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

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

Solar in Action

Berkeley, California

Includes case studies on:

- Smart Solar Independent Client Advising Service
- BerkeleyFIRST—A Property Assessed Clean Energy Financing Program
- Berkeley Solar Map and Calculator

SOLAR AMERICA CITIES

Part of the Solar America Communities program

October 2011

The Brower Center utilizes the latest in energy-saving technologies and recycled building materials. The center's design includes photovoltaic panels that will double as a sun shade device. *Photo from Brower Center, NREL/PIX 18405*

Cover photos from iStock/14782499, City of Berkeley and East Bay

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.

Berkeley's Starting Point

Berkeley was designated by the U.S. Department of Energy (DOE) on June 20, 2007, as a Solar America City. At the start of the Solar America Cities program, Berkeley had a high rate of solar installations, a mature solar industry, an aggressive ratepayer-funded photovoltaic (PV) rebate partnership, progressive utility tariffs and interconnection rules, and a voter mandate for major greenhouse gas reductions.

Berkeley had some exceptional advantages at the start of its Solar America Cities partnership. These include the following:

- Berkeley was ranked by SustainLane to be one of the top five cities in the United States to locate a clean tech business.
- Berkeley was home to clean energy leaders working at Lawrence Berkeley National Laboratory and the University of California.
- Berkeley was home to a major solar assembly company and several solar installers that had been in business for more than 20 years.
- Since 2000, 447 PV installations were completed, totaling 1.75 megawatts (MW_{AC}).
- Rebates in the amount of $2.20 per watt were available for PV installations.
- The state of California had established an energy resource loading order for new capacity and a renewable portfolio standard of 20% by 2020.
- Pacific Gas & Electric (PG&E), the utility, had a net metering tariff and clear interconnection processes.
- Permit fees for solar installations were found to be the lowest in the region.
- 81% of voters had supported an 80% reduction in greenhouse gases by 2050.
- The city had sponsored the founding of nonprofit organizations to promote clean energy, including the Community Energy Services Corporation, Rising Sun Energy Center, and Build It Green.

Building Partnerships and Setting Goals

Adopted in 2009, Berkeley's 2020 Climate Action Plan included several solar-related goals:

- Reducing greenhouse gas (GHG) emissions by a total of 80% by 2050
- Producing 19 gigawatt-hours of solar electricity
- Installing 12 MW of PV capacity
- Reducing GHG emissions by 11,600 metric tons through solar PV and thermal generation.

The City of Berkeley joined forces with multiple partners to help them reach its goals. Partners included:

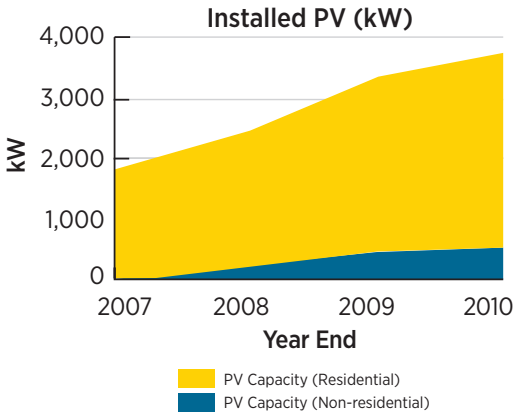
- University of California Berkeley Renewable and Appropriate Energy Laboratory
- PG&E East Bay Energy Watch
- Build It Green
- Community Energy Services Corporation (CESC).

Key activities that the team identified to meet the city's solar goals were to:

- Provide free solar and energy efficiency assessments
- Bundle projects installed under a solar program with energy and water efficiency improvements to reduce loads, system size, and system costs
- Provide standards and uniform bid forms to facilitate transparent contractor quotes

Installed Capacity

Berkeley



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

- Provide excellent customer service and unbiased technical assistance to promote customer confidence about adopting solar
- Establish a financing mechanism to reduce up-front costs
- Establish a solar map and calculator to enable clients to explore solar PV potential.

Accomplishments and Highlights

- Established the SmartSolar program to provide independent advice and services to prospective clients

Solar power panels are shown on the roof of a business in Berkeley. *Photo from SunPower, NREL/PIX 13455*

Berkeley, as shown from the University of California at Berkeley's Haas Business School, has been at the forefront of the solar movement. *Photo from UC Berkeley Haas Business School, NREL/PIX 18403*

- Piloted BerkeleyFIRST, a property assessed clean energy (PACE) financing program
- Created a solar map and interactive financial calculator.

Case Studies: Successes and Challenges

SmartSolar Independent Client Advising Service

The SmartSolar Program is a community-based solar advising service. The City of Berkeley selected CESC, a Berkeley nonprofit organization, to administer the program. The program is designed to accelerate the adoption of solar technology among residents and local businesses in Berkeley and the East Bay.

Although the solar industry is not new in Berkeley, consumers generally do not understand the local industry's protocols or the many ways to improve project cost-effectiveness, such as installing energy efficiency measures before sizing solar technologies and taking advantage of available rebates and tax credits. SmartSolar provides an integrated analytical resource that promotes confidence in solar investments and good consumer decision-making. The program's position as an unbiased informational resource for clients and the public serves the interests of local solar and energy efficiency contractors as well as SmartSolar clients.

SmartSolar promotes confidence in solar investments and good consumer decision-making.

The SmartSolar program was initially implemented only within the City of Berkeley. During this pilot stage of the program, which extended from April 2009 to March 2010, SmartSolar was contracted to provide consultation and analysis for 20 solar thermal, 20 residential PV, and 10 small commercial PV projects.

As of December, 2010, program achievements included:

- Developing client materials and program guidelines to streamline services and enable the replication and deployment of the program in other communities
- Providing general information to hundreds of Berkeley residents and businesses at 45 local community events on topics related to energy use, energy efficiency, and solar technologies
- Conducting site assessments of 76 residential and 22 commercial properties and providing these clients with ongoing project-advising services regarding cost-effective energy efficiency, solar hot water, and solar electric technologies
- Facilitating the installation of 10 PV systems totaling approximately 50 kilowatts (kW) of direct current capacity and one solar hot water installation displacing 14.8 therms from a natural gas water heater.

In addition to these achievements, there are several solar projects in development, including a 500-kW commercial project that SmartSolar is reviewing for the client.

Along with the direct services and installations noted above, the program has increased local knowledge, awareness, technical capabilities, and institutional capacity that will help enable the community to achieve ambitious solar goals in the future.

Below is a summary of the lessons learned during the SmartSolar pilot:

- Residential and commercial solar investments are likely to be motivated by the availability of equity financing programs such as BerkeleyFIRST and other creative financing mechanisms.
- Information about the solar market, technology and analytical tools needs to be updated frequently to reflect the changing market conditions.

- SmartSolar services should be designed to engage the client often, with simple but very informative information.
- Residents and businesses are grateful for a reliable source of solar information and analysis at no cost.
- Partnership with local city government is critical for effective community outreach and program design that complements public policy objectives.
- Public events and the city government are important sources of client referrals.
- Marketing strategies should target the "business case" as well as the environmental benefits of solar and energy efficiency technologies.
- Solar contractors welcome the services provided by SmartSolar; SmartSolar clients are better informed than the general public and are more serious potential clients.

The experience gained in the first year of the pilot program has motivated certain program strategies in 2010 and beyond. CESC is focusing its SmartSolar program and development efforts as follows:

Deployment of SmartSolar into other East Bay communities—CESC has already received a funding commitment from DOE and PG&E, to expand SmartSolar client services in 2010–2011 into five more Bay Area communities: Oakland, Emeryville, Albany, El Cerrito, and Richmond, in addition to continuing work in Berkeley.

Technical transfer of SmartSolar-type programs into other California communities—CESC is consulting with the five other communities in the new focus territory about developing their own SmartSolar programs. This involves training staff in those communities and helping them design a program that complements their public policy goals and related energy and environmental programs. It also involves determining the most appropriate assessment tools and calculators for all SmartSolar programs to use, as well as streamlining SmartSolar client materials and services.

Improvements to site report and data management—SmartSolar managers are simplifying the site report, which is provided to clients and summarizes solar and energy efficiency potential, to ensure it doesn't overwhelm clients. They are implementing software modifications to streamline the database and reduce labor required to draft a site report. SmartSolar managers feel this is the only way to scale a program in order to achieve market transformation.

Improvements in information services and customer service—SmartSolar customers' top inquiries when contacting the program involve learning a) what technology is available to meet their current and future energy needs, b) how it can be paid for or financed (e.g., rebates, incentives), and c) whom to talk to (contractors, vendors). SmartSolar is developing case studies to offer clients that will demonstrate successful solar projects in the community and will answer questions in such a way that propels customers to take the next steps to adopt solar. Customer information needs will be better satisfied and fewer onsite analyses be requested of SmartSolar staff. This efficiency will enable the program to handle more requests. SmartSolar also will organize cross-community events so that speakers, vendors, and city and utility representatives can answer the top community inquiries.

Berkeley Mayor Tom Bates announces the SmartSolar Program that provides city residents with free solar consulting services.
Photo from Community Energy Services Corporation (CESC), NREL/PIX 18406

Funding development—Although some clients may be willing and able to pay for consulting services, SmartSolar is designed to serve the community in a broader role and, as a nonprofit, CESC is not motivated to offer consulting on a fee-for-service basis. SmartSolar services are offered at no charge to serve the best interests of clients while promoting public policy objectives. To make SmartSolar sustainable, CESC is investigating ongoing funding sources; this is a long-term goal.

BerkeleyFIRST — A PACE Program

PACE programs allow property owners to finance energy efficiency and renewable energy projects on their home or business and pay the project's cost back as a line item on their property tax bill over an extended period, often 20 years. This innovative financing mechanism was first piloted by the City of Berkeley in 2008–2009. Berkeley's pilot program, called BerkeleyFIRST (Berkeley Financing Initiative for Renewable Solar Technology), provided financing for solar PV

installations and is serving as a national model. As of December 2010, 22 states have passed PACE-enabling legislation and Hawaii allows it based on existing law.

In California, a statewide PACE program called CaliforniaFIRST was to be launched in the summer 2010. CaliforniaFIRST was planning to include financing for not only solar PV, but also solar thermal and energy and water efficiency improvements. However, most PACE programs are stalled by the Federal Housing Finance Agency's (FHFA) position that PACE's first lien status, in combination with what the FHFA sees as a lack of robust underwriting and energy retrofit standards, raises safety and soundness concerns. Various entities, from the Office of the Vice President to Congress, state and local agencies, and other interested parties, are working with FHFA to resolve these concerns.

BerkeleyFIRST realized the following achievements and lessons learned:

- BerkeleyFIRST eliminated the main barrier to going solar: the up-front cost. By structuring the payment over 20 years, property owners can take advantage of lowered energy bills while they are repaying the financing.
- Because the solar installation stays with the property, so does the tax obligation—if the property is transferred or sold, the new owners typically can receive the benefit of the energy improvement and continue to pay the remaining tax obligation.
- Financing eligibility is based on the value of the property and the current status of property tax payments, not on personal credit.
- Exposure to information on PV through BerkeleyFIRST prompted many homeowners to install a system using other financing such as home equity loans or a residential lease or power purchase agreement.
- BerkeleyFIRST participants were required to install a certain suite of energy-saving measures prior to installing any solar panels, thereby reducing overall energy needs.
- PACE financing works. Participants installed solar and are paying the costs back on their property tax bill.
- Bigger is better. Berkeley's program tested the PACE concept. The city intends to join a statewide effort that will make clean energy financing available to thousands of property owners in Berkeley and beyond, thus helping to bring down interest rates and lower the city's administrative burden and property owners' administrative costs.
- It is necessary to finance not only solar, but also energy efficiency. Now that it is clear that the concept works, financing can be made available for a broader range of energy and water improvements. This is the plan for CaliforniaFIRST.
- PACE programs need underwriting criteria that will satisfy FHFA concerns.

BerkeleyFIRST eliminated the main barrier to going solar: up-front cost, by structuring payments over a 20-year period.

The BerkeleyFIRST model will benefit from being brought to scale, thereby allowing more property owners to participate and helping to reduce interest rates and administrative costs. To expand the program, the City of Berkeley plans to partner with Alameda County as part of a statewide CaliforniaFIRST program. Efforts are underway to address FHFA concerns, and should they be successful, CaliforniaFIRST and programs across the country will move forward.

Berkeley Solar Map and Calculator

The Berkeley Solar Map is an interactive, Web- based tool developed by University of California Berkeley and accessible at http://berkeley.solarmap.org/solarmap_v4.html. The map allows residents and business owners to estimate the solar potential of their rooftops and view existing solar installations. It calculates the potential size and cost for solar electric and hot water systems on any rooftop within the city, taking into account the building's orientation in relation to the sun and the potential shading caused by roof factors or other obstructions.

The map plots solar installations throughout the City of Berkeley, color-coding them based on the type of installation: residential PV, municipal PV, school/nonprofit PV, commercial PV, financed through BerkeleyFIRST, or solar thermal. Utilizing the UC Berkeley Solar Calculator, the Berkeley Solar Map also helps individuals estimate a system size based on their monthly gas and electricity bills. The calculation factors in any contractor quotes for energy efficiency, solar electric, or solar hot water project costs, and provides users with information on average annual and net system costs, system area in square feet of roof space, total percentage of energy savings, peak output (for PV systems), carbon dioxide savings per year, and a breakdown of annual

average cash flow. Residents and businesses can add their completed solar projects to the map and include notes about benefits they have realized by installing solar.

The calculator allows different levels of user input ranging from a single month's energy bill and default values to 12 months billing, contractor quotes, and other detailed assumptions. Based on the development efforts thus far, the city has realized the following:

- Solar mapping is a good tool to engage potential clients by offering site-specific information. It can help clients decide if they have enough solar potential to warrant consultation with a solar contractor.
- An online calculator can give clients a sense of the financial commitment required to install solar.
- The map and calculator are screening tools; they are not substitutes for onsite assessments.

The city is working with Critigen, a business intelligence consulting firm, to update the map and calculator to make them easier to use.

Top Takeaways

- There is a need to establish stronger relationships between the solar and energy efficiency industries to provide clients with comprehensive and meaningful services. An independent advisor can help facilitate relationships between contractors and clients but cannot efficiently provide technical assessments.
- PACE financing requires clear standards and reliable cost-benefit methodologies to satisfy mortgage lender concerns.
- PACE financing requires a large pool of clients to reduce administrative costs and to provide an uninterrupted funding supply.
- The solar map is an effective interactive Web tool for viewing information and locations of existing solar installations in the city. It provides residents with easy access to information about the potential of solar energy in their neighborhoods. It can be used to determine the potential size and cost for solar electric and hot water systems on any rooftop within the city and allows residents to design a solar energy system that will meet their energy needs.

Next Steps

The City of Berkeley is expanding the SmartSolar program and updating the solar map and calculator as part of a Solar America Cities Special Projects grant. Activities include:

- Partnering with PG&E to fund SmartSolar program expansion
- Enrolling the cities of Oakland, Albany, El Cerrito, Emeryville, and Richmond in the SmartSolar program
- Improving the calculator to provide better integration with the solar map and more options for analysis.

The city council had authorized participation in the CaliforniaFIRST PACE financing program, which was funded by the American Recovery and Reinvestment Act of 2009. Depending on the outcome of federal legislative and regulatory proceedings, CaliforniaFIRST may move forward, providing a longer-term solar financing option for Berkeley property owners.

Additional Resources

- BerkeleyFIRST Guide: www.cityofberkeley.info/berkeleyfirst
- Residential Solar PV Permit Guide: www.cityofberkeley.info/SolarPVPermitGuide/
- Solar Thermal Hot Water Installations, City of Berkeley: www.cityofberkeley.info/solarthermal
- Solar & Renewables/Solar PV, City of Berkeley: www.cityofberkeley.info/solar

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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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