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

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

Solar in Action

San Francisco, California

Includes case studies on:

- Using a Web-based Solar Map to Provide Solar Information to the Public
- Targeting Commercial Property Owners through the Mayor's Solar Founders' Circle
- Facilitating Residential Solar Group Purchases
- Addressing Multi-Tenant Barriers to Going Solar

SOLAR AMERICA CITIES

Part of the Solar America Communities program

October 2011

San Francisco promotes solar in the community through high-profile installations on city-owned buildings such as the Moscone Convention Center, the city's first large-scale solar installation and the largest municipal system (675 kW) in the United States when completed in 2004. *Photo from The City of San Francisco, NREL/PIX 18417*

Cover photos from iStock/8809122, View of San Francisco

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.

San Francisco's Starting Point

San Francisco was designated by the U.S. Department of Energy (DOE) on June 20, 2007, as a Solar America City. San Francisco was making relatively significant progress promoting and enabling solar prior to receiving assistance through the Solar America Cities partnership. At the time of the designation, San Francisco benefited from:

- 2001 voter-approved $100 million bond initiative to pay for solar systems, energy efficiency improvements, and wind turbines for public facilities
- 2002 Electricity Resource Plan with ambitious goals, including 50 megawatts (MW) of renewable energy capacity by 2012 with 31 MW provided by solar
- Priority permitting for solar installations instituted in 2004, with updated streamlined procedures adopted in 2007
- 2004 Climate Action Plan goal to reduce overall greenhouse gas emissions to 20% below 1990 levels by the year 2012
- San Francisco Solar Task Force established in 2007 to develop policy recommendations to accelerate the number of solar installations on residential and commercial rooftops in the city
- Three municipal solar installations with 1.2 MW capacity, including the 675 kilowatt (kW) system on the Moscone Convention Center, which was the largest municipal installation in the country at the time
- More than 500 residential and commercial solar installations with approximately 1.8 MW in capacity.

San Francisco has very good solar resource potential. San Francisco's clearest weather is during cooler months in the spring, fall, and winter, meaning that the solar cells remain cool and operate more efficiently than in hotter climates.

Building Partnerships and Setting Goals

San Francisco set a goal to both install 31 MW of solar and to reduce overall greenhouse gas emissions to 20% below 1990 levels by 2012. To help reach these goals, the San Francisco Department of the Environment (SF Environment) focused efforts on several approaches to spur solar market growth:

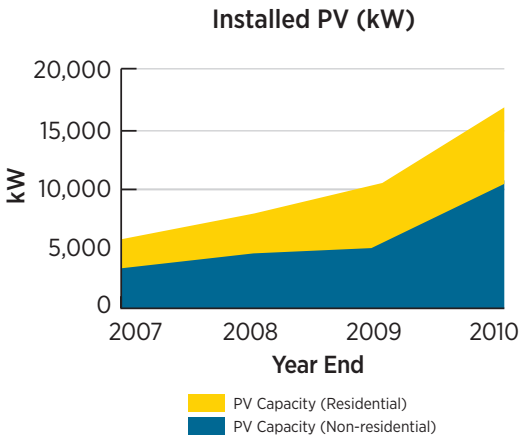
- Increasing public awareness through installation of solar energy systems on municipal buildings and by conducting outreach and education to increase knowledge of the availability and opportunities for solar in San Francisco
- Creating a solar map to provide residents and businesses with a comprehensive solar information resource
- Identifying sites for large installations and marketing to those building owners
- Providing technical assistance for consumers wanting independent third-party help with proposed solar projects. In particular, developing a program to group solar customers into aggregated purchasing pools to be marketed to solar installers
- Addressing cost and financing issues through solar-friendly policy development, such as expediting permitting processes and exploring ways the city can help attract preferential prices and reduce up-front costs
- Developing a local solar incentive program
- Identifying and addressing barriers to solar on multi-tenant buildings, which make up 68% of residential units in the city.

SF Environment identified the following key activities to meet overall solar goals:

- Develop a program to group solar customers into aggregated purchasing pools to be marketed to solar installers
- Identify sites for large installations and market to those building owners

Installed Capacity

San Francisco



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

- Identify and address barriers to installing solar on multi-tenant buildings
- Create a solar map to provide residents and businesses with a comprehensive solar information resource
- Develop a local solar incentive program.

San Francisco set a goal to both install 31 MW of solar and to reduce overall greenhouse gas emissions to 20% below 1990 levels by 2012. *Photo from The City of San Francisco, NREL/PIX 18416*

The Sunset Reservoir's 5-MW PV system, financed through a Power Purchase Agreement, significantly boosted solar generation in San Francisco. *Photo from The City of San Francisco, NREL/PIX 18419*

Accomplishments and Highlights

The Solar America Cities program enabled San Francisco to expand the scope of its solar efforts to increase the amount of information and technical assistance available to the public.

The city also worked to address barriers posed by the high upfront cost of solar and difficulties for multi-tenant solar projects.

Highlights of San Francisco's accomplishments include the following:

- Developed the San Francisco Solar Map, which is the go-to resource for solar information for city property owners, receiving 1,300 visits per month. It serves as a "one-stop shop" Web portal for residents and businesses interested in finding their solar rooftop potential and the information they need to successfully go solar
- Completed three neighborhood group purchases with support from SF Environment, with 134 residential systems totaling more than 300 kW
- Assisted One Block Off the Grid (1BOG) with the development of their first group purchase request for proposal (RFP); 1BOG has since facilitated San Francisco group purchases of 115 residential systems totaling 300 kW
- Created the GoSolarSF local incentive program, reaching $10M in reservations for 4.3 MW in the first 2 years, as well as supporting 40 new jobs in the local solar industry
- Installed eight municipal systems with 2-MW capacity and another 5.4 MW in progress
- Launched the GreenFinanceSF PACE (Property Assessed Clean Energy) financing program for renewable energy, energy efficiency, and water conservation projects in April 2010.

> Many residents were unaware that San Francisco has very good solar potential.

Case Studies: Successes and Challenges

Using a Web-based Solar Map to Provide Solar Information to the Public

Prior to the Solar America Cities San Francisco Solar Initiative, SF Environment identified a lack of public awareness and information about solar energy use in the city as a barrier to solar market penetration. It is important that property owners make decisions about solar energy use based on the correct information.

Many residents were unaware that San Francisco actually has very good solar potential. San Francisco receives solar radiation equivalent to 93% of that seen in San Diego, and cooler temperatures during clear months allow for more efficient energy production than in hotter areas, because PV systems operate more efficiently at lower temperatures. The city's micro-climates, where some neighborhoods experience more foggy days than others, contribute to a misperception that solar won't work well here.

Misperceptions about the time and cost required for solar permitting persisted even though the permitting process became easier and cheaper. It was unclear where to find information for reputable installers, what questions to ask them, and how to compare differing bids.

Rebates and tax incentives could also be difficult to identify and understand.

With these concerns in mind, SF Environment developed resources to provide easy access to all the information necessary to understand what it takes to pursue and complete a successful project in the city, and to promote the value in choosing to do so.

The San Francisco Solar Map offers a centralized website where users can obtain this information. The map was developed in partnership with the engineering consulting firm CH2M HILL's sustainability solutions group. Using new software technology, the map allows users to find the solar potential of any rooftop in the city. Users can evaluate the economics of using solar at a particular site and find information and guidance for all the steps along the path to solar installation and use. The map also includes markers and information for installed systems and is updated regularly with relevant local solar news.

Targeting Commercial Property Owners through the Mayor's Solar Founders' Circle

The Mayor's Solar Founders' Circle was created to target owners of the largest roofs, offering free personalized technical analysis of their estimated solar potential and financial analysis of the estimated system costs and benefits. In September 2008, San Francisco targeted the 1,500 largest rooftops in the city when then-Mayor Gavin Newsom challenged their owners to join the Mayor's Solar Founders' Circle by installing a solar energy system by September 2009. This outreach campaign sent letters notifying building owners of their solar potential and the solar benefits they could enjoy based on initial estimates. Businesses that responded received free energy efficiency audits and solar site assessments from SF Environment in addition to an extra $1.50 per watt GoSolarSF incentive, up to a cap of $10,000.

Aerial view of the 675-kW PV installation at the Moscone Convention Center in San Francisco. *Photo from The City of San Francisco, NREL/PIX 18417*

Then-Mayor Gavin Newsom and John Lushetsky, DOE's Solar Energy Technologies program manager, celebrate San Francisco's designation as a Solar America City. *Photo from The City of San Francisco, NREL/PIX 18421*

Between October 2008 and May 2009, more than 100 building owners responded with requests for assessments. Site assessors visited these properties to gather more detailed information. They then analyzed the available roof area and solar exposure, and estimated the potential size, energy production, cost, and payback for a solar system on each building. This information helped building owners decide whether to move forward with a solar energy system.

Ninety-three building owners followed through with prerequisite energy audits, provided their utility bills for use in the analysis, and received final solar assessment reports.

Based on follow-up conversations, there have been no installs by program participants, with most citing the inability to provide or secure the upfront capital necessary to install.

However, 13 sites followed recommendations from the energy audits to make energy efficiency upgrades estimated to save 770,000 kilowatt hours per year (kWh/yr), equivalent to about 450 kW of solar.

Through this process, San Francisco identified a lack of financing options for small- to mid-size commercial solar projects as an additional barrier. This issue is being addressed with San Francisco's Solar America Cities Special Project, launched in 2010.

Facilitating Residential Solar Group Purchases

The installed cost for smaller solar systems is typically higher when approached one-by-one through individual purchases because of the time required by installers to market, pursue

leads, assess the solar feasibility of sites, and complete the sale. The customer pays for higher transaction costs related to this invested time.

Grouping individuals into larger, aggregated purchasing pools is one approach that has been proven to allow customers to receive the best price. Organized groups have the advantage of providing installers with a large pool of already interested leads, reducing the individual transaction costs, and achieving greater purchasing power through an economy of scale.

With this in mind, San Francisco identified neighborhood groups interested in organizing solar group purchases and provided them with assistance to reach this goal.

SF Environment worked with these neighborhood groups to educate them on the details of solar energy use, assess their solar potential, and develop documents they needed to facilitate this process. With help from technical advisors at the National Renewable Energy Laboratory (NREL), group purchase RFPs and contract templates were created and made available to these residents.

Three group purchases were supported by SF Environment, leading to a total of 134 residential installations with a combined capacity of more than 300 kW. Participating residents were able to install solar at prices discounted by 20% or more.

Along with the support of community-led solar purchasing groups, San Francisco also provided assistance to 1BOG. This newly formed organization offered to gather prospective customers into solar purchasing pools and manage the entire process for them. SF Environment and NREL technical advisors worked with 1BOG to develop their first RFP.

1BOG has been successful in San Francisco, with 115 members installing residential systems with a combined capacity of 300 kW. Following initial success with this model in San Francisco, 1BOG expanded its campaigns to 16 cities in nine states, and plans to move into more cities in the future.

In their most recent San Francisco campaign, 1BOG obtained a base price of $5.39 per watt for their members, which was more than 30% below the average market price for individual residential systems installed in the city.

San Francisco met with installers, landlords, and tenants to identify barriers to multi-tenant solar.

Addressing Multi-Tenant Barriers to Going Solar

Of San Francisco's 346,000 housing units, 68% are within multi-tenant buildings, with nearly 35% of these in buildings having between two and nine units and the other 33% in buildings having 10 units or more. There are numerous complex issues associated with getting solar onto these buildings. Barriers to solar exist for most multi-tenant rental housing, as well as owner-occupied units, such as condominiums.

San Francisco organized meetings among solar installers, landlords, tenants, and relevant city departments to identify the barriers to multi-tenant solar. From these meetings, a number of issues surfaced. One issue that was dealt with relatively quickly and easily was changing the requirement that stipulated the GoSolarSF local incentive payment go to the host customer (account holder) rather than allowing it to go to the landlord who purchased the system.

A more difficult issue to address was that of net-metering in rental properties. The vast majority of multi-tenant buildings in San Francisco are sub-metered for electricity rather than master-metered, meaning each unit has its own electric account held and paid for by the tenant. Current net-metering rules require each account (meter) be connected to its own solar system, and credits can only go to offset the electricity use by that account. In this situation, the economic case for solar is hard to make to landlords who make both the decision whether to use solar and the system purchase.

Since the landlord doesn't pay the electric bill for tenant units, he or she is unable to receive the benefit of the savings provided by offsetting utility use with solar energy.

It also is unclear whether landlords can receive approval from the San Francisco Rent Board to pass solar system costs through to tenants who benefit.

SF Environment and the Rent Board amended the rent ordinance to specify solar as a "qualified renewable energy improvement," but have been unable to get this legislation through the Board of Supervisors. It is possible that landlords could get pass-through approval, but it is uncertain because, to date, no landlord has pursued this and set precedent.

The GoSolarSF incentive has provided some ability to overcome the economic barriers by allowing building owners to take a residential incentive for each meter served by solar.

Additional obstacles identified include the difficulty landlords and installers have obtaining tenants' electrical usage history from the local utility, which is needed to size systems appropriately; the amount of duplicate paperwork required to apply for a solar rebate for each meter served under both the state California Solar Initiative (CSI) and GoSolarSF programs; and the limited amount of roof area available for solar, many times making it impossible to serve more than the common area loads of the buildings.

Most buildings are master-metered for gas use and landlords pay the bill. With the new CSI-Thermal state incentive program for solar water heating (SWH), the ability to make the economic case for SWH is easier than for photovoltaics (PV) on these buildings. SWH also needs much less roof area than PV to produce enough energy for the related load. For these reasons, San Francisco has turned its focus on multi-tenant solar to water heating rather than PV installations.

Top Takeaways

San Francisco has the following recommendations for other local governments looking to support solar energy:

- Provide easy access to a comprehensive information resource for residents exploring the solar option and lead by example with high-profile municipal solar projects.
- Reduce the cost of solar to bring more customers into the market through organized group purchases and local incentive programs.
- Identify and understand barriers, such as those experienced by multi-tenant building owners in San Francisco. However, this is only half the battle. Most solutions are fairly complex. For example, a virtual net metering program requires a combination of technical (metering), administrative (billing), and legal/equity (determining how credits are apportioned) considerations, to name a few. Potential solutions include creating a robust feed-in tariff program that disconnects on-site demand from solar generation payments, or, barring that, some sort of virtual metering solution similar to what San Diego is piloting for the CSI program.

Next Steps

Supported in part by the Solar America Cities Special Projects funding, San Francisco will focus on the following activities:

- Developing an innovative solar financing option for small to mid-size commercial sites
- Developing an innovative solar financing option for schools
- Supporting the Mayor's Office of Housing in the development of innovative debt financing for solar water heating on affordable housing buildings.

San Francisco will continue with solar efforts outside of the Solar America Cities Special Projects, including:

- Continued planning and development of new municipal solar installations
- Streamlined permitting for SWH
- Options for providing additional incentives for in-city solar generation in coordination with San Francisco's Community Choice Aggregation program, CleanPowerSF
- Exploration of the options available for developing a "community solar" program, such as Sacramento Municipal Utility District's Solar Shares, to allow residents who are unable to install their own solar systems to contribute to and receive benefit from an off-site solar system.

Additional Resources

- SF Environment: www.sfenvironment.org/renewableenergy
- San Francisco Solar Map: sf.solarmap.org
- GoSolarSF: www.solarsf.org
- GreenFinanceSF: www.greenfinancesf.org
- CleanPowerSF: www.cleanpowersf.org

For more city information, contact:
Department of the Environment, City of San Francisco Email: sfenvironment@sfgov.org Telephone: 415-355-3700

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/

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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)*

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