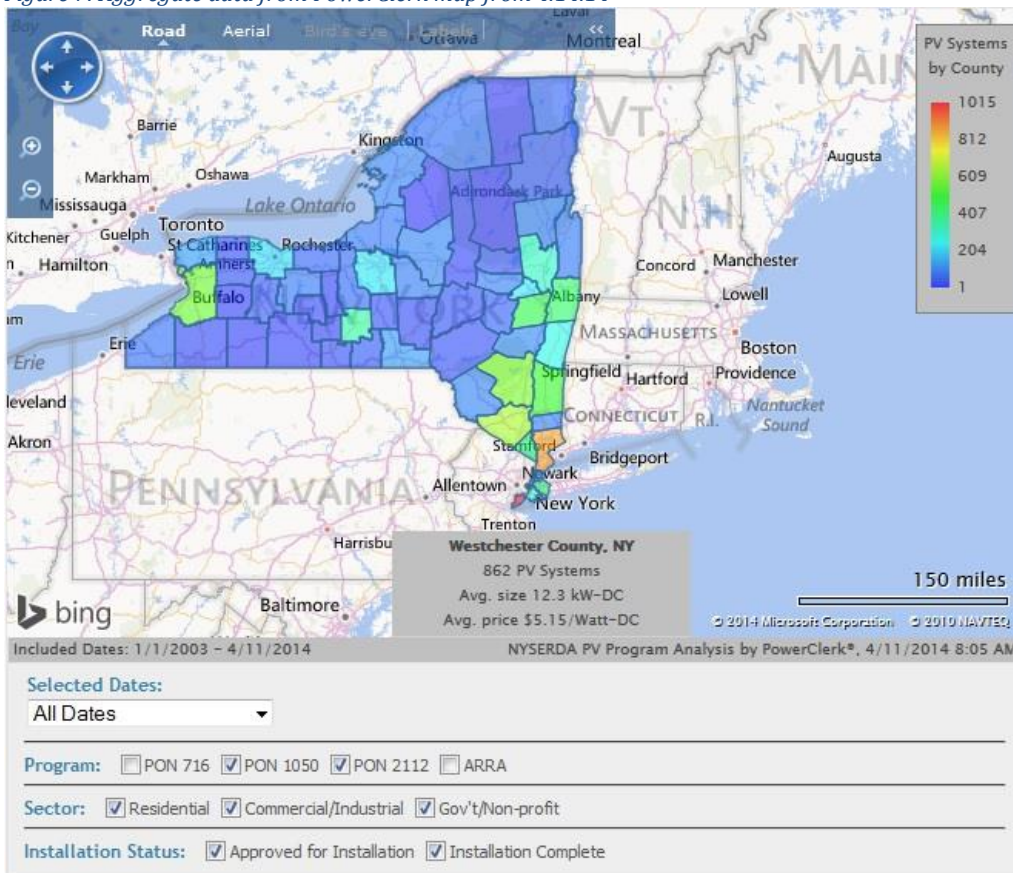
The heat map has real-time data that allows searches based on date range, incentives, status, and sector. As shown in Figure 6 below, the map can pinpoint individual installations, and identify capacity size (kW), price per watt (\$/W), and installation data. On a statewide level (Figure 7), data are aggregated into counties by total solar PV installations, average size of the installations, and average price per Watt. Installations on Long Island are excluded because PSEG-LI/Long Island Power Authority administers those incentive programs. The NYSEERDA map is continuously updated: as of April 4, 2014, the total number of residential solar installations was 7,243.

Figure 6: Individual Data from PowerClerk map from 4.28.14



^f The website of the NYSEERDA’s online report of solar PV installations powered by PowerClerk is nyserda.powerclerkreports.com.

Figure 7: Aggregate data from PowerClerk map from 4.14.14



National Renewable Energy Laboratory (NREL)

The Open PV Project managed by the NREL is a collaborative effort between government, industry, and the public to compile a national solar PV installation database.¹¹⁴ Information on installations includes the size/capacity, location, total cost, and date installed. This data is voluntary, but installers are encouraged to provide additional information,¹¹⁵ which can provide data inconsistencies. To address any data disparities, NREL regularly reviews data and assigns submissions a “score” based on quality.¹¹⁶ Data is available by state, installation size, date, contributor, and zip code, which may be the best way to review statewide solar penetration.

CUNY

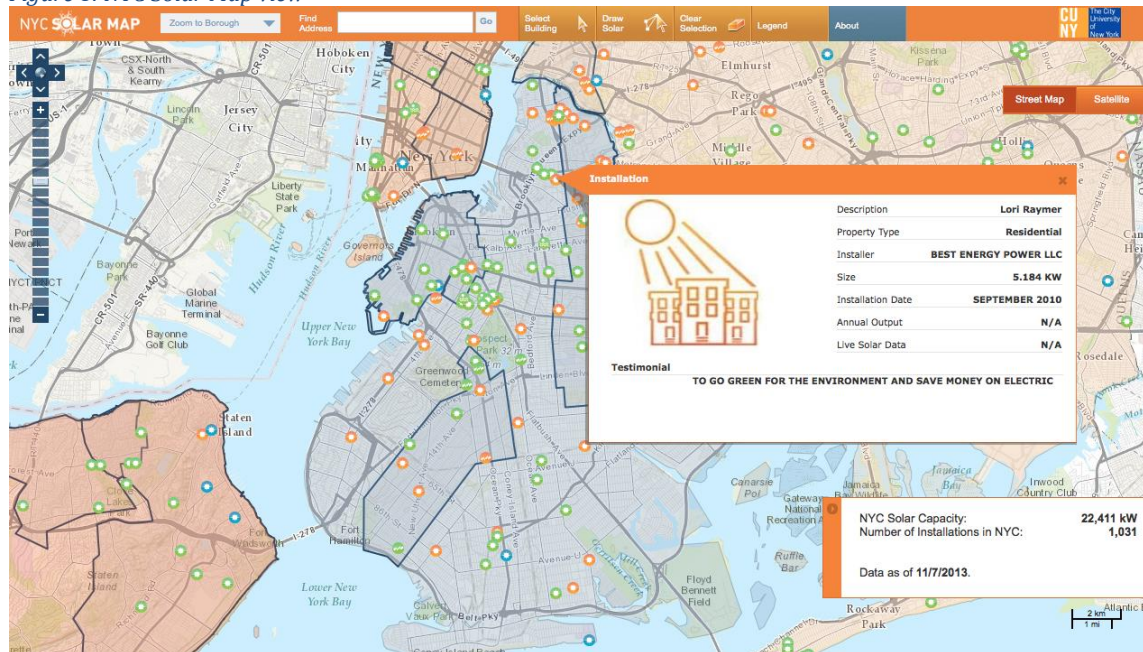
The New York City Solar America City Partnership, led by the City University of New York (CUNY), and integrated by the Mayor’s Office of Long-term Planning and Sustainability and the NYC Economic Development Corporation, created an interactive “New York City Solar Map”^g with current and potential solar installations.

^g The map was funded by the U.S DOE’s “Solar America Cities” program, part of the Solar America Communities program. NYSERDA provided additional funding, while NREL and Con Edison gave technical assistance. The map was created by the Center for Advanced Research of Spatial Information at CUNY’s Hunter College. <http://nycsolarmap.com>.

When installations are highlighted, the map shows its description, property type, installer, size, installation date, annual output, live solar data, and testimonials (see Figure 8). While it only displays solar energy systems that are registered by owners for display, the map contains 1,031 installations and was last updated in November 2013.

The map allows viewers to estimate rooftop solar potential using a computer model that calculates incoming direct and diffuse solar radiation for every square meter of New York City based on the position of the sun, overall atmospheric conditions, latitude, and most importantly, shading. This is an extremely powerful siting tool.

Figure 8: NYC Solar Map view



Methodology

Solar PV Installation by County

We combined residential solar PV installation data from the NYSERDA map with data from the U.S. Census¹¹⁷ to create a scatter plot comparing residential solar installations per 10,000 residents against the median household income by county. This determined the level of solar adoption in low-income counties.

Solar PV Installation by ZIP Code

We used U.S. Census median household income data from the last 12 months¹¹⁸ and NYSERDA's definition of low-income (total income equal to or lower than 80% of the Uniformity with State or Area Median Income, whichever is greater¹²⁰) to determine a low-income threshold of \$44,055 or less. This determined the level of solar adoption in low-income zip codes.

Solar PV in Multifamily Projects in NYC

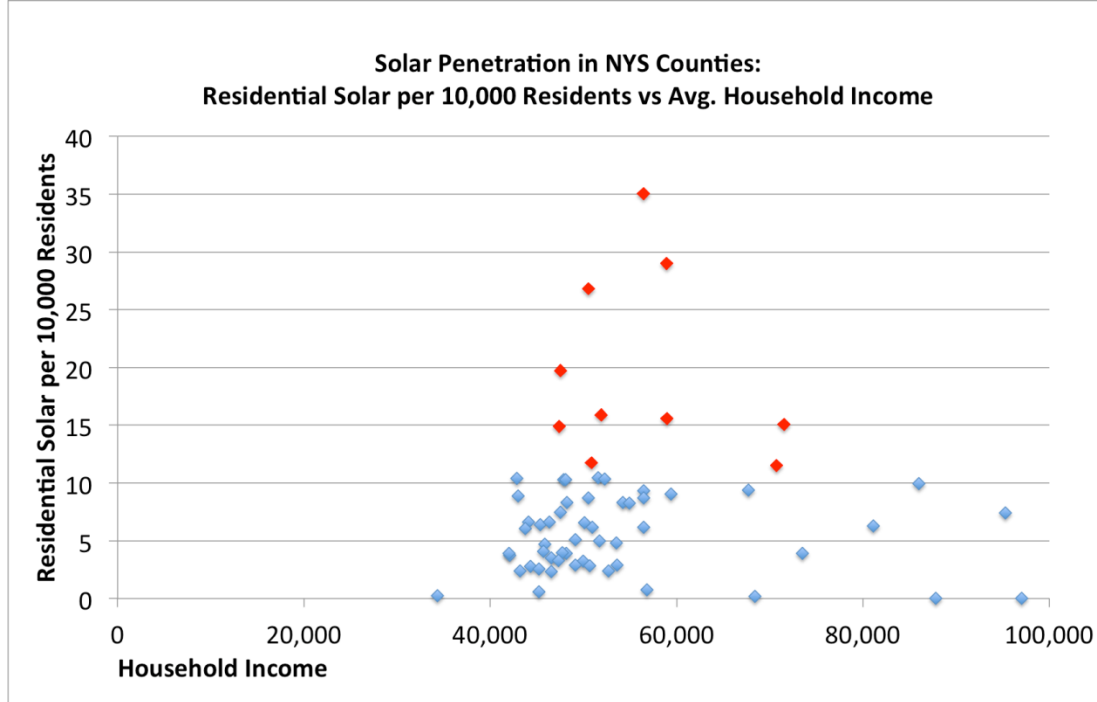
Multifamily projects in New York cannot receive incentives under PON 2112, and instead have to apply under PON 2156, which provides incentives for any type of installations greater than 50 kW.^h With this information, residential projects greater than 50 kW in the NYC Solar Map were identified as multifamily projects. Each project was reviewed to see if it was built as affordable housing or for low-income residents.

Data Analysis

Solar PV Installation by County

The majority of solar installations are on homes in counties with average or above-average household income. The scatter plot in Figure 9 below shows the number of residential solar installations per 10,000 residents against median household income by each county. Each county is represented with a dot; red dots indicate those with the most solar installations (Westchester, Ulster, Dutchess, Orange, Rockland, Erie, Albany, Tompkins, Rensselaer, and Columbia counties).

Figure 9: Solar Penetration in NYS Counties: Residential Solar per 10,000 Residents vs. Avg. Household Income



Solar PV Installation by ZIP Code

Using the NREL data provided by ZIP codes, only 515 solar PV installations are located within low-income (as defined by NYSERDA) ZIP codes. This represents only 7.7% of the total number of solar PV installations in the state (6,731 installations, as of March 31, 2014).

^h PON 2156 is a competitive incentive program for any type of installations greater than 50 kW.

As demonstrated in Table 2 and Figure 10 below, Kings County has the largest number of low-income ZIP codes and low-income solar installations (24% of total installations). Dutchess and Ulster counties, which have relatively high median household income (\$71,508 and \$58,934, respectively), have a considerable amount of solar installations in their low-income ZIP code areas. This may be due to the high volume of solar installations within the counties overall (480 and 574 installations, as of April 4, 2014), in other words, a trickle-down effect on low-income communities. Bronx and Chautauqua counties, which have relatively low median household incomes (\$34,300 and \$41,975, respectively), have fewer installations in total, so the ratios of low-income solar installations to total solar installations are quite high (56% and 37%, respectively).

Table 2: Top 10 Counties with Solar Installations in Low-income ZIP Codes

County	# of Low-income ZIP Codes	# of Solar Installations in Low-income ZIP Codes	Total # of Solar Installations per county	Percent of Low-income Solar Installations
Kings	14	35	147	24%
Broome	5	26	94	28%
Dutchess	1	25	480	5%
Ulster	7	23	574	4%
Erie	11	20	302	7%
Greene	8	20	105	19%
Bronx	9	19	35	54%
Chautauqua	8	19	52	37%
Otsego	6	19	42	45%
Fulton	2	17	37	46%

Figure 10 Number of solar installations in low-income ZIP codes by county in New York State

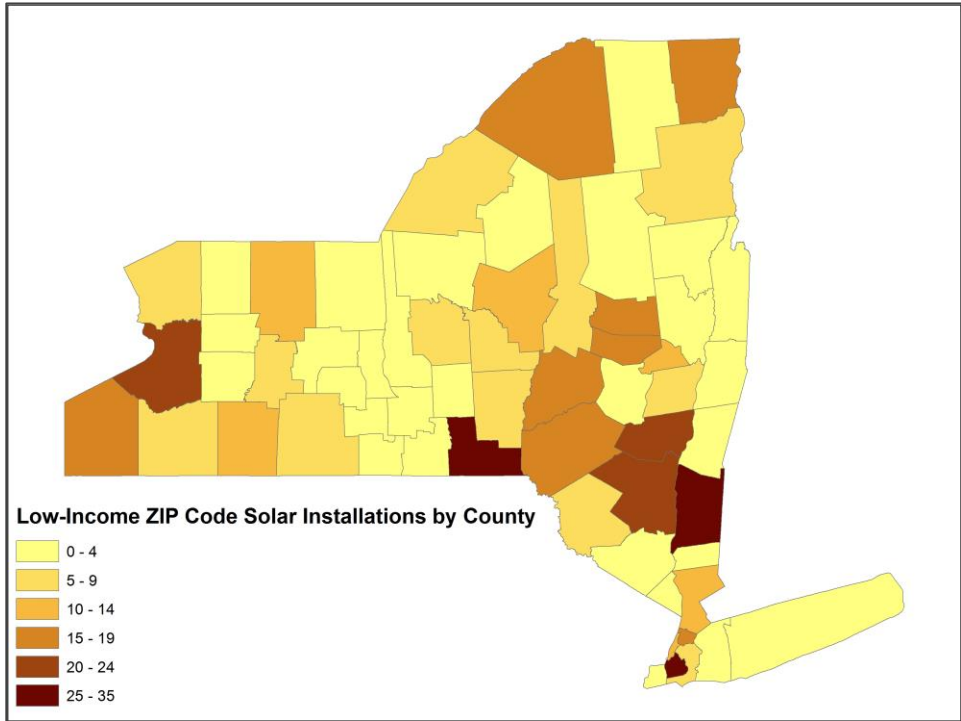


Table 3 shows the top 10 counties ranked by solar installations in low-income ZIP codes per capita. The relatively high rate of adoption suggests that there may be specific factors that drive increased adoption (e.g., activities of local installers, local incentives).

Table 3: Top 10 Counties with Solar Installations in Low-income Zip Codes (per capita)

County	# of Low-income ZIP Codes	# of Solar Installations in Low-income ZIP Codes	Population	# of Solar Installations (per 10,000 residents)
Greene	8	20	48,673	4.11
Montgomery	2	17	49,941	3.40
Delaware	8	15	47,276	3.17
Fulton	2	17	54,925	3.10
Otsego	6	19	61,709	3.08
Essex	5	9	38,961	2.31
Allegany	6	10	48,357	2.07
Clinton	4	16	81,654	1.96
Chenango	2	8	49,933	1.60
Saint Lawrence	9	17	112,232	1.51

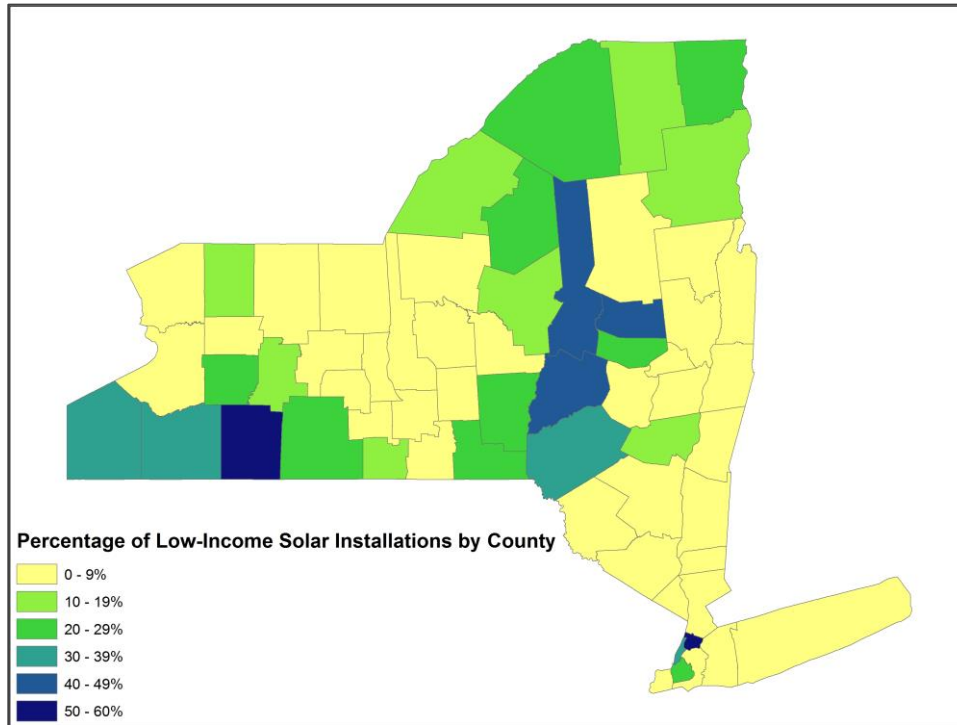
Table 4 and Figure 11 below show the top 10 counties ranked by the ratio of low-income solar installations to total installations. It is important to note that most of these counties have relatively low median household income, thus, a relatively low

total number of solar installations unlike a relatively affluent county like Westchester, with the highest number of solar installations (663 as of April 4, 2014). Bronx and Allegany counties have more than 50% of solar installations in their respective low-income ZIP code areas. Where the total number of installations in a county is small, the ratio of low-income installations to total installations is generally high.

Table 4: Top 10 counties with ratio of low-income solar installations to total solar installations

County	# of Low-income ZIP Codes	# of Solar Installations in Low-income ZIP Codes	Total # of Solar Installations per county	Median Household Income	Percent of Low-income Solar Installations
Bronx	9	19	35	\$34,300	54%
Allegany	6	10	19	\$42,095	53%
Fulton	2	17	37	\$45,333	46%
Otsego	6	19	42	\$46,358	45%
Herkimer	4	8	20	\$44,288	40%
Chautauqua	8	19	52	\$41,975	37%
Delaware	8	15	42	\$43,004	36%
New York	5	12	34	\$68,370	35%
Cattaraugus	5	6	19	\$43,202	32%
Montgomery	2	17	59	\$42,830	29%

Figure 11 Ratio of Solar Installations in low-income ZIP codes to total solar installations by county in New York



Solar PV in Multifamily Projects in NYC

According to the NYC Solar Map, New York City has installed 16 multifamily solar projects, six of which are on low-income properties (see Table 5).

Solar installations in Manhattan (11) make up the majority of projects. These are mainly installed on new, LEED-Certified, high-rise apartment buildings in Battery Park. The six multifamily low-income solar projects were specifically designed as new affordable housing. Of those six, three are located in Brooklyn, two in Manhattan and one in the Bronx. Bright Power, Inc. was the installer for four installations (see [Appendix 4](#) for more detail). In general, the economics of solar are more favorable for new construction than retrofits, as the building can be designed to maximize the benefits (and minimize implementation issues) of solar installation.

Table 5: Multifamily Solar Installations in New York City

Borough	Total Installations	Low-income Installations
Manhattan	11	1
Bronx	2	2
Brooklyn	3	3
Queens	0	0
Staten Island	0	0
Total	16	6

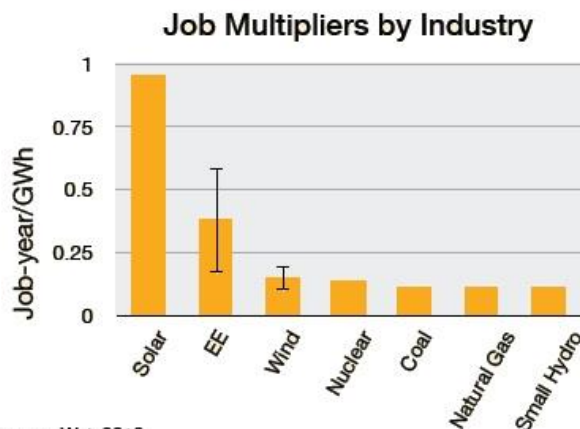
Solar Employment Data

In 2011, the Brookings Institution reported that the clean economy employs 2.7 million people and grew at an average annual rate of 3.4% between 2003 and 2010.¹²¹ Within this sector, solar jobs are growing particularly rapidly: 10 times faster than the national average employment rate of 1.9%.¹²² It is estimated that over 142,000 Americans are employed in the solar sector.¹²³

Solar Jobs Often Pay Better and Have a Multiplier Effect

Brookings found that median wages for workers in the green economy in general pay 13% higher than median U.S. wages.¹²⁴ For workers with less formal education, green jobs offer a particularly strong opportunity to climb the economic ladder because “green collar” jobs tend to pay relatively well.¹²⁵ Furthermore, solar jobs provide the greatest job multipliers in the energy sector, meaning that when one job is created in an industry, it leads to the creation of further employment. Figure 12 shows that for every GWh of solar power generated, there is approximately one job created per year. Fossil fuels generate less than 0.25 jobs per GWh generated.

Figure 12: Out of all energy industries, solar power (per energy produced) creates the most jobs



Sources: Wei, 2010

Solar Jobs and Opportunities in New York

Due to the physical, on-site nature of solar installations, distributed solar jobs are particularly valuable to the local economy because they cannot be outsourced. According to Brookings’ New York state profile, as of 2011, there are a total of 185,038 clean jobs, of which 556 were solar PV jobs.¹²⁶ Jobs in solar PV increased 14.5% per year between 2003 and 2010.¹²⁷ However, the Solar Foundation cites a higher number, claiming 5,000 solar jobs in New York.¹²⁸ An increase of 13,000 solar jobs is expected as a result of a 10-year extension of the NY-Sun Initiative.¹²⁹

Numerous government agencies and non-profits in New York work on issues of workforce development, and may provide opportunities for partnership with GRID Alternatives. See [Appendix 5](#) for a table detailing many of these organizations, with an emphasis on opportunities in New York’s six largest cities.

Policy Recommendations

To effect legislative or regulatory changes, GRID should continue to participate in working groups and share its expertise to contribute to existing efforts. On issues where no working group exists, GRID may want to spearhead one.

Support Virtual Net Metering

Adopting a virtual net metering policy in New York is crucial because it allows property owners to allocate energy credits to a number of tenants from one metered system.¹³⁰ This is one reason California that has been so successful with their MASH program. New York SB 3217 (Parker), introduced January 31, 2013, and referred to the Energy and Telecommunications Committee on January 8, 2014 for further review, aims to create a virtual net metering policy. Assemblywoman Amy Paulin (D-88), the Chair of the committee, is also developing legislation to be introduced in 2014 that would establish a virtual net metering policy and allow residents of multifamily buildings to invest in renewables.¹³¹ Passage of legislation would help community solar programs reach low-income communities and residents whose homes may not currently be suitable for solar PV. GRID should connect with the offices of Senator Kevin Parker and State Assemblywoman Paulin as well as with advocates from Vote Solar to determine how best to support their efforts.

One way to showcase the benefit of virtual net metering policies is to establish a community solar pilot project. By addressing any pricing or credit concerns raised by solar opponents, GRID would be able to show a successful example of community solar projects and the potential for growth in New York. Successful results could be used to petition the Public Service Commission and/or lobby the Legislature to pass virtual net metering policies, and to mandate community solar to include retail price requirements for excess energy produced.

Advocate for a Higher Net Metering Cap and Increased Transparency

Another policy crucial for continued solar adoption is to raise New York's net metering cap. The current policy requires net metering benefits to be capped at 3% of 2005 peak demand, or a maximum installed capacity of 36 MW. This cap must be increased at a rate that is reasonable for utility companies to manage. This would reassure solar companies in the continued growth of solar in New York State and spur the expansion of installations. There is also a need for greater transparency from the utilities. GRID may want to join with other solar advocates in calling for utilities to reveal how much solar capacity is being net metered on a monthly or quarterly basis in order to see how close the state is towards reaching the 3% cap. Great transparency on this issue would provide greater certainty and stability in New York's solar market.

Collaborate with Other Groups to Streamline Licensing Requirements

Standardization of contractor licensing requirements would lower contractor costs, which are passed on to consumers, and accelerate the rate of solar adoption. This is

especially true in less populated areas of New York where municipalities are relatively small. GRID should work with industry groups and other parties to promote the adoption of a uniform licensing body like the Contractors State License Board in California.

Foster Implementation of Standardized Permitting

Standardization of the permitting processes would also reduce the soft costs required of solar contractors and developers. Although the Unified Solar Permit was released in New York on September 20, 2013, not all municipalities in the state use it.¹³² Not only should implementation be incentivized, but also transparency, ease-of-use, and public feedback should be considered. GRID should explore collaboration with CUNY to support their work on this issue as part of a Department of Energy SunShot Initiative grant.

Advocate for Low-income Specific Incentive Programs

New York can learn from successful solar incentives aimed at low-income communities in other states. California and DC claim the most successful programs in the country. California's SASH/MASH programs have funds specifically allocated for low-income families. A similar program in DC grants qualifying low-income families rebates on solar installations. Other programs have a variety of incentives that address various aspects of low-income adoption of solar. GRID should discuss with working groups the feasibility and potential efficacy of such programs in New York.

Encourage New Models to Finance Low-income Solar Adoption

There are several creative financing models GRID should consider supporting. First, encourage low-income households to take advantage of solar financing options recently made available through the Green Jobs, Green New York program. Second, advocate for the expansion of PACE programs in New York. Third, urge the use of long-term, low-interest rate loans (similar to the Cozy Home Loan Program in Connecticut). Fourth, use solar lease or PPA models that are better suited to lower-income homeowners, as used by Posigen and Connecticut's Solar Lease II program. It is possible that all of these programs may be coordinated through the New York Green Bank, and so establishing a dialogue there should prove valuable.

Advocate for Shared Solar Programs

A popular method for installing solar systems for multifamily buildings or areas where houses may be unsuitable for solar panels are community solar gardens. These gardens allow a number of households to benefit from a single, separate solar system. The first community solar installation, installed by SolarGardens in 2001, offered local residents the option to buy power produced by a large array of panels.¹³³ While some areas in the U.S. do not allow community solar panels and/or

discourages it because there are no virtual net metering policiesⁱ, this may prove to be a suitable option for a large city like New York. One popular method for installing these solar gardens is to place them on former brownfields or other areas that may otherwise be unsuitable for development. To stimulate this model, GRID should encourage the passage of incentives that not only allow community solar gardens, but also motivate gardens to be placed on unused lots. This would help low-income families benefit from solar energy as well as reuse otherwise abandoned brownfields, which may serve no other purpose to the local community.

Monitor Utility Rate Structure Reform and Utility Regulation

Ratemaking is complicated and reflects the needs of numerous stakeholders, including the utility shareholders as well as residential, commercial, and industrial ratepayers. GRID should participate in utility ratemaking matters and continue to monitor how changes to rate structures might impact solar adoption for low-income communities. GRID should also connect with the Edison Electric Institute and the Natural Resources Defense Council (NRDC) on their recent agreement to promote policies and regulations that benefit utilities, customers, and the environment. This agreement specifically states, “We will work together to ensure that energy efficiency services reach underserved populations, including the increased deployment of utility programs focused on affordable multi-family housing.”¹³⁴ This section of the agreement may be expanded to include access to renewable energy with GRID’s input.

Consider Additional Partnerships and Projects

GRID Alternatives may benefit from additional partnerships with solar developers or industry groups, organizations focused on low-income residents, and other solar proponents active in the New York market. Solar developers and other industry groups could help address the operational hurdles for solar implementation, promote greater use of uniform permitting standards and/or encourage greater standardization of building codes and licenses for contractors. Low-income focused groups, like NYSERDA’s Low-income Forum on Energy (LIFE), could assist in advocating policies specific to this sector’s needs. Other solar proponents include industry experts that may be able to brainstorm opportunities not previously considered to increase low-income solar adoption.

Expand Workforce Certification Efforts

GRID should consider partnering with SUNY College of Environmental Science and Forestry’s Solar Power As Renewable Energy (SPARE) program^j or other workforce development groups.¹³⁵ SUNY may be able to help GRID volunteers become NABCEP certified, and GRID may be able to help SUNY recruit students from low-income communities in which GRID works.

ⁱ Community solar programs could also work with feed-in-tariff policies like those in place on Long Island, though virtual net metering is the most popular method.

^j SPARE prepares students to become North American Board of Certified Energy Practitioners (NABCEP) certified.

Expand Multi-family Solar Adoption

Multifamily housing is an important component of low-income housing stock in New York. Therefore, in the intermediate- to longer- term, GRID should consider different strategies to promote solar for low-income residents of multi-family housing including the following:

- Explore possible changes in federal housing policy (e.g., structure of HUD incentives) to encourage renewable energy generation for low-income housing
- Advocate “green building” requirements for newly constructed low-income housing; see case studies from new green construction referenced in [Appendix 4](#).
- Consider initiatives adopted in other states to increase demand for solar (e.g., point system for green features in public housing)
- Research what exactly would drive increased demand and interest (e.g., educational materials in other languages, seminars, social media)
- Work with NYSERDA, NYPSC, NYPA, and PSEG-LI to encourage evaluation of solar as part of multifamily energy efficiency programs
- Increase engagement with the community of low-income multifamily residents to better understand their needs

Areas for Further Research and Collaboration

The Columbia University consulting team identified the following areas that would be valuable to explore, each requiring additional time or data.

1. Identify additional organizations that support low-income communities as well as solar installers and environmental justice groups in NYS for future partnerships.
2. Establish relationships with NYS legislators that are focused on solar and/or low-income issues.
3. Identify large low-income property owners who may be interested in installing solar systems or participating in pilot projects.
4. Review additional sources for solar and low-income data. GRID could also encourage additional data to be made public and easily accessible.
5. Research the potential to model a NYS program on the City of Santa Clara’s municipal solar utility program to supply, install, and maintain solar water heating systems for residents.¹³⁶
6. Identify stakeholders who will participate in rulemaking related to the 2015 RPS deadline. Consider how best GRID can support an RPS extension and/or expansion to include requirements for low-income communities.
7. Evaluate the role of decoupling in NY. Though this policy has been adopted, it is unclear whether it is effective. Consider California’s decoupling policies and its relation to their solar market.
8. Evaluate Florida Light and Power’s voluntary program where customers can make donations for solar power. Reach out to utility companies that may be interested in implementing a similar program for their service areas.

9. Utilize volunteer umbrella organizations such as NYC Service or NY Cares to leverage volunteer capacity to educate low-income communities on solar eligibility through programs offered by GRID.

Conclusion

While distributed solar is not a panacea for U.S. energy issues, it does offer certain benefits. Moreover, given the constantly changing complexion of national and global energy markets, overreliance on any one generation type may be risky; this too argues for distributed solar as part of a well-diversified national energy strategy. On a more local level, distributed solar creates jobs for installers, and improves housing affordability for residents.

Today, solar remains expensive relative to conventional energy sources. Incentives are likely a necessary part of the renewable energy equation unless high taxes are imposed on, and/or favorable incentives removed from, conventional energy. Until that time, or until solar technology improves to a level where solar is cost-effective without subsidy, incentives are necessary. Given different policy tools at each level of government, a mix of incentives is likely to continue to include renewable portfolio standards, tax credits, and renewable energy credits.

New York currently has many well-designed policies to increase solar adoption, but more can be done, especially with regards to low-income residents. This report suggests different potential policy changes that address a wide range of operational, financial, demand, and procedural issues. The authors of this report hope that these recommendations provide opportunities for further information gathering and deliberation, and that this dialogue leads to policies that increase the adoption of solar generation among low-income households for the benefit of all New Yorkers.

Appendix

Appendix 1: Case Study of Arizona Net Metering Battle

One particular policy, which has led to debates in policy arenas across the country, is the issue of net metering. Arizona in particular has been polarized by the debate between rooftop solar companies and utilities. Utility companies have accused the solar industry of “spending hard-earned tax dollars to subsidize their wealthy customers” while rooftop solar believes the Arizona Public Service wants to eliminate their companies altogether.¹³⁷ This debate is not just occurring in Arizona but in other states like California, Colorado and Louisiana. Utility companies have claimed that they welcome the solar industry as long as businesses and homeowners pay a share of the costs it takes to maintain electricity grids. They have often called for reduced incentives or charges for customers who choose to install solar panels on their roofs. Though the Solar Electric Power Association has been trying to work with utilities to compromise with the solar companies, the process is far more complicated than it may seem. Many of these utilities are regulated and in some states these regulators are elected instead of appointed. Therefore, their political agendas come in to play when looking to please their constituents that would help them get elected another term.

Appendix 2: Case Study of Opposition to RPS Improvements

Petitions filed with the New York State Public Service Commission, as well as the related comments in response, are public information and give insight into the main participants in the renewable energy market. For the purpose of identifying the main actors, a petition filed by 10 environmental groups was examined. The petition was “seeking approval for (1) the immediate renewal and completion of contracting analysis to remove the ten-year cap on Main Tier contracts^k and allow NYSERDA to use alternative incentive structures for these contracts and (2) directing NYSERDA to immediately issue a 2014-2015 Main Tier solicitation schedule to include a minimum of three solicitations”.¹³⁸ Petitioners believed that the Main Tier system was not meeting its targets and these adjustments would guarantee the future success of the program. Also, though there are active projects under contract with past Main Tier solicitations, there are none that are currently active or that are planned to be active in the future. The lack of transparency in this process is concerning and causes uncertainty in the solar market. The petitioners, supporters,

^k The Main Tier solicitation system is part of the New York Renewable Portfolio Standard program. RPS has energy targets that fall into three categories: Main Tier aimed at large-scale generation, Customer-Sited Tier aimed at small scale generators, and other market activities from individuals and businesses. Source: <http://www.nyserdera.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Program-Planning/Renewable-Portfolio-Standard.aspx>

opponents and undecided groups that registered comments in response are listed in the table below.¹

Table 6: Active petitioners, supporters, opponents and other groups with registered comments

<u>Petitioners</u>	<u>Supporters</u>	<u>Opponents</u>	<u>Undecided</u>
-Pace Energy and Climate Center -Alliance for Clean Energy New York -Sierra Club -NRDC -Renewable Energy Long Island -New York League of Conservation Voters -NYPIRG -Vote Solar Initiative -Citizens Campaign for the Environment -Environmental Advocates of New York	-NYSERDA -The City of New York -ReEnergy Holdings LLC -Bloom Energy -Independent Power Producers of New York -New York Biomass Energy Alliance -Iberdrola Renewables -Nextera Energy -ClearEdge Power -Starphire.Net, Inc. -Solar Energy Industries Association -Sierra Club	Multiple Intervenors-- Members: -Alcoa, Inc. -Burrows Paper Corp. -Cornell University -Corning, Inc. -Crucible Industries LLC -Griffiss Utility Services Corp. -Occidental Chemical Corp. -Olin Corp. -Potsdam Specialty Paper, Inc. -Quad Graphics, Inc. -Revere Copper Products, Inc. -State University of New York -Wegmans Food Markets, Inc.	-Consolidated Edison Company of New York, Inc. -Orange and Rockland Utilities, Inc. -Central Hudson Gas and Electric Corporation -New York State Electric & Gas Corporation -Rochester Gas and Electric Corporation -Posigen Solar Solutions

The petition was filed on December 16, 2013. As a case study on supporters and opponents of solar policies in New York State, the comments indicate that an organization called Multiple Intervenors^m, located in Albany, NY has repeatedly and consistently filed comments against the petitions by environmental organizations seeking to strengthen NYSERDA’s renewable energy programs. Multiple Intervenors describes itself as “an unincorporated association of large industrial, commercial and institutional energy consumers with manufacturing and other facilities located throughout New York State”.¹³⁹ A list of member organizations is provided in the table above. The comments they registered in response to the petition directly reflect the nature of their organizations.

Their reasoning to deny the petition is as follows:

- Proposals would increase RPS charges to customers and would shift market risk from project developers
- Petitioners already submitted the same petition and therefore granting this petition would encourage organizations to submit redundant filings
- Changes would be in opposition to the Commission’s and NYSERDA’s intent to reduce reliance on customer-funded subsidy programs
- NYSERDA would lose their flexibility to not solicit Main Tier projects when market conditions are unfavorable and electricity prices are low. This is currently the only method NYSERDA has to control their program costs

¹ A full list of registered comments can be found at <http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=17612>.

^m For more information visit <http://www.multipleintervenors.com/multipleintervenors/home.aspx>.

- There is no evidence that a rigid Main Tier solicitation system would benefit renewable markets or the absence would cause harm

Others that have submitted comments but were not substantially against or for the petition being granted included a group of utilities and the energy company Posigen. The joint utilities expressed concerns that ending the ten-year cap on Main Tier contracts would not be cost-effective and urged caution against adopting contracts to make up differences in reaching goals. However, they did agree with the petitioners' call to require a Main Tier solicitation schedule but would prefer the setting of the specific schedule for NYSERDA to determine.

Posigen Solar Solutions submitted a comment in response that instead urged the Commission to require NYSERDA to create a solar incentive program that would allow low- to moderate-income families to participate in their renewable energy programs. According to their estimates, nearly twice as much of low-income families' incomes go to utilities as upper-income households. They also believed that between 2005 and 2015 approximately \$268 million would be collected from ratepayers with FICO scores less than 600 with an addition \$192 million from homeowners with scores in the 600-700 range. Therefore, they urged the Commission to adopt a solar program that would allow this group that makes up over a third of New York's population to participate, regardless of credit.

Appendix 3: NYCHA Energy Efficiency/Renewables Discussion

The New York City Housing Authority (NYCHA) provides safe, affordable housing and access to necessary services for low- to moderate- income citizens of New York. NYCHA has 334 public housing projects.¹⁴⁰ Additionally, 92,561 apartmentsⁿ were rented as part of the Housing Choice Voucher program or Section 8 subsidized rent assistance program for another 225,000 New Yorkers in private homes.^o The focus of NYCHA is principally on the preservation of its housing stock and partners with the City as part of the Mayor's New Housing Marketplace plan to develop new affordable housing units.

NYCHA purchases electricity from NYPA that is delivered by ConEdison (ConEd). While NYCHA does not have any solar photovoltaic or solar thermal installations, it has undertaken different initiatives to reduce NYCHA's energy costs and/or improve affordability for its tenants. One interesting case study to reduce energy consumption is at 344 East 28th Street, a 26-story building with 225 apartments and about 470 residents. Efforts include the use of geothermal heating for domestic water, and the installation of wireless energy modules which track tenant energy consumption and produce data every 15 minutes.¹⁴¹ Tenants do not pay for power in the building, so the geothermal system reduces energy costs for NYCHA, while the modules allow data to be gathered which can assist NYCHA in further energy saving

ⁿ As of January 1, 2013.

^o As of March 28, 2013.

initiatives. Additionally, the data can be given to residents looking for feedback on how to save energy. Wireless energy modules were also installed in 2009 in NYCHA's Castle Hill Houses development in the Bronx, as the initial pilot site for wireless energy modules.¹⁴²

Approximately 95% of NYCHA's housing developments are master metered (i.e., one meter for the building or development, apartments not individually metered). This diminishes the economic incentive for any individual tenant to reduce energy consumption. The balance of the NYCHA system (~5%) does, however, consist of individually metered units. These developments are typically low-rise buildings of 100 units or less (e.g., brownstone with 10 units or fewer). In these instances, the residents pay for electricity through ConEd, but get a subsidy (e.g., \$50) from NYCHA. If the customer can lower their electricity costs below the subsidy, they can keep the difference, and similarly, they pay any excess above the subsidy. This provides an economic incentive to reduce energy consumption.

ConEd named NYCHA the Public Partner of the Year for completing a massive energy-efficiency project in 5,300 public housing units that are 5-75 units in Manhattan, the Bronx, and Brooklyn. The Multi-Family Energy Efficiency Program provides free energy efficiency surveys and incentives to owners of residential buildings with five-to-75-units for heating, cooling and lighting upgrades to common areas. Under the available incentives, NYCHA qualified for free compact fluorescent lamps (CFLs), showerheads, faucet aerators, and smart strips (surge protectors) for electrical appliances. NYCHA anticipates an energy savings of at least \$1 million per year.¹⁴³

On other fronts, NYCHA has entered into an \$18 million Energy Performance Contract for energy efficiency retrofits. These contracts cover initiatives such as boiler upgrades, wireless energy modules, or installation of compact fluorescent lighting (some of the upgrades benefit from utility company incentive programs). More generally, NYCHA has other initiatives including its "Green Agenda" that help promote environmental sustainability and reduce energy costs.¹⁴⁴ This gets residents involved, and can also connect residents with "green economy" jobs. It also addresses NYCHA's goals of decreasing its environmental footprint, saving on energy costs, and preserving public housing.¹⁴⁵

Notwithstanding the current absence of solar installations in NYCHA housing, it remains a potential option given both the opportunity to reduce energy costs and NYCHA's interest in sustainable approaches. Practical considerations include roof condition, building orientation and shading, availability of roof space (given HVAC equipment or required access), and FDNY regulations. Assuming such considerations are addressed, financing installations through a solar lease/PPA may be appropriate given the inability of NYCHA to directly employ the federal Investment-Tax Credit for solar. Other financing structures may also be feasible, but all structures first assume a certain level of cost-effectiveness of the installation.

Appendix 4: Multifamily Solar Housing Developments in NYC

Project 1	Rheingold Gardens, Brooklyn
Installer	altPower, Inc.
Developer	The Bluestone Organization
Installation Date	2005
Source	http://altpower.com/projects/multifamily/rheingoldgardens/
Description	Located at an affordable housing unit in Brooklyn, this project was implemented at the urging of the Ridgewood Bushwick Senior Citizens Council under the direction of developer, The Bluestone Organization. Partly funded by NYSERDA, the buildings at 533 and 555 Bushwick Avenue each have identical 10.08 kW (peak) photovoltaic arrays on the roof, utilizing a mounting system and modules provided by RWE Schott Solar. The PV system received final utility approval and became operational in June 2005. The Council has also opted to set up a live web-feed which displays the amount of power being produced, environmental impact and other information.

Project 2	David and Joyce Dinkins Gardens, Harlem, Manhattan
Installer	Bright Power, Inc.
Developer	Jonathan Rose Companies
Installation Date	2008
Source	http://brightpower.kiosk-view.com/dinkinsgardens
Description	David and Joyce Dinkins Gardens is an affordable housing property in Harlem, built by developer Jonathan Rose in conjunction with Harlem Congregations for Community Improvement (HCCI). The 7-story residential building at 263 West 153rd Street, is managed and owned by HCCI, and has 85 apartments, 26 that are designated for youth aging out of foster care. The remaining apartments are designated for low-income households earning less than 60% of the area median income (AMI). In addition to its residences, David and Joyce Dinkins Gardens features classroom space for use by HCCI's Construction Trades Academy, a training and job placement program that provides Harlem residents with access to careers in the construction industry. Sun shading keeps apartments cooler in the summer and maximizes sunlight in the winter. Improved indoor air quality is achieved at little additional cost by using low-VOC paints and other non-toxic materials, and ventilating each unit individually. ENERGY STAR-rated appliances and light fixtures provide direct cost savings to residents. The project restores a community garden at the site and includes a rooftop patio and landscaped garden for residents. A rainwater harvesting system funnels water from the roof into storage tanks for irrigation, further reducing utility costs and storm water run-off. Part of the roof is planted with a modular green roof system and a solar panel installation, partially funded by NYSERDA incentive program that reduces the building's common electric bill by about 13%. Bright Power was hired to design and install a solar PV system for Dinkins Gardens. Additionally, Bright Power helped the project apply for and obtain over \$100,000 in incentives towards installation costs.

Project 3	1085 Manhattan Ave, Bronx
Installer	Bright Power, Inc.
Developer	Bronx Pro Real Estate Management
Installation Date	2009
Source	http://www.brightpower.com/1085washington
Description	The LEED certified building complex has 90-units and over 9,000 square feet of

	commercial space. Green building features include a 1,850 square foot green roof, high-efficiency boilers, a solar hot water system to pre-heat water before it reaches the boiler, low-flow faucets and shower heads, an additional layer of insulation and dual flush toilets. The solar hot water system provides about 15% of the domestic hot water for the building, thereby reducing the amount of energy used by the boiler.
--	--

Project 4	Dumont Green, Brooklyn
Installer	Bright Power, Inc. (AeonSolar according to CUNY map)
Developer	The Hudson Companies Incorporated
Installation Date	2010
Source	http://www.brightpower.com/1490dumont
Description	This 8-story building contains 176 units for low-income families. All the units are available for households earning between 30 and 60 percent of the area median income, with 36 units set aside for formerly homeless households. In order to control long term operating costs, the building includes rooftop photovoltaic solar panels providing 80,500 watts of electricity, or 68% of the building's demand. This was the largest solar PV energy system to date on a multifamily building in New York City. The site was purchased using the NYC Acquisition Loan Fund through Enterprise Community Foundation and construction was financed with a mix of tax-exempt bonds and subsidies from New York City Housing Development Corporation, NYCHDC, City capital funding, NYSEERDA and over \$15M in Low-income Housing Tax Credits. The building reached full occupancy in summer 2011 and earned multiple awards including the National Grid Energy Efficiency Award by the Brooklyn Chamber of Commerce and the HOME Excellence Award from the National Association of Local Housing Finance Agencies (NALHFA).

Project 5	Via Verde, Bronx
Installer	Bright Power, Inc.
Developer	Jonathan Rose Companies
Installation Date	2011
Source	http://www.brightpower.com/nhny
Description	Via Verde is an affordable, multifamily project in the Bronx, developed by Jonathan Rose Companies and Phipps Houses. Winner of the 2006 New Housing New York competition, the 300,000 square foot urban infill project, which is targeting LEED Gold certification, consists of 151 units of affordable housing in 18 stories, and includes a 66 kW building-integrated PV system, onsite cogeneration, green roof, community vegetable gardens green interior finishes, rainwater harvesting and drought tolerant vegetation.

Project 6	Gateway Elton Street, Brooklyn
Installer	
Developer	The Hudson Companies Incorporated – CAMBA (non profit)
Installation Date	2012-Phase II and III under development
Source	http://www.hudsoninc.com/gateway-elton-street/
Description	An 8-building neighborhood center will provide 660 units of green affordable housing and ground floor retail and community facilities. Phase I of Gateway Elton will include 197 rental units in four buildings for households earning less than 60% AMI and over 16,000 SF of neighborhood-focused retail. 40 units are set aside for individuals sponsored by the NY State Office of Mental Health (OMH). Amenities will include computer rooms, children's playrooms, fitness rooms and free Wi-Fi access for all residents in the common areas.

	<p>Designed to exceed LEED for Homes Platinum standards, Phase I will surpass Dumont Green as the largest Solar PV system installed on a residential development in NYS with 214,000 watts of renewable energy. Construction was financed with a mix of tax-exempt bonds and second mortgage from HDC, HPD City Capital funds, NYSERDA and almost \$26M in Low-income Housing Tax Credits. Construction was by CH Builders LLC, a partnership with Cheever Development Company. Phase I construction is complete and the buildings are fully leased. Gateway Elton Phase II, comprised of 175 rental units in three buildings with 24,000 SF of ground-floor retail and community facilities, began construction in March 2013. Phase II will have units ranging from Studios to 4-bedrooms and include pre-installed desks/workstations in every apartment. Apartments will be available for households earning between 40% and 60% AMI and include 30 units for individuals sponsored by OMH. Similar amenities to Phase I. Designed for LEED for Homes Platinum and Enterprise Green Communities, Phase II will also have 275,000 watts of solar PV installed. Construction will be financed with tax-exempt bonds and second mortgage from HDC, HPD Capital Funds, NYSERDA, Brooklyn Borough President Marty Markowitz, and almost \$27M in State and Federal Low-income Housing Tax Credits.</p>
--	---

Appendix 5: Selected Green Jobs Providers in New York State

ORGANIZATION	LOCATION	WEBSITE
AmeriCorps	National	http://www.nationalservice.gov/programs/americrops
Clean Edison	National	http://www.cleandison.com/government-and-non-profit/workforce-development/
National Work Readiness Council	National	http://www.workreadiness.com/testsite.html
Urban Green Council	Statewide	http://gpro.org/courses/electrical/
NYS Department of Labor	Statewide	https://labor.ny.gov/workforcenypartners/training-events.shtm
Solar One	NYC	http://www.solar1.org/programs/workforce/about-workforce/
NYC College of Technology Continuing Studies Center	NYC	http://www.citytechce.org/renewable-energy.html
Green City Force	NYC	http://www.greencityforce.org
NYC Service	NYC	http://www.nycservice.org
Habitat for Humanity NYC	NYC	https://habitatnyc.org
Buffalo Employment & Training Center	Buffalo	http://www.workforcebuffalo.org
Volunteer Buffalo	Buffalo	http://www.volunteerbuffalo.com/locations/downtown.html
Volunteer Center (Western NY)	Buffalo	http://www.volunteerwny.org
Habitat for Humanity Buffalo	Buffalo	http://www.habitatbuffalo.org
Rochester Works!	Rochester	http://www.rochesterworks.org
Workforce Development Institute (energy program)	Rochester	http://wdiny.org/programs/energy/
Flower City Habitat for Humanity	Rochester	http://www.rochesterhabitat.org
Carlson Metro YMCA	Rochester	http://rochesterymca.org/carlson
Rochester Cares	Rochester	http://www.rochestercares.org

Department of Labor	Yonkers	http://www.labor.ny.gov/workforcenypartners/lwia/localboardsyonkers.shtm
Yonkers Employment Center	Yonkers	http://www.yonkersny.gov/Index.aspx?page=2106
Yonkers Chamber of Commerce Workforce Program	Yonkers	http://www.yonkerschamber.com/workforce.html
City of Yonkers Volunteer Program	Yonkers	http://www.cityofyonkers.com/Index.aspx?page=748
Capital Area Workforce Investment Board	Albany	http://www.capreg.org/
Workforce Development Institute	Albany	http://wdiny.org/category/regions/capital-region/
NYS Capital Region Regional Economic Development Council	Albany	http://regionalcouncils.ny.gov/content/capital-region
Hudson Valley Community College - Capital District Educational Opportunity Center	Albany	https://www.hvcc.edu/catalog/programs/cdeoc.html
Rensselaer County One-Stop Employment Center	Albany	http://www.rensco.com/employment.asp
CNY Works	Syracuse	http://www.cnyworks.com/
Onondaga Community College	Syracuse	http://www.sunyocc.edu/index.aspx?menu=136&collside=492&id=21448
Talent and Education Development at Syracuse University	Syracuse	http://uc.syr.edu/Employers/TalentDevelopment/index.htm
Central New York Technology Development Organization	Syracuse	http://www.tdo.org/
Training Within Industry Institute	Syracuse	http://twi-institute.com/
Onondaga, Cortland, Madison BOCES	Syracuse	http://www.ocmboces.org/teacherpage.cfm?teacher=1262
Onondaga Civic Development Corporation	Syracuse	http://syracusecentral.com/Economic-Development-Services-Civic-Development-Corporation.aspx
CenterState Corporation for Economic Opportunity	Syracuse	http://www.centerstateceo.com

Works Cited

- ¹ US Energy Information Administration, Table 1.1.A. Net Generation by Other Renewable Sources: Total (All Sectors), 2003-December 2013, Table 1.1. Net Generation by Energy Source: Total (All Sectors), 2003-Dec2013, accessed March 21, 2014.
- ² U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, “SunShot Vision Study”, accessed April 28, 2014, <http://energy.gov/eere/sunshot/sunshot-vision-study>.
- ³ SEIA, “Solar Industry Data,” accessed March 30, 2014, <http://www.seia.org/research-resources/solar-industry-data>.
- ⁴ Ibid.
- ⁵ Ibid.
- ⁶ U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, “SunShot, About”, accessed March 25, 2014, <http://energy.gov/eere/sunshot/about>.
- ⁷ Clean Power Research, One Block Off the Grid website, “How Much Does Solar Cost?” accessed March 1, 2014.
- ⁸ Matt McFarland, “Grid parity: Why electric utilities should struggle to sleep at night,” The Washington Post, March 25, 2014, accessed April 6, 2014, <http://www.washingtonpost.com/blogs/innovations/wp/2014/03/25/grid-parity-why-electric-utilities-should-struggle-to-sleep-at-night/>.
- ⁹ National Multifamily Housing Council, “Apartment Quick Facts”, accessed April 1, 2014, <http://www.nmhc.org/Content.cfm?ItemNumber=55508>.
- ¹⁰ Michael Stosser, “Petition for NY-Sun Funding Considerations and Other Program Modifications,” Sutherland Asbill & Brennan LLP, March 3, 2014, accessed April 8, 2014, [file:///Users/chanellemayer/Downloads/Posigen%20Comments%20\(2\).pdf](file:///Users/chanellemayer/Downloads/Posigen%20Comments%20(2).pdf).
- ¹¹ Dave Flessner, “Southerners Spend More Time on Utility Costs,” timesfreepress.com, February 28, 2014, accessed April 9, 2014, <http://www.timesfreepress.com/news/2014/feb/28/southerners-spend-more-of-income-on-utility-costs/>.
- ¹² NYSERDA website, “Section 2: Market Overview,” accessed April 9, 2014, <http://www.nyserda.ny.gov/-/media/Files/EDPPP/LIFE/LIFE-Report-section-2.pdf>.
- ¹³ Ibid, SEIA.
- ¹⁴ Tony Dutzik, Rob Sargent, “Lighting the Way: What We Can Learn from America’s Top 12 Solar States,” Frontier Group, Environment America Research & Policy Center, June 2013, accessed March 30, 2014, http://www.environmentamericacenter.org/sites/environment/files/reports/Lighting_the_way_En_vAM_scrn.pdf.
- ¹⁵ Ibid, SEIA.
- ¹⁶ Union of Concerned Scientists, “Renewable Electricity Standards Toolkit”, accessed March 30, 2014, http://www.ucsusa.org/clean_energy/res/aboutwhat.html.
- ¹⁷ Ibid, Dutzik et al.
- ¹⁸ California Public Utilities Commission, “RPS Program Review” website, accessed March 30, 2014, <http://www.cpuc.ca.gov/PUC/energy/Renewables/overview>.
- ¹⁹ California Energy Commission, “Renewable Portfolio Standard Proceedings” website, accessed March 30, 2014, <http://www.energy.ca.gov/portfolio/index.html>.
- ²⁰ US Department of Energy, Industrial Renewable Center, North Carolina Renewable Center, Database of State Incentives for Renewables & Efficiency website, “Net Metering,” accessed March 30, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA02R&re=1&ee=1.
- ²¹ Travis Madsen, Michelle Kinman, Environment California, “Will Solar Power Have a Home in California? Ending Net Energy Metering Would Put the Residential Solar Market at Risk,” 2013, accessed March 30, 2014, <http://www.environmentcalifornia.org/sites/environment/files/reports/Will%20Solar%20Power%20Have%20a%20Home%20In%20California.pdf>.
- ²² Go Solar California Website, accessed March 30, 2014, <http://www.gosolarcalifornia.ca.gov/>

-
- ²³ US Department of Energy, Industrial Renewable Center, North Carolina Renewable Center, Database of State Incentives for Renewables & Efficiency Website, “Sales and Use Tax Exclusion for Advanced Transportation and Alternative Energy Manufacturing Program,” accessed March 30, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA210F&re=1&ee=1.
- ²⁴ US Department of Energy, Industrial Renewable Center, North Carolina Renewable Center, Database of State Incentives for Renewables & Efficiency Website, “PACE Financing,” accessed March 30, 2014, <http://www.dsireusa.org/solar/solarpolicyguide/?id=26>.
- ²⁵ Solar Energy Industries Association, “Arizona Solar,” accessed March 30, 2014, <http://www.seia.org/state-solar-policy/arizona>.
- ²⁶ Arizona Corporate Commission, Renewable Energy Standard & Tariff Website, accessed March 30, 2014, <http://www.azcc.gov/divisions/utilities/electric/environmental.asp>.
- ²⁷ Douglas Metcalf, Renewable Energy World.com, “Arizona Legislature Exempts the Sale of Renewable Energy Credits from State Sales Tax”, May 8, 2012, <http://www.renewableenergyworld.com/rea/news/article/2012/05/arizona-legislature-exempts-the-sale-of-renewable-energy-credits-from-state-sales-tax>.
- ²⁸ US Department of Energy, Industrial Renewable Center, North Carolina Renewable Center, Database of State Incentives for Renewables & Efficiency Website, “UES - Renewable Energy Credit Purchase Program,” accessed March 30, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ06F&re=0&ee=0.
- ²⁹ US Department of Energy, Industrial Renewable Center, North Carolina Renewable Center, Database of State Incentives for Renewables & Efficiency Website, “Net Metering,” accessed March 30, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ24R&re=0&ee=0.
- ³⁰ James Montgomery, Renewable Energy World.com, “Mixed Result: Arizona Keeps Net Metering, But Levies Smaller Solar Fee”, November 15, 2013, accessed March 30, 2014, <http://www.renewableenergyworld.com/rea/news/article/2013/11/mixed-result-arizona-keeps-net-metering-but-levies-smaller-solar-fee>.
- ³¹ Amanda Miller, Renewable Energy World.com, Rooftop solar applications drop following Arizona's new fee, January 23, 2014, accessed March 30, 2014, <http://www.renewableenergyworld.com/rea/blog/post/2014/01/rooftop-solar-applications-drop-following-arizonas-new-fee>.
- ³² State of New Jersey, New Jersey’s Clean Energy Program, “Installation Summary by Technology,” accessed March 20, 2014, <http://www.njcleanenergy.com/renewable-energy/project-activity-reports/installation-summary-technology/installation-summary-technology>.
- ³³ David Hart, “Making, breaking, and (partially) remaking markets: State regulation and photovoltaic electricity in New Jersey,” Energy Policy, November 2010, accessed March 25, 2014, <http://www.sciencedirect.com/science/article/pii/S0301421510004994>.
- ³⁴ DSIRE.org, “New Jersey Incentives/Policies for Renewables & Efficiency,” Renewables Portfolio Standard, accessed March 28, 2013, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NJ05R.
- ³⁵ Ibid, Hart.
- ³⁶ American Council on Renewable Energy (ACORE), “Renewable Energy in New Jersey, September 2013, accessed March 30, 2014, <http://www.acore.org/files/pdfs/states/NewJersey.pdf>.
- ³⁷ Ibid, Hart.
- ³⁸ Ibid, Hart.
- ³⁹ Ibid, ACORE.
- ⁴⁰ Gabriel Phillips, “SRECs: Boom and Bust in the New Jersey Market,” Renewable Energy World, October 8, 2013, accessed March 28, 2014, <http://www.renewableenergyworld.com/rea/news/article/2013/10/sreCs-boom-and-bust-in-the-new-jersey-market>.
- ⁴¹ Ibid, Hart.
- ⁴² SRECTrade, Inc., “New Jersey is a solar leader, but that’s not necessarily good for SREC pricing,” April 22, 2013, accessed April 25, 2013, <http://www.srectrade.com/blog/srec-markets/new-jersey/new-jersey-is-a-solar-leader-but-thats-not-necessarily-good-for-srec-pricing>.

-
- ⁴³ GRID Alternatives, California Public Utilities Commission, Go Solar California, Single-family Affordable Solar Homes (SASH) Program Q4 2013 Program Status Report, 2014, 9, accessed March 3, 2014, http://www.cpuc.ca.gov/NR/rdonlyres/6EDCAEFB-2F3A-459B-B192-A5210C79DD97/0/Q4_2013_SASH_Program_Status_Report_.pdf.
- ⁴⁴ LegTrack, AB 217 (Bradford): Electricity: solar electricity: low-income households, accessed March 3, 2014, <http://www.legtrack.com/bill.html?bill=201320140AB217>.
- ⁴⁵ California Public Utilities Commission, California Alternate Rates for Energy (CARE), last modified February 5, 2014, accessed March 3, 2014, <http://www.cpuc.ca.gov/PUC/energy/Low+Income/care.htm>.
- ⁴⁶ State of California, California Public Utilities Commission, California Energy Commission, Go Solar California, 2007, Single Family Affordable Solar Housing (SASH), <http://www.gosolarcalifornia.ca.gov/affordable/sash.php>.
- ⁴⁷ Tim Drew, James Loewen, Neal Reardon, Ehren Seybert, Melicia Charles, State of California, California Public Utilities Commission, Go Solar California, California Solar Initiative Annual Program Assessment June 2013, 2013, 47, accessed March 3, 2014, <http://www.cpuc.ca.gov/NR/rdonlyres/7A350E8E-3666-4AA5-98E3-5E9C812D3DE6/0/CASolarInitiativeCSIAnnualProgAssessmtJune2013FINAL.pdf>.
- ⁴⁸ Ibid, GRID Alternatives, California Public Utilities Commission.
- ⁴⁹ Tim Drew, James Loewen, Neal Reardon, Ehren Seybert, Melicia Charles, State of California, California Public Utilities Commission, Go Solar California, California Solar Initiative Annual Program Assessment June 2013, 2013, 47, accessed March 3, 2014, <http://www.cpuc.ca.gov/NR/rdonlyres/7A350E8E-3666-4AA5-98E3-5E9C812D3DE6/0/CASolarInitiativeCSIAnnualProgAssessmtJune2013FINAL.pdf>.
- ⁵⁰ Housing Development Fund, Inc., "Take control of your energy bill with a Cozy Home Loan," 2012, accessed April 1, 2014, <http://hdf-ct.org/lending-products/cozyhome>.
- ⁵¹ Energize Connecticut, "Cozy Home Loan Eligible Measures," accessed March 25, 2014, [http://www.ctcleanenergy.com/Portals/0/Cozy%20Eligible%20Measures%20\(Customer%20Facing\)%20V08202013.pdf](http://www.ctcleanenergy.com/Portals/0/Cozy%20Eligible%20Measures%20(Customer%20Facing)%20V08202013.pdf).
- ⁵² The District of Columbia, District Department of the Environment, Renewable Energy Incentive Program for Residents- Low-income Option, accessed March 3, 2014, <http://green.dc.gov/service/renewable-energy-incentive-program-residents-low-income-option>.
- ⁵³ George L. Nichols, District of Columbia Sustainable Energy Utility Vermont Energy Investment Corporation (VEIC), Stanley L. Greschner, Grid Alternatives, "Successful Solar Incentive Programs Grow Solar Penetration within Low-income Communities #203", accessed March 1, 2013.
- ⁵⁴ FPL.com website, "FPL proposes voluntary, community-based solar partnership pilot to continue advancing affordable, clean energy in Florida," April 2, 2014, accessed April 9, 2014, <http://newsroom.fpl.com/solaranddsm>.
- ⁵⁵ Clean Technica, "Green Bank Academy Provides Lessons Learned, Direction For States Looking To Help Finance Clean Energy," accessed March 20, 2014, <http://cleantechnica.com/2014/03/09/green-bank-academy-provides-lessons-learned-direction-states-looking-help-finance-clean-energy/#rCpirxxuQItJhmZE.99>.
- ⁵⁶ Sun River Electric Cooperative, "Universal Systems Benefit Program," January 1, 2014, accessed March 20, 2014, http://www.sunriverelectric.coop/Membership/Billing_Rates_and_Fees/Universal_Systems_Benefit_Program/index.html.
- ⁵⁷ Bob Decker, "USB: One Part of the Deregulation Debacle That Could Be Corrected," The Policy Institute, June 2008, accessed March 21, 2014, <http://www.thepolicyinstitute.org/usb.pdf>.
- ⁵⁸ LIHEAP Clearing House, "State PBF/USF History, Legislation, Implementation", September 2013, accessed March 20, 2014, <http://liheap.ncat.org/dereg/states/montana.htm>.
- ⁵⁹ NorthWestern Energy, "green \$ense: Making Sound Renewable Energy Sources," accessed March 20, 2014, https://mail-attachment.googleusercontent.com/attachment/?ui=2&ik=28dde9e1a6&view=att&th=144ac97af935f2c8&attid=0.1&disp=inline&safe=1&zw&sadnr=1&saduie=AG9B_P8ZmsJugTxbw94H0iyr2cTy&sadet=1395766009291&sads=Sdu6G_ytHF2YAnWlZbSjER1mm6s&sadssc=1.

-
- ⁶⁰ June Pusich-Leste, interview by Chanelle Mayer, March 10, 2014, interview, email.
- ⁶¹ Pennsylvania Department of Environmental Protection, "PA Sunshine Residential/Small Business Solar PV Program is closed", 2014, accessed March 3, 2014, http://www.depweb.state.pa.us/portal/server.pt/community/grants_loans_tax_credits/10395/PA_Sunshine_Solar_Program/821790.
- ⁶² Pennsylvania Department of Environmental Protection, "Pennsylvania Sunshine Guidelines for the Residential and Small Business Solar Program", 2013, 13, accessed March 3, 2014, <http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/GrantsLoansTaxCredits/Solar/Pa%20Sunshine%20Guidelines.pdf>.
- ⁶³ US Department of Energy- Energy Efficiency & Renewable Energy, Interstate Renewable Energy Council, North Carolina Solar Center, DSIRE: Database of State Incentives for Renewables & Efficiency, Washington Incentives/Policies for Renewables & Efficiency, last reviewed June 28, 2012, accessed March 3, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WA127F&re=0&ee=0.
- ⁶⁴ Katherine Friedrich, "Three Strategies for Low-Income Solar Programs", February 5, 2014, accessed March 15, 2014, http://cleanenergyfinanceforum.com/2014/02/05/three-strategies-for-low-income-solar-programs/?blogsub=confirming#blog_subscription-2.
- ⁶⁵ Clean Technica, "Green Bank Academy Provides Lessons Learned, Direction For States Looking To Help Finance Clean Energy," accessed March 20, 2014, <http://cleantechnica.com/2014/03/09/green-bank-academy-provides-lessons-learned-direction-states-looking-help-finance-clean-energy/#rCpirxxuQItjhmZE.99>.
- ⁶⁶ Ibid.
- ⁶⁷ Daniel Lippman, "States explore green banks to reduce risk of clean energy projects," February 10, 2014, Energy & Environment Publishing, <http://www.eenews.net/stories/1059994277>.
- ⁶⁸ Clean Technica, "Green Bank Academy Provides Lessons Learned, Direction For States Looking To Help Finance Clean Energy," accessed March 30, 2013, <http://cleantechnica.com/2014/03/09/green-bank-academy-provides-lessons-learned-direction-states-looking-help-finance-clean-energy/>.
- ⁶⁹ Ibid.
- ⁷⁰ Solarize Connecticut, "About Solarize," accessed March 30, 2013, <http://solarizect.com/about-solarize/>.
- ⁷¹ Kat Friedrich, "Connecticut's New Solar Lease Program Will Kindle Economic Opportunity," Clean Energy Finance Center, June 30, 2013, accessed March 30, 2013, <http://www.cleanenergyfinancecenter.org/2013/06/connecticuts-new-solar-lease-program-will-kindle-economic-opportunity/>.
- ⁷² Ibid.
- ⁷³ Billy J. Roberts, "Photovoltaic Solar Resource of the United States," National Renewable Energy Laboratory (NREL) for the US Department of Energy (DOE), September 19, 2012, http://www.nrel.gov/gis/images/eere_pv/national_photovoltaic_2012-01.jpg.
- ⁷⁴ Alex Wilson, "Choosing Insulation Levels Based on Your PV Costs," BuildingGreen.com, July 10, 2013, accessed April 10, 2014, <http://www2.buildinggreen.com/blogs/choosing-insulation-levels-based-your-pv-costs>.
- ⁷⁵ Rachel Gelman, "2012 Renewable Energy Data Book," National Renewable Energy Laboratory (NREL) for the US Department of Energy (DOE), Spring 2013, accessed April 10, 2014 <http://www.nrel.gov/docs/fy14osti/60197.pdf>.
- ⁷⁶ Electric Power Monthly Bulletin, "Table 5.6.A. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector," US Energy Information Administration (EIA), March 21, 2014, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6.
- ⁷⁷ Jackson Morris, Andrea Cerbin, Jordan Stutt and Adam Cohn, "New York's Renewable Portfolio Standard: Where to from here?," PACE Law School's Energy and Climate Center, Spring 2014, accessed April 15, 2014, <http://energy.pace.edu/sites/default/files/publications/RPS%20Report.pdf>.
- ⁷⁸ NYSERDA, "2014 RPS Performance Report," April 2, 2014, accessed March 30, 2014 <http://www.nysERDA.ny.gov/-/media/Files/Publications/PPSER/NYSERDA/2014-RPS-Performance-Report.pdf>.

-
- ⁷⁹ Michael Stosser, "Petition for NY-Sun Funding Considerations and Other Program Modifications," Sutherland Asbill & Brennan LLP, March 3, 2014, accessed April 8, 2014, [file:///Users/chanellemayer/Downloads/Posigen%20Comments%20\(2\).pdf](file:///Users/chanellemayer/Downloads/Posigen%20Comments%20(2).pdf).
- ⁸⁰ New York Power Authority, "Solar Market Acceleration Program (Solar MAP)", accessed March 10, 2014, <http://www.nypa.gov/solar/solarmap.htm>.
- ⁸¹ The New York State Renewable Portfolio Standard Performance Report," NYSERDA, December 31, 2012, accessed March 10, 2014, <http://www.nyserdera.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/Renewable-Portfolio-Standard-Reports.aspx>.
- ⁸² NYSERDA, "PON 2112 - Solar PV Program Financial Incentives", n.d., accessed February 23, 2014.
- ⁸³ PSEG Long Island, "Clean Solar Initiative Feed-In Tariff II - 100MW," accessed February 28, 2014, <https://www.psegliny.com/page.cfm/FIT>.
- ⁸⁴ Peter Olmsted, "5 Reasons for New York Solar Greatness," The Vote Solar Initiative, January 10, 2014, <http://votesolar.org/2014/01/10/5-reasons-for-new-york-solar-greatness/>.
- ⁸⁵ Grants & Research Department of National Association of Regulatory Utility Commissioners (NARUC), "Decoupling For Electric & Gas Utilities: FAQ", September 2007, accessed March 1, 2014, http://epa.gov/statelocalclimate/documents/pdf/supp_mat_decoupling_elec_gas_utilities.pdf.
- ⁸⁶ PSEG Long Island, "Clean Solar Initiative Feed-In Tariff II FAQ," accessed March 25, 2014, <https://www.psegliny.com/page.cfm/FIT/FIT-IIFAQ>.
- ⁸⁷ SEIA, "Issues and Policies," mid-2012, accessed March 25, 2014, <http://www.seia.org/policy/state-solar-policy>.
- ⁸⁸ The Solar Foundation, "New York", November 2013, accessed March 25, 2014, <http://thesolarfoundation.org/solarstates/new-york>.
- ⁸⁹ NY PSC, "New York Environmental Disclosure Program," DSIRE USA. January 6, 2013, accessed March 25, 2014, http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY04R&re=0&ee=0.
- ⁹⁰ Amy Heinemann, interview by Erica Helson, April 22, 2014, interview, email.
- ⁹¹ City University of New York, New York State NYSolar Smart Survey Final Report", January 2014.
- ⁹² DSIRE USA, "New York City of Riverhead - Energy Conservation Device Permitting Fees," July 10 2012.
- ⁹³ NYC Department of Buildings, "Solar Installation FAQs", accessed March 30, 2014.
- ⁹⁴ DSIRE USA, "New York Residential Solar Tax Credit," August 27, 2012, accessed March 28, 2014.
- ⁹⁵ NYSERDA, "Current Funding Opportunities, PONS, RFPs, and RFQs," accessed March 29, 2014, <https://www.nyserdera.ny.gov/Funding-Opportunities/Current-Funding-Opportunities.aspx>.
- ⁹⁶ Ibid.
- ⁹⁷ NYSERDA, "PON 2156," accessed March 29, 2014, <https://www.nyserdera.ny.gov/Funding-Opportunities/Closed-Funding-Opportunities/PON-2156-Renewable-Portfolio-Standard-CustomerSited-Tier-Regional-Program.aspx>.
- ⁹⁸ Ibid.
- ⁹⁹ NYSERDA, "PON 2672 Photovoltaic Balance-of-System Cost Reduction," accessed March 30, 2014, <http://www.nyserdera.ny.gov/nysun-bos>.
- ¹⁰⁰ The NY-Sun Initiative, "Local Community Tools," accessed March 20, 2014, <http://ny-sun.ny.gov/Local-Community-Tools>.
- ¹⁰¹ New York State Public Service Commission, "System Benefits Charge," February 13, 2013.
- ¹⁰² Energize New York, "Commercial", accessed March 9, 2014, <http://energizeny.org/page/finance/>.
- ¹⁰³ NYSERDA, "Green Jobs Green New York," January 31, 2013, <http://www.nyserdera.ny.gov/Features/Green-Jobs-Green-New-York.aspx>.
- ¹⁰⁴ NYSERDA Official Statement, \$24,300,000 Residential Energy Efficiency Financing Revenue Bonds, Series 2013A, dated July 31, 2013.
- ¹⁰⁵ New York Construction Law Center, "Construction Licenses," accessed March 30, 2014, <http://www.newyorkconstructionlawyercenter.com/lawyer-attorney-1415132.html>.
- ¹⁰⁶ Dan Higgins, "Contractors upstate aren't licensed. Why not?" *TimesUnion.com*, July 12, 2008, <http://blog.timesunion.com/advocate/contractors-upstate-arent-licensed-why-not/281/>.
- ¹⁰⁷ Brett Davidsen, "New York State Exposed: Why aren't New York contractors licensed?" *WHEC* Rochester, November 11, 2013, accessed March 24, 2014, <http://www.whec.com/article/stories/s3214749.shtml>.

-
- ¹⁰⁸ Dan Higgins, “Contractors upstate aren’t licensed. Why not?” *TimesUnion.com*, July 12, 2008, accessed March 24, 2014, <http://blog.timesunion.com/advocate/contractors-upstate-arent-licensed-why-not/281/>.
- ¹⁰⁹ New York Construction Law Center, “Construction Licenses”, accessed March 30, 2014, <http://www.newyorkconstructionlawyercenter.com/lawyer-attorney-1415132.html>.
- ¹¹⁰ City University of New York, “New York State NYSolar Smart Survey Final Report”, January 2014.
- ¹¹¹ Dr. Moon Wha Lee, “Housing New York City 2011”, p. 280, November 2013.
- ¹¹² Ibid.
- ¹¹³ Ibid, p. 282.
- ¹¹⁴ NREL, “The Open PV Project”, 2013, accessed March 30, 2014, <https://openpv.nrel.gov/search?state=NY&zipcode>.
- ¹¹⁵ Ibid.
- ¹¹⁶ Ibid.
- ¹¹⁷ US Census Bureau, “State & County QuickFacts: New York”, accessed April 3, 2014, <http://quickfacts.census.gov/qfd/states/36000.html>.
- ¹¹⁸ US Census Bureau, “American FactFinder”, 2013, accessed April 5, 2014, http://factfinder2.census.gov/faces/nav/jsf/pages/guided_search.xhtml.
- ¹¹⁹ The State of the USA, “Measuring Economic Well-being: GDP vs. Median Income”, accessed March 30, 2014, <http://www.stateoftheusa.org/content/measuring-economic-well-being.php>.
- ¹²⁰ NYSERDA, “Assistance for Low and Moderate Income Households”, accessed March 30, 2014, <http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Residential/Programs/Low-Income-Assistance.aspx>.
- ¹²¹ Mark Muro, Jonathan Rothwell, and Devashree Saha, “Sizing the Clean Economy: A National and Regional Green Jobs Assessment,” The Brookings Institution, July 13, 2011.
- ¹²² The Solar Foundation, “National Solar Jobs Census 2013,” February 11, 2014, accessed March 30, 2014, <http://thesolarfoundation.org/research/national-solar-jobs-census-2013>.
- ¹²³ Ibid.
- ¹²⁴ Ibid, Muro.
- ¹²⁵ Ibid.
- ¹²⁶ Ibid.
- ¹²⁷ Ibid.
- ¹²⁸ The Solar Foundation, “State Solar Jobs,” November 2013, accessed March 30, 2014, <http://thesolarfoundation.org/solarstates/new-york>.
- ¹²⁹ New York Solar Energy Industries Association, “NYSEIA Applauds Governor Cuomo’s Commitment of 3,000 MW Through NY-Sun,” January 9, 2014, accessed March 30, 2014, <https://nyseia.memberclicks.net/assets/nyseia%20sots%20jan%209%202014.pdf>.
- ¹³⁰ California Public Utilities Commission, “Virtual Net Metering”, December 16, 2011, accessed March 30, 2014, <http://www.cpuc.ca.gov/PUC/energy/DistGen/vnm.htm>.
- ¹³¹ Amy Paulin, “Wrapping up 2013,” AmyPaulin.com, December 30, 2013, accessed March 25, 2014, http://amypaulin.com/press_rel_detl.asp?id=428.
- ¹³² NYSERDA, “NY-Sun Unified Solar Permit to Streamline Permitting Processes throughout State,” September 20, 2013, accessed March 25, 2014, <https://www.nyserda.ny.gov/About/Newsroom/2013-Announcements/2013-09-20-NY-Sun-Unified-Solar-Permit-to-Streamline-Permitting-Processes-throughout-state.aspx>.
- ¹³³ Katherine Friedrich, “Three Strategies for Low-Income Solar Programs”, February 5, 2014, accessed March 25, 2014, http://cleanenergyfinanceforum.com/2014/02/05/three-strategies-for-low-income-solar-programs/?blogsub=confirming#blog_subscription-2.
- ¹³⁴ Edison Electric Institute, “EEI, NRDC Joint Statement to State Utility Regulators,” February 12, 2014, accessed March 30, 2014, http://docs.nrdc.org/energy/files/ene_14021101a.pdf.
- ¹³⁵ SUNY ESF website, “SPARE”, accessed April 14, 2014, <http://www.esf.edu/outreach/spare/>.
- ¹³⁶ US Department of Energy, Industrial Renewable Center, North Carolina Renewable Center, Database of State Incentives for Renewables & Efficiency Website, “Santa Clara Water & Sewer - Solar Water Heating Program,” accessed March 30, 2014, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA19F&re=1&ee=1.

¹³⁷ Mark Gunther, "With Rooftop Solar on Rise, U.S. Utilities Are Striking Back", September 2, 2013, accessed March 30, 2014,

http://e360.yale.edu/feature/with_rooftop_solar_on_rise_us_utilities_are_striking_back/2687/.

¹³⁸ Comments in Opposition of Multiple Intervenors, Multiple Intervenors, January 31, 2014.

¹³⁹ Multiple Intervenors, 2011, accessed March 28, 2014,

<http://www.multipleintervenors.com/multipleintervenors/home.aspx>.

¹⁴⁰ New York City Housing Authority, website, accessed March 28, 2014.

¹⁴¹ New York City Housing Authority, interview dated March 27, 2014.

¹⁴² Ibid.

¹⁴³ Ibid.

¹⁴⁴ New York City Housing Authority, website, accessed March 28, 2014.

¹⁴⁵ Ibid.