

Challenges and Successes on the Path
toward a Solar-Powered Community

Solar in Action



New York City, New York

Includes case studies on:

- Interconnecting Photovoltaics on a Network Grid
- NYC Solar Empowerment Zones
- Including Solar in Emergency Preparedness Planning



Solar Energy Systems installed this 49.1-kW solar photovoltaic system on the rooftop of the Novelty Crystal corporation in Queens, New York. *Photo from Solar Energy Systems, NREL/PIX 18521*

Cover photos from iStock/4318388, New York City skyline.

About the U.S. Department of Energy's Solar America Communities program:

The U.S. Department of Energy (DOE) designated 13 Solar America Cities in 2007 and an additional 12 cities in 2008 to develop comprehensive approaches to urban solar energy use that can serve as a model for cities around the nation. DOE recognized that cities, as centers of population and electricity loads, have an important role to play in accelerating solar energy adoption. As a result of widespread success in the 25 Solar America Cities, DOE expanded the program in 2010 by launching a national outreach effort, the Solar America Communities Outreach Partnership. As the Solar America Cities program evolved to include this new outreach effort, the program was renamed Solar America Communities to reflect DOE's commitment to supporting solar initiatives in all types of local jurisdictions, including cities and counties. Visit Solar America Communities online at www.solaramericacommunities.energy.gov.

New York City's Starting Point

New York City was designated by the U.S. Department of Energy (DOE) on June 20, 2007, as a Solar America City. Prior to that, the city had been actively laying the groundwork for strengthening the solar energy market within the city as part of the DOE Million Solar Roofs (MSR) Initiative. Between 1997 and 2005, 94 coalitions across the country signed on as official MSR partnerships. These partnerships comprised 971 private sector firms, electric utilities, builder-developers, nonprofit organizations, and governmental entities—all voluntarily committed to facilitate the installation of a specified number of “solar roofs.”

During the New York City MSR Initiative, the city conducted a baseline assessment of its solar infrastructure, identified barriers to market growth, and developed a set of recommendations through a collaborative stakeholder process. In 2006, Mayor Michael Bloomberg established a new Office of Long-Term Planning and Sustainability, which was charged with creating a long-term sustainability plan for the city through the year 2030. Early in 2007, Mayor Bloomberg announced the PlaNYC initiative, whose goals include reducing citywide carbon emissions 30% by 2030 and having the cleanest air of any large U.S. city.

Building Partnerships and Setting Goals

When the opportunity arose for cities to apply for participation in the Solar America Cities program, several organizations joined forces to propose a strategy for supporting large-scale solar energy market growth in New York City. These partners included:

- New York City Economic Development Corporation
- The City University of New York's Center for Sustainable Energy
- Mayor's Office of Long Term Planning and Sustainability
- New York State Energy Research and Development Authority
- New York Power Authority
- Con Edison, a local utility

To pursue the goals of the Smart Solar City Project, the New York State Energy Research and Development Authority (NYSERDA) and Locus Energy are working with the initiative as contributing partners. The project is supported by the New York City Council's Infrastructure Task Force and Council Member Daniel Garodnick.

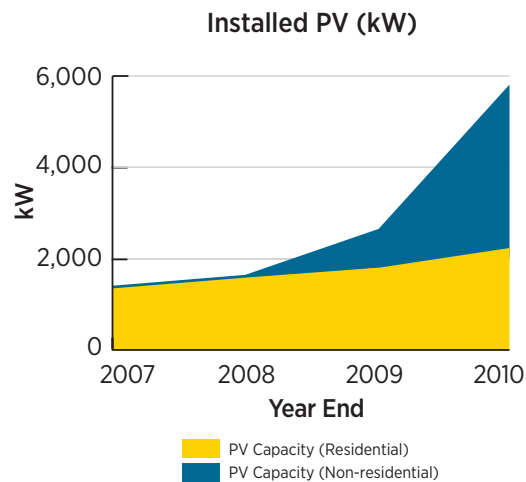
New York City has created a strategy for supporting large-scale solar energy market growth that complements its PlaNYC 2030. New York City's strategic partnership with DOE through Solar America Cities is an important component in the city's broader, long-term goal to ensure clean, reliable energy for every New Yorker.

The city views solar energy deployment as an opportunity for economic development and job creation. New York City is looking to encourage local green industries and to serve as a hub for growing markets like clean energy and green building. The city hopes these industries will replace some of the manufacturing jobs lost in recent years. Numerous studies have shown that solar energy development creates more jobs per megawatt than does conventional generation. Moreover, these jobs are inherently local and, by supporting them, New York City is ensuring investment in the economic development of jobs situated in the five boroughs. The New York City Economic Development Corporation (NYCEDC) has established a "Green Industry" desk to attract and retain green business clusters.

The New York City Solar America City Initiative team fosters a local solar energy market that will be economically sustainable while providing the city with clean, reliable, affordable electricity. The city is using a three-part strategy that (1) lays the foundation to support industry growth by

Installed Capacity

New York



Installed PV capacity increase from December 31, 2007, to December 31, 2010

reducing barriers and educating the workforce, (2) uses the city's resources to spur the market and create economies of scale to lower prices, and (3) creates institutions to plan and monitor future growth.

As part of the long-term planning process, the mayor announced a 30% greenhouse gas reduction goal for 2030 based on 2005 levels. This builds on the city's previous commitments made as part of ICLEI's Cities for Climate Protection and as a signatory to the U.S. Mayors' Climate Protection Agreement. This ambitious new target represents a significant long-term commitment. As New York City's largest local renewable energy resource, solar energy could



Solar Energy Systems installed this 68.4-kW solar photovoltaics system. Photo from Solar Energy Systems, NREL/PIX 18522



Aeon Solar installed this solar PV rooftop system in Brooklyn.
Photo from Aeon Solar, NREL/PIX 18523

make a significant contribution to the city's greenhouse gas reduction goal. Not only could it offset fossil fuel-based electricity generation, but it could make a contribution to reducing the city's peak load—the time when high demand requires the older, dirtier, less efficient power plants to run. Because the output of photovoltaic (PV) systems in New York City is greatest during the peak summer load, it is especially useful as a peak load management tool.

The establishment of a long-term solar energy target is a vital part of the city's current energy planning and a priority for the city's Office of Long-Term Planning and Sustainability. The city's preliminary target for 2015 maximizes what is allowed under the net metering caps instituted by the New York State Public Service Commission (PSC) for the Con Edison utility territory. According to PSC regulations, the amount of net metered PV capacity allowed within each state utility's territory is capped at 0.1% of the utility's 1996 peak load.

The city has set a goal to increase the PV capacity installed within the five boroughs from 1.1 megawatts (MW) in 2005 to 8.1 MW by 2015. This 8.1-MW target was the capacity cap as set by New York's net metering law prior to 2008. To attain this goal, the city will identify and address barriers, facilitate PV projects, and support workforce development.

Greenhouse Gas Reduction Goal: 30% below 2005 levels for city operations by 2017 and citywide by 2030 (NYC Climate Protection Act)

Solar Installation Goal: 8.1 MW PV by 2015

Solar Accomplishments and Highlights

The New York City Solar America City Initiative addressed technical, policy, and financial barriers to PV in New York City. While these barriers still exist to some extent, significant progress has been made by the initiative to implement solutions across the city.

- The National Renewable Energy Laboratory (NREL) and Con Edison explored technical solutions to interconnection on a network grid, resulting in a roadmap to overcome technical barriers.
- An advisory group consisting of representatives from several city agencies, Con Edison, the New York Department of Public Service, NYSERDA, and the New York Power Authority undertook a rigorous assessment process to select solar empowerment zones where the Solar America Cities partnership will focus its outreach and program development.
- Through collaboration with the city's Office of Emergency Management and other stakeholders, potential uses for solar power in emergency response were identified.

Case Studies: Successes and Challenges

Interconnecting PV on a Network Grid

Although most areas of the country use simpler radial distribution systems to distribute electricity, larger metropolitan areas like New York City typically use networks to increase reliability in large load centers. Unlike the radial distribution system, where each customer receives power through a single line, a network uses a grid of interconnected lines to deliver power to each customer through several parallel circuits and sources. This redundancy improves reliability, but it also requires more complicated coordination and protection schemes that can be disrupted by energy exported from distributed PV systems. Currently, Con Edison studies each potential PV system in New York City to evaluate the system's impact on the network, but this process is time consuming for utility engineers and may delay the customer's project or add cost for larger installations. City leaders would like to streamline this process to facilitate faster, simpler, and less expensive distributed PV system interconnections.

To assess ways to improve the interconnection process, NREL conducted a four-part study with support from DOE. One of

the solutions identified by the NREL report was the role of smart grid technology and advanced communication in overcoming technical barriers to interconnection. The Smart Solar City data acquisition system, described below, will directly address this barrier, not only helping Con Edison understand how much PV can be deployed safely across the city, but also by laying the foundation for PV to be part of the electricity generation solution for New York City. The two years of collaboration between New York City, NREL, and Con Edison to quantify and understand the impacts on, and potential benefits of, solar PV to New York City’s electrical system were a turning point in Con Edison’s approach to solar.

NYC Solar Empowerment Zones

The NYC Solar Empowerment Zones are strategically selected geographical regions where solar power is most viable and beneficial from a technical standpoint. Each of the three initial zones has a “day-peaking” energy usage profile that conforms closely to the daily production of solar power. The three zones are also portions of Con Edison’s network grid that are expected to need upgrades in system infrastructure to meet anticipated electrical usage over the next several years. Finally, each of the zones has a significant amount of rooftop square footage to accommodate solar installations.

Targeted solar power development in the three empowerment zones could play a critical role in reducing peak electricity consumption from the grid—and associated pollution from dirtier power plants used to produce energy during peak loads—while also potentially deferring or eliminating the need for costly upgrades to the electrical system that would increase electricity rates. Focusing the Smart Solar City Project in the zones will also be an opportunity to pilot processes, policies, and incentives that could be rolled out throughout New York City.

NYC Solar Empowerment Zone objectives include:

- **Technical assistance:** Three solar ombudsmen will offer technical assistance to building owners and operators who are considering solar power.
- **Incentives assistance:** Ombudsman will provide guidance navigating through the city, state, and federal incentive programs and paperwork that help make systems more affordable.

- **Data monitoring systems:** Free data monitoring devices will be installed on systems in the zones to communicate with the utility grid and inform users of system performance.
- **Streamlined permitting:** The partnership is working with permitting agencies, Con Edison, and NYSERDA to create a more streamlined and uniform permitting process.
- **Education and outreach:** The partnership will develop programs for organizations and businesses in the zones on energy efficiency and how to go solar.
- **Strategic opportunities:** The partnership will target opportunities in the zones and assist in developing applications for state renewable portfolio standard (RPS) funding. RPS funds for the downstate region will also be targeted for potential projects in the solar empowerment zones by educating and providing technical assistance to large building owners in these areas.

Solar power deployment can reduce pollution and the need for costly grid upgrades.

Including Solar in Emergency Preparedness Planning

The goal of the Emergency Management Support project was to establish best solar technology alternatives for maintaining reliable power supplies during crisis events for public safety, business, and economic continuity based on a clear characterization of the current status of the NYC Office of Emergency Management’s (NYCOEM) alternate power plan and on available solar technologies.

The objectives of the NYCOEM Solar Initiative Strategy were to:

- Consider how worldwide experience in the use of solar energy for emergency preparedness can be used by NYCOEM
- Clarify NYCOEM’s needs regarding solar energy
- Establish best solar technology alternatives for maintaining reliable power supplies for emergency preparedness
- Provide next steps for implementing preferred solar technologies.

Through collaboration with NYCOEM and other stakeholders, potential uses for solar power were identified. These uses were presented as a baseline of potential uses upon which further assessment to ascertain feasibility and suitability relative to criteria defined by NYCOEM could be conducted.

Emergency management personnel need to understand their community's energy needs and PV technology to make the right application choice. Studies and experience have shown that PV can play an important role in response, recovery, and mitigation in disasters. Portable systems under 1 kilowatt (kW) may meet many of the needs of disaster organizations in response efforts where 1- to 5-kW systems provide critical stationary power. Small utility-interactive PV systems with battery backup increase the effectiveness of disaster resistant buildings and ultimately support communities to meet distributed generation needs.

Challenging applications for PV include the large-scale power needs of sewer and water facilities, hospitals, large shelters, and distribution and emergency operations centers. As PV technology advances, more capabilities may emerge for these large-scale operations. However, at this time, these larger, more energy-intensive operations are better served by larger, dispatchable generators and perhaps supplemented by PV. Locations or equipment requiring hundreds of kilowatts of emergency power require large areas of open space, and direct purchases of large PV arrays can cost hundreds of thousands of dollars.

Additionally, PV systems supplying power to buildings (provisional housing, temporary shelters, mega shelters, etc.) are more effective when the loads are energy efficient and the building is designed for efficiency. "Disaster resistant buildings" minimize destruction and disruption to lives during a disaster by minimizing energy requirements. Net zero-energy buildings balance energy efficiency and conservation with self-generation to create a zero energy balance or better.

Top Takeaways

- A city government can have a significant impact on the local solar market through strong partnerships and strategic planning. Since the creation of the New York City Solar America City Partnership, installed capacity in New York City has gone from 1.1 MW to 6 MW, and commercial systems are seeing a 4-year payback.
- Con Edison's experience proves the concept that solar PV can be interconnected to network grids. Working closely with the local utility is crucial to overcoming these barriers.

- Objective analysis of the benefits of solar PV on peak demand reduction, electrical grid reliability, economic development, and carbon reduction efforts is central to engaging stakeholders.
- Constant, iterative feedback from public- and private-sector partnerships is important to keep focused on removing the most relevant barriers and on identifying new opportunities and obstacles as solar markets change.

Next Steps

In response to a DOE funding opportunity for Solar America Cities Special Projects, the New York City Solar America Cities Initiative developed the Smart Solar City Project.

Through the initiative, New York City has made significant progress toward understanding the technical barriers associated with interconnecting distributed PV to a network grid. Building on this work and to support further PV deployment on the New York City grid, a citywide Data Acquisition System (Smart Solar City DAS) that communicates with Smart Grid technology is crucial. The Smart Solar City Project will implement this system and a series of related tools in order to make scaled-up PV deployment possible in the city. Through a comprehensive strategy and discrete implementation tactics, the Smart Solar City Project will meet the following goals:

- Build Smart Solar City DAS to provide real-time solar generation information to the local utility
- Coordinate New York City Solar America City Initiative efforts with Con Edison's smart grid development
- Engage New Yorkers in the city's solar strategy
- Contribute to New York City's long-term energy plan and sustainable energy infrastructure
- Share technological achievements with other cities.

To meet these goals, the Smart Solar City Project will use a number of tools and strategies:

Smart Solar City DAS. The largest barrier for implementing inverter-based distributed PV on a large scale in New York City is the lack of real-time data on interconnected solar arrays. Without this data, Con Edison cannot determine how much power a service area's PV systems are producing. This

Solar can help maintain reliable power for public safety, business, and the economy during a crisis.

lack of information impedes PV deployment because Con Edison is concerned that interconnecting high volumes of intermittent generating capacity could potentially destabilize the grid. Furthermore, because it is unclear how much electricity the PV installations are producing, Con Edison cannot depend on the systems to reduce peak demand or displace the need for non-renewable generation sources. A Smart Solar City DAS for PV would provide critical real-time power production data to Con Edison, laying the foundation to overcoming technical barriers to PV deployment on New York City's network grid.

Community solar. The concept of community solar encompasses several regulatory, legislative, and financial models that enable greater participation in solar projects, even if project participants do not themselves have the resources for solar PV. Most residents in New York City are not able to purchase and install PV on their homes. This is due to the large upfront cost of installing PV as well as city-specific barriers such as limited roof space on residential buildings and the high percentage of city residents that are tenants rather than homeowners. While many New Yorkers embrace PV and would be willing to pay a premium for the environmental attributes of solar energy, these barriers limit New Yorkers' participation in solar deployment. Community solar will

expand New York City's PV generating capacity by empowering remote residents to participate in solar electricity generation even if they cannot support solar arrays on their own homes or businesses. New York City is researching community solar models and will implement a pilot project in one of the solar empowerment zones.

Smart Solar ombudsmen. Two Smart Solar ombudsmen will work with the New York City Solar America City Initiative solar coordinator to implement all aspects of the Smart Solar City Project. The ombudsmen will work with all Smart Solar City Project partners to implement the DAS, manage the build-out of the Smart Solar City virtual community, and work to engage the communities within the solar empowerment zones.

Additional Resources

- City University of New York (CUNY) NYC Solar America City Web page: www.cuny.edu/about/resources/sustainability/solar-america.html
- CUNY's Center for Sustainable Energy Website: www.csebcc.org/

For more city information, contact:

Alison Kling, New York City Solar Coordinator Email: nycsolar@mail.cuny.edu Telephone: (212) 346-8581

For more information on going solar in your community, visit *Solar Powering Your Community: A Guide for Local Governments* at http://solaramericacommunities.energy.gov/resources/guide_for_local_governments/

For more information on individual cities' solar activities, visit www.solaramericacommunities.energy.gov/solaramericacities/action_areas/

Ann Arbor Austin Berkeley Boston Denver Houston
 Knoxville Madison Milwaukee Minneapolis-Saint Paul
 New Orleans **New York** Orlando Philadelphia Pittsburgh
 Portland Sacramento Salt Lake City San Antonio San Diego
 San Francisco San José Santa Rosa Seattle Tucson



Clockwise from top left: Photovoltaic system in Philadelphia Center City district (photo from Mercury Solar Solutions); rooftop solar electric system at sunset (photo from SunPower, NREL/PIX 15279); Premier Homes development with building-integrated PV roofing, near Sacramento (photo from Premier Homes, NREL/PIX 15610); PV on Calvin L. Rampton Salt Palace Convention Center in Salt Lake City (photo from Utah Clean Energy); PV on the Denver Museum of Nature and Science (photo from Denver Museum of Nature & Science); and solar parking structure system at the Cal Expo in Sacramento, California (photo from Kyocera Solar, NREL/PIX 09435)

U.S. DEPARTMENT OF
ENERGY
 Energy Efficiency &
 Renewable Energy

EERE Information Center
 1-877-EERE-INFO (1-877-337-3463)
www.eere.energy.gov/informationcenter

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.

Prepared by the National Renewable Energy Laboratory (NREL) NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Operated by the Alliance for Sustainable Energy, LLC

DOE/GO-102011-3215 • October 2011