New York City's Solar Energy Future

Part II:
Solar Energy Policies and Barriers in New York City

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Prepared by

The Center for Sustainable Energy at Bronx Community College

for

The City University of New York's Million Solar Roofs Initiative

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- The City University of New York (CUNY) began the Million Solar Roofs Initiative (MSRI) in partnership with the US Department of Energy's Million Solar Roofs program in summer 2005. Under the MSRI, CUNY set a target to install 500 solar roofs in New York City by 2010. To meet this target, CUNY planned an outreach and education campaign that includes an assessment of the solar energy market in New York City, the identification of barriers to solar energy development, and the facilitation of solar projects throughout the City. The CUNY MSRI is being managed by the Center for Sustainable Energy at Bronx Community College.

- The Center for Sustainable Energy was founded in 2003 at Bronx Community College through a Congressional appropriation sponsored by the Honorable José Serrano. The Center's mission is to promote a stronger economy and a healthier environment through education, training, and research focused on advanced and emerging energy technologies. These technologies include renewable energy systems like solar and wind power, energy efficiency technologies, and alternative fuel vehicles.

- Solar New York is an organization dedicated to accelerating New York's transition to a solar energy economy. Solar New York seeks to identify the barriers to solar energy development and develop policy strategies to address them. Solar New York has partnered with the Center for Sustainable Energy and CUNY to fund the Million Solar Roofs Initiative in New York City. Solar New York is a program of Clean Energy Clean Environment, a non-profit organization.

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Photos on the report cover courtesy of (from top to bottom altPower, Inc., St. Francis of Assisi School, and DUCE Construction Corporation.

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Executive Summary

This is the second of a two-part study of solar energy in New York City. The first report identified the size and recent growth of New York City's solar energy market. The primary purpose of this study is to identify the policies and barriers that shape New York City's solar energy market and discuss the potential for future market growth.

Section 1 reviews the mix of federal, state, and local policies affecting market growth in New York City's commercial, residential, and municipal building sectors. The table below summarizes the incentives that are discussed.

	Eligibility		
	Residential	**Commercial**	**Municipal**
Federal Incentives			
Federal Business Energy Tax Credit		X	
Modified Accelerated Cost-Recovery System		X	
Federal Renewable Energy Production Incentive			X
Clean Renewable Energy Bonds			X
Federal Residential Solar & Fuel Cell Tax Credit	X		
State Incentives			
Energy $mart PV Incentive	X	X	
Energy $mart Loan Fund	X	X	
Renewable Portfolio Standard	X	X	
Green Building Tax Credit	X	X	
Energy Systems Property Tax Exemption	X	X	
Solar Sales Tax Exemption	X		
Solar and Fuel Cell Tax Credit	X		
Net Metering	X		
Local Policies			
Sales tax exemption	X		

Section 1 also reviews interconnection, codes, green construction mandates, and unique photovoltaic (PV) incentive programs derived from clean air settlement funds, demonstration funds, etc.

In order to demonstrate the interaction and cumulative impact of federal and state policies, an economic model was developed using the Center for Energy and Environmental Policy's *PV Planner* software. Using average data for New York City, the analysis revealed that system economics are currently the best for commercial systems (9.48 year payback), followed by residential systems (12.24 year payback). The fact that there are no incentives available on a consistent basis for municipal systems, coupled with the low cost of public sector power, means that the municipal PV system modeled did not pay for itself over its lifetime. These examples are intended to illustrate how the different incentives interact. The models are highly sensitive to changes in system cost and to the mix of policies available.

Section 2 reviews the barriers to continued market growth in New York City. Although the range of policies that have supported New York City's market is impressive, it is doubtful that the current policy mix will be sufficient to sustain market growth. The reasons for this are (1) insufficient funds (2) rising costs (3) technical barriers and (4) inadequate policy mix for New York City.

Since 2003, the System Benefit Charge (SBC) has provided a consistent source of funding for PV systems. With the passage of the New York State Renewable Portfolio Standard (RPS), funding for PV has been moved from the SBC to the RPS customer-sited tier. PV is scheduled to be allocated $13.8 million under the RPS through 2009. If it is assumed that market growth will be driven primarily by the RPS, this funding will not be sufficient to sustain market growth at 25% annually (the low growth scenario projected in Part I of this study). This is true even under the optimistic assumption that New York City will receive the entire $13.8 million of the RPS funds. In addition to the RPS not having sufficient funds to sustain New York City's market, there is no predictable source of funding for municipal systems. Historically, the public sector in New York City has installed the majority of the City's PV capacity. Moving forward, it is uncertain whether and how the public sector can continue its leadership role in PV installations.

In addition to insufficient funds, New York City is also facing rising PV installation costs. While module costs in New York City have fallen compared to New York State, this decrease has been offset by an increase in labor and balance of system costs. Furthermore, both New York City and New York State installed costs have trended upward. Neighboring markets in New Jersey and Long Island, meanwhile, have trended sharply downward. This discrepancy could be attributable to the comparative size of the PV markets. Both Long Island and New Jersey have invested more in their PV programs than New York State has on both a gross and per capita basis. Industry stakeholders have commented that these comparatively large markets to either side of New York City have achieved cost reductions through economies of scale and the creation of competition, while New York City's technical barriers and smaller market size have made it a less attractive place to operate and have driven up costs.

Interconnection is another significant barrier to market growth in New York City. Installers report that delays processing interconnection applications and uncertainty about the technical feasibility of feeding power back into New York City's grid raise the costs of PV systems and make New York City a less attractive market to work in. Costs are also raised by requirements for a manual disconnect switch, and a recent amendment to the New York City electrical code requiring systems to be tested onsite by national testing lab representatives.

A final barrier to market growth in New York City is the structure of current policies. New York City is a dense, urban environment with a high concentration of large, commercial buildings. Most New York State policies, however, target small, residential systems and therefore limit the effectiveness of PV in reducing New York City load. In addition, energy planning efforts do not currently take the benefits that PV has for the utility grid into account.

While these four barriers are treated separately in this report, it should be noted that they are closely inter-related. NYSERDA PV Incentives, for example, target small systems because of insufficient funds to target larger PV systems. Insufficient funding may also be contributing to the comparatively higher costs in New York State than in neighboring markets. Finally, interconnection barriers and costs further compound the upward cost trends within the City.

Section 3 presents a set of policy recommendations to address the barriers identified in Section 2. Several strategies to address the lack of funding include increasing PV funding under the RPS, allowing PV to qualify for SBC funds again, creating a New York City-specific fund, and creating a voluntary green power program to support PV. Strategies to address rising costs include putting substantial incentives in place that are scheduled to decline over time, exploring bulk procurement opportunities, exploring alternative ownership and financing mechanisms, and lowering NYPA's management fee. Strategies for the technical barriers include initiating a collaborative dialogue between Con Edison and distributed generation installers within the City, launching an online interconnection tracking system to identify delays, working to identify the technical limits for PV in the network grid and linking those limits to citywide PV targets, and removing redundant or unnecessary interconnection and code requirements. Finally, strategies to adjust policies so that they more accurately target New York City's infrastructure include expanding current incentives to all customer classes, removing or raising current system size caps, requiring PV through the City's green building mandates, and acknowledging the grid-side benefits of PV in current energy planning and peak load management efforts.

Introduction

Sunlight is New York City's largest potential source of locally available energy, and recent studies argue that the City could meet a significant percentage of its future energy needs using solar power. Solar energy development has also been promoted as a strategy for mitigating rising fuel prices, blackouts, air pollution, environmental justice concerns, and climate change.

This report is the second in a two-part study focusing on solar energy's potential in America's largest urban center. The first report, entitled *The Market for Photovoltaic Systems in New York City*, sought to quantify the potential contribution of solar power to the City's energy supply. The report concluded that at the end of 2005, there were 45 photovoltaic (PV) systems, totaling 1.1 megawatts (MW), installed in the five boroughs. These installations supplied approximately 0.002% of the City's electricity. Considering that the technical potential for PV within New York City has been estimated to be between approximately 6000 MW (Ettenson, 2006) and 15,000 MW (Chaudhari et al., 2005), there is enormous potential for PV market growth.

This report explores whether the PV market in New York City can meet its projected technical potential through existing policies. Although the current installed capacity is small, the City's PV market has grown rapidly during the past four years at rates comparable to the global average (i.e. between 20% and 50%). New York City's market is relatively new, however, and it remains unclear whether this growth trend represents the beginning of a sustained expansion or a temporary surge.

The world's leading PV markets have been driven by substantial, long-term incentives and enabling regulations (Osborn et al., 2005). This report will examine the policies that affect PV deployment in New York City and discuss their implications for market sustainability. Section 1 surveys the federal, state, and local policies that target PV and analyzes their impacts. Section 2 identifies barriers to large-scale solar energy growth in New York City while Section 3 presents a set of policy recommendations.

Section 1: Solar Energy Policy in New York City

As a municipality, New York City benefits from (and is limited by) the mix of solar energy policies, programs, and regulations in place at the federal, state, and local levels. Broadly defined, New York City's solar energy policy framework includes research and development efforts, outreach and education programs, standards and codes, and direct incentives. An exhaustive catalogue of this framework is beyond the scope of this report. However, this section will focus on the enabling regulations and incentives that directly impact the economics of PV systems. In general, these policies include rebates, grants, tax credits and exemptions, subsidized loans, performance-based incentives, metering and interconnection requirements, and electrical codes.

1.1 Federal Policies

The federal government has long supported solar energy development through demonstration projects, research, and outreach efforts such as the Million Solar Roofs Initiative (MSRI). At present, direct federal support for solar energy installations is available in the form of tax incentives, public sector production incentives, and clean energy bonds.

1.1.1 Federal Tax Incentives

Prior to 2005, federal tax support for solar energy systems was limited only to businesses. Commercial and industrial customers who invested in PV could take advantage of an accelerated depreciation schedule and were also eligible for a 10% investment tax credit. In 2004, solar electric systems also became eligible for the Renewable Energy Production Tax Credit (PTC), which provided an inflation-adjusted 1.5 cent per kilowatt-hour (kWh) tax incentive to generators.[1] The Energy Policy Act of 2005 (EPAct), which was signed into law by President Bush in August of 2005, established the first residential investment tax credit in the United States and increased the size of the commercial credit to 30%.

<u>The Business Energy Tax Credit</u>

Under the current business energy tax credit, commercial and industrial customers that install solar energy systems between January 1, 2006 and December 31, 2007 will receive a tax credit equal to 30% of the cost of solar equipment. This tax credit can be carried forward for 20 years if the value of the credit exceeds the entity's tax liability (Martin, 2006). After December 31st, 2007, the tax credit reverts back to 10%. Unlike the residential tax credit, there is no cap on the size of the tax credit that a commercial or industrial entity can claim.

<u>The Residential Solar Energy Tax Credit</u>

The residential solar energy tax credit is a 30% investment credit can be claimed between January 1st, 2006 and December 31st, 2007, after which it will expire. The residential tax credit is capped at $2,000 and can be carried forward to the succeeding year. For

[1] The PTC, however, was not as valuable as the 10% investment tax credit and so few solar system owners, if any, exercised this option. The solar PTC expired at the end of 2005.

cooperatives or condominium buildings that invest in PV, the tax credit is divided proportionately among the shareholders or association members.

Modified Accelerated Cost-Recovery System (MACRS)

The Modified Accelerated Cost-Recovery System (MACRS) outlines the schedule by which businesses can recover investments in solar equipment through depreciation deductions. Under MACRS, PV systems placed in service after 1986 are eligible for the depreciation schedule shown in Table 1 below. Without the MACRS, PV systems would be depreciated over a 20 year period.

Table 1: MACRS Depreciation Schedule for Solar Energy Systems

Year	Percentage
1	20.00%
2	32.00%
3	19.20%
4	11.52%
5	11.52%
6	5.76%

Source: IRS (2005)

The business energy tax credit reduces the value that can be depreciated (i.e. the depreciable basis) by 50% of the tax credit amount (Martin, 2006). In other words, if the 30% tax credit is claimed, then only 85% of the PV system cost can be depreciated.[2] Similarly, if the tax credit reverts back to 10%, the depreciable basis will be 95%. As will be discussed in Section 1.4 below, the depreciable basis can also be affected by state and local incentives.

1.1.2 Renewable Energy Production Incentive

The Renewable Energy Production Incentive (REPI) is an annual incentive payment available to renewable energy systems owned by state governments, local governments, Native corporations, or non-profit electric cooperatives. The REPI was initially authorized under the Energy Policy Act of 1992. It expired in 2003, but was re-established in the Energy Policy Act (EPAct) of 2005. The REPI is intended to be the public sector counterpart to the Renewable Energy Production Tax Credit (PTC). Like the PTC, the value of the REPI is set at 1.5 cents per kilowatt-hour of output in 1993 dollars and indexed to inflation. As of 2005, the inflation-adjusted payments were 1.9 cents per kWh. Generating facilities can apply for the REPI through 2016 and will receive payments for 10 fiscal years. Since REPI payments depend on annual Congressional appropriations, their availability is not certain from year to year. This uncertainty limits its effectiveness for financing renewable energy projects (Bird et al., 2005). Moreover, while REPI payments may be sufficient to create incentives for wind generation, they are not large enough to cover the incremental cost of solar electricity on their own.

[2] 100% – (30% x 50%) = 85%.

In New York State, a few solar systems installed by the New York Power Authority (NYPA) in the mid-1990s received REPI payments. The annual REPI payments to New York State were small, however, and only $50,000 of the $35 million appropriated for REPI funds between 1995-2005 went to NYPA solar systems (see Appendix I).

1.1.3 Clean Renewable Energy Bonds (CREBs)

The Energy Tax Incentive Act of 2005, under Title XIII of the Energy Policy Act of 2005, established Clean Energy Renewable Bonds (CREBs) as a financing mechanism for public sector renewable energy projects. The Act allocates $800 million of tax credit bonds to be issued between January 1, 2006 and December 31, 2007. These funds are allocated by the Secretary of the U.S. Treasury Department with a $500 million cap for government entities (Narefsky, 2006). The Bonds can be issued until January 1, 2008, but the solicitation date for applications closed on April 26, 2006 (Jones and Roth, 2005). CREBs can be issued by a clean renewable energy bond lender, a cooperative electric company, or a governmental body.

While CREBs are similar to conventional bonds, they differ in that the bondholder claims a tax credit from the federal government in lieu of an interest payment from the issuer. Thus, the borrowing entity can issue the bond with a 0% interest rate. The tax credit rate is set daily by the Secretary of the Treasury and can be taken on a dollar for dollar basis to offset the tax liability of the bondholder.

CREBs differ from traditional tax-exempt bonds since the tax credits issued through CREBs are treated as taxable income for the bondholder (Oswald and Larsen, 2006).The tax credit can be taken each year the bondholder has a tax liability as long as the credit amount does not exceed the limits established by the Energy Policy Act of 2005.[3]

In 2006, the City University of New York successfully applied for $2.165 million worth of CREBS bonds to finance five photovoltaic projects totaling 260 kW.[4]

1.2 State Policies

New York State has historically been a leader in solar energy development in the eastern United States. While many stakeholders have played important roles in shaping New York's solar energy policy, the three agencies that administer the state's solar energy programs are the New York State Energy Research and Development Authority (NYSERDA), the New York Power Authority (NYPA), and the Long Island Power Authority (LIPA). This section provides an overview of NYSERDA and NYPA programs, and an overview of New York State's tax benefits and interconnection regulations. The Long Island Power Authority does not serve customers in New York City and so its programs are not reviewed in this section.

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[3] The tax credit shall not exceed the excess of the sum of the regular tax liability (as defined in section 26(b)) plus the tax imposed by section 55, over the sum of the credits allowable under this part.

[4] The New York City Economic Development Corporation applied for $12.9 million worth of CREBS to finance three projects totaling 2 megawatts, but the CREBs were not awarded.

1.2.1 New York Energy Research and Development Authority

The New York Energy Research and Development Authority (NYSERDA) is a state public benefit corporation that develops and administers programs to support energy efficiency and renewable energy. Like the federal government, NYSERDA supports a wide range of solar-related activities including research, outreach and education, training, technology transfer, and small business development. These programs are funded primarily by a surcharge on electrical consumption known as the System Benefits Charge (SBC).

The System Benefits Charge (SBC) is collected on a per kilowatt-hour (kWh) basis from customers of the state's six investor-owned utilities.[5] Renewed in December 2005, the SBC will collect $175 million annually through 2011 (PSC, 2005c). The annual amount collected from each utility will be equal to 1.42% of their 2004 revenue. For Con Edison, this represents an increase from the previous SBC cycle, when the collection amount was calculated based on 1999 revenues. Under the new SBC, Con Edison's contribution to the fund will rise 3.5% and will account for 50% of the total funding (See Appendix II). The SBC surcharge for Con Edison customers, $0.002/kWh (Con Edison, 2006c), is higher than that of customers in other utility service areas.

Since 2002, NYSERDA has supported PV system installations with a capital cost buy-down called the Energy $mart PV Incentive. Starting in September 2006, however, PV funds from the Energy $mart Incentive will be phased out and replaced by funds from the NYSERDA-managed Renewable Portfolio Standard (RPS). This subsection will describe the Energy $mart PV Incentive, the RPS, the Energy $mart Loan Program, and several smaller NYSERDA PV programs that impact solar energy installations in New York City.

Energy $mart PV Incentives

The Energy $mart PV Incentive is a cash incentive designed to reduce the high upfront costs of PV installations. As of November 2006, the base incentive was $4.00 per watt for systems 50 kW and smaller, with a maximum incentive of 60% of the total system cost (NYSERDA, 2006a).[6] The rebate increases to $4.50 per watt for systems installed on New York Energy Star®-labeled homes and for building-integrated PV (BiPV) systems installed through NYSERDA's Energy $mart New Construction program. Systems above 50kW are eligible for the incentive, but the incentive amount is capped at the 50 kW level.[7] In other words, a 100 kW system would only receive $4.00 for the first 50 kW, making the incentive for the entire system $2.00 per watt. To be eligible for the incentive, the applicant must pay into the SBC and the installation must be performed by a NYSERDA-eligible installer.[8] As of July 2006, there were 18 eligible installers listed for New York City, of which eight have completed installations within the five boroughs (Center for Sustainable Energy survey, 2006).

[5] Customers of LIPA, NYPA, rural co-operatives and municipal utilities do not pay the SBC. SBC rates for the 6 investor owned utilities are listed in Appendix II.
[6] Updates can be found on http://www.nyserda.org/funding/716PON.pdf
[7] i.e. 50 kW * $4.00/watt = $200,000; 50kW * $4.50/watt = $225,000
[8] To become an eligible installer, Contractors must apply to NYSERDA. Applications are then judged based on installer experience, training and education, and customer references (see: NYSERDA, 2006a).

The PV Incentive program began in October 2002 with a total budget of $13.9 million through September 2006. As of June 30th, 2006, NYSERDA had allocated $11.5 million to 492 systems totaling 2,791 kW. Of this, 12% of the funds, or $1.7 million went to fund 49 systems totaling 426 kW in New York City.[9]

<u>Renewable Portfolio Standards</u>

A renewable portfolio standard (RPS) mandates that a certain percentage of a state's electricity be supplied by renewable energy. In September 2004, the PSC (2004b) issued an Order requiring 25% of New York State's electricity to be supplied from renewable sources by 2013. Prior to the enactment of the RPS, New York State already derived over 19% of its power from renewable resources, such as hydropower. New York State will therefore need to increase its share of renewable energy by approximately 6% to meet the mandate (New York Department of Public Service, 2003).

The PSC (2004b) also created a customer-sited tier in the RPS to support small-scale PV, wind, fuel cell, and biogas systems that would not otherwise be competitive with utility-scale renewable energy. The Administrative Law Judge stated that the customer-sited tier was justified since distributed generation systems have "high value in their potential to be located near urban, heavy-load areas" (PSC, 2006a: 2). The customer-sited tier is set at 2% of the incremental megawatt-hours (MWh) required to meet the RPS each year. The yearly schedule for the RPS and the customer-sited tier is included in Table 2 below.

Table 2: Yearly Schedule for Renewable Energy (RE) Increases under the NYS RPS

Year	New York RE (%)	Incremental RE (%)	Customer-sited Tier (%)	Incremental RE (MWh)	Customer-sited Tier (MWh)
2006	19.93%	0.81%	0.016%	1,360,424	27,208
2007	20.65%	1.66%	0.033%	2,821,830	56,437
2008	21.38%	2.50%	0.050%	4,306,437	86,129
2009	22.10%	3.31%	0.066%	5,787,968	115,759
2010	22.83%	4.13%	0.083%	7,301,693	146,034
2011	23.55%	4.95%	0.099%	8,867,181	177,344
2012	24.28%	5.75%	0.115%	10,403,939	208,079
2013	25.00%	6.56%	0.131%	11,988,888	239,778

Source: PSC (2004b)

As can be seen in Table 2, the customer-sited tier is projected to require 239,000 MWh of customer-sited generation by 2013. Of this amount, the RPS Order predicted that 21,431 MWh, or over 16 MW, would come from PV systems (PSC, 2004b).

Unlike the other RPS regimes on the East Coast,[10] New York's RPS does not rely on a system of tradable renewable energy credits. Instead, the RPS will use a centralized procurement process managed by NYSERDA and funded by a customer surcharge similar to the SBC. For Con Edison customers, this surcharge is $0.0002/kWh, or one

[9] This figure includes PV systems that have not yet been installed, but for which funding has been approved
[10] CT, DC, DE, MA, ME, MD, PA, NJ, RI

tenth the size of the SBC surcharge (Con Edison, 2005d). The customer-sited tier will distribute $45 million in funding through 2009 (PSC, 2006a), of which PV will get the largest share at $13.8 million (Table 3).

Table 3: Allocation of RPS Customer-sited Tier Funds

Resource	Funds (% of total)	Funds ($)
PV	30.7%	$13,815,000
Fuel cells	24.9%	$11,205,000
Farm biogas	24.4%	$10,980,000
Wind	10.0%	$ 4,500,000
Other	10.0%	$ 4,500,000

Source: PSC (2006)

The average annual PV funding available under the RPS will be $3.45 million through 2009, compared to an average of $2.78 million available each year under the SBC. In addition, 10% of the customer-sited tier fund is reserved for redistribution to new technologies or among the four eligible technologies. If PV were to exceed its annual funding, for example, it is possible that some funds might be reallocated from the 10% reserve. To date, NYSERDA is in the process of writing the Operating Plan for the customer-sited tier. It is therefore uncertain exactly how PV funds will be structured and distributed under the RPS.

Energy $mart Loan Program

The New York Energy $mart Loan Program is a 10-year interest rate buy-down for energy efficient and renewable energy technologies. NYSERDA provides SBC funds to lenders in order to reduce the interest rate for loans by 4% across New York State and 6.5% within Con Edison territory.[11] The different loan limits are listed by customer class in Appendix III.

In order for a PV system to be eligible for the loan program, PV owners must: (1) pay into the SBC fund; (2) hire a NYSERDA-eligible installer to install the PV system; and (3) be approved for financing from a participating lending institution. Between 2002 and 2006, $7 million in interest rate buy-downs were used to leverage over $56 million in loans for energy efficiency and renewable energy. Only one PV system in New York City was financed using the Loan Program during this period. The loan fund for 2006-2011 is budgeted at $10.5 million and is projected to leverage $60 million in loans for over 500 customers (NYSERDA, 2006c).

According to the New York State Department of Taxation and Finance, the Energy $mart Loan Fund does not affect the depreciable basis of the New York State residential tax credit. Energy $mart loans are considered "subsidized energy financing" by the Internal Revenue Service, however, and therefore reduce the depreciable basis for the federal tax

[11] Although the 6% buy-down was previously only available in the New York City Liberty Zone, it was extended to all of Con Edison territory under the 2006 SBC extension

credit. Section 1.4 below discusses the interaction between state and federal tax benefits and incentives in greater detail.

<u>Office of the Attorney General Settlements</u>

In addition to the funds secured through the SBC and the RPS surchages, NYSERDA has also been charged with administering two settlement funds secured by the Office of the Attorney General (OAG). The settlements followed Attorney General Eliot Spitzer's 1999 announcement that New York State planned to sue the utilities that owned 17 power plants in five states for violations of the Clean Air Act (CAA). In the subsequent settlements with both VEPCO and Ohio Edison, a portion of the funds were explicitly allocated for solar projects on public buildings in New York. Cases against American Electric Power Company and Cinergy Corporation are currently pending.

- *VEPCO Settlement*

  In 2003, the Office of the Attorney General announced a settlement with the Dominion Virginia Power Company (formerly VEPCO) for CAA violations. As part of the settlement, Dominion Virginia Power Company was required to reduce air emissions at eight of its plants, and provide $13.9 million for environmental projects. Of this $13.9 million, $2.1 million was allocated to fund solar energy installations on New York State municipal buildings (OAG, 2003). NYSERDA was responsible for administering this fund, and distributed $1.8 million through public opportunity notice (PON) 843 which closed in June 2004. The funds were allocated to 13 PV projects around the state, including a 33.6 kW installation at the Bronx High School of Science, and a 16 kW installation at the New York Hall of Science in Queens.

  Under the PON, PV systems on municipal buildings were eligible for a cash incentive of $6.00/watt, with a cap of 80% of the system cost up to $240,000. If the project was located in load constrained area (including New York City), or if the project employed storage technology, the incentive increased to $6.50/watt with a cap of 80% of system cost up to $260,000.

- *Ohio Edison Settlement*

  In 2005, the Attorneys General of New York, Connecticut, and New Jersey settled a CAA case against Ohio Edison. In addition to reducing air emissions at several of its plants, Ohio Edison was also required to commit $10 million over five years to environmental and alternative energy projects in New York, Connecticut, and New Jersey. New York will receive $6.1 million, of which $1.3 million has been made available for the deployment of PV installations on municipal buildings (OAG, 2005).

  NYSERDA is responsible for administering this fund through a PON (NYSERDA, 2006b). The incentives levels are the same as were available under the VEPCO settlement as noted above ($6.00 per watt/$6.50 per watt).

School Power…Naturally

School Power…Naturally was a $2.1 million program in which 50 New York State schools were selected to receive $24,000 toward a 2 kW PV installation. Ameresco contributed $500 to each school, leaving $1,500 of the project cost to be provided by the schools themselves. To compliment the installations, NYSERDA and SUNY developed a series of PV-based lessons for grade school curricula (NYSERDA, 2004). The fifty schools were selected in 2003 and a second round of funding has not been announced.

In New York City, St. Francis of Assisi school in Brooklyn and the Ethical Culture School in the Bronx were selected to host systems. Both of these schools are private schools that purchase power from Con Edison and therefore pay the SBC.[12] The 2 kW St. Francis system (pictured on report cover) has been installed, while the Ethical culture installation is pending.

1.2.2 New York Power Authority (NYPA)

The New York Power Authority is a state-owned public power enterprise founded in 1931 to develop New York State's large hydropower resources. NYPA's roles and responsibilities have expanded over the years and it is now the nation's largest state-owned power organization. NYPA owns 18 hydropower, natural gas, and oil-fired power plants totaling 6,260 MW of capacity (NYISO, 2005). NYPA sells comparatively low-cost electricity to public agencies in New York State, to the state's municipal utilities and rural electric cooperatives, and to job-producing companies through the Power for Jobs™ program.

NYPA customers do not pay into the SBC or the RPS and therefore cannot access the incentives available through NYSERDA. While NYPA does not have a dedicated fund for renewable energy, they have been actively involved in solar energy development since the early 1990s. By the end of 2005, NYPA had developed 24 PV projects totaling 633.7 kW since 1993. Of these, there are six projects installed in New York City totaling 449 kW.[13]

Funding for these projects has come from a variety of sources. New York City's largest project, the 332 kW Gun Hill Bus Depot installation in the Bronx, was installed in 1996 as a demonstration project using funds from the Solar Electric Power Association's TEAM-UP program (Willey, 2001). The New York City Transit Maspeth warehouse project was funded as a demonstration project in 1993 by the U.S. Department of Energy (DOE), and a large proportion of NYPA's projects have been funded through the Petroleum Overcharge Restitution (POCR) funds.

[12] New York City public schools are NYPA customers, do not pay the SBC, and were therefore ineligible for the program

[13] NYPA solar systems are rated in kW_{ac}. For the purposes of this study, PV capacity has been converted to kW_{dc}.

Petroleum Overcharge Restitution Fund

The Petroleum Overcharge Restitution (POCR) fund was created in the 1970s to finance energy saving projects using funds from a federal settlement against companies that overcharged consumers for gasoline. NYPA manages this fund for New York State, but POCR funds must be appropriated through the state's budgeting process and are subject to DOE approval.

The first POCR fund appropriation for solar projects occurred in 1996 when $500,000 was used to fund 11 systems outside of New York City. In 2003, a second appropriation of $500,000 was made to install solar systems on schools and educational facilities. In New York City, these funds were used to support two 7 kW systems on PS 13 and PS 14 in Staten Island (NYPA, 2005).

ENCORE (ENergy COst REduction) Program

NYPA offers low-cost loans to energy efficiency and onsite generation projects through its ENCORE Program. ENCORE is administered by the Office of Energy Conservation in the Department of Citywide Administrative Services. Through ENCORE, NYPA finances energy audits, energy efficiency upgrades, and onsite generation. Between 1998 and 2004, City agencies completed $162.6 million in ENCORE projects. In 2005, the ENCORE contract was renewed with $50 million in funding. In addition to financing, NYPA also provides project management services for which it charges a 12.5% fee of the overall project cost.

1.2.3 New York State Tax Incentives

In addition to the incentives managed by NYSERDA and NYPA, New York State offers state tax credits and exemptions for solar energy investment.

State Residential Tax Credit

The New York State Tax Credit for solar systems was enacted in 1997 and is only available to residential taxpayers. Prior to September, 2006, this credit allowed taxpayers to claim 25% of the cost of a solar installation (labor and equipment) up to $3,750 (DSIRE, 2006). After September, 2006, the tax credit cap expanded to $5,000. Systems must be net metered, and the maximum system size is 10 kW (see Section 1.2.4). If the credit exceeds the liability of the taxpayer, the remaining balance can be carried forward for five years. While the state tax credit does not impact the depreciable basis of the federal tax credit, the state tax credit is considered income and is therefore subject to federal income tax (Gouchoe et al., 2004).

The New York State Department of Taxation and Finance (DTF, 2004) is explicit that the depreciable basis of the system is reduced by any grants it may receive. In other words, a system that receives an Energy $mart PV Incentive must subtract the grant amount from the total system cost before calculating the state tax credit value. A more detailed discussion of how federal and state tax credits interact with grants and cash incentives can be found in Section 1.4 below.

State Sales Tax Exemption

In July 2005, New York State enacted legislation to allow for the exemption of state sales and use tax for customers installing solar systems on their property (Senate Bill 4926-a). Effective from September, 2005 through December 1, 2009, New York State retail sales of solar energy systems are exempt from the 4% state sales tax. Downstate counties, including New York City, are also exempt from the 0.375% Metropolitan Commuter Transportation District (MCTD) tax (DTF, 2006). Senate Bill 4926-a also allows municipalities the option to grant local sales tax exemptions. However, as will be discussed in Section 1.3.1 below, cities over 1 million inhabitants (e.g. New York City) must approve such local exemptions through a City Council resolution.

Property Tax Exemption

Since 1977, New York State allowed for a real property tax exemption for solar systems. While this program expired in 2005, Senate bill 5966-a revived the property tax exemption in July 2006. Under this bill, property owners are exempt from paying taxes on the increase in property value resulting from the installation of solar panels for 15 years (NYS Office of Real Property Services (ORPS), 2004). For building-integrated PV (BiPV) panels that replace conventional construction materials like façade cladding and awnings, the property value exemption is reduced depending on value of the BiPV component and the value of the material it replaces (see: New York State Office of Real Property Services, 2004). This could be of concern for New York City where over 16% of the capacity installed by the end of 2005, or 187 kW, could be considered building-integrated (Rickerson, 2006).

Of the $47 million in wind and solar property tax exemptions claimed by over 300 properties in 2004, none were located in New York City (ORPS, 2005). The reasons for this are unclear and merit closer attention.

Green Building Tax Credit Program

The Green Building Tax Credit (GBTC) is managed by the New York State Department of Conservation (DEC) and was originally passed in 2000.The first GBTC (2001-2004) allowed taxpayers to apply for unlimited credits with the option of claiming the credits over five years (DEC, 2006b). However, the current GBTC is capped at $2 million per building and allows taxpayers to claim the credits through 2009. These credits can be carried over for up to nine tax years or potentially transferred if the taxpayer cannot claim all of the earned credits. In order for PV systems to be eligible for a credit, the building itself must meet the necessary green space requirements as described in Section 638.7 of the most recent GBTC law (New York State Department of Environmental Conservation, 2006a).

In addition, the revised legislation stipulates that if the funds are not exhausted by the sunset date, this program will be extended until 2010 in order to fully distribute the allocation. Currently, DEC is not accepting applications until the GBTC regulations are updated and promulgated which is anticipated to be no earlier than the first quarter of 2007. However, any building that is issued a final certificate of occupancy after January 1, 2005 will be eligible to apply for the credit program.

1.2.4 Interconnection and Net Metering

In order to offset grid electricity, a PV system must be interconnected to the utility grid. Historically, grid interconnection has been a major barrier to PV installations due to administrative delays, additional fees and charges, expensive technical requirements, and regulatory barriers (Alderfer et al., 2000). To encourage distributed generation like PV, New York State has attempted to streamline the interconnection process through standardization and net metering.

<u>Standard Interconnection Requirement</u>

Interconnection in New York State is governed by the Standard Interconnection Requirements (SIR). The SIR outlines the technical and procedural interconnection steps and requirements, as well as the interconnection policies and practices for utilities. Under the most recent SIR, set forth by the New York State Public Service Commission, solar power is eligible for interconnection to the grid as long as it has a nameplate rating of less than 2 MW (PSC, 2005a). The SIR is also flexible and gives individual utilities the right to add additional safety and security requirements as necessary.

As project developers can attest, the existence of the SIR does not guarantee that a 2 MW project will be interconnected. Interconnection within New York City, for example, poses unique challenges because of the City's distribution system configuration. Not only is the system one of the oldest, but it is also one of the largest network grids in the world.

Most power customers in the United States have their electricity delivered through radial systems. Radial distribution systems rely on a single primary feeder line that delivers electricity from a substation to transformers located along the line. Network grids like New York City's, by contrast, are complex, integrated, and redundant systems with multiple primary feeder lines and transformers that operate in parallel. Network grids are designed to improve grid reliability in space-constrained urban areas.

One of the primary concerns with distributed generation (DG) systems interconnected in network grids is that electricity can be "back-fed" onto the grid in the reverse direction. Special circuit breakers within the network, called "network protectors," are designed to isolate individual sections of the grid in cases of power outages or faults. Reverse power flows caused by DG systems, however, can cause the network protectors to open inappropriately, thereby interrupting electricity service to other customers (Baier et al., 2003).

While New York State's original SIR applied only to radial grid configurations, the PSC extended the SIR to network grids in 2004 (PSC, 2004a). Although this extension allows systems up to 2 MW to be *eligible* for interconnection, interconnection within New York City's network grid is further narrowed by additional requirements specified by Con Edison.

Con Edison publishes a handbook detailing its interconnection requirements (Con Edison, 2005b) and created a website focusing on DG installations within its territory (Con Edison, 2006a). Con Edison has posted maps on its website of where certain types of DG systems cannot be sited within the five boroughs and Westchester County (Con Edison, 2006d). These restrictions do not apply to inverter-based technologies like PV, however, which “may be installed at all locations” throughout the city (Con Edison, 2006d).

Con Edison states that the technical limits to DG installations within its territory are 10 MW per distribution feeder and 20 MW per network substation (Con Edison, 2005b). It is doubtful that PV will approach these penetration levels in the near term. Of greater relevance to the PV market in New York City are the protections required for systems exporting power to the grid. To limit the risk of power being back-fed, Con Edison may require DG systems to install reverse power relays. These relays can add considerable cost to PV projects.[14] Con Edison notes that the risk of back-feeding power from small inverter-based systems like PV is significantly less than the risk posed by synchronous generators. Nevertheless, Con Edison requires engineering studies for non-net metered PV systems to determine whether power will be backfed to the grid. If power is exported, Con Edison may also require a reverse power relay to be installed.

New York State has standard interconnection agreements and application forms, and Con Edison is required under the SIR to review the interconnection applications within 30 days. Once the interconnection is approved, installers can access the New York Energy $mart PV Incentive on behalf of their clients. A summary of the SIR is contained in Appendix VII.

Net Metering

Although PV systems less than 2 MW are eligible for interconnection, residential PV systems must be 10 kW or smaller to be eligible for net metering under the New York Public Service Law. Generally, net metering refers to crediting utility customers for the excess power their onsite power systems generate. Each of the 40 states that have net metering define the terms of their statutes differently (Hughes and Bell, 2005; IREC, 2006).

In New York State, PV system output is reconciled annually at the retail rate. Annual reconciliation means that credit from a given month can be carried forward and applied to future consumption through the end of a year. At the end of the year, the utility pays the customer for any remaining excess credit at the avoided cost rate.[15] Retail electricity bills include charges for the electricity consumed, and fees for transmission and distribution. New York utilities credit both the generation and delivery portions of the bill. In July 2006, for example, Con Edison net metering customers would have received over $0.20/kWh for their system output (see Appendix IV).

While the 10 kW cap is nominally for residential systems, the residential designation is determined by Con Edison’s service classification. There are many multi-family residential buildings in New York City that do not pay for electricity under Con Edison’s Service Classification No. 1, “Residential & Religious.” Thus, these buildings are not eligible to net meter despite the fact they are technically residential properties.

[14] NYC installers reported the added costs of the relays to be $15,000-$40,000
[15] i.e. the wholesale rate for electricity, rather than retail

Conversely, religious buildings that pay the residential and religious rates are in fact able to net meter even though they are not residences.

In addition to the 10 kW system cap, there is also a system-wide cap for DG in each utility service area. The cap is equal to 0.1% of the utility's 1996 peak load for PV, 0.4% for farm-based biogas, and 0.2% for wind energy. For Con Edison territory, this equates to system-wide limits of 8.1 MW for solar electricity, 32.6 MW of farm-based biogas and 14.4 MW of wind (Con Edison, 2005c). The PSC was empowered by the net metering law to change these percents starting in 2005 if they were determined to be in the public interest. To date, no such changes have been requested.

<u>Standby Tariff Exemption</u>
In 2003, the PSC allowed state utilities to establish standby tariffs for owners of distributed generation (DG) (PSC, 2003). When DG systems operate, they are permitted to use their electricity to offset their retail electricity demand. Since the facility remains connected to the utility grid, the utility's electricity delivery service is effectively on standby. Under the standby tariff, Con Edison (2003) charges DG owners a kilowatt (kW) rate for the utility's capacity to deliver electricity during the DG system's operation. The PSC (2003) exempted PV systems installed before May 31st, 2006 from the standby tariff. In 2006, this exemption was extended through May 31st, 2009 (PSC, 2006b). As the regulation currently stands, PV systems installed after this date will be subject to the standby tariff.

1.3 New York City Policies

As a municipality, New York City solar energy policy framework is currently limited to local tax exemptions, construction mandates, codes, and settlement fund expenditures.

1.3.1 Local Tax Exemption

As discussed in Section 1.2.3 above, New York State passed legislation giving New York City the option to exempt residential solar systems from the local sales tax (DTF, 2005). In August 2005, the New York City Council passed Resolution 1121, which exempted the City from the local sales tax of 4% (Van Ooyen et al., 2005). Combined, the state, MCTD, and local tax exemptions total a tax exemption of 8.375% for solar systems purchased in New York City. Using the average system costs for New York City,[16] a 9 kW system in the City would be exempt from paying approximately 2,300 in taxes.

1.3.2 Construction Mandates and Building Codes

By creating environmental guidelines for new construction, New York City has helped pioneer the use of environmental guidelines in U.S. building codes. In particular, Local Law 86, the City's High Performance Building Guidelines, and the Battery Park City Authority's construction guidelines have made New York City a national leader in green building.

[16] Reported by NYSERDA PV Incentive Program for 2003-2006: avg. module price: $4.42/watt, avg. inverter price: $0.95/watt, avg. balance of system price: $1.50/watt

Local Law 86 & High Performance Building Guidelines

Local Law 86, passed in October of 2005, amends the New York City charter to require City agency construction and renovation projects of at least $2 million to be designed using the U.S. Green Building Council's (USGBC) Leadership in Energy and Efficiency Design (LEED) rating system (Burney, 2006). The LEED system assigns points to a building for using specific green techniques during construction. The sum of these points determines whether the building will be rated as Certified, Silver, Gold, or Platinum. Local Law 86 requires applicable City projects to be at least LEED Certified- or LEED Silver-rated. Local Law 86 builds off of the success of the City's High Performance Building Guidelines which were published in 1999 by the Department of Design and Construction and coordinated by the Department's Office of Sustainable Design (Brown, 2002, 1999). The guidelines are voluntary, but they set the stage for the passage of Local Law 86.

Although Local Law 86 is a significant step forward for sustainable building practices in New York City, it remains unclear what impact the Law will have on the City's solar energy market. Under the LEED system, supplying 2.5% of a building's electricity from onsite renewable systems earns one credit (USGBC, 2005). The cost of achieving this credit from onsite PV, however, is significantly higher than many of the other credit categories. Installing a bike racks for employees, for example, also earns one credit and costs a fraction of what a PV system costs (Matthiessen and Morris, 2004). Therefore, many LEED designers may bypass onsite renewable energy credits in favor of other less costly credits. Of the 388 LEED projects certified in the U.S. as of June 1st, 2006, only 4.6% were Silver or Certified projects that also had onsite renewable energy systems (USGBC, 2006).

Battery Park City Authority Commercial/Institutional Environmental Guidelines

While Local Law 86 has no specific solar energy requirement, the Battery Park City section of Manhattan is home to one of the most well-known solar mandates in the United States. Battery Park City is a 92-acre site on the lower west side of Manhattan that is managed by a state public benefits corporation, the Battery Park City Authority (BPCA). The BPCA established construction guidelines that require new buildings to meet a set of performance standards similar to LEED Gold (BPCA, 2002, 2005). Unlike LEED, however, the Guidelines also require that new construction use onsite renewable energy to generate 0.75% of the electricity consumed in the building's common areas.[17]

Largely as a result of the guidelines, eight PV projects totaling 360 kW have been planned within Battery Park City. Those that have been completed have integrated PV panels into the building designs in innovative ways. For example, designers for the residential high-rise building called the Solaire used PV panels in place of traditional façade cladding, and integrated PV into a glass awning at the entrance (Pereira and Jürgens, 2003).

[17] As noted in the BPCA guidelines, this can be generated by PV panels with a rated capacity of approximately 5% of the building's regulated equivalent peak demand.

Codes

The National Electrical Code is the basis for New York City's electrical code technical standards. In 2001, New York City updated its 1968 electrical code by adopting the 1999 National Electrical Code (NEC) with New York City-specific amendments. New York City also established the Electrical Code Revision and Interpretation Committee (ECRIC) and the Electrical Code Advisory Committee (ECAC) to review the City's electrical code on an ongoing basis. Working in concert, ECRIC and ECAC makes recommendations on how to interpret, amend, and implement the code so that it is appropriate to New York City (New York City Department of Buildings, 2006). In 2003, the City adopted the 2002 NEC with New York City-specific amendments. The 2002 NEC included over 30 updates for codes governing PV codes in Article 690 (Wiles and Bower, 2002). To date, the 2005 NEC update was reviewed and amended by ECRIC and ECAC and forwarded to the City Council for formal adoption. The Committees amended the 2005 NEC to include language requiring that "solar photovoltaic systems shall be tested as a complete assembly by a nationally recognized laboratory. These systems shall be listed or labeled after completion of testing." If this provision passes, it will not only increase the cost and time of installations, but would also add an additional barrier to solar deployment in New York City.

1.3.3 Settlement Funds

In addition to the OAG settlement funds managed by NYSERDA and the POCR funds managed by NYPA, there have been a series of energy-related settlements managed by local organizations. In several instances, these funds have been used to support PV installations.

Bronx Initiative on Energy and the Environment

The Bronx Initiative on Energy and the Environment (BIEE) was created in 2003 using funds from a $6.75 million settlement with NYPA. The BIEE, which is managed by the Bronx Overall Economic Development Corporation (BOEDC), allocated $1.15 million to pay for energy efficiency and renewable installations at small businesses and non-profit organizations in the Bronx. From these funds, over $280,000 was awarded to support three PV projects totaling 61 kW. BIEE grants provided gap financing for project costs not paid for by the NYSERDA Energy $mart PV Incentive.

While the initial settlement funding has been exhausted, BOEDC is working to secure $1 million from the federal Empowerment Zone (EZ) Environmental Fund to recapitalize the BIEE. This funding would be used to support green roofs and PV systems installed on Bronx businesses that receive EZ loans.

Clean Air Communities

Clean Air Communities (CAC) is a non-profit organization dedicated to air pollution reduction strategies in New York City's low-income communities. CAC was founded in 1999 and is managed by staff at the Northeast States Center for a Clean Air Future and Northeast States for Coordinated Air Use Management. CAC's past funding came from Con Edison, which donated $5 million from air emissions credit sales, and from NYPA, which gave CAC $2 million for a Queens Clean Air Project (QCAP), following a settlement related to the Charles Poletti power plant in Astoria.

In 2002, CAC matched a $300,000 NYERDA incentive for a 115 kW installation at the Greenpoint Manufacturing and Design Center in Brooklyn. A subsequent grant of $225,000 for a 15 kW system on the Cherry Tree Association's community center in Brooklyn was abandoned when another organization claimed title to the property. In 2005, $225,000 in QCAP funds were used to deploy 44 solar-powered compacting trashcans in eight Queens Business Improvement Districts (see: CAC, 2006).

<u>Community Impact Fund</u>

The KeySpan Community Impact Fund (CIF) was established to support community and environmental projects in Queens as part of negotiations to expand the KeySpan Ravenswood plant in Long Island City. The CIF is a $1,950,000 fund that is administered by the New York City Economic Development Corporation (EDC). Of these funds, $1 million is dedicated to funding renewable energy projects located within KeySpan's service area. Projects must be reviewed and jointly approved by EDC and KeySpan pursuant to the guidelines set forth in the settlement (New York State Board on Electric Generation Siting and the Environment, 2001).

Thus far, a 100kW system at LaGuardia Community College and a 13.68 kW system at Mt. Sinai Hospital have received initial approval for funding. At LaGuardia, the CIF grant will cover $400,000 of the $1.1 million project cost (NYPA, 2006). In addition, NYPA and EDC are exploring the possibility of installing 6 kW systems on four public schools in Long Island City. Upon approval of the project, the arrays will be used for educational purposes and NYPA will also provide the schools with related curriculum and computer software.

1.4 The Interaction of Solar Energy Policies

While the availability of numerous solar energy policies can be encouraging, determining how they interact with one another can be a challenge. Some policies are mutually exclusive, some reduce the magnitude of others, and some policies interact differently at the state level than they do at the federal level. This section attempts to clarify the interaction between different incentive programs and tax credits. Since tax exemptions and interconnection requirements do not affect the economic impact of other policies, they are not discussed in this section. Unique or non-renewable funding sources (e.g. settlement funds) are also not specifically discussed.

1.4.1 The Interaction of the Federal Investment Tax Credit with:

<u>The NYSERDA Energy $mart PV Incentive</u>

The relationship between the federal tax incentive and the Energy $mart PV Incentive remains uncertain. If the PV incentive is subject to federal income tax, then the incentive recipient pays tax on the incentive, and the depreciable basis used to calculate the 30% tax credit is not affected. If the incentive is nontaxable, then the recipient must subtract the value of the incentive from the total system cost before calculating the federal tax credit.

According to the federal Residential Energy Conservation Subsidy Exclusion, *utility* rebates for PV granted to residential customers are non-taxable. It is unclear whether state-administered grant and rebate programs are included under this exclusion (Gouchoe et al., 2004). Furthermore, it is unclear whether rebates to non-residential customers are considered taxable. To date, the IRS has declined to issue formal guidance on these issues.

Recent literature on the treatment of the incentives is inconclusive. A case study from the Lawrence Berkeley National Laboratory and the Clean Energy States Alliance suggests that rebates to non-residential systems are taxable (Bolinger et al., 2006). The Solar Energy Industries Association (SEIA) tax guide (Martin, 2006) reiterates that the tax code is currently unclear, but SEIA's tax credit fact sheet states that the state incentives are nontaxable and reduce the basis for the federal tax credits (SEIA, 2005). Finally, a report prepared for NYSERDA states that New York's capital cost incentives affect the basis of the federal Production Tax Credit (Ing, 2002). Whether this conclusion can also be extrapolated to apply to the investment tax credits is unclear. For the purposes of this report, it is assumed that NYSERDA rebates are nontaxable and therefore reduce the basis of the tax credits. It is important to note, however, that the authors of this report are not credentialed to give tax advice and tax recipients should consult their tax advisors about this issue.

MACRS

The federal tax credit reduces the basis by which MACRS is calculated by 50% of the tax credit value. For the 30% business federal tax credit, MACRS is calculated based on 85% of the system cost (Martin, 2006). If the federal tax credit reverts back to 10%, MACRS will be calculated based on 95% of the system cost. For systems that receive the NYSERDA Energy $mart PV Incentive, the incentive amount must first be subtracted from the depreciable basis before the MACRS is calculated.

The Energy $mart Loan Program

Interest rate buy-down programs are considered "subsidized energy financing" and reduce the basis of the federal tax credit (Martin, 2006). The basis is reduced by the percent of the system financed by the subsidized loan. For example, if 80% of a PV project is financed using the Energy $mart Loan, then only the 20% of the project that is unfinanced can be used to calculate the tax credit's value. Because the Energy $mart Loan is infrequently used by New York City installers, it is assumed in the models in Section 1.5 that PV system owners opt for the federal tax credit and forgo the loan.

State Tax Credit

The federal tax credit does not impact the depreciable basis of the state tax credit and vice versa. As discussed above, however, the state tax credit is considered income and therefore subject to federal income tax.

1.4.2 The Interaction of New York State Tax Credits with:

The Energy $mart PV Incentive

Unlike the federal tax credit, the Energy $mart PV Incentive (and other grants and rebates) clearly reduce the basis by which the state tax credit is calculated.

The Energy $mart Loan Program

Unlike the federal tax credit, Energy $mart Loans do not impact the basis of the New York State Tax credit.

1.5 The Impact of Solar Energy Policies

To better illustrate how these polices might impact PV system economics in New York City, CUNY worked with the Center for Energy and Environmental Policy (CEEP) at the University of Delaware to build a series of models using CEEP's *PV Planner* software. CEEP has worked with the U.S. National Renewable Energy Laboratory (NREL) and others for 12 years on the development of *PV Planner* to analyze the benefits of PV technology beyond its conventional energy-supply value. The software simulates the performance of a PV system operating in an energy supply-only mode (sometimes referred to as a non-dispatchable system as the energy produced by the device must be used immediately) or in a dispatchable mode (where because of the addition of storage, solar energy can be released when needed) (CEEP, 2006).

The software uses financial, economic and policy data from the area where the PV system is to be installed in order to analyze its financial feasibility. The performance of the system is reported using several metrics including present value, payback period, benefit-cost ratio, cash flows and levelized costs. Because the policy environment is constantly developing (particularly with the addition of new incentives to promote renewable energy), *PV Planner* is regularly upgraded to reflect new measures (e.g., recent changes track the new RECs and GHG emission markets).

In order to analyze the impact of different policies on different New York City customer classes, three scenarios were constructed using New York City weather data and electricity rates: a residential case, a commercial case, and a municipal case. CUNY and CEEP used *PV Planner* to conduct a step-wise policy analysis to calculate the impact of each policy on the PV systems' levelized cost of energy (LCOE). The results of these analyses are graphed below. For all three scenarios, an average cost of $9.20/watt was used. As will be discussed in Section 2.2 below, this installed cost is optimistic given recent cost trends, but it expected that prices will fall in the future if the global silicon shortage and other cost barriers are resolved.

1.5.1 Residential System - 3 kW

For the residential case, the performance of a 3 kW system was modeled using the Con Edison Residential & Religious tariff. Additional assumptions behind this model can be found in Appendix VI. The LCOE impacts of the NYSERDA PV Incentive, the 25% state tax credit, and the 30% federal tax credit are analyzed below. In addition, CEEP included an "avoided fuel cost escalation benefit" in the analysis, which reflects the fact that PV's fuel costs do not change, while the price of electricity from the grid increases each year.

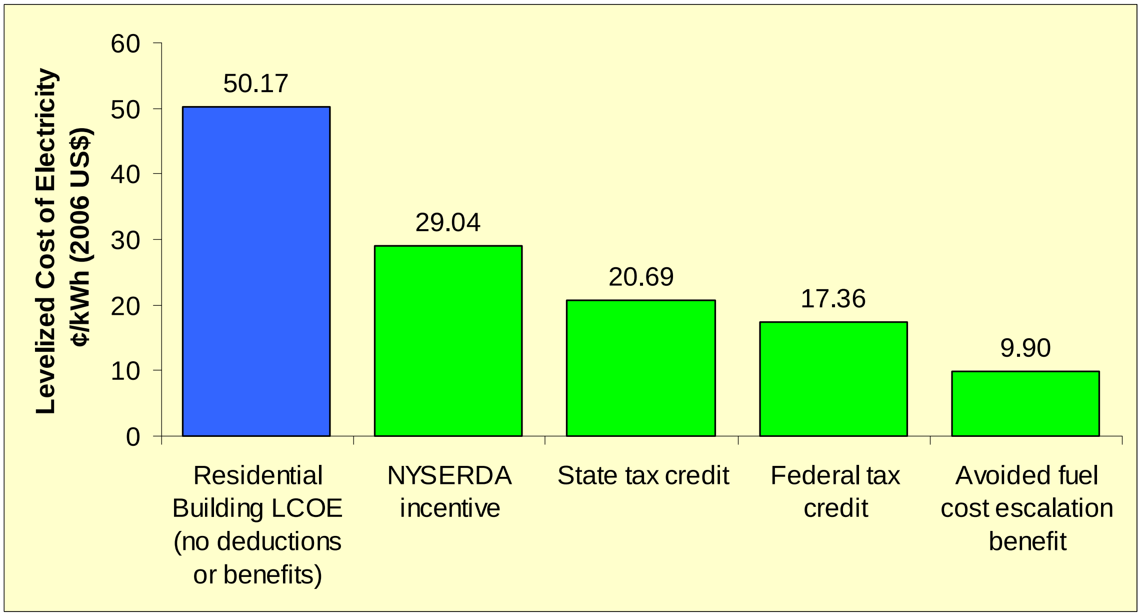


Figure 1: Residential Levelized cost of Electricity with Solar Incentives Based on PV Planner Calculations -- see CEEP (2006)

As can be seen in Figure 1, the NYSERDA rebate has the largest impact on the levelized cost of the system, followed by the state tax credit. The federal tax credit has the smallest impact because of its $2,000 cap. Together, the incentives reduce the LCOE of the system to 17.36 ¢/kWh, which is below the retail rate of residential electricity in New York City. When utility rate escalation is taken into account, the LCOE of the system falls to 9.9 ¢/kWh. The system has a payback of 12.24 years and a benefit-cost ratio of 1.59.

1.5.2 Commercial System - 10kW

For the commercial case, a 10 kW system was modeled using the Con Edison General – Large tariff. It is important to note that the General – Large tariff consists of both a volumetric charge for kilowatt-hours and a demand charge for kilowatts. For the policy analysis, only the impacts on the volumetric charge were modeled. Although PV output closely matches citywide peak load in New York City, the ability of PV to reduce the kW charge at a given building varies according to the building's load. An economic analysis of PV configured to reduce kilowatt demand using a dispatchable battery system can be found in Section 3.4.6.

The LCOE impacts of the NYSERDA PV Incentive, the 30% federal tax credit, and accelerated depreciation, are analyzed below. The model's assumptions can be found in Appendix VI.

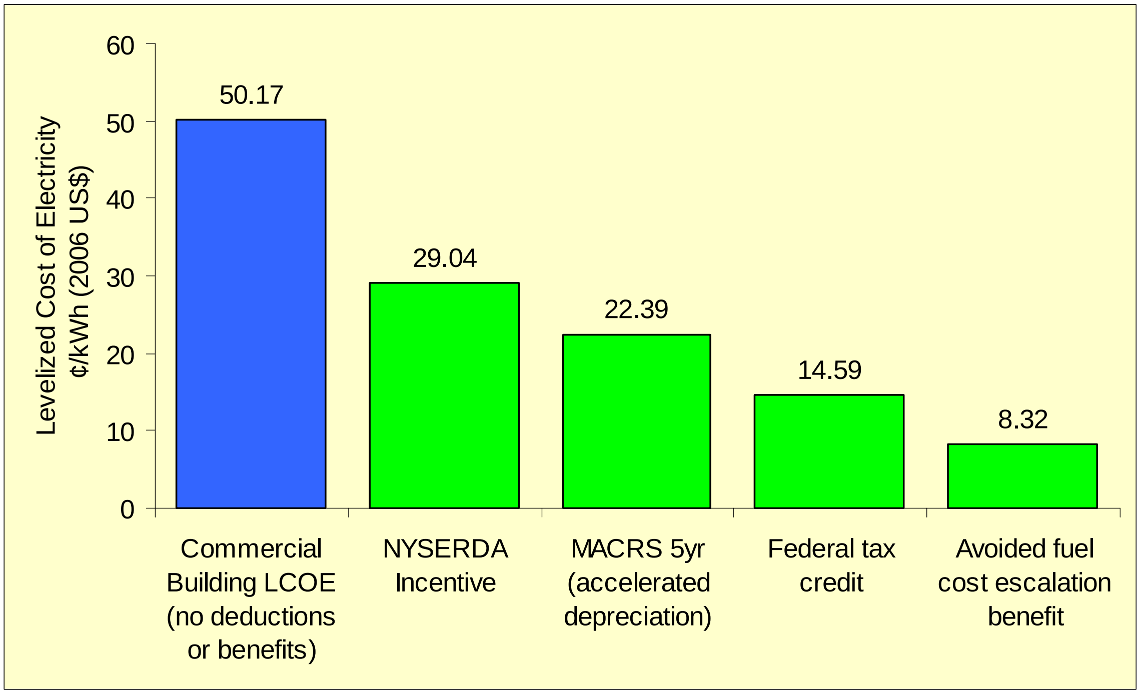


Figure 2: Commercial Levelized Cost of Electricity with Solar Incentives Based on PV Planner calculations -- see CEEP (2006)

In the commercial case, the NYSERDA Incentive again has the most significant impact on the LCOE, followed by the federal tax credit. The magnitude of the commercial tax credit impact is larger than in the residential case because the commercial tax credit does not have a cap. If it were determined that the NYSERDA incentive was taxable and therefore did not reduce the basis of the federal tax credit, the impact of the federal tax credit would improve further (Bolinger et al., 2006). Assuming that the NYSERDA incentive is nontaxable, the system has a payback of 9.48 years and a benefit cost ratio of 1.8.

1.5.3 Municipal System – 10 kW

As will be discussed in greater detail in Section 2.1.1 below, there are no consistently available policies to support public sector PV projects in New York City. As a result, a step-wise LCOE analysis of policy impacts for public sector projects was not possible. A PV Planner analysis of PV system economics using NYPA tariffs concluded that the system would not pay itself back in its 25 year lifetime. Without incentives, the system had a 0.66 benefit-cost ratio and a negative net present value.

These figures are intended to be illustrative. The models are sensitive to the installed cost of the PV system and slight shifts can significantly change system economics for the better or worse. What these models demonstrate is that solar electricity can be competitive with retail grid electricity for commercial and residential customers in New York City if installed costs trend downward and if the current policy mix remains in place. The models also demonstrate that the lack of policy support for municipal projects will hinder public sector projects in the future. Finally, as will be discussed in Section 2, even if existing project economics were attractive to a broad spectrum of New York City investors, the current policy mix lacks the funds and long-term horizon necessary to create a large-scale solar energy market in New York City.

Section 2: Discussion of Policies and Barriers

As reported in Part I of this study, New York City's solar energy market growth has been comparable to the global average since 2003. Federal, state, and local policies have driven this growth, and the primary question addressed in this section is whether the current policy mix will be able to sustain future market growth.

Compared to most states in the nation, support for PV in New York has been broad and aggressive. New York State has demonstrated a commitment to solar energy through targeted polices that have included tax benefits, interconnection standards, net metering, and NYSERDA incentives. City and state stakeholders have also repeatedly allocated portions of air pollution settlements to fund new solar projects.

While these policies have encouraged market growth over the past 4 years, the current policy mix will not be sufficient to sustain New York City's recent growth rates. The four major barriers to wide-scale deployment of PV in New York City include: (1) insufficient funds; (2) rising solar power costs; (3) interconnection and code barriers; and (4) inadequate policy mix for New York City.

2.1 Insufficient Funds

New York City's PV market has been driven primarily by installations sited on public agencies and by installations funded by NYSERDA. Neither of these drivers will be sufficient to sustain market growth at their recent levels.

2.1.1 Solar Funds for Public Buildings

As reported in Part I of this study, 64% of the PV capacity installed in New York City by the end of 2005 was installed on public buildings. This statistic demonstrates that government agencies have played a leadership role in developing PV in the City. The public sector has been entrepreneurial in its pursuit of solar power, but its investment in solar power has been inconsistent and its funding sources are unpredictable. A large portion of New York City's installed capacity is attributable to three projects installed in the 1990s: 332.6 kW on the Gun Hill Bus Depot, 40 kW on the Rikers Island Compost Facility, and 20 kW on New York City Transit's (NYCT) Maspeth warehouse. These projects were funded as demonstration projects by the TEAM-UP program, NYPA, and the U.S. Department of Energy, respectively. No other public sector solar projects were installed again until 2005 and 2006.

The 2005 and 2006 installations were funded by the OAG VEPCO settlement funds, the POCR funds, and the NYCT capital budget. Several more public systems are currently being installed through the KeySpan Community Impact Fund, and it is possible that several New York City government projects will be funded through the Ohio Edison settlement. As with the installations in the 1990s, these sources of funding are not available on a consistent or recurring basis. As a result, it is uncertain whether City agencies will be able to continue to lead New York City in installed capacity after these funds are exhausted.

New York City agencies, which comprise 10% of the City's peak load, cannot access SBC or RPS funds because they purchase power from NYPA and do not pay into the SBC. Furthermore, NYPA does not have a comparable surcharge through which it can fund renewable energy projects on public buildings. Finally, City PV procurement is hindered by the fact that City agencies do not control their own energy budgets. All New York City energy bills are paid centrally through the City's Office of Management and Budget (OMB). This arrangement complicates public sector PV projects because OMB's PV procurement policies are not streamlined, agencies do not directly realize any of the savings from PV projects, and OMB does not permit city agencies to use potential savings from renewable energy and energy efficiency projects for financing.

2.1.2 NYSERDA Funds

NYSERDA has allocated over $2.8 million in funding to PV systems in New York City since 1999. Of this, over $300,000 came from the NYSERDA-administered VEPCO settlement, $50,000 came from the School Power…Naturally program, $950,000 was allocated for demonstration projects, and $1.7 million was allocated through the Energy $mart PV Incentive program. Of these, the PV Incentive Program has been the only funding source that has been consistently available. Statewide, over $13.9 million was allocated through the PV Incentive between 2003 and 2006.

The creation of the RPS customer-sited tier will ensure that New York State will continue to have a predictable source of PV funding over the next several years. Under the RPS, $13.8 million will be available for PV between 2006 and 2009 (i.e. $3.45 million available annually). Although average annual PV funding will be higher under the RPS than under the SBC, $3.45 million represents a decrease in the amount of funds available in 2005-2006. Comparatively, New York State's RPS solar set aside is modest. Of the states that have RPS solar set asides,[18] New York's will support the smallest amount of solar energy as a percentage of retail electricity sales and on a per capita basis (Wiser and Bolinger, 2005).

<u>New York City Market Growth under the Renewable Portfolio Standard</u>

If New York City were to be allocated a share of the RPS PV funds proportional to its share of the state population (i.e. 42%) and the $4/watt rebate level were maintained, the RPS would fund slightly over 360 kW of PV in New York City each year. Provided that RPS funding levels were maintained through 2013, and that no other sources of funds were provided to the City (e.g. settlement funds, demonstration funds, etc.), approximately 4.3 MW would be installed in the city by 2013, compared to the approximately 8.3 MW forecast under the low growth scenario projected in Part I of this study (Figure 3). Even if the New York City market were to receive the entire $3.45 million of RPS funds each year through 2013, the market would still grow to only 7.8 MW.[19]

[18] Colorado, District of Columbia, New Jersey, New York, Nevada, Pennsylvania

[19] Assuming PV does not reach a cost-breakthrough point by 2013 and that policy incentives are the primary driver for market growth.

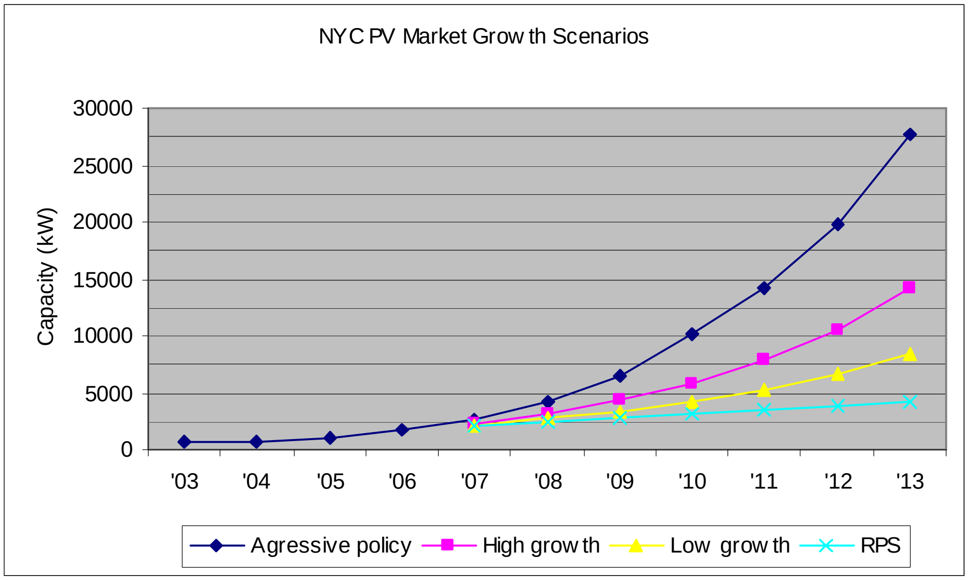


Figure 3: NYC PV Market Growth Scenarios

While it is clear that RPS funds are insufficient to sustain growth, it is important to note that the projection in Figure 3 is optimistic because it assumes that New York City will receive 42% of the available PV funds. Historically, New York City has received a disproportionately small share of the SBC funds relative to its population and to its PV fund contributions.

Although Con Edison territory (New York City and Westchester) paid the highest SBC surcharges, and contributed close to half of the SBC's total funds (PSC, 2005c), the City received an average of 15% of the Energy $mart PV Incentive funding (Figure 4). Under the RPS, Con Edison will no longer pay the largest surcharge, but it will continue to make the largest contribution to the funds.

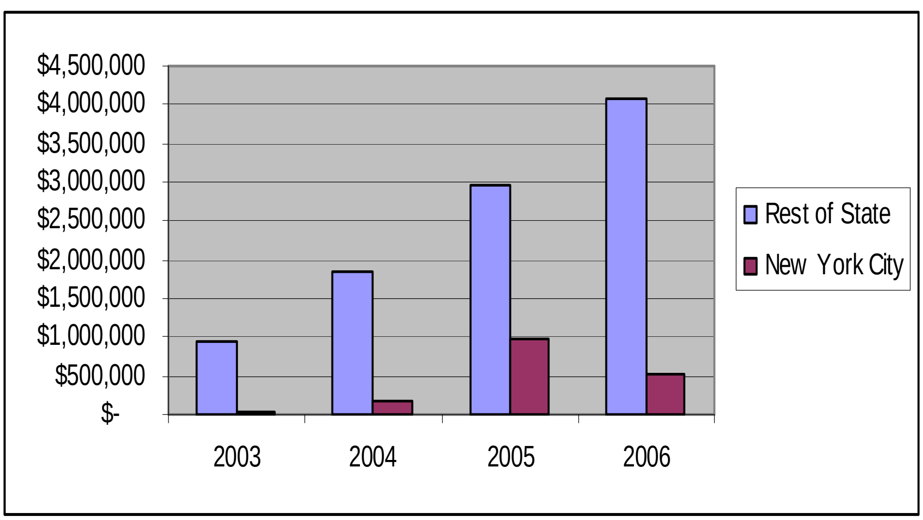


Figure 4: Annual PV Capacity Funded by the Energy $mart PV Incentive

On the one hand, discussions of equity are misplaced because PV rebates are allocated on a first-come, first-serve basis and New York City can only be awarded what it asks for. On the other hand, the PV Incentive may not be appropriately structured to serve New York City's unique infrastructure or overcome the City's cost and regulatory hurdles, as will be discussed in greater detail in Section 2.4.

2.2 Cost of Solar Energy

A second major barrier to PV market growth in New York City is the high and rising cost of solar installations in the City. The cost of PV systems has declined significantly since the 1970s, when PV modules cost close to $80 per watt (Harmon, 2000). During the past three decades, PV module costs have declined by 15-25% for each doubling of demand, and modules can now be purchased for between $3 and $5 per watt (Poponi, 2003; Solarbuzz.com, 2006). Global silicon shortages have caused a sharp increases in the cost of silicon-based PV modules, but it is expected that prices will resume their downward trend when silicon supply ramps up in 2007-2008 (Pichel and Yang, 2005; Prometheus Institute, 2006).

Module costs are only one component of the total installed cost for PV systems. Total installed cost of PV systems includes module cost, inverter cost, labor cost, and balance of system costs (which include racks, wiring, electrical equipment, etc.). In theory, installed costs, like module costs, should decrease as demand rises. An analysis of NYESRDA PV program data reveals, however, that PV system costs in New York City are not following the same trends as other regional markets. First, New York City installed costs are significantly higher than installed costs in the rest of the state. Second, New York State installed costs are higher than in neighboring markets. Third, installed costs in New York City and in New York State have steadily risen over the past four years while installed costs in neighboring markets have steadily fallen.

2.2.1 Costs in New York City and New York State

According to NYSERDA PV program data, the average cost for systems installed in New York City between 2003 and 2006 was $9.51/watt while the average cost in the rest of the state during the same period was $8.47/watt. As can be seen in Figure 5 below, New York City was consistently higher than the rest of the state throughout the four-year period.

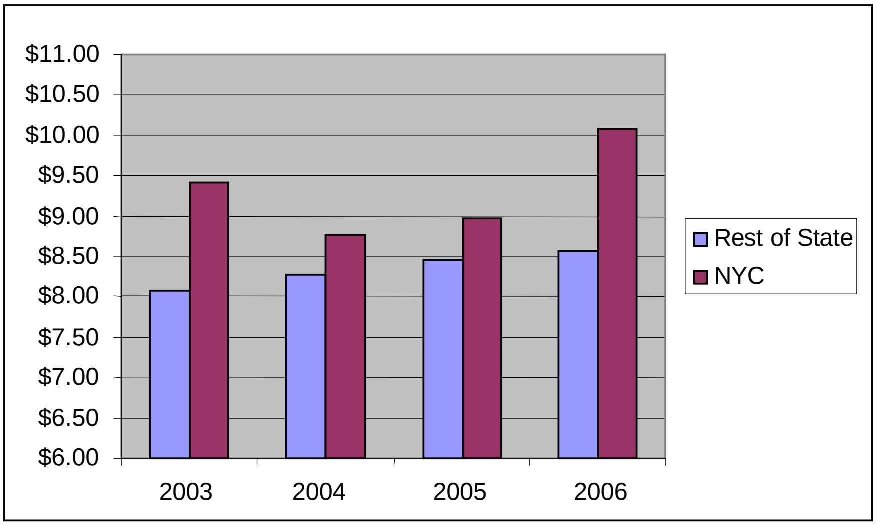


Figure 5: Average Installed Cost for PV Systems in New York City and New York State (2003-2006)

The primary causes of this discrepancy were labor and balance of system costs. As can be seen in Figure 6, module prices were consistently cheaper on average in New York City than they were in the rest of the state, while inverter costs were approximately the same in both markets. Labor costs have been consistently higher in New York City than in the rest of the state, while balance of system costs were higher in New York City during the last two years. Even when higher cost BiPV systems are removed from the data set, these trends remain (Figure 6).

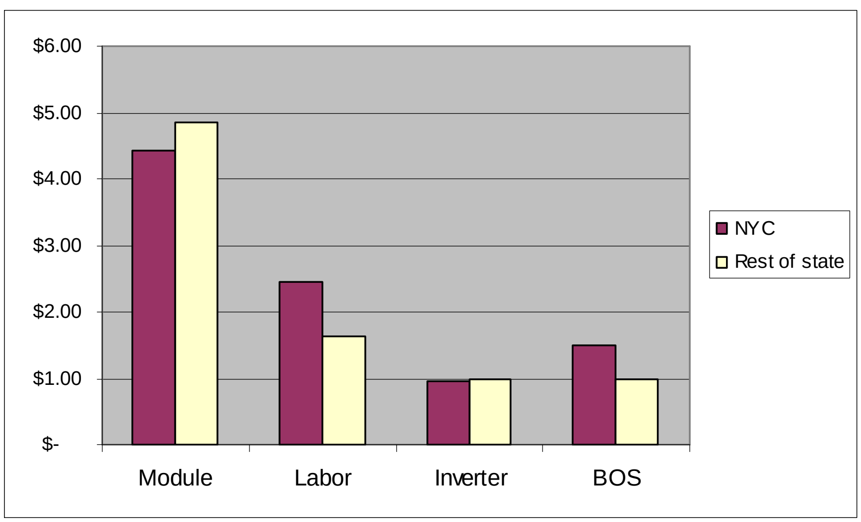


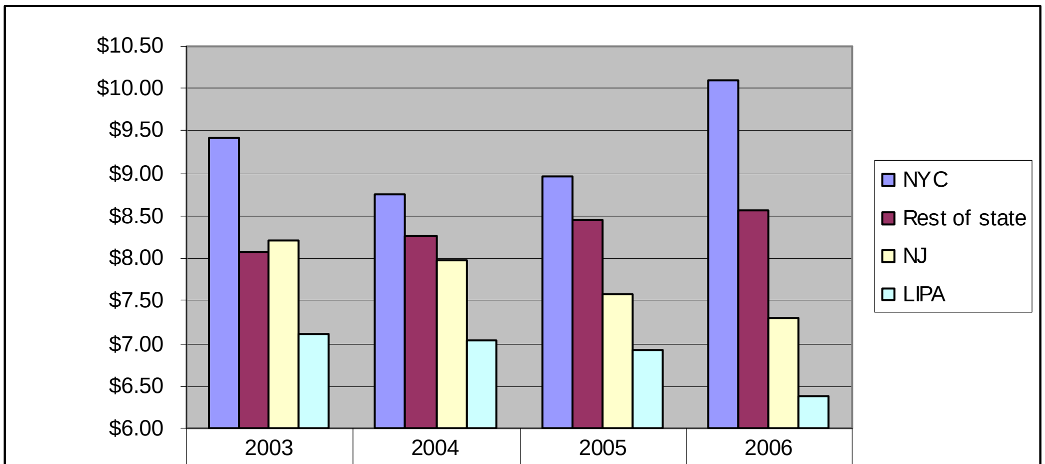
Figure 6: Average Costs for PV System Components in New York City and New York State (2003-2006)

There are a number of reasons why New York City PV systems cost more than they do in the rest of the state. Wages in New York City are typically higher than elsewhere in the state, especially when projects are required to employ union labor. Secondly, New York City's vertical environment requires longer wiring runs and more frequent use of special equipment like cranes than do less dense, suburban areas.

The added expense of the City’s unique interconnection requirements may also contribute to higher system costs. Often, larger PV systems cost less to install than smaller systems due to the economies of scale with lower transaction costs and larger panel orders. An analysis of NYSERDA data for New York City reveals, however, that non-BiPV systems over 10 kW were on average $1.60/watt more expensive than systems under 10 kW in size. This could be because systems over 10 kW must conduct engineering studies and install reverse power relays.

2.2.2 New York State and Neighboring Markets

While New York City installed costs are higher than those in the rest of the state, installed costs in the rest of the state are also higher than installed costs in neighboring markets (i.e. LIPA and New Jersey). Moreover, installed costs in New York City and New York State have trended upward during the past four years while installed costs in LIPA and New Jersey have trended sharply downward (Figure 7).



	2003	2004	2005	2006
NYC	$9.43	$8.76	$8.98	$10.09
Rest of state	$8.08	$8.27	$8.46	$8.57
NJ	$8.22	$7.99	$7.59	$7.30
LIPA	$7.11	$7.04	$6.92	$6.37

Figure 7: Average Installed Cost for PV systems in NYC and Neighboring Markets (2003-2006)

The reasons for this trend are unclear, but industry stakeholders have posited that it is attributable to the comparative investments made in PV in each of the respective markets. NYSERDA funding for PV is substantial compared to most states in the nation, but it is smaller than the markets to either side of New York City. During 2003-2006, New Jersey spent $100 million on PV rebates, the Long Island Power Authority (LIPA), spent $14 million, and NYSERDA spent $13.9 million. On a per capita basis, New Jersey and Long Island spent an average of 16 and 10 times more on their incentive programs, respectively, than NYSERDA did between 2003 and 2006.

To date, New Jersey, LIPA, and NYSERDA had funded 5.4 MW, 2.8 MW, and 1.7 MW of PV capacity through their incentive programs, respectively. The annual capacity additions in NYSERDA territory, New Jersey, and Long Island are shown in Figure 8 below.

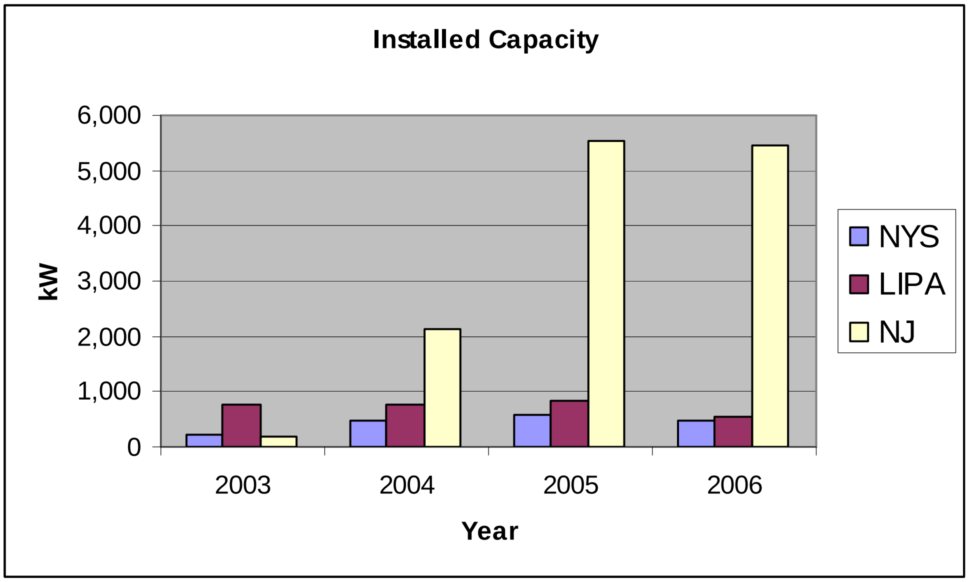


Figure 8: PV Capacity Installed Annually (2003-2006)

In 2005, the PSC rejected per capita comparisons of the SBC by saying, "Comparing New York's expenditures on a per capita basis to other states with significantly different populations, programs, and needs is not particularly illuminating (PSC, 2005c: 22)." While this may be the case for SBC programs in general, the PV funding level disparities between New York State, Long Island, and New Jersey have important implications for New York City's market growth. By investing more aggressively in solar energy, New Jersey and Long Island have been able to rapidly grow their markets. Regional installers have reported that the market size in Long Island and New Jersey makes New York City a comparatively less attractive place to operate – especially when coupled with the City's interconnection barriers, higher transaction costs, and requirements for becoming a NYSERDA-eligible installer.

Moreover, the comparatively larger size of New Jersey and LIPA's markets also created a larger, more experienced installer base which in turn reduced costs through competition. Costs have also declined in New Jersey because the larger project sizes enabled by New Jersey's incentives have allowed installers to more easily capture economies of scale by placing larger panel orders.

Finally, recent analyses indicate that PV programs with larger monetary commitments have been more effective in terms of capacity installed per dollar invested (Hill et al., 2005). This would imply that the impact of NYSERDA's incentive dollars has been less than those in New Jersey's. To date, however, a comparison of the capacity per dollar impact of NYSERDA's PV program compared with that of neighboring markets has not been completed.

The comparatively high (and rising) installed costs in the City are closely related to the other barriers discussed in this section, namely the lack of sufficient funds (Section 2.1), the added costs caused by technical barriers (Section 2.3) and the lack of policies to enable larger systems (Section 2.4).

2.2.3 NYPA Costs

As seen in Section 1.5.3, NYPA-financed public sector projects in New York City are not cost-effective without reliable policy incentives. The business case for public sector projects is further complicated by the low-cost of NYPA power (against which solar electricity competes), by NYPA's project management fees, and by the City budget system (see 2.1.1).

While NYPA provides low cost financing to PV projects, the advantages provided by this financing are offset by the project management fees that NYPA charges for overseeing City projects. The fee is typically an additional 12.5% of the total installed costs.

NYPA involvement in and oversight of public sector projects has been critical for moving the public sector market forward. That said, the impacts of NYPA's management fee on project economics are significant. For example, the average installed cost of NYPA's projects under the TEAM-UP program in 1996 was $10.93/watt (Willey, 2001). The cost of the proposed 100 kW LaGuardia Community College system when it is installed in 2007 is expected to be $11.58/watt (NYPA, 2006). While there are several reasons why the installed cost of NYPA projects has increased during the last decade, the addition of the NYPA project management fee is a significant contributor.

NYPA argues that every PV project involves project management costs, however, these costs are typically not transparently incorporated in the installed costs of the projects. While this is a valid point, some in the solar industry have argued that NYPA's project management fees are unnecessarily and prohibitively high.

2.3 Technical Barriers

A third major barrier to solar energy development in New York City is interconnection and codes. According to a series of interviews with New York City installers, interconnection is one of the most, if not *the* most significant obstacle to PV market growth in the City. Installers report significant administrative delays, a lack of clarity about exporting electricity to the grid, redundant interconnection requirements, and prohibitively expensive code requirements.

2.3.1 Interconnection

Administrative Delays

Despite the SIR and oversight from the Department of Public Service, informational and administrative barriers remain to interconnection within Con Edison territory. One of the most frequently mentioned barriers is administrative delay. According to the SIR, the utility has 30 days to review and process the application before construction begins. After construction is complete, the utility then has 60 days to inspect and approve the system. Installers report that these deadlines are infrequently met and that delays of up to 9 months have been experienced. Con Edison tracks incoming DG applications and reports on any administrative delays to the PSC semi-annually. In its most recent report, Con Edison states it processed 90% of the applications it received between January and June of 2006 in a timely fashion (Consolidated Edison Company of New York Inc., 2006b).

Uncertainty Regarding the Technical Limits of Exported Power to the Grid

A second major interconnection barrier is the uncertainty surrounding the issue of Con Edison's network grid protection requirements. It is unclear how much electricity, if any, a PV system can safely export to the grid. The lack of technical clarity raises questions about the future of the New York City PV market and about future energy policy decisions.

At present, Con Edison's requirements for back-feeding electricity to the grid seem arbitrary. On the one hand, residential PV systems under 10 kW are permitted to net meter and export electricity within the City. On the other hand, comparably sized non-residential systems that do not net meter are restricted from exporting their excess electricity to the grid. One installer reported, for example, that Con Edison required an engineering assessment for a non-residential 7 kW system. This raises the question of whether the barrier to grid export is technical or administrative.

This technical uncertainty has significant implications for the higher costs of PV in New York City. The engineering studies add costs to non-residential projects. Moreover, if a study indicates that a proposed project will export power, then a reverse power relay, which can cost $40,000 or more, must be installed.

Uncertainty about the grid's limitations also impacts future policy making. New York State legislators have attempted to raise the cap on net metering several times during the past few years. If the cap is raised above 10 kW in the future, it is unclear whether net metered systems will be allowed to export electricity under a new, higher cap, or if reverse power relays will be required for both net metered and non-net metered systems above a certain size.

The uncertainty also has implications for the City's energy planning. None of the recent assessments of PV's technical potential in New York City have taken the limitations of the network grid into account. The technical uncertainty surrounding the network grid will prevent the City from taking full advantage of PV, should the technology become competitive under a cost-breakthrough scenario during the next decade (Chaudhari et al., 2005; Solar Energy Industries Association, 2004).

Manual Disconnect Switch Requirements

A third interconnection barrier is the requirement of a utility-accessible, lockable, manual disconnect switch. In the case of power outages, power being fed back into the grid by distributed generation systems poses an electrocution risk to line workers. As a safety precaution, New York State requires that a manual disconnect switch be located outside a PV system owners' buildings so that line workers can shut off power flow from the PV system. This requirement, however, has become redundant because PV inverters are equipped with automatic disconnect switches that stop power flow to the grid in the case of outages (Larsen and Cook, 2004). Recent studies have concluded that manual disconnects are not used by utilities that require them, and several of the leading PV markets in the U.S. have done away with the requirement altogether (National Renewable Energy Laboratory, 2005). In New York City, NYPA has reported that it has secured manual disconnect requirement waivers for several of its PV projects.

2.3.2 Electric Codes

A barrier closely related to interconnection is the City's electrical code requirements. The national updates to Article 690 in the 2002 and 2005 National Electric Codes (NEC) largely correct oversights in the previous NECs and make clarifications regarding intent of the code and safety precautions (Wiles, 2005; Wiles and Bower, 2002). The New York City amendment requiring national lab testing for assembled systems, however, is a significant addition that negatively impacts the solar energy market in New York City.

Although the amendment may be appropriate for custom-built systems whose components have not been tested prior to installation, the individual components of all standard PV systems are tested and listed by national testing labs. According to national code experts, requiring these systems to be tested again once they are assembled is redundant and unnecessary (personal communication with J. Wiles, 2006). Moreover, installers report that having a national testing lab test an assembled system costs at least $2,000. This adds a significant expense to New York City PV installations and could hinder the market for PV in the City, particularly for smaller systems. At present, New York City is the only jurisdiction in the country with this requirement in place.

2.4 Policy Mix for New York City

A fourth major barrier to PV market growth in New York City is that New York State's PV policies are not tailored to support the City's market. As highlighted in a recent report from the Office of the State Comptroller (2005), New York State incentives tend to target small, non-residential systems and therefore exclude a large percentage of New York City's building stock from eligibility. In addition, state, city, and utility policies focus almost exclusively on PV's role as an energy supply technology and do not credit PV for its energy security and peak load reduction benefits.

2.4.1 Energy $mart Rebates and State Tax Benefits

New York City has a high concentration of large buildings and load constraints that will require multi-gigawatt additions to in-City capacity. The 50 kW cap on the NYSERDA incentive discourages the City's largest energy users from installing systems sufficient to significantly reduce their loads. Of the systems installed in New York City using the NYSERDA rebate, only one has been larger than 50 kW – and it was only 51 kW. On the one hand, the 50 kW cap prevents the City from installing systems large enough to meaningfully impact system-wide peak load. On the other hand, there are not sufficient funds to support the installation of larger systems. If the 50 kW cap were removed, for example, one or two projects over 500 kW would exhaust the year's RPS customer-sited tier funding.

The effectiveness of the Energy $mart PV incentive in New York City is limited because it targets small systems. The impacts of the state's PV tax exemption and the PV income tax credit on New York City are limited because they are only available to residential systems. Developing incentives that target non-residential systems in New York City is important for three reasons. First, non-residential buildings account for a large proportion of New York City's load. Second, commercial customers require a lower payback than residential customers do to invest in PV (Hamer et al., 2005). Third, commercial installations in New York City are typically more expensive than residential systems. Finally, the 30% federal tax credit for commercial systems is scheduled to revert back to 10% at the end of 2008 and will erode the economic case for commercial systems. When taken together, these factors seem to indicate a need for greater support for non-residential systems in the City.

2.4.2 Net Metering

New York State's net metering statute is limited to small (10 kW) *and* residential PV systems. In New York City, the residential requirement excludes buildings that account for approximately 60% of the City's annual electricity demand (PSC, 2005b). The 10 kW cap limits the statute's usefulness to large residential buildings that would require larger systems to export power.

The net metering law was amended in 2002 and again in 2004 to include residential wind up to 25 kW, farm-based wind up to 125 kW, and farm-based biogas up to 400 kW. These amendments, while positive, are not applicable to New York City because the City has no eligible farms. Also, New York City's biogas and wind energy resources are comparatively limited (Plunkett et al., 2003a).

Wind and biogas are also preferentially treated under the service area caps. As can be seen in Table 4 below, 32.6 MW of biogas and 14.4 MW of wind are permitted to net meter in Con Edison territory. PV, meanwhile, is limited to 8.1 MW. While these caps do not present an immediate barrier, they could limit PV market growth in the longer term. According to a resource assessment prepared for NYSERDA, New York City's technical potential for farm biogas, wind, and PV capacity is 0 MW, 12 MW and 7,736 MW, respectively (Plunkett et al., 2003b). The New York State net metering laws therefore favor New York City's least available resources over the City's most abundant resource.

Table 4: New York City's Technical Potential

Technology	System cap (% of 1996 peak load)	MW equivalent	Technical potential (MW)	% of NYC GWh (projected 2022)
Biogas	0.4	32.6	0	0
Wind	0.2	14.4	12	0.02%
PV	0.1	8.1	7,736	18%

Sources: Plunkett (2003b); Con Edison (2005c); Rickerson (2006)

2.4.3 Grid-side Benefits to PV

Most of the PV policies, incentives, and regulations in New York State target the customer side of the meter. PV provides a broad range of value beyond simple energy bill savings. Many of these added benefits, like emission reductions, benefit society at large and are difficult to quantify and monetize. A series of studies over the past 10 years have demonstrated, however, that PV can improve the function of the utility grid in quantifiable ways.

As discussed in Part I, PV output correlates closely with New York City's peak demand. Although PV is an intermittent resource, PV has an effective load carrying capacity (ELCC) of 65% within Con Edison territory, which means that PV output matches the City's load 65% of the time (Perez et al., 1993). As a result of the ELCC, PV can dramatically reduce system-wide load in New York City. Recent studies, for example, demonstrated that PV could have prevented both the 1999 power outage in Washington Heights and the 2003 blackout in the Northeast (Perez et al., 2004b; Perez et al., 1999).

In addition to PV's ability to reduce system wide demand, PV can also be used to augment utility infrastructure. In the 1990s, 500 kW of PV were deployed at the Kerman substation in California and its grid-related benefits were monitored. The Kerman installation reduced real and reactive energy losses, deferred transformer replacement, deferred the need for transmission capacity expansion, and enhanced local reliability (Farmer et al., 1995). The value of these benefits more than doubled the PV system's value. While the magnitude of PV's grid support value is site specific, the use of PV in a grid support role is readily replicable around the country.

Despite the ability of PV to shave peak demand, prevent blackouts, and support grid infrastructure, PV has not been actively integrated into the peak load management or system planning efforts in New York City. These include (1) the peak load and demand side management programs managed by both NYPA and Con Edison; (2) Con Edison's energy infrastructure master planning; and (3) NYSERDA's peak load management efforts under the new SBC.

Section 3: Recommendations

In order to encourage a large-scale solar energy market in New York City, the four barriers discussed in Section 2 must be addressed. A reliable, long-term, and substantial source of funding should be established that is designed to reduce PV system costs over time. In addition, the technical barriers should be addressed and the mix of policies that affect New York City should be re-evaluated. The following is a menu of policy options to achieve these goals based on best practices research from other states and cities, interviews with industry stakeholders, and consultations with the CUNY Million Solar Roofs Initiative Steering Committee.

3.1 Insufficient Funding

One of the underlying assumptions of this series of reports is that maintaining PV market growth is important part of New York City's energy future. Once the short-term silicon supply shortage is ameliorated, it is possible that solar could become one of the cheapest sources of energy in the next two decades (Bradford, 2006). Until PV achieves a cost breakthrough, however, policy support will be required to sustain the PV markets. Although New York State has committed to PV funding through the RPS, these funds will be insufficient to sustain market growth in New York City. In order to keep New York City's market growth on track, additional funding could be sought at the state and local levels.

3.1.1 Increase Renewable Portfolio Standard funds for PV

The most obvious solution to the lack of funds for PV is to increase the amount of funding available to PV through the RPS. At present, the RPS will not significantly benefit New York City. It is projected that a large portion of the RPS requirements will be met by upstate and out-of-state wind power and biomass. New York City's 80% in-city capacity requirement, however, will limit the impact of these resources on the City's generation mix. Solar energy is the only RPS-eligible resource that New York City can feasibly deploy within its borders on a large scale. New York State's 16 MW PV projection under RPS is dwarfed by other RPS markets in the region. New Jersey and Pennsylvania's RPS markets are projected to result in 1,500 MW and 800 MW of PV by 2020, respectively.

Despite the shortcomings of the RPS for New York City, the RPS may be difficult to amend. The New York RPS design process has been a three-year effort involving over 100 active parties. While many of the design characteristics have already been set, New York City stakeholders could advocate for greater RPS support for PV through various administrative and legislative channels.

3.1.2 Make SBC funds available to PV

When the RPS was created, New York State decided that PV would no longer be eligible for funds under the Systems Benefit Charge. Through 2011, $896 million will be made available for (1) energy efficiency, peak load, and outreach and education; (2) research and development; and (3) low income programs. If RPS funding for PV cannot be increased, NYSERDA could consider allocating SBC program funds for PV. For example, $40 million is currently earmarked for peak load management. A portion of this fund could be set aside to fund PV in load pockets. A load pocket requirement would ensure that the energy security value of PV would be captured and that New York City would have an additional source of funds to draw on. NYSERDA has previously given explicit policy support for PV in load pockets through the OAG's VEPCO and Ohio Edison PONs.

3.1.3 Create a New York City Solar Energy Fund

In a recent survey conducted by Baruch College's eTownPanel, over 90% of New York City residents favored greater government spending on solar and wind power. Close to 80% stated they would pay $1-$5 per month extra for more wind and solar, while 64% stated that they would pay at least $5.00 more per month (Rickerson et al., 2006).[20] Given the strong public support, New York City could consider developing its own source of PV funds if additional state funds cannot be accessed. At one extreme, New York City could consider imposing its own green power surcharge in addition to the SBC and the RPS. The City could also evaluate creating its own power authority, similar to LIPA, that could provide more targeted support to renewables in the city. Several cities around the country, like Minneapolis, are following the examples of Austin, Texas and Sacramento, CA and exploring their own municipal utilities to support clean energy (Russell, 2005). Political support for such ambitious proposals in New York City may be difficult to secure, however.

New York City could also try to promote a voluntary market for PV power similar to the "solar stock exchanges" currently active in European cities like Zürich, Lausanne, and Copenhagen (Christiansen, 2006). The solar stock exchange is essentially a green pricing program for PV in which voluntary green power buyers are matched with solar system owners. A similar, utility-managed program is currently active in Wisconsin. WE Energies buys renewable energy credits (RECs) from PV system owners for a fixed price of $0.225/kWh for 10 years. These RECs are then blended into the utility's green pricing program and sold to the utility's 14,000 green power subscribers. During the past year, over 200 kW of PV were enrolled in the program (Rickerson and Zytaruk, 2006). Such a green pricing program could be jumpstarted if the City set a green power purchasing requirement for its facilities similar to that required of state agencies under Executive Order 111.

[20] The eTownPanel project is an experimental survey tool that uses an all-volunteer pool of respondents. It is not a random sample, and so the results are not scientifically projectable to the larger population. However, results are weighted by gender, race, age, and geography to more closely reflect the general demographic profile of New York City. For a description of the eTownPanel methodology, visit: http://www.etownpanel.com/methodology.htm

3.1.4 Explore Strategies for Public Buildings

In addition to efforts to secure more funds for the private sector, New York City could also explore funding strategies for PV on public buildings.

Create a PV Funding Source for NYPA Customers

While LIPA collects and distributes funds for renewable energy, NYPA has no comparable program. NYPA's public and private sector clients, which constitute over 10% of the City's load, therefore have no access to predictable PV funding sources. NYPA should consider creating its own surcharge for renewable energy systems. Alternately, NYPA could argue that its public sector clients should have access to NYSERDA incentives because reducing electricity demand is in the interest of the city's SBC-paying taxpayers.

Explore Alternative Financing Mechanisms

During the past ten years, there has been a steady increase in the use of performance contracts to install energy conservation measures on public buildings (Hopper et al., 2005). Federal, state, and local agencies have used energy performance contracts to finance capital-intensive energy technologies by combining them with quick payback energy efficiency measures like lighting retrofits. During the past five years, for example, there has been an increase in the amount of PV blended into performance contracts. In 2003, 10.5% of the PV capacity installed in the US was financed in combination with energy efficiency (Rickerson, 2004).

It has been frequently argued that New York City needs to establish an effective energy performance contracting mechanism for City agencies (Center for Sustainable Energy, 2006; van Wagner, 2002). At present, New York City agencies do not have a streamlined mechanism through which they can use potential savings to finance projects. New York City should work with the Office of Management and Budget to study the best practices found at the federal, state, and local levels and establish a functional energy performance contracting mechanism. Once this mechanism is in place, the City could require that agencies and ESCOs evaluate blending PV systems into planned performance contracts.

The City could also explore alternative ownership models whereby private companies install, own, and operate PV systems on public facilities. The public buildings then purchase solar electricity at a fixed price under a long-term contract. The San Diego Unified School District, for example, recently agreed to purchase power for 20 years from PV systems installed on 15 of its schools.

3.2 Rising Costs

In order to move the PV market forward, New York State should develop strategies for controlling the rising costs of PV system installations statewide and within the City itself. As has been discussed in the sections above, the rising costs may be related to the size of New York State's market as it compares to neighboring markets. Part of the answer may therefore be for New York State to make a more long-term and substantial policy commitment to PV. Other strategies could include declining incentives and bulk purchasing commitments.

3.2.1 Declining Incentives

The world's two largest PV markets, Japan and Germany, use different policies to support their markets. Japan uses a system of upfront rebates, while Germany employs a performance based incentive. Both programs have successfully driven PV market growth because they have been substantial, long-term, and consistent (Osborn et al., 2005). The programs have also achieved cost reductions by establishing a predictable schedule of incentive level declines. If New York State were to make a substantial commitment to PV, the program should be structured so incentives decline in a predictable fashion over the long term.

3.2.2 Bulk Purchasing

There have been numerous studies advocating for government-led bulk procurement as a method for reducing PV costs (Eisl and Commoner, 1993; Stronberg and Singh, 1998) and several cities have pursued PV purchasing strategies. Sacramento used bulk procurement as a way lower PV costs and achieved lower installed costs than in the rest of California (Bolinger et al., 2002). Chicago and ComEd, attempted to encourage economic development by committing to purchase $8 million in PV from Spire Solar Corporation. In response to this, Spire opened a PV manufacturing facility on a brownfield site in Chicago (Wood, 2004). New York City and NYPA could explore partnering for bulk procurement. A bulk procurement initiative could lower PV module prices and could be paired with an attempt to lure PV manufacturers to the City. In-city manufacturing capacity could further lower PV module prices for the city market.

3.2.3 Reduce NYPA management Fee

As discussed above, the NYPA management fee can make the cost of PV installations prohibitively high, especially given the low price of NYPA electricity. In order to facilitate the installation of PV on public sector buildings, NYPA could consider lowering or eliminating its project management fee for PV.

3.3 Technical Barriers

As discussed in the sections above, the technical barriers to PV installations in New York City are related to interconnection and codes. Many of these barriers could be resolved through more transparent processes and targeted research.

3.3.1 Identify and Monitor Administrative Delays

According to its own reports, Con Edison had a 90% success rate with meeting the SIR time limits (Con Edison, 2006b) during the first half of 2006. This success rate does not seem to match anecdotal evidence from the PV installer community.

In order to address the perception of administrative delay, the NY Public Service Commission could work with the CUNY MSRI to host facilitated dialogue between Con Edison and the distributed generation installation community. Through such a dialogue, interconnection problems could be quickly identified and clarified. If the dialogue proved fruitful, it could be expanded into a stakeholder working group that could deal with a broad range of interconnection issues on an ongoing basis.

Another way that administrative delays could be addressed is through a transparent online tracking system that is updated at least daily. The tracking system could be monitored simultaneously by installers, Con Edison, and the PSC. Instead of installers having to notify the PSC and Con Edison of delay, delays would be immediately identified and all three parties would be alerted.

Finally, Con Edison could consider developing an accessible, PV-specific interconnection guide in partnership with PV stakeholders.

3.3.2 Clarify Technical Limitations of the Grid

As was discussed above, the uncertainty about the technical limitations to the grid have significant implications for PV system cost, policy, and energy planning. These uncertainties need to be clarified and ambiguities need to be removed. If residential PV systems under 10 kW can net meter, for example, then non-residential systems under 10 kW should be allowed to export power to the grid without completing engineering studies or installing reverse power relays. Moreover, the threshold for “safe” PV system size needs to be clarified and verified. If technical studies reveal that PV systems 100 kW and under can safely export power to the grid, for example, then they should be allowed to do so. If it is determined that grid security requires that all PV systems install reverse power relays, then this should be acknowledged and implemented and other strategies should be explored. As suggested by Hammer (2004), for example, New York City could explore exporting power from PV systems directly into high-voltage feeder lines or exporting power directly to other customers through micro-grid configurations.

3.3.3 Remove the Manual Disconnect Requirement

As discussed above, the manual disconnect is redundant, infrequently used, and sometimes waived by Con Edison for PV projects. Given this set of circumstances, New York State should follow the lead of New Jersey and remove the manual disconnect requirement.

3.3.4 Remove System Field Testing Requirement from NYC Code

As discussed above, the amendment requiring that PV systems be tested onsite is redundant and adds unnecessary cost to PV installations. There are many cities in the US and around the world that have larger PV markets than New York City. The City should study how these cities have balanced safety with compliance costs.

3.4 Policy Mix for New York City

Many of the policy options in this section have previously been considered by state policy stakeholders. The New York State Legislature, for example, has introduced several bills to raise net metering caps, and the Office of the State Comptroller recently advocated that tax credits and net metering be expanded to larger and non-residential systems (Office of the State Comptroller, 2005). This section both reiterates these policy proposals and introduces several new ones.

3.4.1 Net Metering

Although New York State was an early adopter of net metering, its net metering statute has since been surpassed by those of other states. In New Jersey, for example, PV systems up to 2 MW in size can net meter and net metering is not restricted to residential systems. In California, the net metering cap is 1 MW. New York State should consider raising the net metering cap to 2 MW for RPS-eligible technologies, and making net metering available to all customer classes. It is important to note that raising the net metering cap may not significantly impact the PV market in New York City unless the technical uncertainties surrounding interconnection can be clarified.

In addition to the 10 kW cap for individual systems, the City will eventually have to deal with the 8.1 MW cap for net metered systems within Con Edison territory. Rather than address this issue now, however, the city should adopt the current 8.1 MW limit as the official citywide target (e.g. 8.1 MW by 2010). Once the target is reached, the City could work with Con Edison and the PSC to re-evaluate the PV limitations under Rider R.

3.4.2 RPS Incentive Cap

If more state funds can be allocated to support solar energy, the state should consider raising the 50 kW cap on PV incentives under the RPS. As discussed above, larger systems would allow New York City to more effectively deploy PV in a load management capacity.

Given that RPS funds are limited, the City could work with the PSC to create a renewable portfolio standard specific to New York City that uses the 8.1 MW net metering cap as its target (as discussed in 3.4.1). Rather than relying on surcharge funds and rebates, the NYC-specific solar RPS could rely on a market-based system of tradable renewable energy credits like Washington, DC’s municipal RPS. A NYC-specific solar RPS might also give utilities greater incentive to resolve the technical uncertainties surrounding interconnection and PV integration in the City.

Given the higher labor and balance of system costs in New York City, New York State could also explore whether higher rebates are merited in the City than in the rest of the state.

3.4.3 Tax Incentives

As with the net metering, the state's tax credit and sales tax exemption should be extended to non-residential customers. New York City could also explore a municipal tax credit for systems installed within the five boroughs.

In addition to expanding the range and scope of tax credits, New York City stakeholders could explore utilizing the state property tax exemption. As of the writing of this paper, no New York City solar system owners had filed for the solar property tax exemption.

3.4.4 Energy $mart Loan Program

As discussed above, the Energy $mart Loan Program reduces the basis for calculating the 30% federal tax credit. As a result, few installers and system owners have taken advantage of the Loan Program to install PV. Because the Energy $mart Loan Program now reduces the interest rate by 6.5% throughout New York City, it deserves closer analysis. City stakeholders should construct economic models to determine if and when the Loan Program might be worth more to end users than the tax credits. At the residential level, for example, the 30% tax credit is capped at $2,000. At the commercial level, the federal tax credit will revert to 10% at the end of 2008. If the Loan Program proves to be more valuable than currently perceived, then it should be more aggressively promoted. As discussed above, only one PV system has been financed using the loan program in New York City.

3.4.5 Building mandates

Several cities around the world have integrated renewable energy into their building codes in recent years. Barcelona, Spain, for example, passed a Solar Thermal Ordinance requiring that all new buildings of a certain size include solar hot water systems. This requirement has spread rapidly to other cities in the country and a similar requirement has now been adopted nationally.

According to the Baruch College green power survey, over 80% of New York City residents favor requiring solar power on all new buildings (Rickerson et al., 2006). Although a Sustainability Advisory Committee has been created to monitor the city's building code, it is politically unlikely that an all-city solar requirement will be included in the code any time soon. Following the example of Battery Park City, however, New York City could amend Local Law 86 to require that new city construction projects include a solar component (Hammer, 2004).

3.4.6 Grid-side benefits

New York City should work with state and utility stakeholders to expand the role of PV in peak demand programs and energy planning. In NYPA and Con Edison demand response and peak load management programs, for example, PV could be given capacity credit equivalent to its effective load carrying capacity. In other words, a 100 kW PV system with a 65% effective load carrying capacity could be credited as being the equivalent of a 65 kW peak load reduction. Another option would be to deploy dispatchable peak shaving PV systems around the city. Dispatchable PV systems charge a battery during off-peak hours, which is then discharged during peak hours to deliver firm, peak shaving power. Numerous economic analyses of dispatchable peak shaving systems have demonstrated their value to demand side management programs and to end-users with high demand charges (Byrne et al., 1996, 1997, 1998). If the commercial building in Section 1.5.2 were to deploy a dispatchable peak shaving PV system under Con Edison's General – Large tariff, the payback of the system would decrease to 8.98 with a benefit-cost ratio of 1.93. If the same system were configured to also supply emergency power, the payback of the system would decrease to 2.67 years and the benefit-cost ratio would increase to 3.43.

In addition to peak load management programs, PV could also be more explicitly integrated into Con Edison's Energy Master Planning efforts and its transmission system upgrade programs (Con Edison, 2005a). A study quantifying the potential of PV as a grid-support technology should be launched in tandem with the effort to clarify the technical limits of PV in the network grid.

PV should also be integrated more explicitly into the City's emergency planning. The ability of PV to prevent blackouts by reducing peak demand, for example, should be taken into account during the PSC investigation of the 2006 Queens blackout. The City could also explore deploying PV equipped with battery back-up systems to provide uninterruptible power to critical infrastructure, or purchasing mobile PV generators that could be used during large-scale power outages or disasters (Young, 2006).

Section 4: Conclusion

New York City's unique infrastructure, high energy prices, and enormous energy consumption have created a substantial opportunity for large-scale solar energy development. While other municipal, state, and national PV markets around the world are projected to continue their rapid growth, New York City's PV market faces a set of barriers to continued expansion. Some of these barriers, like the technical uncertainty surrounding interconnection and the lack of incentives for large commercial systems, have been acknowledged for several years. Some of the barriers, such as the lack of funds under RPS and the new code requirements, are challenges that have emerged only recently. While resolving these barriers will require significant effort, none of them are intractable. The collaborative stakeholder process through which this report was developed under CUNY's Million Solar Roofs Initiative is a successful model to build on. In moving forward, New York City stakeholders should continue to work together to prioritize the policy recommendations outlined above and develop concrete strategies for implementing those deemed most effective. During the next several years, New York City will have an opportunity to "think big and plan bigger" with regard to solar energy and to work with local and state stakeholders to move rapidly toward a solar energy future.

Appendix I: REPI Funding for PV Installations in NYS (1995-2005)

Year	Solar	REPI funding	% NY	% Appropriated
1995	$ -	$ 693,120	0.00%	100%
1996	$ -	$ 2,398,472	0.00%	100%
1997	$ 2,114.00	$ 2,490,893	0.08%	100%
1998	$ -	$ 2,853,997	0.00%	100%
1999	$ 16,710.00	$ 4,000,000	0.42%	100%
2000	$ 7,606.00	$ 1,500,000	0.51%	100%
2001	$ 6,495.00	$ 3,991,000	0.16%	100%
2002	$ 4,110.00	$ 3,787,000	0.11%	100%
2003	$ 6,449.00	$ 4,815,033	0.13%	100%
2004	$ 3,433.00	$ 3,714,911	0.09%	77%
2005	$ 3,477.00	$ 4,960,000	0.07%	69%
TOTAL	**$ 50,394.00**	**$ 35,204,426**	0.14%	

Source: US Department of Energy, Weatherization & Intergovernmental Program (2005)

Appendix II: Utility Contributions to SBC III Funds & Surcharge levels

Utility	2004 Revenues	Annual amount	% of total	Surcharge ($/kWh)
Con Edison	$6,164,406,553	$ 87,476,852	49.99%	$0.002000
National Grid	$3,175,168,934	$ 45,057,668	25.75%	$0.001619
NYSEG	$1,529,822,159	$ 21,709,150	12.41%	$0.001500
RG&E	$ 663,962,122	$ 9,422,045	5.38%	$0.000715
Central Hudson	$ 430,586,411	$6,110,295.00	3.49%	$0.000980
O&R	$ 368,129,383	$ 5,223,990	2.99%	$0.001130

Source: PSC (2005c)

Appendix III: Energy $mart Loan Limits by Customer Class

Customer	Loan limit
Residential	$20,000
Multi-family (existing)	$2,500,000
Multi-family (existing, advanced meter)	$5,000,000
Multi-family (new)	$1,000,000
Other non-residential	$1,000,000
Green buildings	$1,500,000

Source: http://www.nyserda.org/loanfund/

Appendix IV: Con Edison Rates in $/kWh (August 2005-July 2006)

Month	Market Supply charge (MSC)	Monthly Adjustment Charge (MAC)	Total (Supply)	Delivery charges	SBC + RPS	Total (Supply + Delivery + surcharges)
7/1/2006	0.15081	-0.00201	**0.1488**	0.05177	0.0022	**0.20277**
6/1/2006	0.13251	0.00974	**0.14225**	0.05177	0.0014	**0.19542**
5/1/2006	0.12439	0.00899	**0.13338**	0.05177	0.0014	**0.18655**
4/1/2006	0.13171	0.00279	**0.1345**	0.05177	0.0014	**0.18767**
3/1/2006	0.13615	0.00427	**0.14042**	0.05177	0.0014	**0.19359**
2/1/2006	0.13892	0.0045	**0.14342**	0.05177	0.0014	**0.19659**
1/1/2006	0.19595	-0.02461	**0.17134**	0.05177	0.0014	**0.22451**
12/1/2005	0.15281	-0.01177	**0.14104**	0.05177	0.0018	**0.19461**
11/1/2005	0.14695	-0.0095	**0.13745**	0.05177	0.0018	**0.19102**
10/1/2005	0.11928	0.00224	**0.12152**	0.05177	0.0018	**0.17509**
9/1/2005	0.11806	0.00207	**0.12013**	0.05177	0.0016	**0.1735**
8/1/2005	0.12753	-0.00063	**0.1269**	0.05177	0.0016	**0.18027**

Source: http://www.coned.com/rates/

Appendix V: Federal, State, and Local PV Incentives available in NYC

	Eligibility		
	Residential	**Commercial**	**Municipal**
Federal Incentives			
Federal Business Energy Tax Credit		X	
Modified Accelerated Cost-Recovery System		X	
Federal Renewable Energy Production Incentive			X
Clean Renewable Energy Bonds			X
Federal Residential Solar & Fuel Cell Tax Credit	X		
State Incentives			
Energy $mart PV Incentive	X	X	
Energy $mart Loan Fund	X	X	
Renewable Portfolio Standard	X	X	
Green Building Tax Credit	X	X	
Energy Systems Property Tax Exemption	X	X	
Solar Sales Tax Exemption	X		
Solar and Fuel Cell Tax Credit	X		
Net Metering	X		
Local Policies			
Sales tax exemption	X		

Appendix VI: PV Planner Assumptions for all Sectors

RESIDENTIAL SCENARIO

Project Name: New York Residential Building
Evaluation Period: 25 years

Country: US
State: New York
City: New York City

Summary (Present Value)

Benefits

Demand Bill Saving: $0
Energy Bill Saving: $19865.76
Energy Sale Revenue: $0
Investment Tax Credit: $6636.46
Tax Deductions: $445.4
Emission Reduction Benefits: $0
RECs: $0
Total: $26947.62

Costs

Initial Net Capital Cost: $15590
O&M Cost: $1349.7
Tax on Bill Savings: $0
Tax on Sales to Grid: $0
Tax on Rebates &/or RECs: $0
Property Taxes: $0

Total: $16939.7

Financial Performance Indicators

Net Present Value: $10007.92
Benefit Cost Ratio: 1.59
Payback Year: 12.24

Levelized Cost of Electricity (LCOE)

LCOE with Tax Deductions: 50.17c/KWh
LCOE with Policy Benefits: 17.36c/KWh
LCOE with Service Benefits: NA
LCOE with Avoided Fuel Cost Volatility: 9.9c/KWh

Renewable Energy Generation Analysis

PV System Capacity: 3kW dc
Battery Capacity (AC): NA
Maximum Depth of Discharge: NA
Inverter Capacity: 2.91kW dc

System Efficiency (w Temp. eff): 12.13%
Capacity Factor: 16.11%

Surface Insolation: 34909.58kWh
Generation: 4234.37kWh
Average Daily PV Generation: 11.6kWh
Peak Generation: 1.94
Generation per Wp: 1411.46kWh
Specific Yield: 197.6kWh/m2
Average Cell Temperature: 17.92 C

Financial & Tax Inputs

Avg. Income Tax Rate: 33%

Income Tax Analysis: Yes
Tax Depreciation Method: N/A
Depreciation Duration: 25 years
Cap. Equip. Value Subject to Depreciation:85%
Equipment Book Life (years): 25 years
Customer Discount Rate: 5.5%

Loan

Debt Ratio: 0%
Loan Interest Rate: 9.25%
Loan Period: 15 years

PV Array & Support Structure

PV Array: $13260
Support Structure: $0
Capital Cost: $13260
Rebate: $5767.31

Balance of System (BOS)

Inverter: $2617.5
Battery Bank: $0
Other Electrical Equipment: $4362.5
Capital Cost: $6980
Rebate: $3035.88

COMMERCIAL SCENARIO

Project Name: NY Commercial Building
Evaluation Period: 25 years

Country: US
State: New York
City: New York City

Summary (Present Value)

Benefits

Demand Bill Saving: $30572.43
Energy Bill Saving: $42320.53
Energy Sale Revenue: $0
Investment Tax Credit: $14777.25
Tax Deductions: $14071.56
Emission Reduction Benefits: $0
RECs: $0
Total: $101741.78

Costs

Initial Net Capital Cost: $51966.67
O&M Cost: $4499
Tax on Bill Savings : $0
Tax on Sales to Grid: $0
Tax on Rebates &/or RECs: $0
Property Taxes: $0

Total: $56465.66

Financial Performance Indicators

Net Present Value: $45276.11
Benefit Cost Ratio: 1.8
Payback Year: 9.48

Levelized Cost of Electricity (LCOE)

LCOE with Tax Deductions: 38.4c/KWh
LCOE with Policy Benefits: 14.59c/KWh
LCOE with Service Benefits: NA
LCOE with Avoided Fuel Cost Volatility: 8.32c/KWh

Renewable Energy Generation Analysis

PV System Capacity: 10kW dc
Battery Capacity (AC): NA
Maximum Depth of Discharge: NA
Inverter Capacity: 9.69kW dc

System Efficiency (w Temp. eff): 12.13%
Capacity Factor: 16.11%

Surface Insolation: 116365.27kWh
Generation: 14114.56kWh
Average Daily PV Generation: 38.67kWh
Peak Generation: 6.46
Generation per Wp: 1411.46kWh
Specific Yield: 197.6kWh/m2
Average Cell Temperature: 17.92 C

Financial & Tax Inputs

Avg. Income Tax Rate: 33%

Income Tax Analysis: Yes
Tax Depreciation Method: MACRS 5 Years
Depreciation Duration: 5 years
Cap. Equip. Value Subject to Depreciation: 85%
Equipment Book Life (years): 25 years
Customer Discount Rate: 5.5%

PV Array & Support Structure

PV Array: $44200
Support Structure: $0
Capital Cost: $44200
Rebate: $19224.36

Balance of System (BOS)

Inverter: $8725
Battery Bank: $0
Other Electrical Equipment: $14541.67
Capital Cost: $23266.67
Rebate: $10119.61

MUNICIPAL SCENARIO

Project Name: New York Municipal Building
Evaluation Period: 25 years

Country: US
State: New York
City: New York City

Summary (Present Value)

Benefits

Demand Bill Saving: $32684.74
Energy Bill Saving: $31775.01
Energy Sale Revenue: $0
Investment Tax Credit: $0
Tax Deductions: $0
Emission Reduction Benefits: $0
RECs: $0
Total: $64459.75

Costs

Initial Net Capital Cost: $91966.67
O&M Cost: $6290.58
Tax on Bill Savings : $0
Tax on Sales to Grid: $0
Tax on Rebates &/or RECs: $0
Property Taxes: $0

Total: $98257.24

Financial Performance Indicators

Net Present Value: $-33797.5
Benefit Cost Ratio: .66
Payback Year: N/A

Levelized Cost of Electricity (LCOE)

LCOE with Tax Deductions: 39.98c/KWh
LCOE with Policy Benefits: NA
LCOE with Service Benefits: NA
LCOE with Avoided Fuel Cost Volatility: 21.48c/KWh

Renewable Energy Generation Analysis

PV System Capacity: 10kW dc
Battery Capacity (AC): NA
Maximum Depth of Discharge: NA
Inverter Capacity: 9.69kW dc

System Efficiency (w Temp. eff): 12.13%
Capacity Factor: 16.11%

Surface Insolation: 116365.27kWh
Generation: 14114.56kWh
Average Daily PV Generation: 38.67kWh
Peak Generation: 6.46
Generation per Wp: 1411.46kWh
Specific Yield: 197.6kWh/m2
Average Cell Temperature: 17.92 C

Financial & Tax Inputs

Avg. Income Tax Rate: 33%

Income Tax Analysis: No
Tax Depreciation Method: N/A
Depreciation Duration: 25 years
Cap. Equip. Value Subject to Depreciation:85%
Equipment Book Life (years): 25 years
Customer Discount Rate: 3%

PV Array & Support Structure

PV Array: $44200
Support Structure: $0
Capital Cost: $44200
Rebate: $0

Balance of System (BOS)

Inverter: $8725
Battery Bank: $0
Other Electrical Equipment: $14541.67
Capital Cost: $23266.67
Rebate: $0

Appendix VII: Interconnection Supplement and Timeline

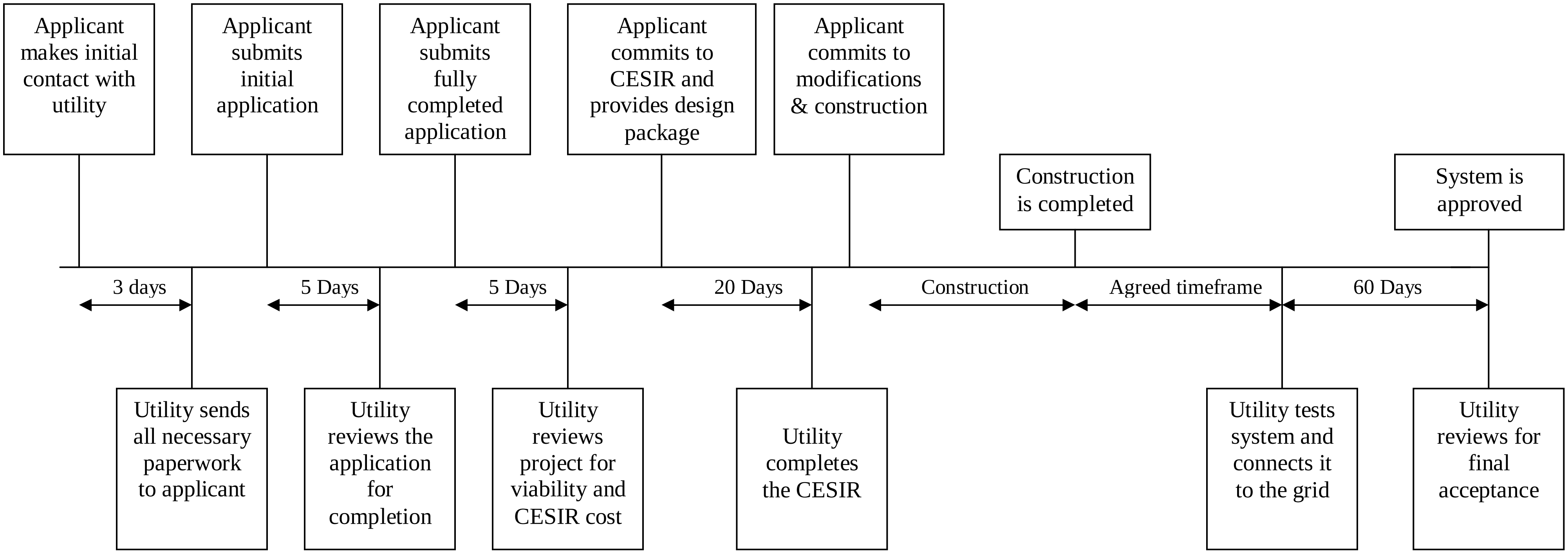
In order for a PV system to be interconnected, a customer must complete an eleven step interconnection process as outlined by the PSC's Standard Interconnection Requirements (SIR), which apply to all new Distributed Generation facilities up to 2 MW in size. The length of time for completing these steps depends upon the size and complexity of the project, and the utility is required to complete certain actions within a required timeframe. Use of certain certified interconnection equipment may expedite the interconnection process and likewise, use of non-certified equipment may require additional technical review.

Prior to submitting an application, customers must first contact their utility to discuss the possibility of interconnection. After this initial contact, the utility has 3 business days to send the customer the proper paperwork needed for an application. Upon submitting the application, the utility is required to respond within five business days indicating whether the application is complete or requires further information. If additions are needed, the customer must revise and resubmit their application. Once the application is fully completed, the utility performs a preliminary review of the system to indicate if the project is compatible with the system and provide an estimated Cost of the Electric System Interconnection Review (CESIR). For systems 300kW and less, the utility is required to complete both tasks and acknowledge in writing to the applicant within five business days. For systems greater than 300kW, the utility has 15 days to complete these tasks (see timeline below).

For systems that are 15kW or less there is no additional fee for either the preliminary review or the CESIR. However, if the project is larger than 15kW, the utility is required to provide an estimate of any additional costs within the same timeframe. Once all the requirements are submitted to the utility as outlined in the SIR, the utility is then required to complete the CESIR within 20 business days for systems less than 300kW and 60 business days for systems greater than 300kW.

Once the CESIR is completed, the utility and applicant enter into an interconnection agreement which includes the timeline for project construction. After the construction is completed, the utility is required to perform an on-site verification of the system and issue a formal letter of acceptance, should all technical requirements be verified, to the customer within 60 days. In addition, the utility is required to compare the realized costs of interconnection to the estimated costs paid early in the process. If there is any discrepancy, the utility will reconcile the differences with the customer. Furthermore, if there are any problems with the utility during this procedure, the applicant can issue a formal complaint with the Commission.

Appendix VII Cont.: Interconnection Supplement and Timeline



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