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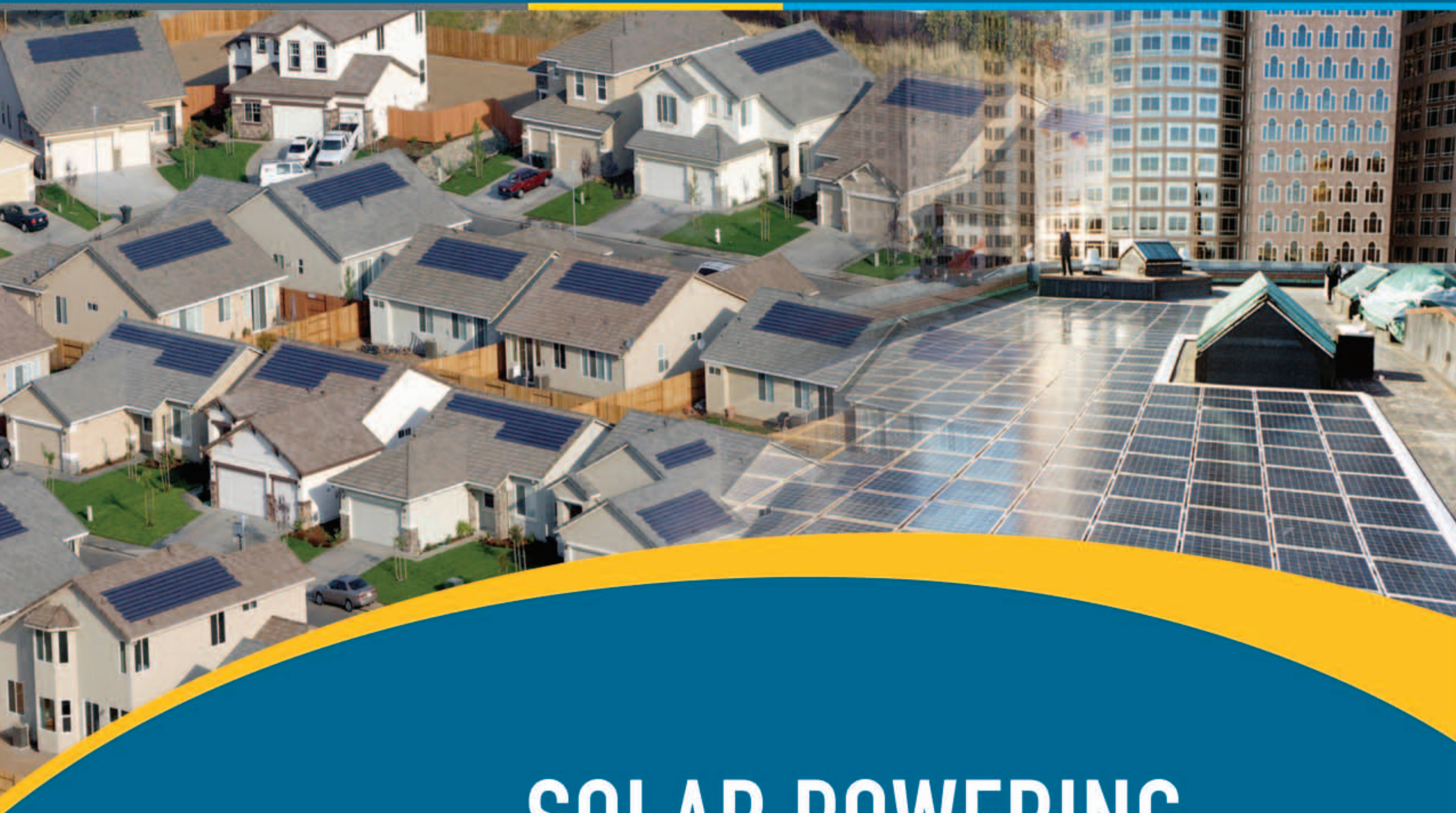

SOLAR POWERING YOUR COMMUNITY:

A GUIDE FOR LOCAL GOVERNMENTS

Second Edition

JANUARY 2011

Created in partnership with:

SOLAR AMERICA COMMUNITIES

NOTICE

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Acknowledgments

DOE funded the development of this guide through the Solar Market Transformation subprogram. The guide represents a collaborative effort among multiple solar market transformation partners. DOE would like to thank the following organizations for their invaluable contributions to writing and reviewing this guide.

- California Center for Sustainable Energy (http://energycenter.org)
- CH2M HILL (www.ch2m.com/corporate)
- Critigen (www.critigen.com)
- Florida Solar Energy Center (www.fsec.ucf.edu/en)
- Interstate Renewable Energy Council (www.irecusa.org)
- Lawrence Berkeley National Laboratory (www.lbl.gov)
- National Renewable Energy Laboratory (www.nrel.gov)
- Network for New Energy Choices (www.newenergychoices.org)
- North Carolina Solar Center (www.ncsc.ncsu.edu)
- Oak Ridge National Laboratory (www.ornl.gov)
- Sandia National Laboratories (www.sandia.gov)
- Solar Electric Power Association (www.solarelectricpower.org)
- Southwest Technology Development Institute (www.nmsu.edu/~tdi)
- Vote Solar Initiative (www.votesolar.org)

Much of the information included in this report is from the Database of State Incentives for Renewables & Efficiency (DSIRE, www.dsireusa.org), a public resource funded by DOE. The database is a product of the ongoing efforts of the North Carolina Solar Center in partnership with the Interstate Renewable Energy Council (IREC).

DOE thanks all organizations that contributed staff time and resources for writing and reviewing the implementation examples, which describe work undertaken in communities across the nation, including DOE's 25 partner Solar America Cities (see www.solaramericacities.energy.gov for a list). The department also thanks local government staff and partnering organizations for their ongoing efforts to integrate solar energy into their respective communities.

The additional references and resources in this guide are the result of the efforts of numerous organizations that are leading solar market transformation across the country; DOE thanks these organizations for accelerating the adoption of solar energy in the United States.

EXECUTIVE SUMMARY

As demand for energy increases, many communities are seeking ways to meet this demand with clean, safe, reliable energy from renewable sources such as sun and wind. Fortunately, many of the key technologies that can unlock the power of these renewable resources are available on the market today. While the U.S. Department of Energy (DOE) continues to fund research and development (R&D) to improve solar technologies, DOE is also focusing on accelerating a robust nationwide market for the currently available technologies.

Development of a nationwide market requires overcoming barriers to widespread adoption of solar energy technologies. These barriers include complicated procedures for permitting and connecting systems to the grid, financing challenges, a lack of awareness of solar energy solutions among key decision makers, and a lack of trained installation contractors. Local governments are uniquely positioned to remove many of these barriers, clearing the way for solar markets to thrive in their locales. Representatives of local governments who understand and prepare for policy and market changes can optimally position their communities in the emerging renewable energy economy.

To accelerate the nationwide adoption of solar energy, DOE established partnerships with 25 "Solar America Cities" around the United States. Local organizations and policy makers in each Solar America City are taking a comprehensive approach to bringing solar to their cities. Their work lays the foundation for a viable solar market and offers a model for other communities to follow.

As a result of the progress made in the 25 Solar America Cities, in 2010 DOE announced a new effort to share the best practices developed with thousands of local governments across the nation. As part of this evolution, DOE created a broader program called Solar America Communities to reflect the intention to promote solar market development within cities, counties, and all other local jurisdictions.

Solar Powering Your Community: A Guide for Local Governments is a comprehensive resource DOE created to assist local governments and stakeholders in designing and implementing a strategic local solar plan. This guide includes examples and models that have been field-tested in cities and counties around the country. Many of the examples are the direct result of DOE's Solar America Communities program.

This guide can help stimulate ideas or provide a framework for a comprehensive solar plan for a community. Each section is divided into topic areas—typically within the jurisdiction of local governments—that are integral in creating and supporting local solar markets. Each topic area includes:

- An introduction that describes the policy or program and states its purpose
- Information on benefits of implementing the policy or program
- Tips and options for designing and implementing the policy or program
- Examples that highlight experiences from communities that have successfully implemented the policy or program; and additional reports, references, and tools that can offer more information on the topic.

DOE recognizes that there is no one path to solar market development, so this guide introduces a range of policy and program options that can help a community build a sustainable solar infrastructure. DOE doesn't imply that a community must undertake all of these activities; instead, community leaders should tailor their approach to fit their community's particular needs and market barriers.

This second edition of the guide was updated to include new market developments and innovations for advancing local solar markets that have emerged since the first edition was released in 2009. DOE plans to continually revise and improve the content as new strategies arise for moving solar energy into the mainstream. Comments and suggestions are welcomed and can be submitted at solarguide@ee.doe.gov. The entire guide can be downloaded from www.solaramericacommunities.energy.gov.

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INTRODUCTION

Demand for energy is continuing to rise, and communities are increasingly looking to renewable sources such as sun and wind to meet that demand with clean, safe, reliable energy. Fortunately, many of the key technologies that can unlock the power of these renewable resources are on the market today. Rapidly declining prices for solar technologies, in combination with federal, state, and local policy changes, are bringing increasing amounts of solar energy into the mainstream. Local government representatives who understand and prepare for policy and market changes will be able to best position their communities in this new renewable energy economy.

The Bushnell Company in the Germantown neighborhood of Philadelphia uses an 85 kW rooftop PV installation. (Mercury Solar Solutions/ PIX 18064)

The American Recovery and Reinvestment Act of 2009 (the Recovery Act) was signed into law on February 17, 2009, providing unprecedented levels of investment in renewable energy. The U.S. Department of Energy (DOE) is playing a significant role in the effort to reduce costs and increase the use of renewable energy technologies.

To accelerate the nationwide adoption of solar energy, DOE developed the Solar America Cities program, centered on partnerships with 25 major U.S. cities. This program is designed to complement top-down federal policy approaches with federal–local partnerships that are helping to build a robust U.S. solar market.

Local governments are in a unique position to remove many of the barriers to widespread solar energy adoption and make solar energy more affordable and accessible for their residents and businesses. These barriers include complicated procedures for permitting and connecting systems to the grid, financing challenges, a lack of awareness of solar energy solutions among key decision makers, and a lack of trained installation contractors. The 25 Solar America Cities vary by size, geographic location, and maturity of solar market, which has enabled DOE to identify challenges and solutions at various stages of market development. Local planners and policy makers in each Solar America City are taking a comprehensive approach to bringing solar to their cities. Many of the examples presented in this guide are direct results of the DOE Solar America Cities partnerships. To learn more about what these cities have accomplished, visit www.solaramericacommunities.energy.gov/cities.

As a result of widespread success in the 25 Solar America Cities, in 2010 DOE announced a new outreach effort to share the best practices developed in concert with thousands of local governments across the nation. As part of this evolution, DOE created a broader program called

Solar America Communities, reflecting the intention to promote solar market development within cities, counties, and all other local jurisdictions. Solar America Communities program activities include the partnerships with the 25 Solar America Cities, along with "special project" awards to develop innovative new approaches for increasing solar energy use, technical analyses on emerging market issues, and outreach to communities across the nation.

DOE designed this guide—*Solar Powering Your Community: A Guide for Local Governments*—to assist local government officials and stakeholders in designing and implementing strategic local solar plans. The 2010 edition contains the most recent lessons and successes from the 25 Solar America Cities and other communities promoting solar energy. Because DOE recognizes that there is no one path to solar market development, this guide introduces a range of policy and program options that can help a community build a local solar infrastructure. Communities do not need to undertake all of these activities; instead, each community should tailor its approach to fit its particular needs and market barriers.

Each section of the guide is divided into topic areas—typically within the jurisdiction of local governments—that have been integral to creating and supporting local solar markets. Each topic area begins with an introduction that describes the policy or program and states its purpose, followed by more information in several categories, as noted below:

BENEFITS

Identifies benefits from implementing the policy or program.

IMPLEMENTATION TIPS AND OPTIONS

Lists various tips and options for designing and implementing the policy or program.

EXAMPLES

Highlights experiences from communities that have successfully implemented the policy or program.

ADDITIONAL REFERENCES AND RESOURCES

Lists reports, references, and tools that offer more information on the topic.

Solar technologies fall into these main categories: **photovoltaics** (PV), **concentrating solar power** (CSP), **solar water heating** (SWH), and **solar space heating and cooling**.[1] PV and CSP technologies produce electricity; SWH and space heating and cooling technologies produce thermal energy. This guide includes information on policies and programs to expand the use of all types of solar technologies. For basic technology overviews and more in-depth information, visit www.solar.energy.gov.

Solar Powering Your Community: A Guide for Local Governments is a work in progress. DOE continually revises and improves this guide as new strategies arise for moving solar energy into the mainstream, and welcomes feedback and input in making this guide as accurate, comprehensive, and current as possible. Please direct comments and suggestions to solarguide@ee.doe.gov.

[1] For more details on terms in bold type, see the glossary at the end of this guide.

Getting Started: Assessing A Community's Policy Environment

Federal, state, and local policies, along with regulations and incentives, constitute the foundation on which the solar energy industry can build. Identifying the regulatory, policy, and incentive framework that currently affects solar energy adoption in a community will help community leaders accurately assess the changes necessary to advance solar energy in their area.

Jurisdictional authority over many of the policies that affect the solar energy market can vary depending on whether a community is served by an investor-owned, cooperative, or municipal utility. States typically have jurisdiction over investor-owned utilities and policies with statewide applications such as **renewable portfolio standards (RPSs)**, **net metering**, and **interconnection**. Many states also operate solar incentive programs. State policy makers and regulators, however, often allow local governments to define or build on these policies for their particular area and utility. Some programs and policies that promote solar energy—such as streamlining permitting processes and educating local code officials—fall exclusively under the jurisdiction of local governments.

Here are some tips for assessing the policy and market environment in a community:

- Use the table that follows to understand the market conditions for solar energy technologies in the area. This list focuses on the policies and incentives that have proven essential to establishing a solar market.

ASSESSING A COMMUNITY'S POLICY ENVIRONMENT FOR SOLAR ENERGY	
IS THERE A POLICY REQUIRING CLEAN ENERGY INVESTMENT?	
RPSs, specifically those with solar carve-outs, encourage solar development by requiring utilities to acquire a certain amount of solar energy. Because energy prices may not adequately reflect the costs and benefits associated with different energy sources, many states have enacted these mandates to boost demand for clean energy technologies.	Read more in 2.1 Renewable Portfolio Standards
ARE INCENTIVES AND FINANCING MECHANISMS AVAILABLE TO REDUCE UP-FRONT COSTS?	
Cash incentives and access to low-cost loans and third-party financing all help to reduce up-front costs—the primary market barrier to solar energy adoption.	Read more in 2.2 Cash Incentives 2.4 Third-Party Residential Financing Models 2.5 Property Assessed Clean Energy Financing 2.6 Low-Interest Loans 7.3 Select the Appropriate Financing Mechanism
ARE POLICIES IN PLACE TO ENSURE THAT SOLAR SYSTEM OWNERS/HOSTS ARE COMPENSATED FOR THE ENERGY THEY PRODUCE?	
Feed-in tariffs (FITs), performance-based incentives (PBIs), and net-metering policies all make payments to solar system owners and hosts based on the energy output of their systems, helping those who invest in solar energy recoup costs over time.	Read more in 2.2 Cash Incentives 2.3 Feed-In Tariffs 4.2 Net-Metering Rules
IS THERE A CLEAR AND SIMPLE PROCESS FOR INSTALLING AND INTERCONNECTING SOLAR SYSTEMS?	
Straightforward permitting processes and rules for connecting solar energy systems to the electric grid reduce the time and cost involved in installing such systems.	Read more in 3.3 Streamlined Solar Permitting and Inspection Processes 4.1 Interconnection Standards

- Access the Database of State Incentives for Renewables & Efficiency (DSIRE) at www.dsireusa.org to identify federal, state, and local, and utility policies and programs currently in place in the area.
- Identify the policy and program areas under local government jurisdiction and the areas in which local leaders can collaborate with regional or state authorities.
- Read the information in this guide on each area of interest.
- Understand that the policies and incentives in the table that follows, although important to a truly robust solar market, represent only some of the options for supporting solar adoption in a community. If, for jurisdictional or other reasons, some of these best practices are beyond a community's immediate reach, many other action areas are described throughout this guide that local leaders might wish to focus on until their broader policy environment improves.

Additional References and Resources

PUBLICATIONS

Freeing the Grid

Network for New Energy Choices (NNEC), Vote Solar Initiative, Interstate Renewable Energy Council, North Carolina Solar Center, Solar Alliance, December 2010

This report outlines the best and worst practices in state net-metering and interconnection policies.

Report: http://www.newenergychoices.org/uploads/FreeingTheGrid2010.pdf

Taking the Red Tape Out of Green Power: How to Overcome Permitting Obstacles to Small-Scale Distributed Renewable Energy

Network for New Energy Choices, September 2008

In this report, the Network for New Energy Choices reviews a wide variety of political perspectives and priorities expressed in a range of local permitting rules. The report suggests how existing rules can be altered to support growing renewable energy markets.

Report: www.newenergychoices.org/uploads/redTape-rep.pdf

Clean Energy State Program Guide—Mainstreaming Solar Electricity: Strategies for States to Build Local Markets

Clean Energy Group, April 2008

This report describes a road map of actions states can take to effectively bring solar electricity into the mainstream.

Report: www.cleanegroup.org/Reports/CEG_Mainstreaming-Solar-Electricity_Apr2008.pdf

Developing State Solar Photovoltaic Markets

Vote Solar Initiative, Center for American Progress, January 2008

This report includes case studies of four states that have developed robust solar markets. Policies described in the report serve as models for a state interested in building a thriving solar market.

Report: www.votesolar.org/linked-docs/CAP_solar_report.pdf

CESA State Program Guide: State Strategies to Foster Solar Hot Water Program Development

Clean Energy Group, December 2007

This program guide outlines straightforward strategies to support the adoption of solar water heating technologies, including financial incentives, installer training, and consumer education.

Report: www.cleanenergystates.org/Publications/CESA_solar_hot_water_rpt_final.pdf

The dedication ceremony of a solar covered landfill in San Antonio, Texas. (City of San Antonio/ PIX18068)

1.0

ORGANIZING AND STRATEGIZING A LOCAL SOLAR EFFORT

The most difficult part of strategically accelerating the adoption of solar energy technologies is getting started. The range of opportunities is vast and many of the issues are complex. Taking the time to organize and develop a strategic approach will help community leaders make the best choices for their community. This section introduces activities that have proven effective in the early planning stages of designing a local solar energy strategy. The topic areas and associated examples contain more information about specific planning activities, and the chart below shows which of the 25 Solar America Cities have undertaken each of these planning activities.

	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St. Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tuscon
1.1 Create a Solar Advisory Committee or Task Force					●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
1.2 Hire or Designate a Local Solar Coordinator			●	●	●			●		●	●	●	●	●	●		●				●	●	●	●	●	●
1.3 Survey Residents and Businesses to Identify Barriers		●		●	●	●	●	●		●					●		●	●	●		●					●
1.4 Conduct an Installation Baseline Survey		●		●	●	●		●		●	●		●	●			●	●		●	●	●				
1.5 Establish Solar Installation Targets			●	●	●		●	●	●	●	●		●	●	●	●	●	●	●		●	●	●	●	●	●
1.6 Include Solar in Broader City, County, or Regional Planning Efforts			●	●	●	●		●	●		●		●		●	●	●	●		●	●	●	●	●		●

Data current as of August 2010

1.1

Create a Solar Advisory Committee or Task Force

Building a sustainable local solar market requires a comprehensive and coordinated effort among many community stakeholders. A good starting point is to create an advisory committee or task force that includes a broad cross section of the community. A comprehensive advisory group helps local governments understand the perspectives of the various market participants involved in solar energy. Guidance from an advisory group is invaluable for shaping successful solar markets.

BENEFITS Creating a task force or advisory committee allows for a comprehensive approach to designing a solar infrastructure in the local community. This approach helps facilitate the buy-in necessary for building a sustainable solar market.

Implementation Tips and Options

Invite local solar industry and advocacy group leaders to participate in stakeholder meetings.

Include a local utility representative in the early stages of the planning process.

- ☐ Gather input from all the municipal or county entities involved with solar energy, including permitting, inspections, procurement, facilities management, and outreach departments. Invite department representatives to participate in stakeholder meetings, and identify parties responsible for various portions of the solar initiative.
- ☐ Include a local utility representative in the early stages of the planning process.
- ☐ Invite local solar industry and advocacy group leaders to participate in stakeholder meetings.
- ☐ Consider inviting local city council members and county supervisors, along with other government officials and decision makers, to participate in the planning process.
- ☐ Consider inviting local education and training institutions to be involved in the early stages of planning.
- ☐ Invite groups from business and industry such as the finance and investment community, chambers of commerce, and workforce development boards.
- ☐ Be flexible so organizers can add to or segment the advisory committee as needs arise.

Examples

Houston, Texas: Creating an Advisory Council and Correspondence Group

Houston selected the Houston Advanced Research Center (HARC) to manage its Solar Houston Initiative. HARC established an advisory council and a correspondence group. The 14-member advisory council consists of representatives from local businesses, universities, school districts, environmental organizations, and foundations. It meets quarterly to review plans and discuss progress. The correspondence group consists of stakeholders interested in promoting solar energy technologies throughout the city. Members of the group receive project updates that they can use to inform their networks. Correspondence group members can also make suggestions to the advisory council about the direction and progress of the Solar Houston Initiative.

Milwaukee, Wisconsin: Initiating the Milwaukee Shines Advisory Committee

Milwaukee created Milwaukee Shines, a citywide program designed to advance solar energy, through its Solar America City grant. The city works with several partner agencies with a stake in Milwaukee becoming a sustainable solar city: We Energies (local utility), Focus on Energy (state public-benefit energy fund), Johnson Controls (Milwaukee-based technology leader), and the Midwest Renewable Energy Association (MREA, a site assessor and installer training agency). Other partners include the Milwaukee Area Technical College, which offers courses in renewable energy and hosts a large annual green energy summit; the University of Wisconsin–Milwaukee's Center for Economic Development; Caleffi Hydronic Solutions (a local **solar water heating** [SWH] system vendor); Milwaukee School of Engineering; and Milwaukee Public Schools. Many partners have given in-kind or matching-cash support for the program. Milwaukee Shines relies on the advisory committee for technical assistance, market updates, and consultation on proposals and plans. The advisory committee created subcommittees for finance, marketing and outreach, manufacturing, and training. Its members are volunteers. The team considers voluntary participation to be important because it ensures that tasks are approached with interest, enthusiasm, and buy-in. The subcommittees have increased the resources available to Milwaukee Shines to address barriers to solar development.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Solar America Cities

www.solaramericacommunities.energy.gov/solaramericacities

The Solar America Cities activity is a partnership between the U.S. Department of Energy (DOE) and 25 U.S. cities. All participants are committed to accelerating the adoption of solar energy technologies at the local level. Each Solar America City has its own Web page that includes a list of project partners.

1.2

Hire or Designate a Local Solar Coordinator

When a community begins a local solar energy program, it's important to select a solar coordinator to oversee all program activities. A solar coordinator can help spearhead a community's solar initiative, and can build momentum across levels of government and throughout the community. The solar coordinator is responsible for coordinating the various stakeholders within a community's solar energy initiative—such as local government agencies, utilities, academia, nonprofits, the solar industry, and state government representatives—and should ensure that the goals and objectives of the community's solar initiative are met.

Ideally, a solar coordinator is hired as part of the local government staff. If a community doesn't have the resources to fund an internal position, some local governments have found that external groups, such as a local nonprofit or higher education institution, can be a good choice for managing portions of their solar initiative. It's important, however, to have someone on staff to coordinate with an outside administrator to ensure that the initiative has the necessary buy-in from city departments.

Solar coordinators hired as local government staff can be housed in a variety of ways within the government structure. If a local government has a very strong solar initiative that's a high priority to the chief elected official, the solar coordinator could serve in the executive office as part of an initiative on solar or more broadly, on sustainability. Placing a solar coordinator in a leadership or crosscutting branch of government not only raises the profile of the initiative, but can also help facilitate solar coordination efforts across various departments. A solar coordinator could also reside in a local government's energy or environmental office, in the facilities or planning department, or in a sustainability program.

BENEFITS

A designated solar coordinator can help spearhead a local government's solar initiatives and ensure a coordinated and strategic effort by providing a lead point of contact for solar program activities. Customers, solar stakeholders, and partners in the solar initiative can turn to this single point of contact to request services and furnish input on the program.

Implementation Tips and Options

- ☐ Identify the best placement for the solar coordinator within the local government. Determine where the coordinator can be most effective in implementing the solar energy initiative and in working across departments to increase solar adoption.

- ☐ Identify an individual with a solid understanding of the solar market and local needs that can objectively coordinate a solar energy program on behalf of the local government.
- ☐ Define clear roles and responsibilities for the solar coordinator and identify communications channels for the individual to stay coordinated with other levels of government and related initiatives across local government, as well as with other solar stakeholders in the community.
- ☐ Ensure that the solar coordinator meets regularly with management to make sure that program goals are being met and to readjust goals in response to evolving market needs.
- ☐ Raise awareness in the community about the solar coordinator by including the coordinator's contact information and other information related to the solar initiative on a Web site and in marketing materials.
- ☐ Identify sustainable funding sources for the solar coordinator position; for example, cost savings from energy efficiency and renewable energy projects.

Examples

Salt Lake City, Utah: Choosing a Local Nonprofit To Manage the Solar Salt Lake Partnership

Salt Lake City's choice to manage the Solar Salt Lake Partnership, Utah Clean Energy (established in 2001), is a local nonprofit organization. The nonprofit is actively engaged on numerous clean energy issues across Utah and supplies information, resources, and technical understanding of complex energy issues to help the Solar Salt Lake Partnership navigate their efforts to advance solar energy. Utah Clean Energy partners closely with Salt Lake City, Salt Lake County, Kennecott Land, and all the other Solar Salt Lake partners and affiliates to coordinate solar training sessions and workshops, offer input in the regulatory arena on solar-related issues (e.g., **net metering** and **interconnection**), coordinate with Utah's building community to advance solar best practices, and collaborate with Utah's utilities to identify barriers to solar adoption and solutions. Utah Clean Energy also supplies resources and information to the public through its Web site (http://utahcleanenergy.org), list serve, and presentations.

New York City, New York: Using a Solar Coordinator To Implement the City's Solar Partnership

Through the City University of New York, the city hired a full-time solar coordinator to implement New York City's Solar City Partnership. This work includes facilitating the city's efforts to streamline permitting for solar systems, overseeing an update to the city's long-term solar policy strategy, and implementing the Solar Empowerment Zones strategy, under which the city will focus solar deployment efforts in three high potential zones. The solar coordinator is a key member of a network of staff members from New York City agencies, including the Department of Buildings, the Mayor's Office of Long Term Planning, and the Fire Department. The solar coordinator serves as the liaison among the project partner agencies, the utilities, the state government, the solar energy industry, and other stakeholders. For more information, see www.cuny.edu/about/resources/sustainability/solar-america.html.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

1.3

Survey Residents and Businesses To Identify Barriers

Because every local community could face a different set of real and perceived barriers to solar adoption, it's important to identify those that are the most significant in a specific community. Community leaders can do this by holding discussions with the solar industry, conducting literature searches, reaching out to other local government representatives in their state and beyond, contacting their state energy office, and soliciting citizen or stakeholder feedback. Engaging multiple stakeholder groups enables the organizers of a solar initiative to analyze their feedback, which can be obtained through mechanisms like online or mailed surveys, focus groups, town hall meetings, and workshops. Common market barriers include complex solar installation permitting procedures; a lack of financing mechanisms for solar projects; shortages of trained workers to support a growing market; minimal consumer awareness; and inadequate interconnection standards, net-metering policies, and utility-rate structures.

BENEFITS

Conducting surveys or holding stakeholder workshops helps communities discover the factors that are important to residents and businesses when they decide to purchase solar energy systems, identify roadblocks for solar energy installations, and determine which areas would benefit from communication and outreach.

Implementation Tips and Options

- ☐ Make a list of all stakeholder groups from which to obtain input, including residents, businesses, nonprofits, utilities, and local solar installation contractors.
- ☐ Determine whether to survey residents, businesses, utilities, and the solar industry entities jointly or separately.
- ☐ Invite stakeholders to complete a survey or participate in a face-to-face meeting.
- ☐ Ask questions about the demand for solar energy in the community; the local industry's ability to meet demand; and perceptions of the cost, effectiveness, and reliability of solar technologies.
- ☐ Identify the major barriers to solar adoption for each stakeholder group and consider actions that can overcome or diminish those obstacles.

Examples

Berkeley, California: Surveying Businesses and Residents To Identify Barriers

Berkeley partnered with the University of California, Berkeley to survey residents and business owners about barriers to implementing energy efficiency and solar energy technologies and upgrades. The survey indicated that the most common obstacles are the cost, the difficulty of the information search, financial uncertainties, and unequal access to information between consumers and equipment installers. After analyzing the survey results, the city designed the SmartSolar Program, which furnishes access to accurate, trustworthy information through general education events; site-specific assessments; assistance in selecting products and installation contractors; and post-installation quality control. The program offers personalized consultations to homeowners and business owners, and guides them through the variety of energy efficiency and solar energy options and incentives available. SmartSolar site assessors use a comprehensive, whole-building approach. Visit www.solaramericacommunities.energy.gov/City_Info/Berkeley/Berkeley_Market_Research_Client_Survey.pdf for a summary of the survey results.

New York City, New York: Conducting an Installer Survey

As the first step in updating its long-term solar policy strategy, the City University of New York (CUNY) conducted a comprehensive installer survey in spring 2010. CUNY interviewed 36 individuals whose companies had completed, in aggregate, 94.3% of all photovoltaic (PV) installations in the city. The interviewees answered questions about their companies, along with perceived barriers to solar and possible solutions. The survey results were instrumental in identifying priorities for the New York City Solar America Cities Partnership. For instance, the survey showed that more than half of installers were relatively new to the local market and didn't understand local permitting processes. As a result, CUNY has made streamlining and clarifying permitting a major focus and will be increasing efforts to educate local installers. More information is available in the survey report, which can be downloaded at www.cuny.edu/about/resources/sustainability/solar-america/installingsolar.html.

San Diego, California: Identifying Barriers and Solutions Through Solar Survey and Focus Groups

To identify challenges and opportunities for advancing residential solar, San Diego performed a citywide survey of property owners with PV installations and conducted three focus groups of specific market segments: real estate and associated professionals, municipal permit review staff members, and residential consumers of solar power. The survey yielded an overview of the experiences of residents who have PV installations. The three focus groups explored the impediments to solar adoption that exist from the perspectives of each market segment addressed. The real estate focus group identified the two greatest barriers: inadequate explanation and appreciation of the cost savings from an installed system, and buyers' inability to determine how well the system is functioning. Participants suggested that these challenges could be addressed by

- Equipment warranties
- Documentation of cost savings

- Buyer education on ease of operation.
- Information on the modular nature of systems and the ease of repair.
- The inclusion of government-subsidized loans for PV systems in the American Recovery and Reinvestment Act of 2009, a federal stimulus plan.

The focus group comprising city and county permitting officials and inspectors identified three potential improvements that could help streamline the permit and inspection process:

- Define the role of fire departments in the permitting process.
- Standardize the permitting system statewide so contractors don't have to deal with different policies that can cause delays and add costs.
- Develop special training for permitting and inspection officials to keep them updated on new technologies and training for contractors/installers on how to submit a PV system application and how to prepare for an inspection.

The residential PV consumer focus group identified the following barriers: overall cost of the system, problems with utility interconnection, inadequate government incentives, and problems with city/county permitting and/or inspections. Although almost half of participants experienced no barriers or challenges, those who did encounter barriers commented that the obstacles could be mitigated by more education for the potential purchaser about the true costs and savings of the systems, warranties, installation contractor reputations, and optimal system output.

Detailed findings from the focus groups, as well as the survey results, can be found in the September 2009 report titled *Barriers and Solutions, A Detailed Analysis of Solar Photovoltaics in San Diego*, available for download at www.sandiego.gov/environmental-services/sustainable/pdf/090925SOLARCITYSURVEYREPORT.pdf

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

1.4

Conduct an Installation Baseline Survey

An important part of designing a successful local solar strategy is accounting for all solar energy installations that already exist in the community. This is called an **installation baseline**, and it helps provide insight into a community's level of experience with solar energy and enables community leaders to set realistic goals. Although this can be a time-consuming process, knowing where a community started is essential information needed for assessing progress, trends, and accomplishments.

Most installation baseline surveys include information about the type of solar technology installed (typically **photovoltaics** [PV] or **solar water heating** [SWH]) and the sector in which the installation exists (e.g., commercial, residential, municipal, industrial, or agricultural). Information about the current installations in a community can reside within several organizations, including renewable energy programs, city permitting offices, and local utilities. Additionally, state solar and renewable energy programs and associations are often excellent sources for statistics on installed solar energy systems.

BENEFITS

Identifying the number of solar systems currently installed in a community creates a benchmark for setting realistic **installation targets**. An installation baseline is also an indicator of local market maturity and can help determine what policy decisions might be most beneficial in the future.

Implementation Tips and Options

- Contact the state's **public benefits fund** manager or solar rebate program administrator to find out whether installation statistics are tracked. If unsure how to reach these sources, start with the state energy office. State energy office contact information is available at www.naseo.org/members/states/default.aspx.
- Identify the permits required for installing PV and SWH systems in the community and contact the appropriate departments to find out how many permits have been approved. In areas that don't require permits specifically for solar systems, permits could fall under electrical for PV systems or plumbing for SWH systems, or they might fall under building permits for either technology.
- Contact the local utility to request information on PV interconnections. Utility representatives might be hesitant to give detailed information on installations because of

customer privacy concerns (or other business-sensitive reasons). If this is the case, ask for the aggregated data for all systems installed in the local area. This more general information would be sufficient for generating an installation baseline for PV systems.

- Contact local solar installation contractors and gather their installation statistics to help quantify the total number of installations in the area. If contractors are hesitant to share that data, try to obtain aggregate information from industry associations, such as local chapters of the Solar Energy Industries Association (SEIA).
- Gather data on the number of solar energy systems installed to date as well as the actual **installed capacity** of PV and SWH systems.
- Consider developing a Web site that residents and businesses can use to submit details, photos, and testimonials about their solar energy systems, or raise awareness of an existing Web site that serves this purpose, such as openpv.nrel.gov.

Examples

Boston, Massachusetts: Quantifying the City's Installation Baseline

Boston and its Solar America City team quantified Boston's solar installation baseline by interviewing local installers, the local utility, and the state's solar rebate program administrator (Massachusetts Renewable Energy Trust). The team also gathered information using installer directories at www.findsolar.com and the Solar Business Association of New England Web site (www.sebane.org). Next, the team compiled a list of installation contractors operating in the Boston area. Installers at each company were interviewed to identify the number of PV and SWH systems installed in Boston since 2007. Solar Boston staffers asked installers about system sizes, installation dates, system type, ownership type, and installation addresses. To track progress toward the city's renewable energy goals, the team has repeated this interview process each summer since the Solar Boston initiative began. After the initial baseline process was conducted in 2007, the city hired undergraduate interns to interview installers during subsequent years. As of August 2010, the city had identified more than 3 megawatts of solar capacity in Boston, up from 421 kilowatts in 2007. To view Boston's solar map, visit http://gis.cityofboston.gov/solarboston.

Milwaukee, Wisconsin: Using the Installation Baseline as an Outreach and Management Tool

To determine the number of solar site assessments and PV and SWH installations completed in the Milwaukee area, the city worked with Focus on Energy (the state's public benefit energy fund), We Energies (the local utility), and the Midwest Renewable Energy Association (MREA; Wisconsin's solar site assessment program administrator). Focus on Energy staffers record detailed information on every solar energy installation that receives a Focus on Energy rebate, including the type of solar energy technology installed, the system size, the installation company, the amount of the rebate granted, and estimated energy production over the system's life. We Energies collects data on all PV systems that are interconnected to the electricity grid. MREA records information about the number of PV and SWH site assessments performed in the Milwaukee area. This information helps the city make accurate projections for solar energy installations and set appropriate local solar installation targets. It also helps the city quantify the number of installation contractors and site assessors operating in the region. The detailed data on each installed solar energy system are compiled in a database and on a Web-based solar map cataloging Milwaukee-area installations. The city of Milwaukee and Focus on Energy sent a letter to property owners who had installed solar and asked if they were interested in being featured on the solar map at www.MilwaukeeShines.com. For privacy reasons, only those that granted permission are listed on the map. As a result, the solar capacity listed on the map is not comprehensive. It does, however, serve as an inexpensive public outreach tool because an intern created it in Google maps at no charge over the summer of 2009. The catalog/solar map helps the city recognize installation trends, identify neighborhoods that are well suited for solar energy systems, and track installations.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

The Open PV Mapping Project

http://openpv.nrel.gov

The Open PV Mapping Project is a collaborative effort to compile a comprehensive database of PV installation data for the United States. Data for the project are voluntarily contributed from a variety of sources including governments, utilities, installers, and the public. The constantly changing data are actively maintained by the contributors, providing an evolving, up-to-date snapshot of the U.S. solar power market.

PUBLICATIONS

Identification and Tracking of Key Market Development Metrics across the 25 Solar America Cities

Prepared by Critigen in partnership with CH2M HILL for the U.S. Department of Energy, December 2010

This report includes data on the number of installations and installed capacity of PV and SWH systems in the 25 Solar America Cities in 2007 and 2008.

Report: www.solaramericacommunities.energy.gov/pdfs/SolarAmericaCitiesMarketDevelopmentMetrics.pdf

U.S. Solar Market Trends 2009

Interstate Renewable Energy Council, July 2010

This report provides an overview of PV, SWH, and **concentrating solar power** (CSP) market trends in the United States in 2009.

Report: http://irecusa.org/wp-content/uploads/2010/07/IREC-Solar-Market-Trends-Report-2010_7-27-10_web1.pdf

Tracking the Sun II: The Installed Cost of Photovoltaics in the U.S. from 1998-2008

Lawrence Berkeley National Laboratory, October 2009

This report summarizes trends in the installed cost of grid-connected PV systems in the United States from 1998 through 2008.

Report: http://eetd.lbl.gov/ea/ems/reports/lbnl-1516e.pdf

1.5

Establish Solar Installation Targets

Community leaders can use current data on solar installations in the community as the baseline for projecting targets for the number of installations or amount of **installed capacity** they want to reach by a specific date. These targets are often set to achieve broader energy, climate change, or sustainability goals or **renewable portfolio standard** (RPS) requirements (see 2.1, Renewable Portfolio Standards). Several key factors influence the reasonable **installation target** range for a given community, including the policy environment, the available **solar resource**, the market maturity, the local cost of electricity from the grid (for **photovoltaics** [PV]) or heating fuel (for **solar water heating** [SWH]), and the availability of objective information in the marketplace.

Federal, state, and local policies have a tremendous effect on a community's level of solar energy adoption. When there are favorable market conditions, including incentives that reduce the up-front cost of solar systems and streamlined permitting and **interconnection** processes, local governments are justified in setting higher installation targets. Communities with higher electricity and gas prices have a greater incentive to install solar systems because solar energy is more cost competitive than it might be in areas with low electricity and gas prices.

All regions of the United States receive adequate sunlight to make solar energy technologies viable. If a community has substantial solar resources, it will be able to generate more electricity—with the same amount of installed system capacity—than areas that receive less sun. This shortens the payback term for solar systems. If a community is in a particularly sunny locale, community leaders might consider setting higher installation targets.

BENEFITS

Setting solar installation targets helps clarify the role solar energy will play in achieving a community's broader environmental, climate change, or sustainability goals. Setting targets helps create momentum for a solar program with stakeholders working toward common goals. It also guides the strategy for increasing solar installations in a community and enables leaders to track progress against a published goal. Solar installation targets can also aid in attracting the solar industry to bring jobs and economic benefits to a community.

Implementation Tips and Options

- ☐ Use the results of the **installation baseline** survey to identify the community's starting point. See 1.4, Conduct an Installation Baseline Survey.

- ☐ Identify programs and policies that currently support solar energy in the state, which will provide a sense of the current market conditions. See Getting Started: Assessing A Community's Policy Environment.
- ☐ Determine local market barriers to solar adoption. See 1.3, Survey Residents and Businesses To Identify Barriers.
- ☐ Gauge the robustness of the solar industry in terms of the number of solar installers and solar-related firms, the size and complexity of systems being installed, and the level of competitiveness in solar system pricing.
- ☐ Use a solar mapping tool to identify the amount of unshaded roof space or land area suitable for solar installations in the community and calculate the associated potential installed capacity.
- ☐ Identify the role solar energy can play in meeting the region's broader economic and environmental objectives. Consider how renewables can contribute to the community's overall energy supply.
- ☐ Evaluate the political motivation for rapid change in the community. If the political will to set stretch goals exists, the community could benefit by encouraging stakeholders to move beyond incremental improvements and develop radical new ways of making solar energy more accessible and affordable.
- ☐ Consider setting separate goals for separate categories of installations. Examples of such categories are residential, commercial, industrial, agricultural, municipal, and utility.
- ☐ Set long-range, multiyear installation targets.
- ☐ Compare the community's installation targets to those of other communities in the region or in other similar cities or counties. Many Solar America Cities list installation targets on their individual city Web pages (see www.solaramericacommunities.energy.gov/solaramericacities).
- ☐ Set milestones for achieving solar installation targets and measure progress, ideally in a way that's transparent to stakeholders and the public.
- ☐ Celebrate reaching installation target milestones with public events.

Examples

Boston, Massachusetts: Determining Boston's Solar Installation Targets

In 2007, Boston set a goal of achieving 25 megawatts of cumulative installed solar capacity in the city by 2015. To derive this target, Solar Boston first conducted a rough technical feasibility analysis of the city's rooftops. Using assumptions about the percentage of usable roof space available for solar installations drawn from studies by Navigant Consulting, the New York State Energy Research and Development Authority (NYSERDA), and Columbia University, Solar Boston concluded that city roofs (conservatively) can support between 670 and 900 megawatts of PV, and that available roof space is not the limiting factor in setting an installation target. The city then projected its target by using the baseline of installed capacity at that time (435 kilowatts installed, plus another 900 kilowatts of planned capacity additions) and analyzing historical PV market-growth rates at the municipal, state, national, and international levels. Using these growth rates, the city developed three potential market-growth scenarios: a conservative case, assuming a 25% compound annual growth rate; a business-as-usual case, assuming a 35% growth rate; and an aggressive policy scenario, assuming a growth rate of 45% and greater. Solar Boston selected the 35% growth rate as a defensible projection and based the target on this rate; the target was further validated by a comparison with state solar goals. The Commonwealth Solar Program set a statewide target of 250 megawatts by 2017. Because Boston is home to approximately 10% of the state's population, 25 megawatts would be the city's proportional contribution to the state target.

Portland, Oregon: Setting Citywide Installation Targets

In its *City of Portland and Multnomah County Climate Action Plan 2009* (see www.portlandonline.com/bps/index.cfm?a=268612&c=49989), the city set a goal of 10 megawatts of installed PV capacity by 2012. At the beginning of 2008, the cumulative installed capacity was 324 kilowatts. Based on past growth of the solar installations, city staffers projected moderate but reasonable growth in both residential and commercial sectors, taking into account some new tax credits for commercial systems. Solar installations in the city quickly increased over the following 2 years, and Portland is more than halfway to the goal, with 7.1 megawatts installed as of July 2010.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

National Renewable Energy Laboratory, In My Backyard

www.nrel.gov/eis/imby

The In My Backyard (IMBY) tool estimates PV array and wind turbine electricity production based on specifications of system size, location, and other variables.

National Renewable Energy Laboratory, Renewable Resource Data Center

www.nrel.gov/rredc

This site provides access to an extensive collection of renewable energy resource data, maps, and tools.

Solar America Cities

www.solaramericacommunities.energy.gov/solaramericacities

The Solar America Cities activity is a partnership between the U.S. Department of Energy and a select group of 25 cities across the country. The participants are committed to accelerating the adoption of solar energy technologies at the local level. Each Solar America City has its own Web page that lists the city's solar installation target if one has been set.

PUBLICATIONS

Break-Even Cost for Residential Photovoltaics in the United States: Key Drivers and Sensitivities

National Renewable Energy Laboratory, December 2009

This report examines the break-even cost for residential rooftop PV technology, defined as the point where the cost of PV-generated electricity equals the cost of electricity purchased from the grid. The break-even cost for the largest 1,000 utilities in the United States as of late 2008 and early 2009 are examined. This report can help communities understand the economics behind potential solar growth rates in their areas.

Report: www.nrel.gov/docs/fy10osti/46909.pdf

Analysis of Web-Based Solar Photovoltaic Mapping Tools

National Renewable Energy Laboratory, June 2009

A PV mapping tool visually represents a specific site and calculates PV system size and projected electricity production. This report identifies the commercially available solar mapping tools and thoroughly summarizes the source data type and resolution, the visualization software program being used, user inputs, calculation methodology and algorithms, map outputs, and development costs for each map.

Report: http://solaramericacommunities.energy.gov/PDFs/Analysis_of_Web_Based_Solar_PV_Mapping_Tools.pdf

The 100 kW ground-mounted PV system is co-located with an electrical substation in Ann Arbor, Michigan. (Vipin Gupta/PIX179326)

1.6

Include Solar in Broader City, County, or Regional Planning Efforts

Solar power is a reliable energy option that can help urban planners manage increasing energy demand. Solar technologies generate clean power, extend the life of a community's conventional energy supplies, create jobs, and support economic development. **Solar energy** can also help a community reach its economic, environmental, and sustainability goals. By incorporating solar into a community master plan, as well as into these complementary planning endeavors, planners can coordinate the community's efforts and reach common goals more easily. Because large infrastructure projects and land use changes can take years to develop and implement, it's important to begin considering now how such efforts might take advantage of solar energy as it becomes increasingly cost competitive over the next several years. Integrating the solar plan into broader local and regional planning efforts firmly establishes solar as a viable energy option and supports a growing market in the community.

BENEFITS

Integrating a solar plan into broader local or regional planning efforts affirms a community's commitment to solar energy, promotes strategic long-term thinking, and can help secure resources and political will to accomplish solar goals.

Implementation Tips and Options

- ☐ Identify ways solar energy can assist the community in reaching its broader climate change, environmental, and sustainability goals.
- ☐ Identify how solar energy can contribute to economic development and community revitalization. See 5.0, Creating Jobs and Supporting Economic Development.
- ☐ Work with the local planning department and utility to integrate solar energy into the community's infrastructure and resource planning activities.
- ☐ Update government procurement processes to include solar as appropriate.
- ☐ Define roles for each organization involved after determining where the solar plan can be integrated into broader planning efforts.

Examples

Berkeley, California: Including Solar Provisions in a Climate Action Plan

Berkeley's climate action plan, updated in June 2009, incorporates solar energy as a means of meeting many broader goals, including carbon reduction, energy independence and security, workforce development, and improved building energy standards. In November 2006, voters passed Measure G, an initiative to reduce Berkeley's **greenhouse gas** (GHG) **emissions** by 80% from 2000 levels by 2050. To meet its requirements, the city aims to eliminate 11,600 **metric tons of carbon dioxide equivalent** ($MtCO_2e$) per year by 2020 through decentralized solar electric installations on residential and nonresidential buildings. Decentralizing these installations will decrease the vulnerability of the local electricity grid and reduce the city's dependence on fossil fuels.

The city's Office of Energy and Sustainable Development and its partner, the Community Energy Services Corporation, offer numerous services to encourage decentralized solar installations, including innovative financing programs, personalized energy consultations, and an online solar map that estimates the solar energy potential for Berkeley homes and businesses. To meet growing demand for solar energy, the city's action plan includes programs to increase the skilled workforce in Berkeley. The city is implementing youth development job training and placement programs that will match local residents with high-quality green jobs. The plan also incorporates solar energy technologies into new building energy use standards by calling for all new construction to meet zero net-energy performance standards by 2020. Visit www.ci.berkeley.ca.us/ContentDisplay.aspx?id=19668 to download a copy of the plan.

Boston, Massachusetts: Incorporating Solar into Transportation and Emergency Planning

Solar Boston is incorporating **photovoltaic** (PV) battery backup systems at traffic intersections along one of the city's major evacuation routes. These systems will ensure that if the grid fails, the transportation infrastructure at those intersections will continue to function long enough to allow for evacuation. These systems will have the added benefit of feeding solar power into the grid during nonemergency situations. The city's Office of Environmental and Energy Services worked with a cross-departmental team that included the Mayor's Office of Emergency Management, the Boston Transportation Department, the Public Works Department, and the Boston Police Department to develop the solar evacuation route concept. The city is also in the process of developing a long-term energy assurance plan that will incorporate solar power resources.

Tucson, Arizona: Collaborating Regionally on the Greater Tucson Solar Development Plan

Tucson collaborated on a regional level with the Pima Association of Governments (PAG), the Arizona Research Institute for Solar Energy (AzRISE) at the University of Arizona, and the Clean Energy Corporation (CEC) to draft the Greater Tucson Solar Development Plan. The PAG vetted the plan through the Southern Arizona Regional Solar Partnership. The plan forecasts expected solar installations in the greater Tucson region, outlines the status of various solar-related rules and regulations, and suggests strategies for reaching 15 megawatts of installed solar capacity in the region by 2015. Because Tucson is surrounded by Pima County and several small communities, installers and developers must deal with numerous jurisdictions. Thinking regionally and moving to coordinate solar planning and execution facilitates solar deployment and opens the door to more uniform permitting rules and code adoptions through cooperation between the jurisdictions. More information about the regional solar development plan is available at www.pagnet.org/Programs/EnvironmentalPlanning/SolarPartnership/StrategicPlan/tabid/723/Default.aspx.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

American Planning Association, Planners Energy and Climate Database

www.planning.org/research/energy/database/

This database contains examples of communities that have integrated energy and climate change issues into planning, and states that have addressed climate change issues in plans or policies.

An 8 kW solar PV installed in the Chestnut Hill area of Philadelphia is shown above. (Mercury Solar Systems/ PIX18067)

2.0

MAKING SOLAR AFFORDABLE FOR RESIDENTS AND BUSINESSES

Although the cost of solar energy systems is expected to decrease significantly over the next decade, a solar system remains a large investment. Because Americans are used to paying for energy on a monthly basis as opposed to in a lump sum, financial incentives and financing mechanisms are required to make solar energy affordable for the majority of residents and businesses. Developing incentives and financing programs to bolster local market demand attracts solar businesses and will establish a community in a growing industry. Financial incentives such as rebates and tax credits can reduce the up-front cost of solar energy systems, and loans and other financing mechanisms enable customers to spread costs over time.

	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St.Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tuscon
2.1 Implement Renewable Portfolio Standards*		●	●	●	●	●	●		●	●	●		●		●	●	●	●		●	●	●	●	●	●	●
2.2 Offer Cash Incentives			●	●		●			●	●	●	●	●	●	●			●		●		●			●	●
2.3 Implement a Feed-in Tariff								●	●					●			●	●		●					●	
2.4 Support Third-Party Residential Financing Models						●								●												
2.5 Develop a Property Assessed Clean Energy Financing Program				●		●				●		●									●	●		●		
2.6 Offer Loans for Solar Energy Systems			●			●				●	●			●	●			●	●							
2.7 Organize a Group Purchase Program		●				●					●						●	●				●	●			
2.8 Develop a Community Solar Financing Program														●				●							●	●
2.9 Offer Property and Sales Tax Incentives						●				●	●	●	●	●				●				●			●	●

Data current as of August 2010

*Cities in states with a renewable portfolio standard.

The private sector has developed innovative financing models to reduce the up-front cost of solar, such as power purchase agreements and leasing arrangements. In areas with high electricity prices, these models are already cost competitive, but in areas with lower electricity prices, state or local incentives are generally still required to make the economics work. Renewable portfolio standards, which are popular mechanisms for stimulating demand and are often associated with incentive program creation, are also described in this section.

State and local governments might have overlapping authority to implement some of the incentive programs and financing mechanisms outlined here; others can fall exclusively under local jurisdiction. Many state and local incentives are designed to complement the current 30% **federal investment tax credit** for solar energy systems.

The topic areas and associated examples in this section contain more information about incentive and financing options. Community leaders should consider this information as they work to determine the best course of action for their community.

Located along Interstate 35, near Austin, Texas, is a PV installation of 15 Mueller PV sunflowers. (Vipin Gupta/PIX17928)

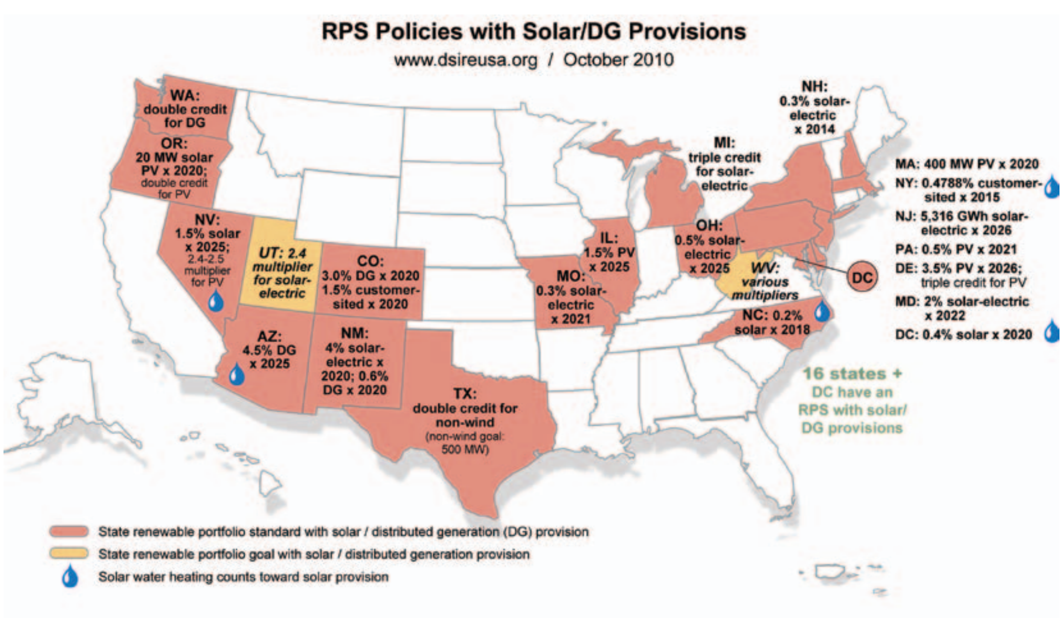
2.1

Renewable Portfolio Standards

A **renewable portfolio standard** (RPS) requires all obligated utilities to use qualifying renewable energy or **renewable energy certificates** (RECs) to account for a specific percentage of their retail electricity sales or, in some instances, **generating capacity** within a specified time frame. A renewable portfolio goal is similar to an RPS but not legally binding and therefore not as effective in driving renewable energy development. RPS policies are often enacted in conjunction with incentive programs such as up-front rebates or solar REC (SREC) programs that make renewable energy more affordable.

Although the intent and design of the RPS is to promote the broad deployment of renewable energy technologies, in practice development is skewed toward large-scale utility projects. To encourage **customer-sited distributed generation** (DG) projects, a number of states have designed their RPSs to augment support to technologies like **photovoltaics** (PV) and **solar water heating** (SWH) that can be located at the load site. This additional support comes in the form of a **credit multiplier**, which gives on-site generation (like that from solar technologies) additional credits toward meeting the RPS, or a **set-aside** (sometimes termed a "carve-out"), which requires part of the RPS to be met with these targeted technologies.

As of October 2010, 29 states plus the District of Columbia and Puerto Rico had mandatory RPS policies, and 16 of those included specific provisions for solar or DG technologies.



Typically, the RPS is a statewide policy that applies only to investor-owned utilities. Only a few states require rural electric cooperatives or municipal utilities to comply with the RPS requirements. In states without a comprehensive RPS, a number of local jurisdictions have enacted their own RPSs, and some jurisdictions have included a solar set-aside that primarily applies to their own municipal utilities.

BENEFITS

If well designed, an RPS sets forth a clear mandate for expanding renewable energy installations in a jurisdiction. There's a direct correlation between increased solar development and the existence of a mandatory solar set-aside. In addition to serving as a successful mechanism for driving the growth of renewable energy installations, an RPS can bring significant ancillary benefits to the table, including economic development and environmental improvements.

Implementation Tips and Options

The National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Laboratory (LBNL) have conducted extensive analyses on RPS design and implementation. Here are the implementation tips and options resulting from these studies.

- ☐ Establish a solar set-aside, a credit multiplier, or a combination of the two. Some states have switched from using a credit multiplier to using a set-aside, which is emerging as the policy design of choice in the United States. Appropriate set-asides for different technologies can be based on factors such as regional resource and market potential, costs, and local industry infrastructure and training capabilities.
- ☐ Identify the various types of solar electricity installations—for example, customer-sited, utility-scale, in-state, and out-of-state—that will be eligible.
- ☐ Develop a system to monitor solar energy systems to verify their production.
- ☐ Establish clear guidelines on whether the utility, customer, or solar provider owns the RECs. To realize the monetary value of small quantities of RECs, such as those generated from small customer-sited installations, system owners must have access to **REC trading mechanisms or REC aggregators**.
- ☐ Make a long-term commitment to the RPS policy up front. It's important to be consistent and provide an obligated utility with a consistent and reliable market. For example, by establishing a long-term predictable **alternative compliance payment** (ACP), the developer, the investors, and the utility can proceed with projects without concern about extreme market fluctuations in SREC values. This will result in long-term SREC agreements and **power purchase agreements** (PPAs) necessary to support solar development at a commercial scale.
- ☐ Ensure the RPS is consistent with other renewable policies and programs in place at the local and state level.

Examples

Austin, Texas: Including a Solar Set-Aside in Austin Energy's Renewable Portfolio Standards

Texas municipal utilities and cooperatives aren't subject to the state's RPS, but they can opt in. Austin decided to develop its own RPS policy. In December 2003, the city council approved Austin Energy's 10-year strategic plan, which includes a 20% RPS by 2020 and a commitment to develop 100 megawatts of solar generating capacity by 2020. To help achieve the solar generation requirement, the utility established a rebate program for PV systems. In February 2007, the city increased the overall RPS requirement to 30% by 2020 as part of the mayor's climate protection plan; the solar requirement remained unchanged at 100 megawatts by 2020. On April 22, 2010, the city council approved the Austin Energy *Resource, Generation and Climate Protection Plan to 2020* (see www.austinenergy.com/about us/Environmental Initiatives/climateProtectionPlan/index.htm). The goals for renewable energy increased from 30% to 35%, and the solar component of the renewable energy goal increased from 100 to 200 megawatts. As of January 2009, 4.2 megawatts of PV capacity had been installed. A 30-megawatt solar farm is expected to come online in 2011, which will be financed through a PPA. The city will conduct an affordability study before the updated RPS and solar requirement can be fully implemented.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Austin Energy Strategic Plan

www.austinenergy.com/about us/newsroom/Reports/strategicPlan.pdf

Austin Energy developed this 20-year strategic plan, which focuses on the utility's mission to deliver clean, affordable, reliable energy and excellent customer service in a rapidly changing environment for utilities.

PUBLICATIONS

State of the States 2009: Renewable Energy Development and the Role of Policy

National Renewable Energy Laboratory, October 2009

This report examines the status of renewable energy development at the state level. It also compiles and evaluates the status of best-practice state policy design and proposes a strategy for better understanding the role of policy in renewable energy development based on market-transformation principles

Report: www.nrel.gov/docs/fy10osti/46667.pdf

Renewable Portfolio Standards in the United States: A Status Report with Data Through 2007

Lawrence Berkeley National Laboratory, April 2008

This report contains information on design, early experience, and projected effects of RPS policies in the United States.

Report: http://eetd.lbl.gov/ea/ems/reports/lbnl-154e.pdf

2.2

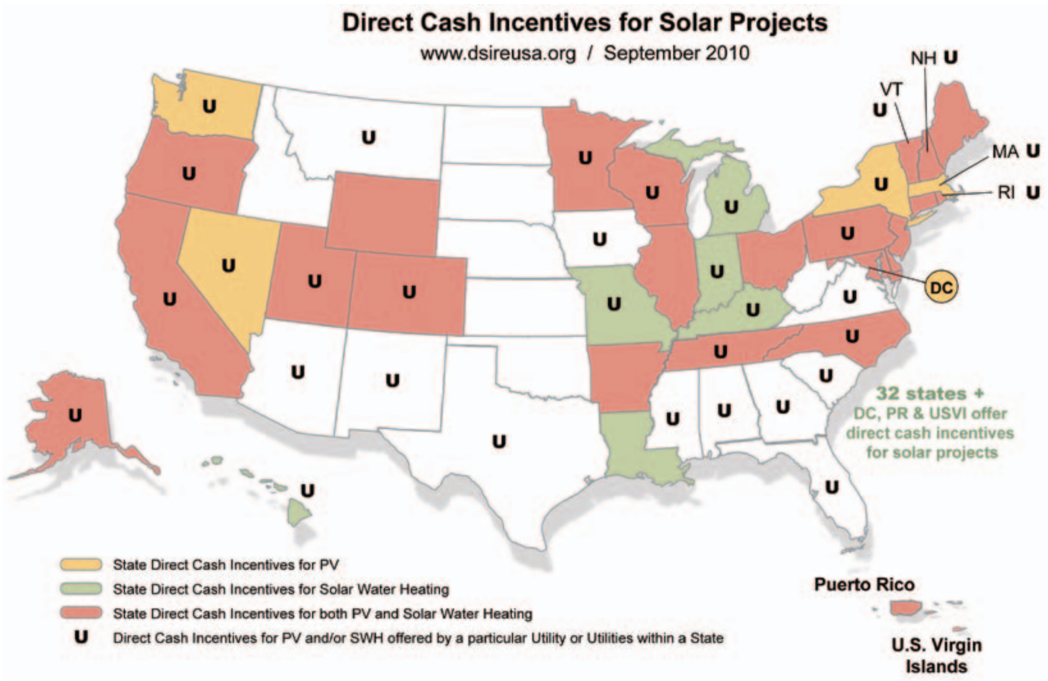
Cash Incentives

Direct cash incentives give consumers cash back for a qualified solar installation. **Direct incentives** include rebates, grants, and **production-based incentives** (PBIs) that complement other incentives such as tax credits.

- Rebates are cash incentives issued to a purchaser after the system has been installed.
- Grants are funds awarded for solar installation projects.
- PBIs are cash payments distributed to project owners over several years based on the amount of energy a system produces.
- **Expected performance rebates** are cash incentives based on solar system capacity as well as system rating, location, tilt and orientation, and shading. Expected performance rebates can be distributed in a lump sum but are calculated based on the expected energy output of the system. Note that expected performance rebates don't commit installers and system owners to maintain system generation as do true PBIs paid over time.

Rebate and grant amounts are often based on system size (i.e., capacity) or system cost—otherwise known as the investment cost—and the funding is typically awarded at the time of installation. Payments based on performance or expected performance rather than capital investments are gaining prominence among program administrators because they lead to optimized system design and installation.

Many states and local governments offer bonus incentives for installing solar on affordable housing; using components manufactured in state; using certified installers; and installing solar in certified green buildings, ENERGY STAR homes, new construction, and public buildings. States and utilities usually administer direct cash incentive programs, but some local governments also offer these incentives to consumers. The U.S. Virgin Islands, Washington, D.C., and 26 states offer direct incentives for solar installations, as do 130 U.S. utilities (see map). The incentives typically cover 20% to 50% of project costs and range from a few hundred to millions of dollars. Direct incentives are often funded through a **public benefits fund**, a **revolving loan fund**, or the **general fund**, but could also be funded with fees collected through an energy or environmental mitigation program.



BENEFITS

Up-front cash incentives encourage customers to install renewable energy technologies by helping reduce high equipment costs. Although PBIs don't reduce up-front costs, they do generate revenue that can help secure financing and offset financing costs. Direct incentives are useful to a broad range of consumers, especially those who can't take full advantage of other incentives such as tax credits. With direct cash incentives, program administrators can track program participation, **installed capacity**, and any problems encountered and their solutions.

Implementation Tips and Options

Experience with state incentive programs has brought a number of best practices to light.

- ☐ Determine direct incentive levels in the context of complementary incentives such as tax credits.
- ☐ Ensure that the overall financial incentive package is enough to stimulate adequate demand to meet the community's **installation targets**.
- ☐ Set higher direct incentive levels for sectors that aren't eligible for tax credits. Offer an incentive program with stable, long-term funding that decreases over time.
- ☐ Establish a consistent but cost-effective quality-assurance mechanism to protect consumers and guarantee adequate system performance. For example, require installers to hold a solar certification. In some states a solar contractor's license requires contractors to provide system and component warranties. See 3.5, Installer Licensing and Certification.
- ☐ Design an easy and concise application process.

- Allow flexibility for program modifications.
- Develop a coordinated set of policies to complement direct incentives, including net metering, **interconnection standards**, low-interest financing, standardized permitting processes, and solar access laws.
- Work with other agencies and relevant stakeholder groups to educate the public about renewable energy technologies and to market the incentive program.
- Track program effectiveness by documenting the number of program participants, administration costs, environmental benefits, and energy cost savings resulting from solar energy installations. This enables program managers to evaluate and improve the program along the way.

Examples

Austin, Texas: Offering Performance-Based Incentives for Commercial, Multifamily, and Nonprofit Customers and Up-Front Rebates for Residential Customers

In 2010, Austin Energy, Austin's municipal utility, introduced a fixed PBI program for commercial, multifamily, and nonprofit customers. Designed to improve the rebate program the utility launched in 2004, Austin Energy will pay members of this customer class for each kilowatt-hour of electricity they produce over a 10-year period. This PBI not only gives a solar system owner a fixed payment flow on which payback can be calculated, it also encourages proper system design and maintenance to maximize the amount of energy the systems produce. Customers that sign up in the first year will receive 14 cents per kilowatt-hour of solar energy produced, which will be fixed over the 10-year payback period. The incentive will be indexed to the actual price of **photovoltaic** (PV) modules, which is expected to decrease. Customers who sign up in subsequent years will receive a lesser incentive, but their incentives will also be fixed throughout their 10-year period. Over the 5-year sign-up period, and accounting for the decreasing incentive, the PBI program is expected to offer, on average, 8 cents per kilowatt-hour of solar energy produced. Program funding will support an estimated 260 solar systems, each up to 20 kilowatts. Total payments are projected to be $4.8 million.

When Austin Energy's rebate incentive program began in 2004, it offered as much as $5.00/watt for all customer classes. The program was so successful that over the years, Austin Energy has been able to gradually decrease the incentive amount while still obligating all funds that are available in each year's budget cycle. Austin Energy is continuing to offer a rebate of $2.50 per installed watt to residential customers, with annual rebates limited to $15,000 and maximum rebates set at $50,000 over the life of installations at a single property. Austin Energy performs pre-inspections of residential sites to ensure adequate solar access of the proposed installation and to verify that homes meet certain energy efficiency requirements. Together, these assessments determine eligibility for the homeowner rebate.

Boulder, Colorado: Supporting the ClimateSmart Solar Grant Fund

The city of Boulder offers grants for installing PV or **solar water heating** (SWH) systems on housing for low- to moderate-income families and on the facilities of nonprofit entities. The city's Office of Environmental Affairs administers the grant program and holds two application cycles per year. The program is funded by revenues generated through a solar rebate ordinance approved by the Boulder City Council in 2006. The city collects tax on the sales of solar technologies and uses 65% of the revenue to fund the ClimateSmart Solar Grant Fund. The remaining 35% of the revenue is given back as a sales tax rebate to those who pay solar sales taxes.

As of September 2010, a total of $154,281 has been awarded to nonprofit organizations and homeowners participating in the city's affordable housing program since the first grant cycle in March 2008. The grant funds have resulted in 22 solar PV systems, 206 kilowatts of installed PV capacity, and two solar thermal systems, which reduced **carbon dioxide** (CO_2) **emissions** in the area by approximately 275 metric tons per year. In addition, annual energy cost savings exceed $25,000.

San Francisco, California: Creating a Multifaceted Direct Incentive Program

The San Francisco Public Utilities Commission administers a PV incentive program designed to accomplish many municipal goals. In addition to encouraging more solar energy installations, the GoSolarSF Incentive Program (see www.solarsf.org) targets **environmental justice** areas, encourages residents to hire installers who employ graduates of the city's workforce development program and installers whose headquarters are within city limits, and offers additional incentive money for low-income residents. Commercial enterprises and nonprofits are also eligible for the payments, with higher incentives available for nonprofits and affordable housing units. As of June 30, 2010, the end of the program's second year, 1,248 applications have been received, totaling $10.6 million in requested incentives. The program has reserved $9.8 million, paid $7.4 million for completed installations, and seen 4.4 megawatts of solar installed or committed. In addition, 40 green jobs have been created. GoSolarSF is funded by the San Francisco Public Utilities Commission (SFPUC).

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org

DSIREusa.org, maintained by North Carolina State Solar Center in partnership with the Interstate Renewable Energy Council (IREC), is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy funds this ongoing effort.

PUBLICATIONS

Developing an Effective State Clean Energy Program: Renewable Energy Incentives

Clean Energy States Alliance, March 2009

This paper summarizes innovative approaches and practices that have worked effectively for providing small renewable project incentives at the state level.

Paper: www.cleanenergystates.org/Publications/CESA_Renewable_Energy_Incentives_March09.pdf

Case Studies of State Support for Renewable Energy: Designing PV Incentive Programs to Promote Performance: A Review of Current Practice

Lawrence Berkeley National Laboratory, October 2006

This report examines PV incentive programs aimed at promoting PV system performance, including (but not limited to) PBIs used in 32 states across the country.

Report: www.cleanenergystates.org/library/Reports/LBNL-61643_Designing_PV-Incentive_Programs.pdf

This PV array has 465 solar panels split between roofs on the southeast and southwest wings of the Denver Museum of Nature and Science. The installation was made possible through a collaboration of Hybrid Energy Group, Partnership for Sustainability, Xcel Energy, and Namasté Solar Electric. (Denver Museum of Nature and Science / PIX18045)

2.3

Feed-In Tariffs

The **feed-in tariff** (FIT) is another popular mechanism for stimulating the solar market. A FIT requires energy suppliers to buy electricity produced from renewable resources at a fixed price per kilowatt-hour, usually over a fixed period of 15 to 20 years. FIT policies are in place in 40 countries around the world and are often cited as the main driver of the renewable energy markets in Spain and Germany.

State or local governments can implement a FIT as a stand-alone policy or as a means of meeting a **renewable portfolio standard** (RPS). For example, a FIT can be structured to help meet a solar **set-aside** in an RPS. An advantage of a FIT is that states can use it in tandem with other renewable energy policies to advance renewable energy development. Communities can tailor a FIT policy to utility-scale projects owned by **project developers** or **distributed generation** projects owned by individuals. Many European FIT policies are designed so that utilities must purchase electricity from large utility-scale project developers as well as from individuals who generate electricity from renewable sources on their private properties.

As a result of the success of the FIT in Europe, as of October 2010, four states had created FIT policies and numerous others are considering doing the same: the California Public Utilities Commission (CPUC) approved a FIT policy for seven of the state's utilities in February 2008; Vermont passed a FIT in May 2009; Oregon launched a FIT pilot program for photovoltaics (PV) in July 2010; and the Hawaii Public Utilities Commission established FIT rates in October 2010 after ordering the creation of a FIT program in 2009. Note that Oregon's pilot program is called a volumetric incentive rate and payment program for PV, although it was referred to as a FIT in early legislation. For more information, visit http://dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=OR134F&re=1&ee=1.

Numerous other states (Arkansas, Connecticut, Illinois, Indiana, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Rhode Island, Texas, Virginia, Washington, and Wisconsin) are considering or have considered FIT legislation. In February 2009, Gainesville Regional Utilities (GRU) of Florida became the first municipal utility to implement a FIT policy. In 2010 FIT programs were adopted by CPS Energy, the municipal utility in San Antonio, Texas, and by the Sacramento Municipal Utility District, the municipal utility serving the Sacramento, California area. Additionally, three California cities (Los Angeles, Palm Desert, and Santa Monica) have proposed FIT policies.

Although a FIT results in guaranteed revenue streams for developers, which assists in securing long-term financing, it doesn't reduce a developer's up-front costs or investments. As costs change because of technological innovations and as markets mature, the policy will need to be revised to reflect these shifts. Because these implementation details are critical to the success of a FIT, a long-term implementation plan is necessary.

BENEFITS

FITs are intended to increase the adoption of renewable energy technologies and encourage the development of the renewable energy industry, but they can also bring significant ancillary benefits to the table, including economic development and environmental improvements. For states that want to assure investors about future revenue, drive more capital to the market, and get more projects built, a FIT can be a useful complementary policy to the RPS. For states that don't have an RPS in place, the FIT can jump-start the renewable energy market. Additionally, FITs can promote high performance levels in terms of system production; commitment by owners and installers to long-term reliability; and companies that offer the best equipment from a cost, efficiency, and performance standpoint.

Implementation Tips and Options

The United States is now looking to the European experience with FITs to best understand policy design. Because other policies have been favored in the United States, particularly the RPS, it's important to understand how the RPS and the FIT might interact. NREL has developed a series of recommendations for designing FITs.

- ☐ Determine the basis for valuing payments for renewable energy purchased through FITs. Payments can be based either on the **levelized cost** of generating the electricity, or on the value to society or the utility of producing electricity from renewable sources.
- ☐ Identify which FIT payment structure—fixed price (predetermined payment independent of market rates for electricity); nonvariable premium price (a fixed, predetermined adder); or premium price (where the premium varies with **spot-market** electricity prices)—will best serve the jurisdiction's policy objectives.
- ☐ Establish different FIT payment levels based on factors such as technology type (e.g., wind, solar, biomass, and geothermal); the quality of the resource at the particular site (to encourage broad deployment of the technologies); and the specific location of the project.
- ☐ Evaluate how the FIT will interact with an RPS if the jurisdiction has such a policy in place.
- ☐ Decide what the acceptable cost burden might be for the jurisdiction and how to weigh that impact relative to job creation and economic benefits.
- ☐ Determine who will own the **renewable energy certificates** (RECs) that result from FIT generation—the utility or the system owner. A utility can use RECs to meet RPS goals or mandates; system owners can sell the RECs on the REC market to utilities, businesses, or governments.

Examples

Gainesville, Florida: Implementing a Solar Feed-In Tariff

GRU implemented a tariff mechanism modeled after Germany's FIT. The utility purchases energy from qualified PV systems via a standard offer contract at set rates for 20 years. Both residential and commercial generators are eligible for the FIT. The fixed FIT rate starts at $0.32 or $0.26 per kilowatt-hour, depending on the size and application of the systems for contracts executed in 2009 and 2010, and decreases over time. All RECs stemming from customer generation belong to the utility. As of November 2009, GRU had received enough applications to meet the program's caps of 4 megawatts per year through 2016, and is no longer accepting applications. A large percentage of the total allocations went to a single developer, so other municipalities considering this type of program might want to consider adding program parameters to encourage sustained local solar market development. To learn more, go to http://www.gru.com/OurCommunity/Environment/GreenEnergy/solar.jsp.

San Antonio, Texas: Launching CPS Energy's SolarTricity™ Producer Program

CPS Energy, San Antonio's municipal utility, launched a solar FIT program called the SolarTricity™ Producer Program in June 2010. It offers a special electricity purchase rate of $0.27 per kilowatt-hour for PV systems located within its service territory. The rate is available as a standard open offer for systems ranging from 25 kilowatts to 500 kilowatts AC. The rate is available to any legal entity that's authorized to enter into a contract with the utility. The participant does not need to be a CPS Energy customer unless energy is supplied from the utility to power ancillary facility equipment. The seller is obligated to sign a SolarTricity Solar Power Purchase Agreement with the utility for a term of 20 years, although the seller may opt-out of this contract at any time. This is a sell all arrangement; it is not compatible with systems designed to generate energy to serve on-site needs (e.g., net-metered systems). Payments for purchased electricity will be made on a monthly basis. Payments are subject to a maximum payment arrived at through monthly production estimates using accepted modeling software (e.g., PVWatts, Solar Advisor Model) and specified in the contract. For more information, visit www.cpsenergy.com/Services/Generate_Deliver_Energy/Solar_Power/Solartricity/index.asp.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

PUBLICATIONS

State Clean Energy Policies Analysis (SCEPA) Project: An Analysis of Renewable Energy Feed-in Tariffs in the United States

National Renewable Energy Laboratory, Revised June 2009

This report defines a FIT policy, explores U.S. FIT policy design, and highlights a few of the best practices in FIT policy design. It also explores how FITs can be used to target state policy goals and examines policy interactions with other renewable energy policies. The report includes an overview of FIT effects (jobs and economic development) in Europe.

Report: www.nrel.gov/docs/fy09osti/45551.pdf

Feed-in Tariff Policy: Design, Implementation, and RPS Policy Interactions

National Renewable Energy Laboratory, March 2009

This report explores the design and implementation of FIT policies, including a policy definition, various payment structures, and payment differentiation options. The report also discusses the interaction between FIT and RPS policies.

Report: www.nrel.gov/docs/fy09osti/45549.pdf

Feed-In Tariffs and Renewable Energy in the USA—A Policy Update

North Carolina Solar Center, Heinrich Boll Foundation, World Future Council, May 2008

This report reviews FIT legislation enacted and proposed across the United States and discusses the implications of a federal FIT policy.

Report: www.wind-works.org/FeedLaws/USA/Feed-in_Tariffs_and_Renewable_Energy_in_the_USA_-_a_Policy_Update.pdf

Cylindrical Solyndra PV panels are installed on top of the City Parks Warehouse in Tucson, Arizona. (City of Tucson /PIX18041)

2.4

Third-Party Residential Financing Models

Several models for financing solar energy systems and reducing their up-front costs have evolved in the marketplace. Municipalities can pave the way for private sector solar companies to thrive in their communities or partner directly with the private sector to offer residents financing options. Two popular new models for consumers interested in purchasing solar for their homes are residential solar leasing and residential **power purchase agreements** (PPAs). These new models complement the more conventional use of cash or home equity loan financing for solar installations.

Under third-party financing mechanisms, the homeowner does not purchase the **photovoltaic** (PV) system but enters into an arrangement with a company to make periodic lease payments or electricity payments for the system. These third-party financing mechanisms can be attractive for homeowners because they can reduce the risk and complexity involved in owning and operating a PV system. And PV systems owned and operated by third-party providers often perform better because the providers frequently monitor their electricity output and experts perform any necessary maintenance or repair.

The concept of residential solar leasing is fairly straightforward. Instead of purchasing a PV system, homeowners enter into a contract with the owner of a PV system who will install the system on the homeowner's roof. The homeowner puts little or no money down and agrees to make monthly lease payments during a set period of time (typically 10 to 20 years) while consuming electricity from the PV system. Typically the combined lease payment and monthly utility bill (which pays for power needed when the sun isn't shining) is competitive with and sometimes lower than previous electric bills. Meanwhile, the party owning the system (i.e., a solar company) benefits from the tax credits and accelerated depreciation of the solar equipment as well as any available rebates.

At the end of a lease period, the homeowner may have the opportunity to purchase the system. If the homeowner isn't interested in purchasing the system, it can be removed or the lease can be extended. If the home is sold, it may be possible for the existing homeowner to transfer the lease to the new homeowner. Residential solar leases can be an attractive feature for homeowners who want to benefit from solar power but don't want to incur the up-front costs of purchasing a system or the ongoing maintenance costs of owning their own systems.

Under a residential PPA, a third party (usually a solar company or its investors) owns and operates a PV system located on the homeowner's roof. The homeowner enters into a contract with this third party to buy all of the electricity that the PV system generates over an extended period of time, typically up to 20 years. The third party, as the owner of the system, is responsible for all operations and maintenance of the PV system. The third party will take the available tax incentives and local rebates and use them to lower the cost of electricity to benefit the homeowner. The homeowner will continue to purchase some electricity from the utility to complement the electricity produced by the PV system.

The primary difference between a solar lease and a residential PPA comes down to making a monthly lease payment to a third party in a solar lease versus purchasing electricity under a PPA. In most markets, the consumer will have the option of either a solar lease or a residential PPA, but not both. This is due to a number of factors including whether or not the PPA is permissible by law and how electricity sales are taxed vis-à-vis leases. For consumers in a market where both the PPA and the lease are available, there are a number of factors to compare, including the following:

- The up-front cost of each option
- The rate at which either the lease payment or the PPA price increases each year (rate of escalation)
- Whether maintenance is included in the lease or PPA price
- Whether online system monitoring is included
- The costs associated with terminating the lease or the PPA at the end of the term.

As of September 2010, residential third-party financing, either through a solar lease or a solar PPA, is available in the following states: Arizona, California, Colorado, Connecticut, Hawaii, Massachusetts, Minnesota, New Jersey, Oregon, Pennsylvania, and Texas.

BENEFITS

Paving the way for private sector financing or directly partnering with the private sector to offer financing options will benefit the community by reducing the primary barrier to PV deployment: high up-front cost. The advantages of residential PPAs and leases include low-upfront costs; predictable and competitively priced electricity costs in the future; no ongoing maintenance obligations; and a variety of options at the end of the PPA or lease, such as purchasing the system, having it removed, or extending the term of the contract.

Implementation Tips and Options

- ☐ Local governments can create a solar-friendly environment that allows for private sector solar financing models to thrive. Streamlined permitting processes and reasonable permitting fees, property and/or sales tax waivers or discounts, and solar access laws help facilitate private sector financing models.
- ☐ Partner with companies offering solar financing to help market the option to residents. Many residents are unaware that solar financing options exist, and given that many homeowners perceive solar as a new technology, they will be more likely to participate in a solar financing program if the local government has endorsed it.
- ☐ For homeowners interested in owning a solar system as opposed to having a third party operate a system on their roof, consider creating a PACE program (see 2.5, Property Assessed Clean Energy Financing Program).

- Work with the state or public utility commission to ensure that residential leases and PPAs are allowed in the state.
- Develop a community solar financing program for residents whose roofs aren't suitable for solar energy systems (see 2.8, Community Solar).

Examples

Phoenix, Arizona: Forming a Partnership between the City of Phoenix and SolarCity

Solar Phoenix is a collaborative effort among the city of Phoenix, the solar leasing company SolarCity, Arizona Public Service, and the National Bank of Arizona. The city is supporting the program by providing certain protections against homeowner defaults via its Industrial Development Authority. Program participants can install a solar system with no up-front cost and a low monthly lease payment. The new lease payment plus the new lower electricity bill is typically lower than the utility bill homeowners paid before they installed a PV system, saving the average Phoenix homeowner 15% on monthly electricity costs. Participants must be in good financial standing and have a minimum FICO score of 700 to be eligible for Solar Phoenix's financing. Visit www.solarphoenix.org for more information.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

PUBLICATIONS

Homeowners Guide to Financing a Grid-Connected Solar Electric System

National Renewable Energy Laboratory, October 2010

This guide explains multiple financing options available to homeowners considering the installation of a PV system. The report includes short descriptions and a table comparison of financing a PV system though a cash purchase, home equity loan, solar lease, residential PPA, and a PACE financing program.

Publication: www.eere.energy.gov/solar/pdfs/48969.pdf

Solar Leasing for Residential Photovoltaic Systems

National Renewable Energy Laboratory, Revised April 2009

This fact sheet provides an overview of the residential solar lease and compares it to a cash purchase and system financed through a home equity loan.

Fact sheet: www.nrel.gov/docs/fy09osti/43572.pdf

Solar Photovoltaic Financing: Residential Sector Deployment

National Renewable Energy Laboratory, March 2009

This report presents the information that homeowners and policy makers need to facilitate PV financing at the residential level. It covers the full range of cash payments, bill savings, tax incentives, and potentially available solar attribute payments. Traditional financing is compared with innovative solutions, many of which are borrowed from the commercial sector. By calling attention to these innovative initiatives, this report aims to help policy makers consider greater adoption of these models to benefit homeowners interested in installing a residential PV system.

Report: www.nrel.gov/docs/fy09osti/44853.pdf

Solar Leasing for Residential Photovoltaic Systems

National Renewable Energy Laboratory, February 2009

This publication examines the solar lease option for residential PV systems and describes two existing solar lease programs, and helps homeowners revisit the comparison between the solar lease and home-equity financing.

Publication: www.nrel.gov/docs/fy09osti/43572.pdf

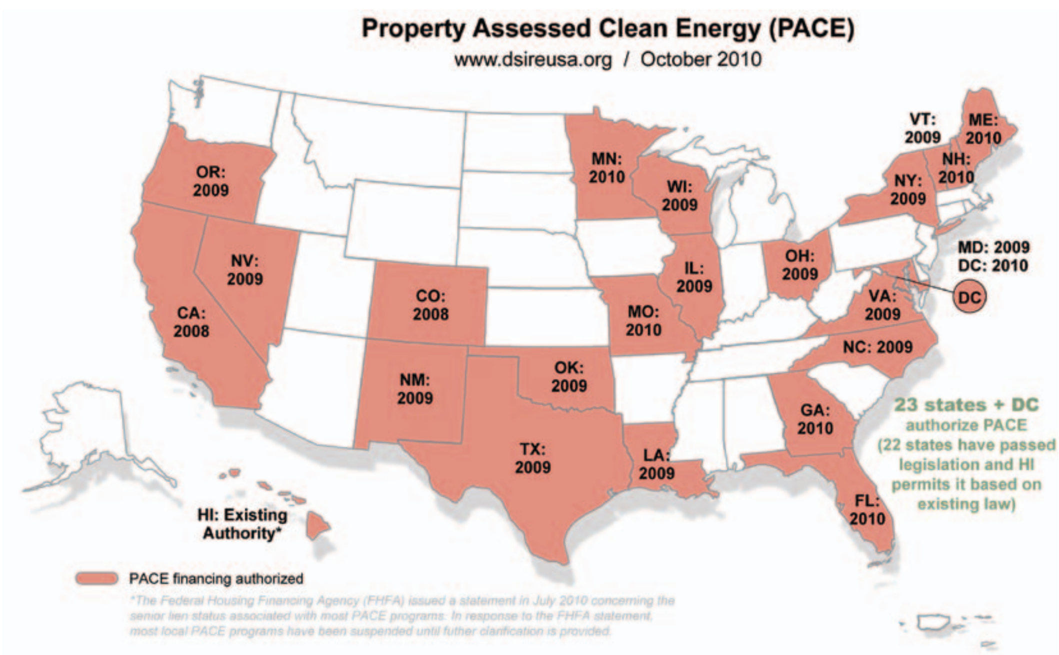
The Denver International Airport (DIA) features a 2 MW PV system. DIA is now host to a second 1.6 MW array system. (Denver International Airport/PIX18043)

2.5

Property Assessed Clean Energy Financing

A new structure to finance **renewable energy** and energy efficiency investments is the **property assessed clean energy** (PACE) program model. A PACE program seeks to address both the up-front cost barrier to solar and the hesitancy of homeowners to make long-term investments in their homes, given that many people move every 5 to 7 years.

In a PACE program, the city or county finances the up-front costs of the energy investment, either directly or as an intermediary for private investors. The property owner repays the loan over an extended period (10 to 20 years) through a special property tax assessment. PACE programs are modeled after traditional land-secured financing, so in order for this type of financing to work, local jurisdictions must have authorization to create a special assessment district or another mechanism that allows energy retrofits to be financed through property tax bills.



Most states already authorize municipalities and counties to create special districts to finance "public goods" such as street beautification or sewer-system upgrades. In most states, the most straightforward method is to amend an existing special district authority to allow clean energy projects on private property. Some states have opted to create a new stand-alone law. Cities and counties in some states also have specific "charter" or "home rule" authority and can authorize

PACE programs via local ordinance. As of October 2010, 23 states plus the District of Columbia have enabling legislation that allows local governments to create clean energy financing districts. Hawaii also allows PACE based on existing law.

With enabling legislation in place, a clean energy financing district is created by a local government. Individual property owners then decide whether to opt in to the district to enable financing of energy improvements on their properties. Property taxes remain the same for those who decide not to participate in the program—this is a key element in the marketing of the program. Only energy improvements that are affixed to the property are eligible under PACE programs. If a participant in the clean energy financing district sells the property, the special property tax assessment typically remains with the property, although in some cases the transfer can be a negotiation point at sale.

Funding for a PACE program has taken a number of different forms in the handful of initiatives that have already been launched. Boulder County, Colorado, is using voter-approved bond financing; Berkeley, California, is working with a private investor; Palm Desert and Sonoma County, California, used **general funds** to start the program. It is likely that large-scale PACE programs will eventually be financed using private capital provided through the **municipal bond** markets.

The American Recovery and Reinvestment Act of 2009 (the Recovery Act) removed the federal government's "anti-double-dipping" rule, which was introduced in the Energy Policy Act of 2005. This rule created uncertainty about whether a PACE program financed by tax-exempt bonds prevented the property owner from also taking the **federal investment tax credit** (ITC). Property owners now are allowed to claim both the 30% federal ITC and take advantage of "subsidized energy financing" that can be an element of a PACE program.

In May 2010, financial regulators including the Federal Housing Finance Agency (FHFA), Federal Deposit Insurance Corporation (FDIC) and the Office of the Comptroller of the Currency (OCC) expressed concerns about pilot PACE financing programs. On May 5, 2010, Fannie Mae and Freddie Mac sent a letter stating that their Uniform Securities Instruments prohibit loans that have a senior lien priority to a mortgage. In response to these concerns, U.S. Department of Energy (DOE) and White House officials have met repeatedly with Fannie Mae, Freddie Mac, and the financial regulators as well as PACE stakeholders across the country. In addition, DOE issued updated guidance for pilot PACE financing programs on May 7, 2010 (see Additional References and Resources). As of August 2010, efforts were under way to address this issue through legislative action with the introduction of bills before Congress in support of PACE.

As a result of this regulatory uncertainty, most PACE programs in the country are on hold. That said, some local governments continue to offer PACE programs for residential projects (e.g., Sonoma County) and for commercial projects (e.g., Boulder County). Commercial PACE programs are not subject to the FHFA rulings. In addition, some communities are exploring second-lien structures as an alternative to priority-lien PACE programs.

BENEFITS

The PACE financing model offers a number of benefits to **solar energy** system owners, including a long-term, fixed-cost financing option; an assessment tied to the property (instead of the system owner's credit rating); a repayment obligation that can transfer with the sale of the property; and the potential to deduct the loan interest from federal taxable income as part of the local property tax deduction. The benefits of this financial model for local governments include meeting climate and energy goals with little to no liability or exposure to a municipality's general fund. These programs do have administrative costs, but those costs can be included in a bond issuance and repaid by program participants. The program can be structured to fully leverage private investment, so a municipality or county can implement a PACE program with almost no budget impact

Implementation Tips and Options

- ☐ Determine whether the local jurisdiction is authorized to create a special district within an existing state statute and whether an amendment to broaden the statute is necessary. As an alternative, a community might be able to bypass the special district process and pass an ordinance that enables citizens to add a line item to their property tax bill for energy efficiency and renewable energy loans, or tap other funds; for example, a solid waste fund to finance the program. Vote Solar's Web site provides sample documents of enabling legislation (see www.votesolar.org/PACE).
- ☐ Consider including an allowance for contracts for the production of clean energy at the property in enabling legislation so third-party financiers can qualify for PACE funding.
- ☐ Identify whether existing bonding authority is adequate to support a PACE program in the community. Other funding sources, including federal tax credit bonds like **qualified energy conservation bonds** (QECBs) and public–private partnerships might also be possible.
- ☐ Design a financing structure that yields enough revenue to cover the principal and interest payments to the investors/bondholders, the program administration costs, and a reserve fund to cover participant delinquencies. Be aware, though, that some homeowners will be able to finance their projects more cost effectively using other sources of credit, such as a home-equity loan.
- ☐ Assess the scope of work involved in the program and determine whether an internal or external organization is better suited to administer the program.
- ☐ Work with the program administrator to create a simple application process for property owners.
- ☐ Educate the solar industry about the program and engage industry in program marketing. Installers talk to potential program participants, so it's important to ensure that installers know all the program details.
- ☐ Include energy efficiency measures as eligible projects in addition to renewable energy projects, and prioritize property owners who have received **energy audits** or have otherwise made informed decisions about the most cost-effective improvements to their property.

- ☐ Understand the alternative financing arrangements—such as leasing or power purchase agreements (PPAs)—that are available to potential participants. Be sure to educate potential participants on all financing options.

Examples

Boulder County, Colorado: Establishing Boulder's ClimateSmart Loan Program

In November 2008, voters in Boulder County authorized the county to issue up to $40 million in bonds to offer special financing options for renewable energy and energy efficiency improvements to local residential property owners. This program differs from the Berkeley model in several ways. The repayment period is shorter—loans to homeowners are repaid over 15 years as a special assessment on the homeowner's property tax bill. Boulder County is the first local government to issue federally tax-exempt as well as taxable bonds to finance a PACE program; other jurisdictions have used taxable bonds only. Boulder County also decided to aggregate applicants and then issue a large bond based on demand instead of issuing individual "mini-bonds" for each project as Berkeley did. Applicants must attend a workshop to learn about the program requirements and to receive information on energy audits and the benefits of investing in energy efficiency measures before renewable energy measures. A commercial program is under way and bonds are anticipated to be sold in late 2010.

In March 2009, more than 1,700 people attended program workshops. Boulder County held its first application round for the ClimateSmart Loan Program in April 2009. In the first round of funding, 393 residential projects were financed at interest rates of 5.20% and 6.68%, respectively, for the income-eligible (tax-exempt) and open (taxable) bonds. In October 2009, an additional 219 residential projects were financed at 5.8% and 6.8%, respectively. PV is the most popular investment, with 229 installations financed via the ClimateSmart program with $3.6 million in grant funds as of September 2010. After a successful first year, Boulder launched its first round of commercial PACE funding in January 2010. For more information, visit www.bouldercounty.org/bocc/cslp.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

U.S. Department of Energy, Weatherization and Intergovernmental Program's Status Update Page on Pilot PACE Financing Programs
www.eere.energy.gov/wip/pace.html

The Vote Solar Initiative
http://votesolar.org/PACE

Vote Solar works with state and local governments to pass enabling legislation and clear the way for PACE financing programs. This Web site features case studies, legal analyses, and model requests for proposals (RFPs) for program administrators.

PUBLICATIONS

Photovoltaics (PV) as an Eligible Measure in Residential PACE Programs: Benefits and Challenges

National Renewable Energy Laboratory, June 2010

This fact sheet can help policy makers to determine if residential PACE programs should include PV as an eligible measure.

Fact sheet: www.nrel.gov/docs/fy10osti/47845.pdf

Transferring PACE Assessments Upon Home Sale

Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory, Solar America Cities, April 2010

This policy brief analyzes one of the advantages of PACE, which is the option to transfer the special assessment from one homeowner to the next when the home is sold. This analysis focuses on the potential for the outstanding lien to affect the sales negotiation process, rather than the legal nature of the lien transfer itself.

Policy brief: http://eetd.lbl.gov/ea/emp/reports/ee-policybrief_041210.pdf

Recovery through Retrofit

Middle Class Task Force, Council on Environmental Quality, Vice President of the United States; Executive Office of the President of the United States, October 2009

This report discusses the energy-saving and job-creation opportunities offered by a comprehensive and national energy efficiency retrofit program. PACE financing is cited as a primary mechanism to finance this initiative.

Report: www.whitehouse.gov/assets/documents/Recovery_Through_Retrofit_Final_Report.pdf

Guide to Energy Efficiency & Renewable Energy Financing Districts for Local Governments

Renewable and Appropriate Energy Laboratory (RAEL), University of California, Berkeley. September 2009

This comprehensive guide to PACE programs addresses topics such as financing, marketing, legal issues, and program administration. It also contains a number of helpful case studies.

Report: http://rael.berkeley.edu/sites/default/files/old-site-files/2009/FullerKunkelKammen-MunicipalEnergyFinancing2009.pdf

Renewable and Appropriate Energy Laboratory Financing Seminar Presentations

University of California, Berkeley, April 2009

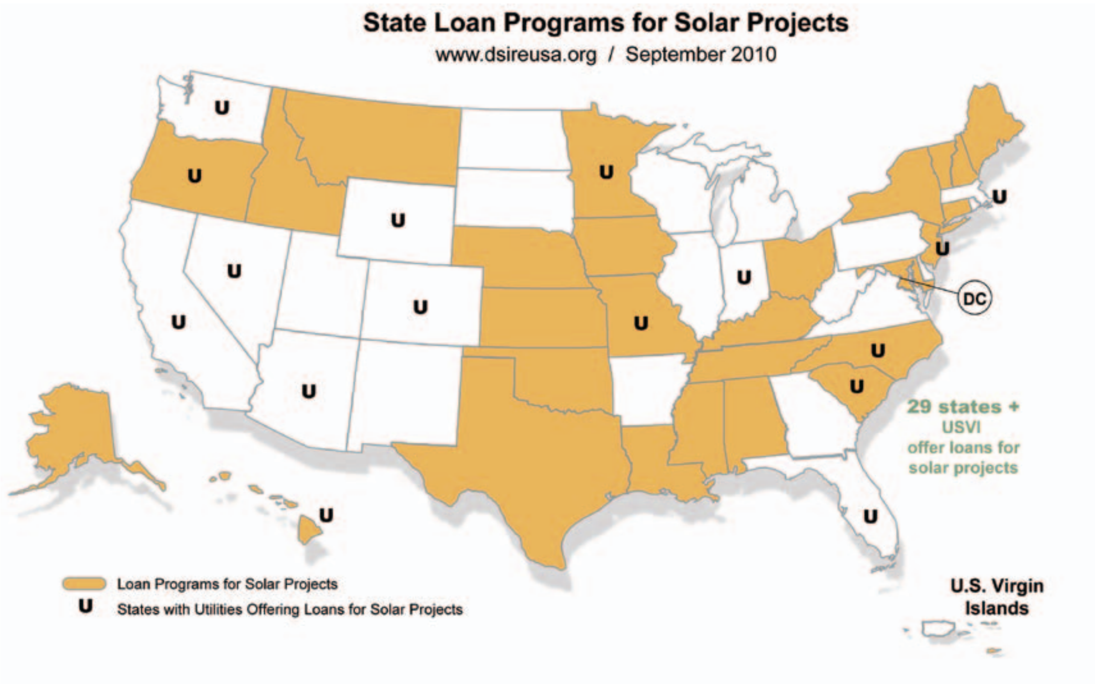
The RAEL Financing Seminar held in Berkeley, California, featured experts on municipal financing of clean energy. Program managers from Berkeley, Palm Desert, and Sonoma County, California, and Boulder, Colorado, discussed their experiences with implementing clean energy financing programs, including PACE financing programs.

Set of presentations: http://sites.google.com/site/raelfinancingseminar/Home/ppts

2.6

Low-Interest Loans

States, utilities, and local governments can use low-interest loans to encourage the adoption of **renewable energy** technologies. Agencies and utilities can administer a loan program directly or leverage funds by working with private lenders. Most state loan programs emphasize energy efficiency improvements that can include solar. As of September 2010, about one-third of the 30 existing renewable energy state loan programs under which solar installations are eligible target nonprofit and public buildings, including local government buildings and schools. Maximum loan amounts typically are about $1 million for commercial systems and $10,000 to $30,000 for residential systems, with varying interest rates and repayment terms from 3 to 20 years. States typically collaborate with private lenders in administering a program. Utility loan programs usually target residential solar installations. Repayment schedules vary and are usually determined on an individual project basis, but some utilities offer a repayment term of up to 10 years. Local governments offer a variety of loan programs. Most municipalities and counties collaborate with a local bank or community economic development organization to secure favorable terms or to structure interest rate **buy-downs**.



Note: For the most up-to-date information on states and municipalities with property and sales tax incentives for solar, visit www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1.

BENEFITS

State, utility, and local government loan programs encourage customers to install solar energy systems by allowing consumers to spread up-front equipment costs over the life of a loan. These loan programs offer lower interest rates, better terms, and lower transaction costs relative to private lenders. Loan programs might be more politically viable than cash incentives, and they can even become self-sustaining through a revolving fund mechanism.

Implementation Tips and Options

- ☐ Evaluate multiple options for funding loan programs, including the following:
  - Revolving loan funds
  - **Public benefits funds**
  - **Renewable portfolio standard** (RPS) **alternative compliance payments** (ACPs)
  - Environmental noncompliance penalties
  - Sale of bonds
  - Annual appropriations.
- ☐ Incorporate key features of effective loan programs, as follows:
  - A low interest rate, longer repayment terms (at least 10 years), and minimal fees
  - An easy and concise application process
  - Coordination with other state and local programs and relevant stakeholder groups in educating the public about solar technologies and to market the loan program
  - A mechanism for tracking the details of program use, costs, and energy savings or production to enable program evaluation and improvement.

Examples

Maui County, Hawaii: Establishing 0% Interest Loans for Solar Water Heating Systems

Maui Electric Company (MECO) and Maui County teamed up to launch the Maui Solar Roofs Initiative to increase the use of renewable energy in the county. Under the initiative, MECO offers 0% interest loans for **solar water heating** (SWH) as well as a $1,000 rebate for installations completed by one of its approved solar contractors. Resident homeowners that use electric water heaters are eligible and must make a down payment equal to 35% of the system cost after MECO's rebate. The loan program also accepts applications from renters who have the property owner's permission to install an SWH system. Maui County supplies the funds and MECO administers the loans. As of January 2010, the county had invested $700,000 in a revolving fund to support the program, with more than 500 families participating in the program. Loan payments are based on expected monthly energy cost savings. As payments replenish the fund, more applicants can be served. Some of the funds have been designated specifically for households with income that's less than or equal to the area median income.

Visit www.mauielectric.com/portal/site/meco/menuitem.ed4aed221358a44973b5c410c510b1ca/?vgnextoid=f94c5e658e0fc010VgnVCM1000008119fea9RCRD&vgnextfmt=default&cpsextcurrchannel=1 for more information.

Orlando, Florida: Offering Loan Buy-Downs and On-Bill Financing Program

The Orlando Utilities Commission partners with the Orlando Federal Credit Union to offer low-interest loans for residential solar installations. Customers can borrow up to $7,500 for an SWH system at an interest rate of 0% to 4%, depending on the repayment term, which ranges from 3 to 7 years. Customers can borrow up to $20,000 for a **photovoltaic** (PV) system at an interest rate of 2.0% to 5.5% over a term ranging from 3 to 10 years. Customers can repay loans over time as fixed payments on their monthly utility bills. This program complements the utility's **production-based incentive** (PBI) program for PV and SWH. As of April 2010, 64 customers had received the low-interest loans, 6 for PV and 58 for SWH. For more information, go to www.ouc.com/en/conservation_initiatives/renewables/solar.aspx.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org

This Web site contains a summary of renewable energy loan programs in the United States. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with the Interstate Renewable Energy Council (IREC), is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy (DOE) funds this ongoing effort.

PUBLICATIONS

State Clean Energy Policies Analysis: State, Utility, and Municipal Loan Programs

National Renewable Energy Laboratory, May 2010

This report relies on six in-depth interviews with loan program administrators to provide descriptions of existing loan programs. Findings from the interviews are combined with a review of relevant literature to elicit best practices and lessons learned.

Report: www.nrel.gov/docs/fy10osti/47376.pdf

Developing an Effective State Clean Energy Program: Clean Energy Loans

Clean Energy Group and Clean Energy States Alliance, March 2009

This paper summarizes innovative loan approaches and practices that have worked effectively to advance clean energy programs at the state level.

Paper: www.cleanenergystates.org/Publications/CESA_Loan_Programs_March09.pdf

2.7

Group Purchasing

Solar group purchases—or **solar aggregation** programs—reduce the up-front cost of solar installations by giving groups of individuals or businesses a discounted rate for bulk purchases. Local governments can organize **customer aggregation programs** or help fund or market programs run by third parties. In most cases, members of a community interested in installing solar are grouped into one purchasing pool, which negotiates a reduced rate from a solar provider for the cost of the systems and the installation.

Various organizations offer solar group purchases to local residents, and these types of purchases are growing in popularity. Another emerging group purchasing structure is the "co-op" model, in which home and business owners in an area come together as a group to secure preferential pricing from installation firms.

BENEFITS

By participating in a solar group purchasing program, buyers can lower their up-front purchase costs for **solar energy** systems. Such programs can help local governments reach solar energy goals faster by accelerating solar purchases.

Implementation Tips and Options

- Hold informational meetings with neighborhood associations or community groups to educate them on solar aggregation programs and to gauge their interest in participating.
- Create an online forum for community members interested in participating in such a program.
- Assist the community group or purchasing pool with preparing a request for proposal (RFP) for solar vendors.
- Review proposals from solar vendors and determine which best meet the needs of the aggregate purchasing pool (factors to consider include best cost, system type, and quality assurance).
- Select one or more reputable vendors with a track record of high-quality installations and be very clear about the terms of the contract.

Examples

San José, California: Targeting City Employees for Solar Group Buy Program

Recognizing the need for additional financing tools to remove the up-front cost barrier of going solar, San José's Solar America City Program teamed up with the San José Credit Union to establish the San José Employee Solar Group Buy Program. San José has more than 6,000 employees and retirees and wants to enable all staff to lead by example. The program and credit union partnership has assisted an employee group in organizing a grassroots effort that offers a low-interest home-equity loan (as low as 3.99%) and the benefit of volume purchasing. As a result, city employees and retirees who are also credit union members are participating in this innovative program, which is the first of its kind in the United States. The program is unique because it

- Enables reaching a large number of people who share a common workplace and financial institution
- Welcomes participants from different areas of the city to the group (this differs from other group buy models that are city specific)
- Pioneers the first group buy in California for solar thermal systems
- Remains independent of the city's or credit union's procurement processes.

The partnership has also lent its combined technical and strategic expertise to help group members organize a competitive bid process, an independent evaluation committee, and a review process to select vendors. As of August 2010, the selected vendors offered the lowest pricing in California for **photovoltaic** (PV) and **solar water heating** (SWH) systems (40% off current market cost). The greater the participation, the lower the pricing schedule (up to 50% off the current market cost). A series of workshops allowed group participants to obtain information from the selected vendors and also garnered interest from prospective program participants.

Portland, Oregon: Coordinating Community-Based Volume Purchasing Campaigns

Portland is partnering with several neighborhood coalition offices to offer programmatic and technical support for neighborhood-based volume purchasing campaigns. Solarize Portland creates an easy, streamlined process for going solar with consistent pricing offered for a limited time. To help ensure that the grassroots campaigns are professionally run, Portland helps with program design, technical support for the neighborhoods in selecting solar contractors, and communication and outreach materials. The city also helps coordinate and deliver educational workshops about the volume purchasing concepts and the benefits of solar energy. For more information, visit www.portlandonline.com/bps/solarize.

San Francisco, California: Assisting Neighborhood Group Purchases

San Francisco's Department of the Environment works directly with local communities to facilitate solar group purchases. Organizers from neighborhoods, including Precita Valley Neighbors (100 households), Cathedral Hill (4 multitenant buildings), and St. Francis Woods (30 households), approached the city for assistance in obtaining preferential pricing from solar installers. The city supplied information on solar aggregation and assisted the communities in preparing RFPs for solar installers. The city also worked with One Block Off the Grid (1BOG), a program that organizes residential group purchases of solar energy systems, to get its program started in San Francisco. The city helped 1BOG prepare an RFP that went out to all of the solar installers that serve San Francisco. Because of its success in San Francisco, 1BOG has now expanded nationwide.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

2.8

Community Solar

Traditionally, installing **photovoltaic** (PV) systems has been examined in the context of a single project with one owner. With the emergence of a "community solar" project trend, a single large PV system is installed, usually in coordination with the local municipal utility. Community members either claim proportional ownership in the system or subscribe to representational "shares." Given the benefits associated with economies of scale, community projects can reduce the cost of PV systems on a per-watt basis. These projects can also expand access to solar electricity because individuals who don't own property or whose property doesn't receive adequate sunlight to make a PV system practical can still invest in a community solar project. This type of program can enable renters and condominium owners (among others) to have a stake in a tangible, local PV installation.

Participants in a community solar program can receive **virtual net-metering** benefits in exchange for their financial contribution to a solar project. This contribution can take the form of an up-front purchase of PV panels or a monthly charge on the customer's utility bill. As the community solar system generates electricity—which is typically fed directly into the grid—the participants get a utility-bill credit or some other agreed-on form of compensation for the electricity their share of the system produces. In certain cases, utilities guarantee a minimum amount of production under **virtual net metering** to encourage participation in the project. There could also be alternatives to virtual net metering, such as a separate payment from the utility for the electricity generated by the community solar project.

For the most part, the tax credits normally associated with solar installations are not available to participants in a community solar program. Some encouraging examples are found at the state level, however, where certain incentives are made available to members of a community solar project. In Washington State, participants in a community solar program are eligible to receive **production-based incentives** (PBIs) of up to $5,000 per participant per year through 2020. In Utah, community solar participants can take the 25% state income tax credit. As interest in community solar programs grows, the additional incentives available to single-owner solar installations will also, ideally, be available to participants in community solar projects.

Depending on how a community solar program is structured, certain issues arising from federal and state securities laws could be relevant. If an actual ownership stake in a community solar project is sold to participants with the expectation of some financial return on this investment, the project might need to be registered as a security. Typically, community leaders would prefer to avoid this process, which is why community solar projects are often legally owned by the utility instead of by the program participants themselves. In any case, have an attorney review the proposed structure before launching a community solar program.

If a community solar program is not feasible in a community, consider encouraging solar in the local utility's **green pricing** program. Green pricing programs allow utility customers to pay a premium on their utility bill to support renewable energy generation. This is another attractive option for residents and businesses that are unable to install solar on their own properties.

BENEFITS

Community solar projects create an opportunity to invest in **solar energy** for many people who can't currently install a PV system on their own rooftop. Virtual net metering enables participants to receive utility-bill credits or some other agreed-on form of compensation for the electricity produced by their share of the system. Participation levels in a community solar project can be tailored to meet different needs and budgets.

Implementation Tips and Options

- ☐ Survey the sectors of the community that would have the most interest in participating in a project to gauge interest, willingness to pay, and expectations of benefits. Learn whether prospective participants are interested in a positive financial return or if they're willing to support the project regardless of whether the economics are in their favor.
- ☐ Make sure that the utility is engaged from the start, because it's a primary participant in the project. Municipal utilities often have greater flexibility to pursue unique projects. Determine whether the utility will own and maintain the system or if another model would work better in the community.
- ☐ Determine what financial incentives are available (or could be made available) to participants in the program, including the ability to net meter virtually.
- ☐ Design a program that includes community input so that there's demand once it's launched.
- ☐ Decide whether the project will simply be located where physical conditions (solar resource, grid connection) are optimal or if public awareness and visibility also play a factor in siting the PV system.
- ☐ Have an attorney review the proposed program structure with an eye toward any potential securities issues. If not structured properly, a community solar project could be considered a financial investment opportunity which might make it subject to state and federal Securities regulations. Care should be taken to avoid this as it implies significant reporting requirements and potential liability for the project sponsors.

Examples

Sacramento, California: Subscribing to "Shares" in a Utility-Scale Photovoltaic System

In July 2008, the Sacramento Municipal Utility District (SMUD) launched an innovative green pricing program called SolarShares. The program, the first of its kind, allows customers to purchase a portion of the solar energy generated by a 1-megawatt PV installation in Sacramento County. SMUD purchases the output of the third-party-owned system and resells it to SolarShares customers for a fixed monthly fee based on customer electricity usage and the size of the block they choose to purchase. Customers can buy the output of 0.5-kilowatt increments up to 4 kilowatts. Participants currently spend an extra $4 to $50 on their electric bill each month, and SMUD credits the value of that generation to each participant's energy bill through virtual net metering. The program sold out the initial 1-megawatt PV system in the first 6 months, and enrollment has remained stable at about 700 participants. The following Web site has details on the district's SolarShares program: www.smud.org/en/community-environment/solar/pages/solarshares.aspx.

St. George, Utah: Setting the SunSmart Community Solar Program in Place

St. George's Energy Services Department (a municipal utility) and Dixie Escalante (a neighboring electric cooperative) together inaugurated a 100-kilowatt community PV system. With new funds available from the American Reinvestment and Recovery Act of 2009, the system is slated to more than double with the addition of another 150 kilowatts. The PV system will be expanded in 100-kilowatt increments based on demand.

Residents of the city of St. George and surrounding areas served by Dixie Escalante can purchase units in the SunSmart program in 0.5- and 1-kilowatt increments for $3,000 and $6,000, respectively, up to 4 kilowatts per customer. The participants own their shares for 19 years, at which point the city will determine whether to extend the program and, if so, whether any equipment repairs are necessary. Any repair costs will be passed on to program participants who renew their participation. Each month, customers receive kilowatt-hour credits on their utility bills, representing the amount of electricity generated by their share of the PV system. The credit is calculated at the retail rate of electricity (i.e., true net metering). The RECs associated with the project go to the city utility.

One unique aspect of the SunSmart program is that participants can take advantage of the 25% state tax credit available for PV along with St. George's solar rebate of $2/watt up to 3 kilowatts (participants cannot, however, receive the **federal investment tax credit**). The interesting thing about this tax policy, reportedly the first of its kind in the country, is that the tax credit is for a PV project that the program participant does not fully own and is not located on his or her private property. As such, participants who move to another home in St. George can either transfer their share to their new address or sell it with the old home. For more information on the program, see http://sgsunsmart.com/index.htm.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

PUBLICATIONS

Community Renewables: Model Program Rules

Interstate Renewable Energy Council, November 2010

This guide provides an overview of best practices in facilitating coinvestment in local renewable power facilities and outlines model community solar program rules.

Date, author, description stay the same.

Report: http://irecusa.org/wp-content/uploads/2010/11/IREC-Community-Renewables-Report-11-16-10_FINAL.pdf

Investing in Solar as a Community

Dana Hall, James Rose, and Laurel Varnado for Solar Today, March 2010

Magazine article: www.solartoday-digital.org/solartoday/201003?pg=31 - pg31

The Northwest Community Solar Guide

Bonneville Environmental Foundation, Northwest Sustainable Energy for Economic Development, 2009

This comprehensive guide covers all aspects of implementing a community solar project. It focuses on the Northwest, but has in-depth case studies, project economics, and information on various state and federal incentives.

Report: www.nwseed.org/documents/NW Community Solar Guide.pdf

Creating and Implementing Your Community Solar Plan

Solar Minnesota & the Minnesota Renewable Energy Society

This comprehensive solar manual describes a step-by-step analysis of the process of developing a community solar project. It has several Minnesota case studies, but the guide is useful for anyone interested in a community solar project.

Report: www.state.mn.us/mn/externalDocs/Commerce/Community_Solar_Plan_032509032652_CommunitySolarGuide.pdf

A Guide to Community Solar: Utility, Private, and Non-profit Project Development

Prepared for the National Renewable Energy Laboratory, November 2010

This guide is designed as a resource for those who want to develop community solar projects, from community organizers or solar energy advocates to government officials or utility managers. By exploring the range of incentives and policies while providing examples of operational community solar projects, this guide will help communities to plan and implement successful local energy projects. In addition, by highlighting some of the policy best practices, this guide suggests changes in the regulatory landscape that could significantly boost community solar installations across the country.

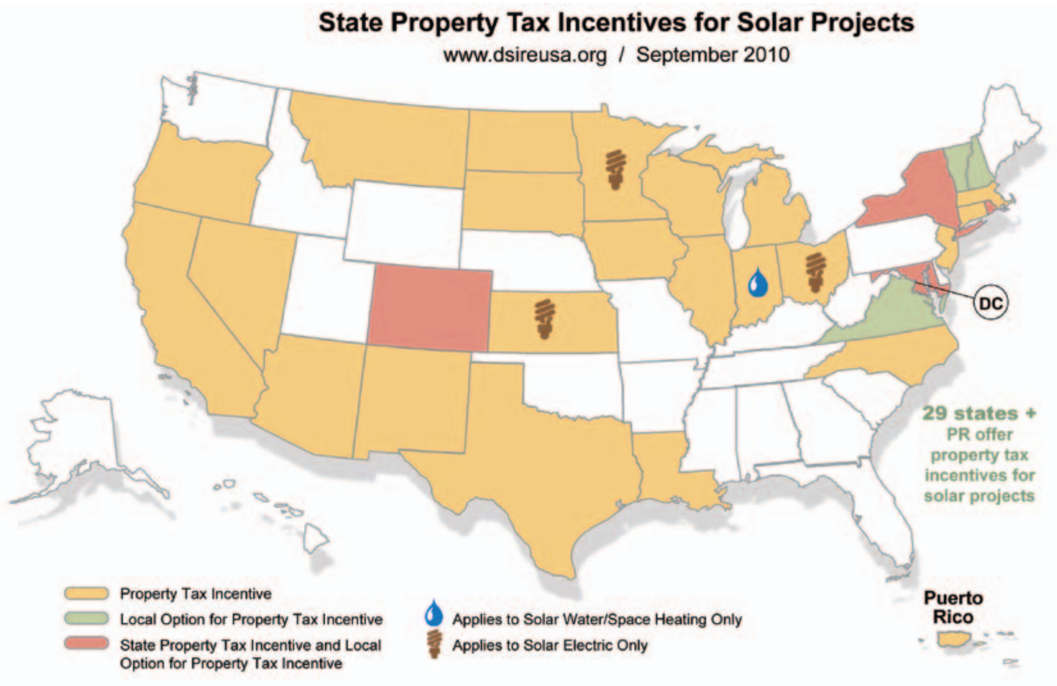
Report: http://solaramericacommunities.energy.gov/pdfs/A%20Guide%20to%20Community%20Solar.pdf

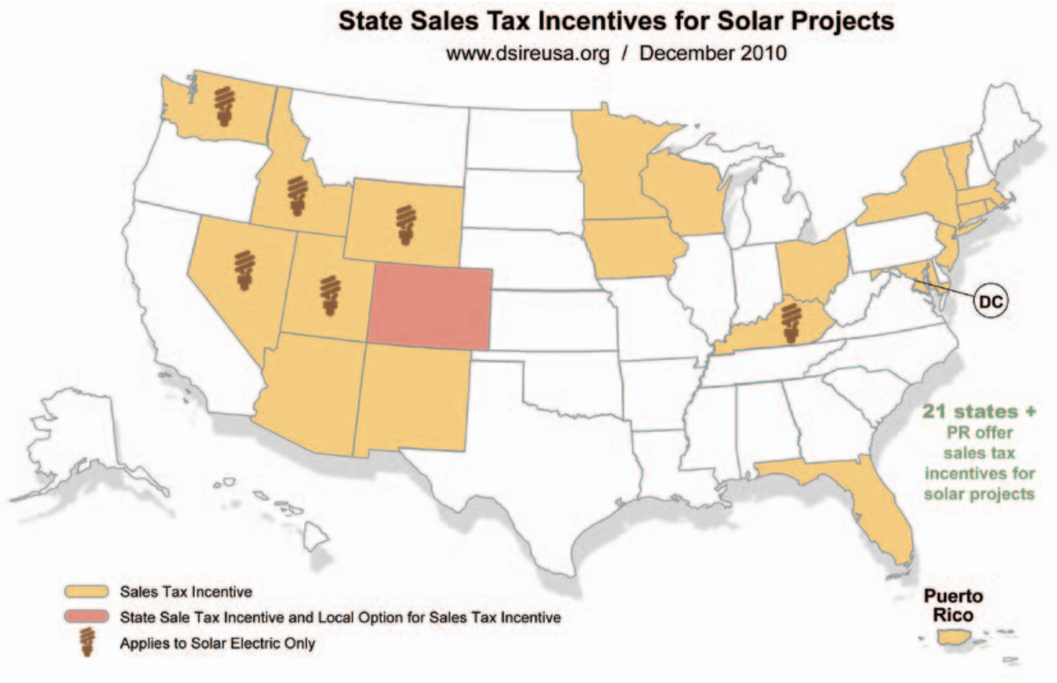
2.9

Property and Sales Tax Incentives

Property tax incentives for solar energy systems include exemptions, **tax abatements**, and tax credits. **Sales tax incentives** include exemptions from—or refunds of—sales tax for purchasing and installing solar energy components and systems. As of September 2010, 29 states plus Puerto Rico offer property tax incentives for solar projects, and 21 states plus Puerto Rico have sales tax incentives in place. Although property taxes can be levied at the state, county, municipal, or school district level, nearly all property tax dollars are collected at the local government level. State legislatures, however, set overall property tax policy and processes. In states where local governments have the authority to offer property tax incentives, a local government could use this authority to insulate residents and businesses from higher property taxes that might result from installing solar on their properties. Local governments can provide an additional incentive for solar installations by offering a significant property tax abatement or credit.

Sales tax exemptions reduce the investment costs associated with solar systems. Because the exemptions are typically not significant enough to reduce costs drastically, these types of incentives work best in places where complementary policies are in place to reduce the costs of solar equipment and installation. Although state legislatures have the authority to implement state sales tax policy, local governments may control a portion of sales taxes.





Note: For the most up-to-date information on states and municipalities with property and sales tax incentives for solar, visit www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1.

Property taxes vary widely by county, municipality, and state, ranging from 0.14% to 1.70%. Most states calculate taxes as a percentage of the assessed value of the property. Most property tax incentives for solar follow a simple model that excludes the added value of solar energy equipment in the property's tax valuation. Although the duration of most property tax incentives is indefinite, a few states allow the tax break for only a limited period, ranging from 5 years in Iowa and North Dakota to 20 years in Massachusetts. With a few exceptions, these policies apply to all types of buildings, to both **solar water heating** (SWH) and **photovoltaic** (PV) systems, and, in some cases, to **passive solar** as well. Some states specify that the systems must produce energy for on-site use.

Given the growth in large-scale solar installations and other facilities that generate electricity from renewable sources, a few states have developed separate property tax incentives for utility-scale renewables. These policies are designed to preserve at least a portion of property tax revenue for local governments or to assess the solar projects at a value comparable to that of a nonrenewable energy facility.

Sales tax rates vary by state, ranging from 2.9% to 7.0%, with most states falling between 4% and 6%. Five states don't have a sales tax (Arkansas, Delaware, Montana, New Hampshire, and Oregon). Thirty-six states also allow sales tax at the county, municipal, or special district level, adding between 1% and 8% in sales tax.

In some cases, states have granted local governments the authority to offer exemptions from local sales taxes for purchasing a solar energy system. Colorado, for example, authorizes counties and municipalities to offer local sales tax rebates or credits. State sales tax incentives for solar projects are usually a full exemption from the state portion of the sales tax on the cost of solar energy equipment. Buyers typically present a certificate of exemption to the seller. The seller retains the form to verify to the state that the sale was exempt from taxation. The exception is Idaho, where consumers get a sales tax refund instead of an up-front exemption.

Kentucky, Ohio, Utah, and Wyoming restrict the sales tax exemption to commercial buildings or to systems that meet certain minimum size requirements. Massachusetts and New York, on the other hand, offer the incentive only for residential systems.

BENEFITS

Property tax incentives for solar projects can encourage customers to install these technologies by reducing overall project costs. Sales tax incentives can encourage solar installations by reducing equipment costs. And when a local sales tax exemption is combined with state sales tax exemptions, a solar energy system becomes even more affordable for residents and business owners.

Implementation Tips and Options

- ☐ Evaluate whether or not property and/or sales taxes are a barrier to the development of a local solar market. Property tax rates and incentives can particularly affect the economic viability of **power purchase agreement** (PPA) projects because the third-party owners of the PV systems absorb these costs and will need to pass them on to the system host in the form of a higher PPA price.
- ☐ Determine whether the local jurisdiction is authorized to offer property and sales tax incentives.
- ☐ Find out if there is a precedent for reducing property taxes on solar energy systems in the county and state.
- ☐ Consider applying taxes on just a portion of the installed costs rather than the entire PV installation.
- ☐ Realize that in most cases offering a sales tax exemption for solar systems will not decrease sales tax revenues compared to past years but will simply not increase those revenues as more and more solar systems are installed.
- ☐ Establish separate property tax incentives for small- and large-scale solar installations.
- ☐ If community leaders decide to tax solar systems, consider setting aside a portion of the revenue to invest in energy efficiency or renewable energy projects, either directly or through an incentive or loan program.

Examples

Boulder, Colorado: Providing City Sales Tax Rebates for Solar Energy Equipment

The city of Boulder applies a portion of sales tax paid on solar energy equipment to a fund for solar system sales tax rebates in the ClimateSmart Solar Grant Fund. This fund supports both PV and SWH systems on housing in the city's permanently affordable housing program and on the facilities of nonprofit entities operating in the city.

New York City, New York: Offering Property Tax Abatement for Photovoltaic Systems

New York City allows property owners to deduct 8.75% of PV installation expenditures from their total real property taxes. Property owners who install solar energy systems can take the deduction annually for 4 years, with a total tax benefit of up to 35% of the installed system cost. In effect, this incentive is similar to an **investment tax credit** (ITC); it differs in that the tax benefits are recouped through reduced property taxes on the host property instead of through reduced income taxes. The first year the tax abatement was offered, 5 applications were accepted for 115 kilowatts of solar; 25 applications were accepted the second year (2009) totaling 515 kilowatts. In 2011 the abatement will begin to phase out and is scheduled to expire at the end of 2013.

New York State: Offering State Sales Tax Exemption for Solar Energy Equipment

New York State allows both homeowners and those renting a home, apartment, or condominium to apply for a sales tax exemption for solar energy systems. The state also authorizes cities and counties (including New York City) to grant this exemption from their local sales taxes. The New York Department of Taxation and Finance publishes a variety of sales tax reports detailing tax rates and exemptions for local governments across the state, including those for solar equipment.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org/solar/incentives/index.cfm?EE=1&RE=1&SPV=1&ST=1&searchtype=Property&solarportal=1&sh=1 and www.dsireusa.org/incentives/index.cfm?SearchType=Sales&EE=0&RE=1

These pages of the DSIRE Web site include a full listing of property and sales tax incentives for renewable energy in the United States. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with the Interstate Renewable Energy Council (IREC), is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy (DOE) funds this ongoing effort.

States Advancing Solar

www.statesadvancingsolar.org

States Advancing Solar is an initiative of the Clean Energy Group, a nonprofit advocacy group working on clean energy and climate change issues. The Web site explains many financial incentives, including sales and property tax incentives.

3.0

UPDATING AND ENFORCING LOCAL RULES AND REGULATIONS

A 100 kW system on single axis trackers on a reservoir deck featured in Tucson, Arizona. (City of Tucson/ PIX18040)

The legal and regulatory framework in a community forms the foundation for building a sustainable solar infrastructure. Effective and streamlined local rules and regulations help reduce installation costs and can significantly improve the market environment for solar energy technologies. State and local governments have overlapping authority in some regulatory areas; other areas fall exclusively under local jurisdiction. In fact, some of the most critical barriers to widespread adoption of solar energy can be removed only by local governments.

This section will help community leaders identify which rules and regulations are in place in their community, and where they can make improvements to accelerate solar energy development.

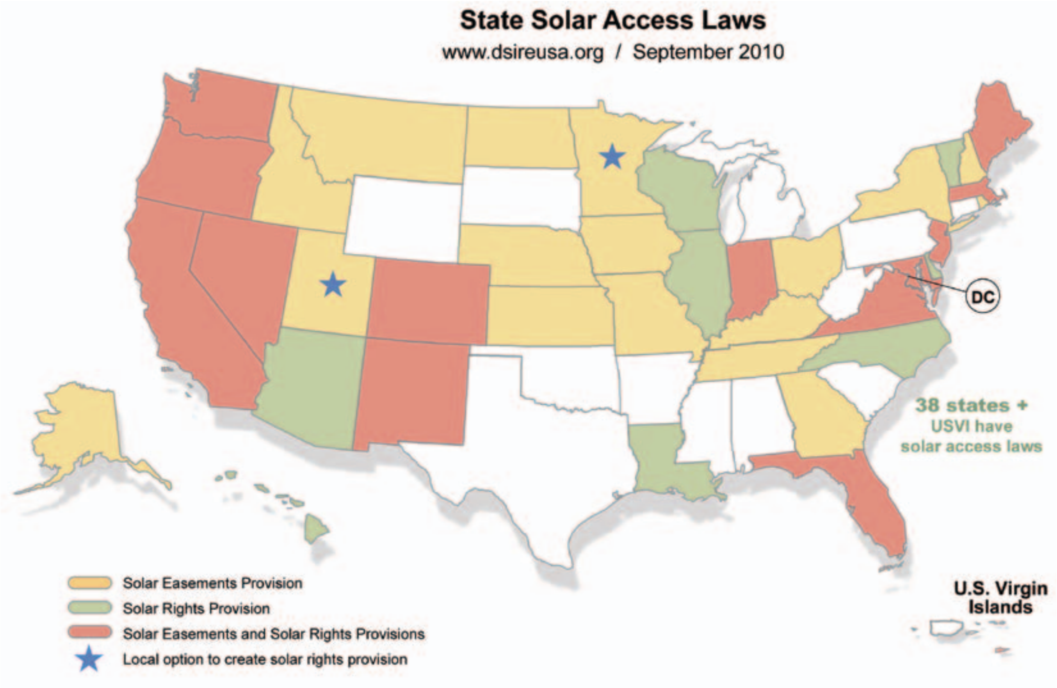
	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tucson
3.1 Develop or Improve Solar Access and Solar Rights Laws						●			●	●				●				●				●		●		●
3.2 Develop Solar-Ready Building Guidelines			●		●																●		●			●
3.3 Streamline and Improve Solar Permitting and Inspection Processes				●	●	●		●	●	●	●	●	●		●		●	●	●		●	●	●		●	●
3.4 Conduct Code Official Training		●	●	●	●	●	●	●	●	●	●	●	●	●			●		●	●		●	●	●	●	●
3.5 Promote Installer Licensing and Certification			●						●	●	●	●		●	●		●		●	●		●				●

Data current as of August 2010

3.1

Solar Access and Solar Rights Laws

To harness the sun's energy, a property owner must have access to sunlight and have the right to install a **solar energy** system that converts that sunlight into usable energy. **Solar access** is most commonly protected through solar easements or ordinances, and solar rights typically must be granted by statute or ordinance. Solar access and solar rights are important issues for local governments to address because—despite the growing support for solar energy at state and local levels—many consumers still encounter local ordinances or homeowners' association rules that prohibit or restrict solar energy system installation. Owners of existing systems can also face challenges when their solar equipment is shaded by growing trees or new structures on neighboring propertie.



Thirty-six states and the U.S. Virgin Islands protect solar access or solar rights (see map). Local governments also have the authority to adopt policies that support solar access and **solar rights**. Solar access can be protected through **solar easements**, which are legal agreements that protect access to sunlight on a property. Access to sunlight means that one property can continue receiving sunlight across property lines without obstruction from landscaping or structures on a neighboring property. Easements can be creatively negotiated to have flexible conditions and terms, including potential compensation requirements if a neighbor interferes with access to sunlight. Solar easements are typically transferred with the property title, and don't terminate unless specified by the easement's conditions. Solar easements are usually voluntary, which limits their effectiveness because system owners have no guarantee of an agreement with a neighbor.

Local governments can create more proactive solar easement processes to help protect solar access, such as a **solar access permit** structure. In this model, a solar easement is automatically created when a property owner receives a permit to install a solar energy system. Local governments can also set forth a degree of solar access protection by specifying certain setbacks in zoning ordinances, so that buildings are constructed far enough apart that they would be unlikely to shade neighboring roofs.

Solar rights laws limit or prohibit restrictions (by neighborhood covenants and bylaws or local government ordinances and building codes) on solar energy system installation. About a dozen states have passed solar rights laws. The laws vary in the types of buildings covered, their applicability to new versus existing construction, and the enforcement of rights. Vague or absent provisions in solar rights laws have led to legal action and installation delays in several of these states.

BENEFITS

Solar access and solar rights laws encourage the adoption of solar energy by increasing the likelihood that properties will receive sunlight suitable for solar energy production, protecting the rights of property owners to install solar systems, and reducing the risk that systems will be shaded and compromised once installed. By logically incorporating solar energy considerations into zoning codes and ordinances, local governments can bring clarity to the responsibilities of various parties, achieve balance between stated government priorities, and avoid costly and time-consuming legal action.

Implementation Tips and Options

- ☐ Revise any local ordinances that pose unintended obstacles. Well-intentioned ordinances such as building-height restrictions or aesthetic requirements can inadvertently restrict solar energy system installation. In many cases, a community can modify these ordinances to serve the original purpose without preventing property owners from installing solar systems.
- ☐ Consider a solar access permit scheme that links solar permits to the creation of solar easements.
- ☐ Set standards for new construction that include east–west street and building orientation, landscaping that doesn't shade solar energy systems, and dedicated solar easements for newly constructed buildings.
- ☐ Establish solar access protections for commercial properties in addition to residential buildings.
- ☐ Require written solar easement agreements that adhere to the same recording and indexing requirements as those for other property interests.

- ☐ Conduct outreach and make an information center available to educate residents, businesses, and homeowners' associations about solar access and solar rights.
- ☐ Include the following elements when developing solar rights policies and ordinances:
  - Define the type of solar energy equipment protected by the law (e.g., **photovoltaics** [PV], **solar water heating** [SWH], or solar space heating and cooling).
  - Set a clear and quantifiable standard for what constitutes an unreasonable restriction on solar energy systems. A restriction that increases the cost of a system by 10%, for example, could be considered unreasonable.
  - Define the types of structures covered by the law (e.g., commercial buildings, residences including single-family homes and multitenant complexes, garages, and other structures).
  - Award costs and reasonable legal fees to the prevailing party for civil actions with homeowners' associations.
  - Don't restrict solar energy systems because of aesthetics.

Examples

Ashland, Oregon: Protecting Solar Access Through Setbacks and Permits

In 1981, Ashland passed one of the first citywide solar access protection ordinances in the United States. This ordinance contains solar setback provisions designed to ensure that shadows at a northern property line don't exceed a certain height, depending on the zone in which the property is located. The ordinance allows for a 16-foot shadow at the northern property line of commercial properties and a 6-foot shadow along the same property line of residential properties. In addition, property owners can apply for a solar access permit for protection from shading by vegetation.

Madison, Wisconsin: Allowing Solar Energy Systems in Historic Districts

Madison formerly prohibited solar installations in some historic districts on the grounds that "solar apparatus is not compatible with the historic character of the district." In other districts, solar could be denied based solely on aesthetics. These provisions were actually illegal, based on state statutes. The city amended its ordinance to allow solar installations in historic districts and created a permitting process for solar installations in these districts and on landmark properties. The new ordinance allows for an easy staff-level permit as opposed to a more cumbersome committee approval process.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org/solar/incentives/index.cfm?EE=1&RE=1&SPV=1&ST=1&searchtype=Access&solarportal=1&sh=1

This page of the DSIRE Web site includes a full listing of state and local solar access laws in the United States. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with the Interstate Renewable Energy Council (IREC), is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy (DOE) funds this ongoing effort.

Rules, Regulations, and Policies: Solar Access Laws

www.statesadvancingsolar.org/policies/policy-and-regulations/solar-access-laws

States Advancing Solar is a Clean Energy Group initiative. The objective is to supply information and assistance to state policy makers and renewable energy programs in developing effective solar programs. The Web site contains a section on solar policies, rules, and regulations, including solar access laws.

PUBLICATIONS

Shadows on the Cathedral: Solar Access Laws in a Different Light

Troy A. Rule, University of Missouri School of Law, 2010

This article applies Calabresi and Melamed's "Cathedral" framework of property rules and liability rules to compare and analyze existing solar access laws and to evaluate a model solar access statute recently drafted under funding from DOE.

Article: http://ssrn.com/abstract=1466224

Renewable Energy and the Neighbors

Troy A. Rule, University of Missouri School of Law, 2010

This article analyzes conflicts between states and communities over land use laws that restrict distributed renewable energy. Framing these conflicts as clashes over scarce "entitlements" to regulate, the article explores the possibility of using liability rule-like approaches to more efficiently allocate these entitlements between states and local governments.

Article: http://ssrn.com/abstract=1649090

Solar Access: Recommendations for the City and County of Denver (Draft)

Prepared by Hannah Muller for GreenPrint Denver, March 2009

This report gives an overview of solar access and solar rights issues and recommends ordinances and enforcement mechanisms for Denver.

Report: www.solaramericacommunities.energy.gov/PDFs/Solar_Access_Recommendations_City_And_County_Of_Denver.pdf

A Comprehensive Review of Solar Access Law in the United States: Suggested Standards for a Model Statute and Ordinance

Solar America Board for Codes and Standards, October 2008

The Solar America Board for Codes and Standards (Solar ABCs) is a DOE-funded central body created to address solar codes and standards issues. This comprehensive review of solar access law across the United States suggests standards for a model statute and ordinance.

Report: www.solarabcs.org/solaraccess/Solaraccess-full.pdf

3.2

Solar-Ready Building Guidelines

Local governments can encourage or require homebuilders and developers to design and build **solar-ready** homes and commercial buildings, so architects and builders can choose viable sites for solar technologies. In the past, the high initial cost of **photovoltaics** (PV), **solar water heating** (SWH), and **solar ventilation preheating** (SVP) systems has prevented them from being included in new construction. With better incentives, technological improvements, and rising conventional power prices, however, energy from solar sources is becoming more cost competitive. Solar-ready buildings are well positioned to take advantage of an environment that's more favorable to renewable energy. Buildings that are not solar ready could render solar installation technically impossible, or the added costs of making infrastructure changes could make solar applications economically prohibitive. Lack of appropriate space on buildings for solar installations has proven to be a significant barrier for many customers wishing to install solar. Planning for the eventual installation of a solar system when designing a building can significantly improve the economics of the investment. Solar-ready building modifications are low- to no-cost at the time of new construction or retrofit and often very costly later in the building's life. By understanding and accounting for solar energy system requirements during the building design phase, installation efficiency can be maximized, costs can be minimized, and system performance can be optimized.

Promoting energy efficiency standards for solar-ready buildings provides additional benefits because a more efficient building requires a smaller solar energy system than it would if the building were operating inefficiently. By encouraging energy efficiency improvements, local governments can promote smart investments in solar energy systems.

BENEFITS

Creating solar-ready guidelines and promoting energy efficiency at the outset can help make future solar installations easier and more cost effective.

Implementation Tips and Options

- ☐ Encourage or require builders and developers to design solar-ready homes, buildings, and developments. A few crucial design considerations can greatly reduce the cost of a solar installation later in the building's life, but at the design stage, these changes are often cost neutral. They include the following:

- Minimize rooftop equipment or cluster equipment on the north side of the roof to maximize available open area for solar array placement.
- Optimize system performance; if the roof is sloped, use the south-facing section; keep the south-facing section obstruction-free if possible.
- Plan for the structure to be oriented to avoid shading from trees and buildings, especially during peak sunlight hours.
- Install a roof that will support the extra loads of a solar array.
- Record roof specifications on drawings; this shows solar designers that the roof was designed to support solar and can prevent a potentially costly engineering study.

☐ Improve building energy standards and policies for local government facilities to make solar energy systems more cost effective and increase local government use of clean energy by promoting the following:

- Equipment procurement policies that mandate using the most energy-efficient equipment available, such as devices that meet federal ENERGY STAR requirements
- Life-cycle cost analysis for all materials and equipment
- Green building and solar-ready design for all new buildings and major renovations
- Installing PV or SWH systems on suitable municipal facilities. See 7.0 Leading by Example with Installations on Government Properties.

Examples

Tucson, Arizona: Requiring All New Residences To Be Solar Ready

In June 2008, the mayor and Tucson City Council unanimously voted to require all new residences in Tucson be solar-ready for PV and SWH systems. The new SWH rules went into effect on March 1, 2009, followed by the new PV rules on July 1, 2009. To obtain a building permit, builders and developers of single-family homes and duplexes must include in the plans an SWH system or a stub-out for a later installation. Arizona tax code allows developers to take a state tax rebate of $75 or the actual cost of the stub-out. The PV rules specify that plans must include space for inverters and other equipment and plans for slots in the service panel to accommodate a future PV installation.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

PUBLICATIONS

Solar-Ready Buildings Planning Guide

National Renewable Energy Laboratory, December 2009

This guide identifies the important aspects of building design and construction to enable installation of solar systems after the building is constructed. It discusses important system requirements for PV, SWH, and SVP systems. Attention to these guidelines when developing building codes or any building- or community-related regulations, as well as during building design, could significantly improve the performance and minimize the cost of solar systems.

Report: www.nrel.gov/docs/fy10osti/46078.pdf

A Step by Step Tool Kit for Local Governments to Go Solar

California Energy Commission's New Solar Homes Partnership, December 2009

This tool kit contains an array of strategies and options that local governments can use to help encourage solar developments. It also discusses approaches for promoting solar through a local green building program. Also included is a model ordinance to adopt a solar energy education program to inform local builders and developers of the benefits and incentives of integrating solar energy technologies into new residential developments.

Report: www.energy.ca.gov/2009publications/CEC-180-2009-005/CEC-180-2009-005.PDF

A Homebuilder's Guide to Going Solar

U.S. Department of Energy, December 2008

This guide assists homebuilders who are contemplating solar-ready or solar homes. It helps them decide whether to install solar energy systems on homes or to make homes solar ready, and helps quantify the benefits for home buyers.

Report: www.eere.energy.gov/solar/pdfs/44792.pdf

The owners of this home installed a triangular shaped PV array system so as not to compromise the design integrity of this historical home. (Vipin Gupta/PIX17930)

3.3

Streamlined Solar Permitting and Inspection Processes

Local jurisdictions typically require a building and/or electrical permit before installing a **photovoltaic** (PV) system and a plumbing and/or mechanical permit before installing a **solar water heating** (SWH) system. Installers obtain permits after an installation is under contract, but before they begin putting in the system. The purpose of permits is to ensure that a solar installation meets engineering and safety standards. Following installation, an inspector will typically verify that the installation complies with code. When the final inspection is completed and approved, the system can begin operation. PV systems need to be approved for **interconnection** by the serving utility before they can begin to operate.

These processes exist for good reason and are legally required in much of the United States. Reasonable requirements can serve as a useful tool for local governments to ensure public safety and track installations in their communities. At the same time, the process of obtaining permits can substantially increase the time and cost of installing a solar system, often becoming a major obstacle to solar market development. Permitting requirements and processes can vary greatly between jurisdictions, presenting informational and logistical challenges to installation contractors working across those jurisdictions. And in some areas, it can take months to complete the plan review process and obtain a permit. Unreasonable requirements can add burdensome costs to local governments, installation contractors, and solar energy system owners.

Several cities have streamlined the **solar permitting process** with clearly defined requirements, expedited processing for standard installations, and the option to submit paperwork online. Some local governments are going a step further and working with other jurisdictions in their regions to make the permitting requirements and process consistent across jurisdictions and throughout the state. Most of the codes and standards for PV installations are national in scope. Even though state requirements for construction contracting do vary throughout the United States, consistent solar permitting standards across the nation should be achievable despite these state contracting differences.

Costs in the permitting process vary widely across the country. Permit fees, which are set by local jurisdictions, also run the gamut—from no fees to more than $1,000 per solar permit. Cities typically set solar permit fees using a flat-fee method, a valuation method, or a combination of the two. Flat-fee assessments charge the same fee regardless of system size. Valuation-based fees are calculated based on the cost of the solar system. Several cities have changed the method behind PV system valuation, subtracting the cost of the actual solar panels from the total cost of the project before calculating the fee. Solar panels, or modules, can represent approximately half the cost of a PV system.

Permit fees are often the focus of concern, but a broader view of cost includes costs to the contractor, jurisdiction, and system owner. Waiving or discounting fees for local building permits, plan-checking, or design review can support local solar market growth. Online document submittals and predictable review schedules, though, can yield greater savings to a project than waiving fees. The key is to develop a process that reduces costs to all stakeholders while maintaining or improving public safety. Even though permit fees are set locally, states can establish standards for municipalities and counties. And although **permitting incentives** alone will not drive solar development, a community can use this important local policy option to complement other federal, state, local, or utility policies.

BENEFITS

Simplifying permitting requirements and processes can increase the likelihood of successful solar installations and save significant time and money for local governments as well as installation contractors and system owners. Creating consistent permitting processes across a state or region benefits solar installers by providing a standard set of operating procedures, reducing uncertainty, and allowing them to produce more accurate estimates. Standardization can also enable jurisdictions to pool resources and share plan checking and inspection staff. And by reducing local permit fees, or adopting fast-track permitting for solar projects, local governments can demonstrate their support for community investment in solar.

Implementation Tips and Options

- ☐ Understand the entire permitting and inspection process for PV and SWH systems and the dynamics among the entities involved (installation contractors, consumers, various city departments and inspection officials, and the local utility).
- ☐ Simplify permit application forms and review processes and leverage resources by coordinating permitting procedures with nearby jurisdictions and providing training to educate building and electrical inspectors about PV and SWH technologies and installations. See 3.4, Conduct Code Official Training.
- ☐ Outline the permitting and inspection process in the community so that prospective solar system owners and solar contractors have a clear understanding of the steps for local approval.
- ☐ Allow over-the-counter building permits for standard residential solar energy systems. Requirements for a prescriptive over-the-counter plan review often include maximums on wattage, distributed weight, and height of the system. Consider instituting a flat-fee method that reflects the actual costs of issuing the permit. The Sierra Club recommends that all cities reduce their solar permit fees to $300 or less for residential PV systems that are flush-mounted to rooftops. The $300 fee is based on the cost of 2 to 4 hours of labor for experienced building department staff members to process the permit and complete the inspection. in 2009, the Solar America Board for Codes and Standards (Solar ABCs) produced a report on expedited permitting process that suggests the following fee guidelines: $75–$200 for small PV systems (up to 4 kilowatts); $150–$400 for large PV

systems (up to 10 kilowatts); and \$15–\$40 per kilowatt for systems above 10 kilowatts. See www.solarabcs.org/permitting for more information.

- ☐ Publicize the fee structure on the permitting agency's Web site along with the required procedures explained in the simplest possible terms.
- ☐ Allow document exchanges to be conducted by company representatives. Some jurisdictions require that licensed electricians pick up permits; this can place an unnecessary burden on installation firms.
- ☐ Fast-track solar permits to the extent appropriate (e.g., for standard residential installations or those from contractors with a reliable track record).
- ☐ Establish a clear path for communications between code enforcement offices and the local utility provider to expedite the interconnection and inspection processes.

Examples

Portland, Oregon: Processing Permit Applications Electronically

Portland's Bureau of Development Services (BDS) developed an electronic permit submittal process for solar installers, making it easier than ever to get residential solar building permits. For qualified projects, installers can e-mail the permit application to the city and expect a review within approximately 2 working days. Permits were also set to a flat fee for residential installations meeting certain requirements; fees for commercial systems use a reduced-valuation method. Contractors can submit multiple applications at the same time, and receive an e-mail when the permits are approved and ready. They can then pick up and pay for the permits at the BDS desk. These changes created certainty for the contractors, and were easy-to-implement, low-tech solutions that have given Portland's solar installers a real business benefit. BDS also trained staffers at the permitting desk as solar experts and set aside weekly times for solar contractors who need help filing their permits in person. Additionally, the Bureau of Planning and Sustainability worked with BDS to develop testing guidelines and best practices for installing solar energy systems on standing seam metal roofs and for installations with ballasted racking systems. For more information on Portland's residential and commercial permitting process for solar energy installations, visit www.portlandonline.com/OSD/index.cfm?c=47394&.

San José, California: Streamlining the Permitting and Inspection Process

In San José, electrical permits for PV systems can be obtained over the counter using a simple checklist. Building permits can be waived for roof installations if the installation meets the following criteria:

- The total panel weight (including frame) is no more than 5 pounds per square foot.
- The maximum concentrated load at each point of support does not exceed 40 pounds.
- The maximum height above the roof surface does not exceed 18 inches.

San José also schedules the post-installation inspection by appointment, usually within a 2-hour window. In some jurisdictions, only a specific day is specified and contractors are sometimes expected to wait for up to 8 hours for the inspector to arrive. This increases the contractor's labor costs and therefore the price the customer pays for the solar system.

The city of San José supplies valuable information on obtaining permits and scheduling inspections, along with property information, past permit history, and zoning information on any property in the city at www.sanjoseca.gov/building. Users can also apply for permits and schedule inspections online.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Solar America Board for Codes and Standards

www.solarabcs.org

The Solar ABCs is a central body created to address solar codes and standards issues. The U.S. Department of Energy (DOE) funds Solar ABCs.

SolarTech: Making Solar Happen

www.solartech.org

SolarTech is a PV industry consortium focused on creating a Solar Center of Excellence in the Silicon Valley. Its goal is to identify and resolve inefficiencies inherent in the delivery of PV systems, and the consortium is developing a set of best practices for permitting PV systems.

Vote Solar: Project Permit

http://votesolar.org/city-initiatives/project-permit/

This Web site allows users to compare the PV permitting process in various communities across the country, and to upload information on the process in their own community.

PUBLICATIONS

Commercial Solar Permit Fee Report

Sierra Club, October 2010

This study reviews commercial permit fees in Northern California. The report includes a detailed list of recommendations for municipalities interested in reducing permit fees and streamlining the permitting process.

Report: http://lomaprietaglobalwarming.sierraclub.org/CommercialPVSurvey.php

Field Inspection Guidelines for PV Systems

Prepared by Bill Brooks for the Interstate Renewable Energy Council, June 2010

This 2010 update to the 2006 edition consolidates the most import aspects of a field inspection into a simple process that can be performed in as few as 15 minutes. Explanation and illustrative pictures are provided to instruct the inspector on the specific details of each step.

Publication: http://irecusa.org/wp-content/uploads/2010/07/PV-Field-Inspection-Guide-June-2010-F-1.pdf

Addressing Institutional Barriers: Opportunities for Streamlining Solar PV Project Timelines

SolarTech Industry Analysis in collaboration with the California Solar Energy Industries Association (CALSEIA), January 2010

In this study SolarTech provided the specific recommendations describing the institutional barriers inhibiting the market acceleration of PV to meet the California Solar Initiative (CSI) goals. This report focuses on proposing methodologies for improving overall project end-to-end cycle times for distributed generation PV projects.

Report: http://solartech.org/index.php?option=com_st_document&view=documentdetail&id=17&Itemid=92

A Step by Step Tool Kit for Local Governments to Go Solar

California Energy Commission's New Solar Homes Partnership, December 2009

The tool kit contains an array of strategies and options that local governments can implement to help encourage solar developments. It discusses incentive and rebate options, focusing on streamlined permitting and permit fee reductions or waivers for solar energy installations, and also includes a model ordinance for a permit fee waiver for residential solar installations.

Report: www.energy.ca.gov/2009publications/CEC-180-2009-005/CEC-180-2009-005.PDF

Expedited Permit Process for PV Systems: A Standardized Process for the Review of Small-Scale PV Systems

Solar America Board for Codes and Standards, October 2009

The expedited permitting process described in this report simplifies the technical requirements for PV contractors submitting an application for construction of a new PV system while also facilitating the efficient review of the application's electrical and structural content by the local jurisdiction awarding the permit.

Report: www.solarabcs.org/permitting

Solar Electric Permit Fees in Northern California: A Comparative Study

Sierra Club, December 2008

This study compares the progress of 131 municipalities in Northern California striving to make permit fees for residential solar energy installations affordable. The report includes a detailed list of recommendations for municipalities interested in reducing permit fees and streamlining the permitting process.

Report: www.lomaprieta.sierraclub.org/global_warming/pv_permit_study.pdf

Taking the Red Tape Out of Green Power: How To Overcome Permitting Obstacles to Small-Scale Distributed Renewable Energy

Network for New Energy Choices, September 2008

The Network for New Energy Choices reviews a wide variety of political perspectives and priorities expressed in a range of local permitting rules in this publication. The report suggests how existing rules can be altered to support growing renewable energy markets.

Report: www.newenergychoices.org/uploads/redTape-rep.pdf

Inspector Guidelines for PV Systems

Pace University Law School, Renewable Energy Technology Analysis Project, March 2006

These guidelines are a framework for inspecting and permitting PV systems. They are divided into two stages: plan checking and field inspection. The objective of these guidelines is to facilitate the installation of safe PV systems at minimal cost.

Report: www.irecusa.org/fileadmin/user_upload/NationalOutreachPubs/InspectorGuidelines-Version2.1.pdf

3.4

Code Official Training

Code officials are primarily responsible for enforcing structural, building, electrical, plumbing, fire, or other codes required by the local government. An organization that enforces the various relevant codes is often referred to as the **authority having jurisdiction** (AHJ). Solar systems that aren't code-compliant could present a risk to building occupants, system owners, the public, solar technicians, and other contractors. Local governments or AHJs generally require solar systems to be installed in a two-step process. Installers must first receive a permit from the local government to begin the project. Permits are issued based on approved information required by the local government, such as engineered designs, equipment specifications, and electrical or structural schematics. After the installation is completed, the code official inspects the system for compliance based on the information submitted in the permitting application. Many code officials are unfamiliar with solar energy technologies, causing improperly installed systems to be approved when they should have been corrected. Inexperienced inspectors can also unnecessarily delay a project because they're concerned that they might approve an installation that isn't up to par. Fortunately, training can demystify solar systems, streamline the permitting and field inspection process, and help ensure safety.

BENEFITS

The benefits of training code officials are to promote safety in the installation process and to expedite the inspection, saving time and money for the system owner, the solar contractor, and AHJs.

Implementation Tips and Options

- ☐ Adopt the most recent version of the *National Electric Code®* (NEC). Although official adoption of versions of the NEC varies in each state, changes in the NEC related to **photovoltaic** (PV) systems can have a significant impact on the quality and safety of these systems. Some local jurisdictions have created special ordinances to adopt the latest NEC version for PV systems even when the state or region is operating under an earlier code version.
- ☐ Identify the various permitting and inspection departments that issue building, electrical, and plumbing permits for PV and **solar water heating** (SWH) systems.
- ☐ Inquire about code official training by contacting organizations that conduct training and education in solar or related trades, as well as local universities, colleges, and training institutions.

- ☐ Collaborate with local solar industry representatives, code officials, and training institutions to identify gaps, needs, and barriers to developing a safe and efficient installation and inspection process.
- ☐ Set up training courses for code officials. Collaborate with other nearby jurisdictions to leverage resources where appropriate.
- ☐ Work with state code and standards authorities to determine whether continuing education units (CEUs) can be offered for the training. Offering CEUs gives code officials additional incentive to attend.

Examples

Salt Lake City, Utah: Organizing a Photovoltaic/*National Electric Code* Training Workshop

In 2008, the Solar Salt Lake leadership team coordinated with the Utah State Energy Program, the Utah Solar Energy Association, Salt Lake Community College, and St. George Energy Services to organize and promote two Solar PV/NEC Code Training Workshops hosted by national expert John Wiles. The workshops targeted solar installers, city/county code officials, electricians, and building inspectors. The Utah Division of Occupational and Professional Licensing offered CEUs. The two workshops attracted more than 300 officials and were a huge success.

Seattle, Washington: Training City Staff on the *National Electric Code*

In 2009 and 2010, Seattle hosted a series of NEC training sessions. Taught by a nationally recognized code expert, the sessions focused on the section of the code that specifically deals with PV. The sessions gave a thorough overview of what's required under the code, addressed commonly seen installation mistakes, explained what to look for in an electrical inspection, and offered ideas on how permitting departments could streamline and simplify their processes. Participants were eligible for six CEUs through the Washington Department of Labor and Industries. More than 250 contractors, utility personnel, and electrical inspectors attended the sessions.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Solar America Board for Codes and Standards

www.solarabcs.org

The Solar America Board for Codes and Standards (Solar ABCs) is a central body, funded by the U.S. Department of Energy (DOE) and created to address solar codes and standards issues.

Southwest Technology Development Institute's Codes and Standards Resource Page

www.nmsu.edu/~tdi/Photovoltaics/Codes-Stds/Codes-Stds.html

This Web site contains information on code requirements and installation techniques used by installers and systems integrators.

PUBLICATIONS

Field Inspection Guidelines for PV Systems

Prepared by Bill Brooks for the Interstate Renewable Energy Council, June 2010

This 2010 update to the 2006 edition consolidates the most import aspects of a field inspection into a simple process that can be performed in as little as 15 minutes. Explanations and illustrative pictures are included to instruct the inspector on the specific details of each step.

Publication: http://irecusa.org/wp-content/uploads/2010/07/PV-Field-Inspection-Guide-June-2010-F-1.pdf

Photovoltaic Power Systems and the 2005 National Electrical Code: Suggested Practices

Southwest Technology Development Institute, New Mexico State University, Updated March 2010

This manual examines the requirements of the 2005 National Electrical Code as they apply to PV power systems. It includes the design requirements for the balance-of-system components in a PV system, including conductor selection and sizing, over current protection device rating and location, and disconnect rating and location. Stand-alone, hybrid, and utility-interactive PV systems are covered. Applicable sections of the NEC are cited.

Report: www.nmsu.edu/~tdi/Photovoltaics/Codes-Stds/PVnecSugPract.html

Inspector Guidelines for PV Systems

Pace University Law School, Renewable Energy Technology Analysis Project, March 2006

The guidelines in this report are a framework for inspecting and permitting PV systems. They are divided into two stages, plan checking and field inspection. The objective of these guidelines is to facilitate the installation of safe PV systems at minimal cost.

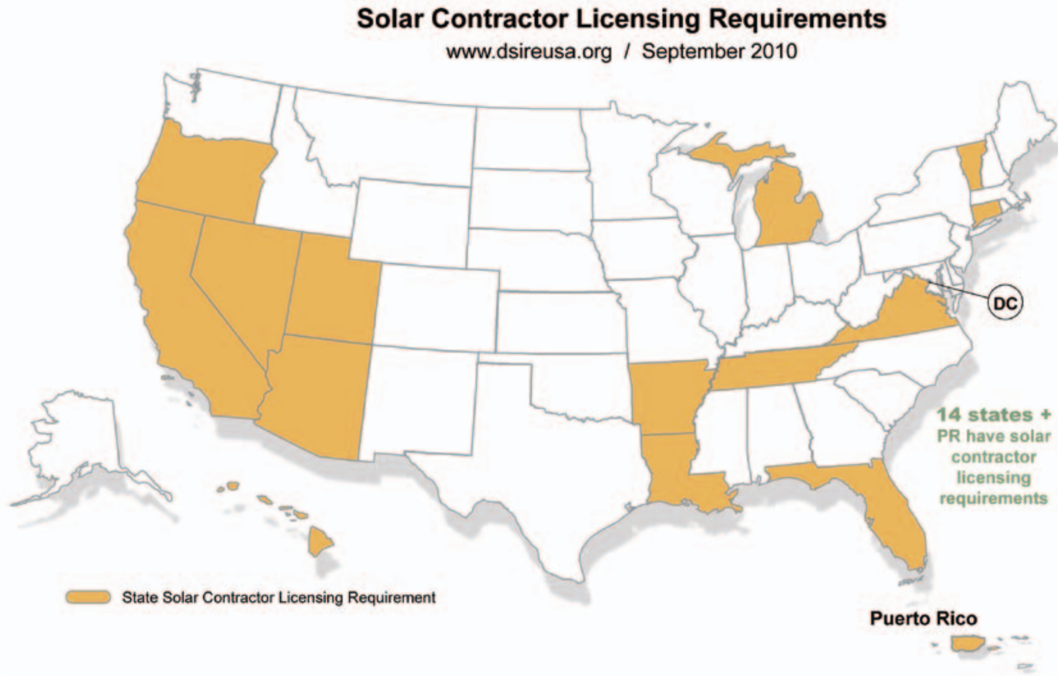
Report: www.irecusa.org/fileadmin/user_upload/NationalOutreachPubs/InspectorGuidelines-Version2.1.pdf

3.5

Installer Licensing and Certification

State regulation and licensing of solar contractors continues to evolve as the industry matures. Typically, states require **solar water heating** (SWH) installers to hold a plumber's license and **photovoltaic** (PV) installers to hold an electrical license. Approximately 10 states have defined a specialized solar contractor's license (see map). In most cases, these are specialties within the electrical and plumbing classifications and are required for contractors who don't hold a plumber's or electrical license. Solar expert Jim Dunlop, P.E., formerly of the National Joint Apprenticeship and Training Committee (NJATC) and the Florida Solar Energy Center (FSEC), summarizes the need for licensing:

> Most solar energy systems are not fully integrated, listed equipment like a plug-and-cord appliance that can be simply installed by the consumer. Rather they are a field assembly of electrical components and hardware subjected to building codes and construction standards and their installation is considered a skilled craft trade that should be performed by properly trained, qualified journeypersons and licensed contractors ("Installations Licensure and Qualifications for Solar Energy Systems." *IAEI News*, September–October 2008).



Licensing, which is conferred by government agencies, is a legal requirement to practice a trade or profession. Certification, though, is a voluntary credential, often awarded by industry stakeholder groups or associations. Licensing is mandatory in most jurisdictions, and certification could be preferred by the consumer or even linked to obtaining a local license.

Certification indicates that an individual or company meets certain standards established by the certifying body. Encouraging national certification is recommended if local governments want to keep pace with national standards developed by a large base of stakeholders. The North American Board of Certified Energy Practitioners (NABCEP) offers one national certification program for PV and SWH system installers. NABCEP's program is an independent and voluntary industry certification program. NABCEP currently certifies PV and SWH installers, and is also developing a certification for PV technical sales professionals. The technical sales certification will cover site and energy consumption analysis, economic and production performance calculations, initial component selection, and customer expectation management.

Candidates for the PV installer certification qualify based on documented PV systems training and installation experience (there is a prerequisite for a minimum amount of installation experience as the responsible person on the job site). Candidates must pass a written examination, sign a code of ethics, and maintain continuing education for recertification every 3 years. Installer certification through NABCEP is intended for experienced installers to demonstrate a high level of knowledge and commitment to excellence. A study commissioned by the New York State Energy Research and Development Authority (NYSERDA) found that "systems installed by NABCEP certificants had fewer problems at time of startup than other systems"(see www.dps.state.ny.us/07M0548/workgroups/WGVII_SOLAR_2008_Paper_0231_PV_Workforce_Development.pdf).

NABCEP has developed job task analyses, which define the general set of knowledge, skills, and abilities typically required of PV and SWH system installers (see www.nabcep.org/wp-content/uploads/2010/04/PV_Technical_Sales_JTA_4_7_2010.pdf). These task analyses are the fundamental basis for establishing the competencies required, the entry requirements, and the content of examinations. Many educational providers use the task analyses as elements in course design. Training providers who have Institute for Sustainable Power Quality (ISPQ) accreditation or certification (see 5.2, Develop Local Workforce Training and Education Programs) have been evaluated using the task analysis elements and can help prepare qualified installers for the field. In addition to its personnel certification program, NABCEP offers an entry-level examination that's designed for students and job-seekers new to the field. Achieving a passing score on the NABCEP PV exam means that an individual has demonstrated his or her basic knowledge of the fundamentals of the application, design, installation, and operation of stand-alone and grid-tied PV systems. Passing the entry level exam does not in any way certify or qualify an individual as a solar installer. A passing score achievement, however, does show potential employers that job-seekers have obtained a basic knowledge of the fundamentals of solar-powered electricity. Most educational programs that teach the NABCEP PV entry level learning objectives have no prerequisites and are open to anyone interested in learning about solar energy system installation.

Although NABCEP certification was originally intended as a voluntary, value-added credential, employing NABCEP-certified personnel is increasingly becoming mandatory for contractors as a prerequisite for participating in many state incentive programs. In a few states the certification is tied to qualifying for a state license. If a solar installation company wants to be eligible for state rebate funds in Maine and Ohio, for example, its PV systems must be installed by a qualified professional who also has a NABCEP certification. Not all NABCEP certificants are duly licensed contractors in any jurisdiction, and the NABCEP Web site (see www.nabcep.org/about-us) clarifies that "NABCEP certification is not a professional license issued by a government agency and does not authorize a certificant to practice. NABCEP certificants must comply with all legal requirements related to practice, including licensing laws." If planning a solar program for the community, it's prudent—from a public liability perspective—to require trade qualifications and licensure for all individuals or businesses that will participate in the program. From a performance perspective, a strong incentive to use certified installers results in properly installed and more reliable systems.

BENEFITS

Consumers, local governments, and the solar industry all benefit from a solar market that encourages high-quality installations. Consumers benefit when contractors are essentially "prescreened" according to legal standards, such as licensing. Additionally, certifications recognized by the industry indicate quality to consumers, and once they become well accepted, these certifications are almost compulsory for contractors. The expectation is that encouraging licensing and certification results in baseline standards being met, which in turn leads to safer and higher performance installations and greater consumer confidence and satisfaction (and therefore fewer contract disagreements). Licensed and certified installers benefit from possessing credentials that demonstrate their proficiency and experience with installing solar energy technologies. Using nationally recognized programs relieves municipalities of the need to create their own certification standards.

Implementation Tips and Options

- ☐ Assess the solar technician training available locally. The rate at which installers receive training and certification largely depends on the existence of locally available instruction and the degree to which financial incentive programs require certain credentials.
- ☐ Develop a training or apprentice program with local or regional solar experts if such a program doesn't exist in the region. See 5.2, Develop Local Workforce Training and Education Programs.
- ☐ Educate consumers about the value of installer licensing and certification; the difference between the two; and the options for nationally accredited, industry-recognized certification.
- ☐ Consider requiring consumers to document hiring a licensed and certified contractor to allow them to participate in a local incentive program or receive a solar permit.

When developing incentive programs and crafting policy language, keep the following in mind:

- ☐ Assess the industry in the area. If the community is home to only a few experienced installers, consider admitting existing solar contractors into a rebate program while requiring that they become licensed or certified within a specific time frame.
- ☐ Be as specific as possible about the type of license, certification, or training required for the program.
- ☐ Include an insurance requirement for installers in the incentive program.

Examples

Austin, Texas: Requiring Installers to Demonstrate Qualifications

All companies participating in the Austin Energy Power Saver™ PV rebate program must have at least one employee with a certificate verifying that he or she has passed the NABCEP test. In addition, a participating company needs to provide a certificate of insurance listing Austin Energy as the certificate holder and proving the following coverage: (1) $500,000 of combined single limit and (2) $500,000 general aggregate of bodily injury and property damage.

Louisiana: Establishing a Solar Classification and Certificate of Training

Louisiana's solar industry lobbied successfully for the state statutes to be revised to include a clause requiring consumers to hire licensed and trained contractors so that the consumers could receive state solar tax credits. Owners must supply specific documentation with their tax filing to receive the state's significant tax credit. The industry intentionally did not specify which certificate of training to require because too few contractors had any single type of training. The advantage of this approach was that restrictions did not hinder the growth of the young industry. The local solar industry in Louisiana, however, views the Solar Energy Equipment (SEE) classification (an add-on that any licensed contractor of any trade can obtain easily) as problematic because the classification lacks a rigorous training requirement. To compensate for this and further protect the consumer and safeguard the reputation of the growing industry, the state requires that installations be performed by a contractor who has a certificate of training in the design and installation of solar energy systems from an industry-recognized training entity or a Louisiana technical college, and holds a license with the SEE classification.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Electronics Training Administration

www.eta-i.org

The Electronics Training Administration offers an alternative energy installer certification and a professional-level alternative energy integrator certification. Both have three degrees of completion: entry level, midlevel, and advanced level.

North American Board of Certified Energy Practitioners

www.nabcep.org

NABCEP offers certifications and certificate programs to renewable energy professionals throughout North America. The Web site includes a complete listing of NABCEP-certified PV and SWH installers in the United States.

PUBLICATIONS

The Qualified Solar Installer

J. Dunlop, Solar Today, September/October 2009

This article discusses solar installer qualifications that should be considered by state and local governments to ensure safe installations that meet local code.

Magazine article: www.solartoday-digital.org/solartoday/20090910/ - pg40

Credentialing: What's in a Name? A Lot

J. Weissman, Solar Today, September/October 2009

This article discusses the various types of credentials for solar installers, and clears up misunderstandings of the terms certification, certificate, accreditation, and licensure.

Magazine article: www.solartoday-digital.org/solartoday/20090910/ - pg44

The City of Shoreline, Washington, installed a 20.2 kW solar electric system on top of the City Hall parking garage. The system uses Washington-made solar modules from Marysville-based Silicon Energy. (City of Seattle/PIX18074)

A 25-kW solar PV system provides power to the county-owned Clarke Planetarium in downtown Salt Lake City. (SLC/PIX18364)

The Denver International Airport (DIA) features a 2 MW PV system at sunset. DIA is now host to a second 1.6 MW array system. (Denver International Airport/ PIX18042)

4.0

IMPROVING UTILITY POLICIES AND PROCESSES

Utilities are important partners in advancing solar adoption in a local community because of their extensive experience in delivering energy to customers, operating the electric grid, and managing increasingly complex rate and billing structures, as well as the fact that they must approve interconnection of photovoltaic systems to the electric grid. The fundamental role utilities play in facilitating customers' solar installations gives utilities the power to accelerate or impede solar adoption in a local community. Municipalities that have jurisdiction over a utility are positioned to significantly affect the ease with which local residents and businesses can purchase and install solar energy systems. In areas served by investor-owned utilities, local governments can collaborate with state and regional governing bodies and with the utilities themselves to influence many of the policies, rules, and regulations that affect solar installations.

This section introduces some of the areas where local governments, either independently or in concert with state authorities and utilities, can work to improve utility policies that affect the adoption of solar energy technologies.

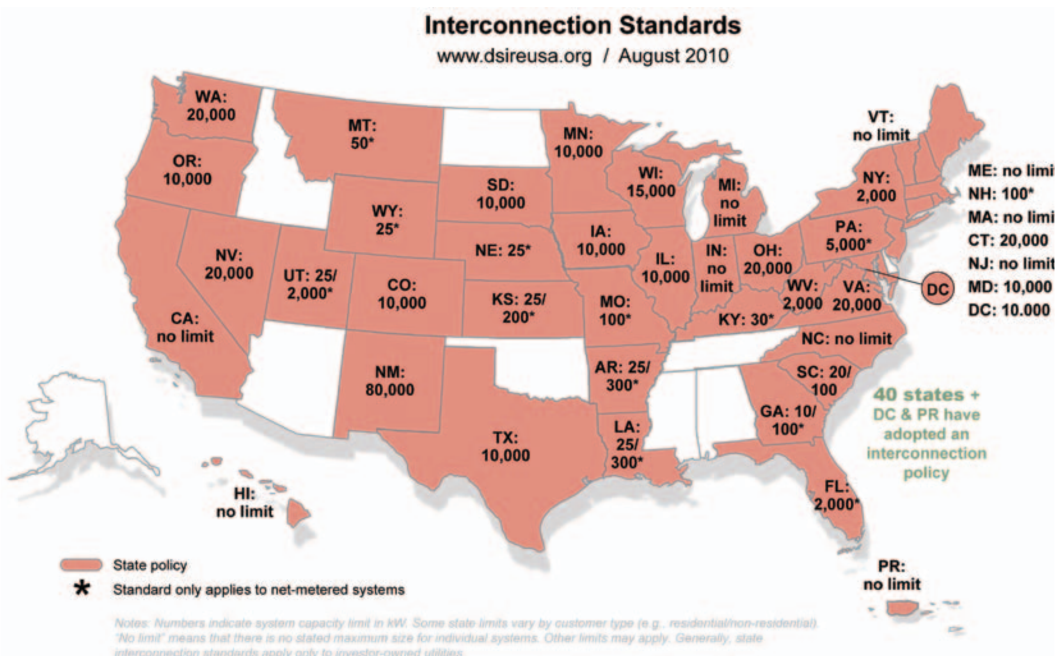
	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St.Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tuscon
4.1 Streamline or Improve Interconnection Standards		●						●				●	●	●				●	●						●	
4.2 Improve Net-Metering Rules		●			●	●							●	●				●	●				●		●	●
4.3 Develop Rate Structures that Appropriately Value Solar														●												

Data current as of August 2010

4.1

Interconnection Standards

Interconnection standards specify the technical, legal, and procedural requirements by which customers and utilities must abide when a customer wishes to connect a **photovoltaic** (PV) system to the grid (**electricity distribution system**). State governments can authorize or require their state public utilities commissions to develop comprehensive interconnection standards. Although most utilities fall under the jurisdiction of state public utility commissions, cities with municipal utilities can have significant influence over interconnection standards in their jurisdiction. Some state interconnection standards apply to all types of utilities (investor-owned utilities, municipal utilities, and electric cooperatives); other states have chosen to specify interconnection procedures only for investor-owned utilities. In setting interconnection standards, most jurisdictions require or reference compliance with the **IEEE 1547** Standard for Interconnecting Distributed Resources with Electric Power Systems, adopted in 2003 (see http://grouper.ieee.org/groups/scc21/1547/1547_index.html). As of August 2010, 40 states plus the District of Columbia and Puerto Rico had interconnection standards in place.



The most efficient interconnection standards specify several different levels of review for generation systems of varying size and complexity. Multiple levels of review for interconnection allow owners of small solar electric systems (typically less than 10 kilowatts) to interconnect systems more quickly and inexpensively without having to endure a process designed for larger multimegawatt systems. Some jurisdictions have also determined that larger systems that don't export electricity to the grid (for example, at a large factory, where the PV system's electricity output never exceeds the facility's electricity demand) should require a less rigorous review process than larger systems that do export electricity. In some areas of the United States, electric utilities have not yet adopted interconnection standards for any consumer systems, or have standards in place only for small systems. In areas without comprehensive interconnection standards, customers often find that connecting a solar electric system to the grid can be confusing, difficult, and expensive—sometimes prohibitively so.

Nearly 94% of electricity distribution systems in the United States are **radial electricity distribution systems** where interconnection of **distributed generation** such as PV is common and relatively straightforward. A less common type of electric distribution system, known as a **secondary network distribution system**, is often seen in central business districts in large cities. These network systems are designed to serve large loads, such as high-rise buildings, with exceptionally reliable service. PV systems located within secondary network distribution systems (commonly called "networks") might require more extensive utility review before interconnection, because devices known as network protectors—which maintain reliability on a secondary network—are sensitive to power coming from sources other than the centralized utility. Understanding the capabilities and limitations of the local electric distribution system is important for setting **installation targets** and designing policies that effectively promote solar energy installations.

BENEFITS

Streamlining interconnection standards encourages the installation of renewable energy technologies by defining an appropriate process for grid connection that reduces unnecessary transaction costs while maintaining business and safety standards.

Implementation Tips and Options

The following implementation tips and options include many of the Interstate Renewable Energy Council's (IREC) best practices for interconnection standards.

- ☐ Require that all utilities be subject to the interconnection standards, including investor-owned, municipal, and cooperative utilities within a state or local jurisdiction.
- ☐ Make all utility customer sectors (residential, commercial, and industrial) eligible to interconnect PV systems.
- ☐ Set forth three or four separate levels of review based on system size and complexity.
- ☐ Don't limit individual system capacity.
- ☐ Minimize application costs, especially for smaller systems (e.g., $50 per application plus $1 per kilowatt).
- ☐ Adopt and enforce reasonable, punctual procedural timelines.

- Use a standard form agreement that's easy to understand. Allow applications and processing to be done online.
- Establish transparent processes for reviewing the technical aspects of an installation.
- Eliminate any requirement for an external disconnect switch for smaller, inverter-based systems that export low-voltage electricity onto the grid. Inverters provide the safety measures of an external disconnect switch without the extra cost of installing the switch. The external disconnect switch is not necessary for smaller systems.
- Eliminate any requirement for liability insurance (above and beyond the coverage in a typical property owner's insurance policy). Prohibit utilities from requiring customers to add the utility as an additional insured party.
- Allow interconnection to secondary distribution networks with reasonable limitations, where appropriate.
- Establish a clear path for communications between the local code enforcement officers and the local utility provider to expedite the interconnection process once inspection is complete.
- Combine the interconnection and permitting applications into one, if possible.

Examples

New York City, New York: Interconnecting Photovoltaics on the City's Network

New York City is home to the most expansive set of secondary network distribution systems in the country. The New York City Solar America City team studied the technical aspects of interconnecting PV systems on the city's networked grid. The city worked with the National Renewable Energy Laboratory (NREL) and local **electric utility** ConEdison to define the maximum technical potential deployment of PV in New York City and to analyze the effect of that amount of PV on the city's networks. The team used NREL's In My Backyard (IMBY) mapping tool to estimate the electricity that could be produced if all suitable rooftop space in 10 sample networks around the city were covered with PV **arrays**. IMBY uses a map-based interface that allows users to specify the exact location of a proposed PV array or wind turbine. Based on the location, system size, and other variables, IMBY estimates the electricity production expected from the system. Comparing IMBY's estimates of hourly PV power generation to actual hourly load levels on each network shows how full PV deployment affects each network.

The team found that in 6 of the 10 networks, under full PV deployment, PV generation could exceed network load and export electricity to the secondary network distribution systems. Exporting was greatest in the middle of the day (when production is highest), on weekends (when building demand is lowest), and during the spring (when building demand is low relative to PV generation). Exporting is most likely in areas with more rooftop space per person; generally, the lower density networks are in the outer boroughs, which are made up of single-family homes and shorter commercial buildings.

The study concluded that low levels of PV penetration on networks generally are acceptable. Based on the results, ConEdison now allows PV systems of less than 200 kilowatts to connect to networks without requiring a comprehensive engineering review. The study is included in an NREL report, *Photovoltaic Systems Interconnected onto Secondary Network Distribution Systems—Success Stories*, available online at www.nrel.gov/docs/fy09osti/45061.pdf.

Santa Clara, California: Establishing Collaboration between City and Municipal Utility

In Santa Clara, the municipal utility, Silicon Valley Power, proved to be a major roadblock for PV system installations. The city of Santa Clara was able to review the permit applications within a few days, but did not have the ability to issue the permits until the engineers of the municipal utility completed their interconnection review. This extended process and frustration from applicants resulted in a strong desire for the city and municipality to work together. The municipal utility eliminated its role in reviewing the interconnection plans for systems less than 10 kilowatts. Dialogue with the city proved not only that the city officials were well suited to review the interconnections, but also that the city and municipality were essentially performing the same reviews. As a result of the utility removing itself from the process, it was able to significantly decrease costs from the labor performed by their engineers. The utility then gave back a portion of its cost savings to the city in the form of sending building officials through the North American Board of Certified Energy Practitioners (NABCEP) training. The building department is now able to avoid consumer frustrations and release permits more quickly.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency: Rules, Regulations, & Policies for Renewable Energy

www.dsireusa.org/summarytables/rrpre.cfm

This Web site contains summary maps and tables for policies that affect utilities, such as net-metering and interconnection standards. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with IREC, is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy (DOE) funds this ongoing effort.

Solar America Board for Codes and Standards

www.solarabcs.org

The Solar America Board for Codes and Standards (Solar ABCs) is a DOE-funded central body created to address solar codes and standards issues.

The Solar Alliance

www.solaralliance.org/

The Solar Alliance is a state-based advocacy group of companies involved in the design, manufacture, construction, and financing of PV systems. The Web site gives the industry perspective on areas critical for building a local solar market, including interconnection standards.

PUBLICATIONS

Model Interconnection Procedures: 2009 Edition

Interstate Renewable Energy Council, November 2009

IREC's model interconnection standard incorporates the best practices of small-generator interconnection standards developed by various state governments, the Federal Energy Regulatory Commission (FERC), the National Association of Regulatory Utility Commissioners (NARUC), and the Mid-Atlantic Distributed Resources Initiative (MADRI).

Report: http://irecusa.org/wp-content/uploads/2009/12/IREC-IC-Model-Final-Nov-8-2009-2.pdf

Freeing the Grid: Best and Worst Practices in State Net-Metering Policies and Interconnection Procedures, 2010 Edition

Network for New Energy Choices, Vote Solar Initiative, Interstate Renewable Energy Council, November 2009

This report outlines the best and worst practices in state net-metering and interconnection policies.

Report: www.newenergychoices.org/uploads/FreeingTheGrid2010.pdf

Photovoltaic Systems Interconnected onto Secondary Network Distribution Systems—Success Stories

National Renewable Energy Laboratory, April 2009

This report examines case studies of PV systems integrated into secondary network distribution systems. It includes findings from case studies conducted in San Francisco, California; Washington, D.C.; Denver, Colorado; and New York City.

Report: www.nrel.gov/docs/fy09osti/45061.pdf

Connecting the Grid: A Guide to Distributed Generation Interconnection Issues, 6th Edition

Interstate Renewable Energy Council, 2009

This guide is designed for state regulators and other policymakers, utilities, industry representatives, and consumers interested in the development of state-level interconnection standards.

Report: www.irecusa.org/wp-content/uploads/2009/10/Connecting_to_the_Grid_Guide_6th_edition-1.pdf

Comparison of the Four Leading Small Generator Interconnection Procedures

Solar America Board for Codes and Standards, Interstate Renewable Energy Council, October 2008

This report reviews four sets of interconnection procedures that regulators often consider when developing state and local procedures. As a framework for review, the report uses the grading criteria developed by the Network for New Energy Choices (NNEC) and used that organization's review of state interconnection procedures.

Report: www.solarabcs.org/interconnection/ABCS-07_studyreport.pdf

Utility External Disconnect Switch: Practical, Legal, and Technical Reasons to Eliminate the Requirement

Solar America Board for Codes and Standards, Interstate Renewable Energy Council, September 2008

This report documents the safe operation of PV systems without a utility external disconnect switch in several large jurisdictions. It includes recommendations for regulators contemplating utility external disconnect switch requirements.

Report: www.solarabcs.org/utilitydisconnect/

Utility-Interconnected Photovoltaic Systems: Evaluating the Rationale for the Utility-Accessible External Disconnect Switch

National Renewable Energy Laboratory, January 2008

This report examines the utility-accessible external disconnect switch debate in the context of utility-interactive PV systems for residential and small commercial PV installations. It focuses on safety, reliability, and cost implications of requiring an external disconnect switch.

Report: www.nrel.gov/docs/fy08osti/42675.pdf

4.2

Net-Metering Rules

Net metering is a billing method that credits solar system owners for electricity exported onto the electricity grid. Under the simplest form of net metering, a utility customer's billing meter runs backward as solar electricity is generated and exported to the electricity grid, and forward as electricity is consumed from the grid. At the end of a billing period, the customer receives a bill for net electricity, which is the amount of electricity consumed minus the amount of electricity produced and exported by the utility customer's **photovoltaic** (PV) system. This policy allows PV system owners to offset electricity purchases from the utility with every kilowatt-hour of solar electricity a PV system produces.

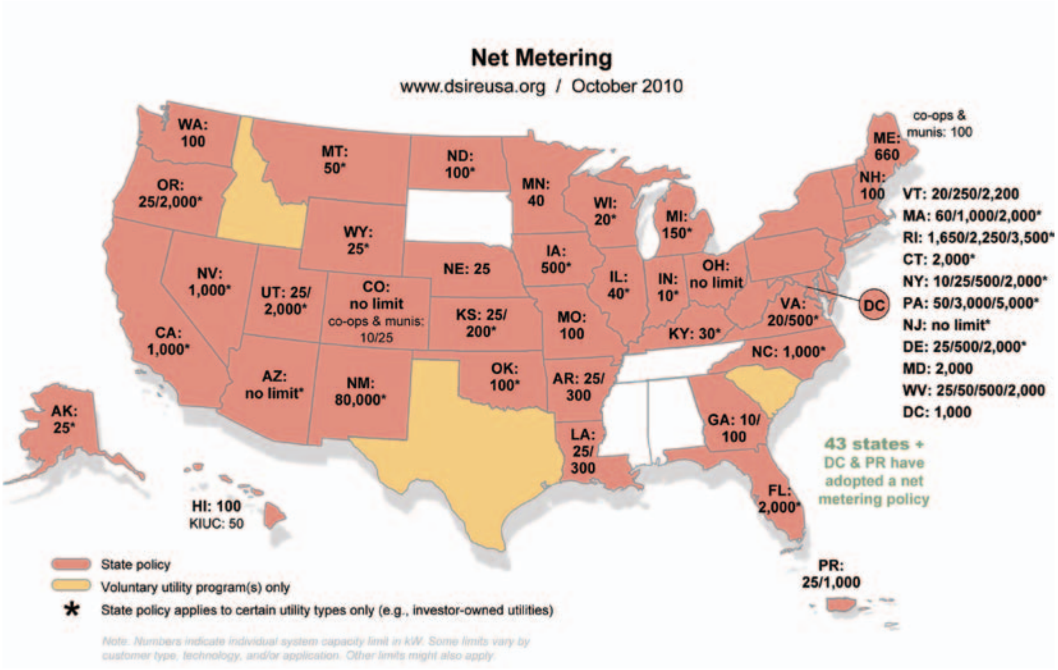
Under an alternative billing policy, sometimes called "dual metering" or "net purchase and sale metering," utilities install a second meter at the customer site and pay a different rate for solar electricity exported to the grid, generally a wholesale **avoided cost rate**. Customers who own PV systems in areas with a dual-metering policy generally receive a lower (wholesale rate) bill credit for solar electricity exported to the grid than customers in areas with net metering. A few utilities with dual-metering policies, however, offer a higher-than-retail rate payment for solar electricity generated by customer-owned systems.

If no net-metering policy is in place, a PV system owner typically has two options: (1) send excess solar electricity back to the grid without compensation; in this case, owners size the system so that production never exceeds base load, which minimizes the amount of free electricity sent to the grid; or (2) purchase a battery storage system to capture excess electricity and store it for future use. Neither option is particularly financially attractive, so many customers might choose to forego the solar installation altogether or install a small system that produces only enough electricity for immediate consumption on site. The lack of a net-metering policy, then, can discourage investment in solar energy systems.

Some states allow a single PV system to be used to offset electricity purchases on multiple customer billing meters. Such programs, however, might be limited to meters that are on the same or an adjacent piece of property owned by the same customer. This type of arrangement is often called "meter aggregation." Meter aggregation is particularly important for municipalities, agriculture customers, universities, shopping malls, and other users with multiple meters that seek to offset their energy use with solar and bring down the cost of installations through economies of scale. Expanding on this approach, some states allow aggregation of meters on *different*, geographically dispersed properties owned by the same customer. This allows an owner of multiple properties to offset the electricity use for all locations with PV systems located at sites that are best suited for solar installations, regardless of each facility's electricity load.

Some states have taken meter aggregation one step further, allowing the owner of a PV system to offset the electric loads of other utility customers or permitting joint ownership of a PV system. Typically, the utility customers and the PV system are required to be in the same utility service territory. In these situations, net-metering credits are often distributed to utility customers via **virtual net metering** or **joint billing**. This expanded approach to facilitate participation in solar programs is sometimes referred to as **community solar** (see 2.8, Community Solar), and requires regulators and utilities to allow multiple customers to net meter with a single renewable energy system. Virtual net metering enables customers to receive a utility bill credit at full retail rates. This maximizes value to the customer by allowing them to offset peak electricity just as they would with an on-site system. The utility bill credit is typically calculated as a percentage of production from the solar energy facility.

Most states have established net-metering policies through legislation. State laws commonly require public utilities commissions to adopt administrative rules to implement net-metering policies. As of October 2010, the District of Columbia, Puerto Rico, and 43 states have net-metering policies, but there are subtle differences and rules vary by state and by utility. Some state policies, for example, apply to customers of all types of utilities (investor-owned utilities, municipal utilities, and electric cooperatives); others apply only to customers of investor-owned utilities. Net-metering policies also vary widely in terms of individual system **capacity limits**, aggregate enrollment limits, eligible system types, treatment of net excess generation, and ownership of a **renewable energy certificate** (REC) associated with customer-owned generation. Municipalities that have jurisdiction over a utility are well positioned to improve net-metering rules. Even in areas served by investor-owned utilities, however, local governments can influence net-metering rules by collaborating with state and regional governing bodies.



States with **interconnection standards** were graded on a scale of A to F in the Freeing the Grid report, as shown in the table.

State	Net Metering	Interconnection	State	Net Metering	Interconnection
Alabama	n/a	n/a	Montana	C	F
Alaska	n/a	n/a	Nebraska	B	F
Arizona	A	C	Nevada	B	B
Arkansas	C	F	New Hampshire	C	C
California	A	B	New Jersey	A	B
Colorado	A	B	New Mexico	B	B
Connecticut	A	D	New York	D	B
D.C.	B	B	North Carolina	D	B
Delaware	A	D	North Dakota	D	n/a
Florida	A	C	Ohio	B	C
Georgia	F	F	Oklahoma	D	n/a
Hawaii	C	F	Oregon	A	B
Idaho	F	n/a	Pennsylvania	A	B
Illinois	B	B	Rhode Island	B	n/a
Indiana	F	D	South Carolina	n/a	F
Iowa	C	F	South Dakota	n/a	B
Kansas	B	F	Tennessee	n/a	n/a
Kentucky	B	F	Texas	n/a	D
Louisiana	B	F	Utah	A	F
Maine	B	n/a	Vermont	B	C
Maryland	A	B	Virginia	B	A
Massachusetts	B	B	Washington	C	D
Michigan	B	C	West Virginia	D	n/a
Minnesota	C	F	Wisconsin	D	D
Mississippi	n/a	n/a	Wyoming	B	F
Missouri	C	F	–	–	–

Grade Score: A - 15+ B - 9 to <15 C - 6 to <9 D - 3 to <6 F - <3

States Without Statewide Net Metering	
Alabama	South Carolina*
Alaska	South Dakota
Idaho*	Tennessee
Mississippi	Texas*

States Without Statewide Interconnection Standards	
Alabama	North Dakota
Alaska	Oklahoma
Idaho	Rhode Island
Maine	Tennessee
Mississippi	West Virginia

*Voluntary net metering available

Note: A score of 7.5 was added to interconnection scores to normalize grading with net metering.

Source: Network for New Energy Choices, Vote Solar Initiative, and Interstate Renewable Energy Council. December 2010. *Freeing the Grid: Best and Worst Practices in State Net-Metering Policies and Interconnection Procedures*. www.newenergychoices.org/uploads/FreeingTheGrid2010.pdf

BENEFITS

Net metering encourages utility customer investment in solar energy by allowing customers who install PV systems to receive credit for excess electricity generation, which improves the return on their investment. Utilities benefit from net metering if customer-sited generation is located in an area that allows a utility to avoid distribution- and transmission-system upgrades. Utilities also benefit when they own RECs associated with net-metered generation and can use those RECs to meet state renewable energy requirements.

Implementation Tips and Options

The following implementation tips and options include many of the Interstate Renewable Energy Council's (IREC) best practices for net-metering policies.

- Require that all utilities be subject to the net-metering rules, including investor-owned, municipal, and cooperative utilities within a state or local jurisdiction.
- Allow all customer classes to participate in net metering.
- Ensure that individual system capacity doesn't exceed the customer's **service entrance capacity**. Otherwise there should be no individual system capacity limit.
- Don't impose an aggregate system-capacity limit.
- Allow customers to carry net excess generation credits forward to the next billing period at the full retail value of 1 kilowatt-hour indefinitely or for at least 12 months.
- Waive any application fee for net metering.
- Don't add charges or fees to a customer account for net metering.
- Avoid net metering as an addendum to another tariff. Net metering as a tariff should be able to optimize the value of solar energy by accounting for its inherent advantages under time-of-use and seasonal operation. See 4.3, Rate Structures that Appropriately Value Solar.
- Permit meter aggregation so customers can use a centrally located solar energy system to offset electricity load measured by multiple meters on the same property.
- Establish clear guidelines on who owns the RECs associated with the solar energy generation—the utility, the customer, or the solar provider.

Examples

New Orleans, Louisiana: Enacting Citywide Net-Metering Rules

In 2007, the New Orleans City Council adopted net-metering rules requiring jurisdictional utilities—particularly Entergy New Orleans, an investor-owned utility regulated by the city—to offer net metering to customers with systems that generate electricity using solar, wind, hydropower, geothermal, or biomass resources. The rules apply to residences with a maximum capacity of 25 kilowatts and commercial and agricultural systems with a maximum capacity of 300 kilowatts. These capacity limits and certain other conditions are specified in Louisiana's net-metering statute, which applies to all utilities in the state. New Orleans requires utilities to supply **customer generators** with a meter capable of measuring the flow of electricity in both directions, and customers can be charged a one-time fee for meter installation. Net excess generation is credited at the utility's retail rate and carried over to the customer's subsequent bill indefinitely.

Orlando, Florida: Allowing Net Meter Aggregation

The Orlando Utilities Commission (OUC) offers customers that install PV on a site with multiple electric meters the option to aggregate their meters through consolidated billing. Any excess solar production on one meter can be credited against the aggregated energy usage at the site. OUC's net-metering policy is applicable to all customer classes for systems up to 2 megawatts. Net excess generation is credited at the utility's retail rate and carried over to the customer's subsequent bill indefinitely. A customer can request a check at any time for any credit on the account.

Salt Lake City, Utah: Influencing Statewide Net-Metering Rules

Utah requires the state's only investor-owned utility, Rocky Mountain Power (RMP), along with most electric cooperatives in the state, to offer net metering to customers who generate electricity using solar energy, wind energy, hydropower, hydrogen, biomass, landfill gas, or geothermal energy. Net metering is available for residential systems with capacities of up to 25 kilowatts and nonresidential systems of up to 2 megawatts in capacity. In 2008, Utah's legislature revised the state's net-metering policy, making significant improvements to the existing law. At the same time, the legislature deferred many of the key decisions to the appropriate governing authority (Public Service Commission for RMP and the board of directors for the rural co-ops). In 2009, the Solar Salt Lake Partnership partnered with IREC and more than 40 businesses, local governments, and citizens to send comments to the Utah Public Service Commission on the key issues yet to be decided. Their efforts were successful, and in February 2009, the commission ruled that net-metering customers receive full retail credit for every kilowatt-hour of excess electricity generated, PV system owners retain the RECs associated with the electricity they produce, and RMP must allow aggregate interconnection of PV systems up to 20% of the utility's 2007 peak demand. The Public Service Commission's ruling earned Utah an "A" in the Network for New Energy Choices, Vote Solar Initiative, and IREC's *Freeing the Grid* report—up from an "F" in 2007.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency: Rules, Regulations, & Policies for Renewable Energy

www.dsireusa.org/summarytables/rrpre.cfm

This Web site contains summary maps and tables for policies that affect utilities, such as net-metering and interconnection standards. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with IREC, is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy (DOE) funds this ongoing effort.

Interstate Renewable Energy Council's Connecting to the Grid

www.irecusa.org/irec-programs/connecting-to-the-grid

IREC's Connecting to the Grid Program supplies services and resources to facilitate the development of interconnection procedures and net-metering rules for renewable energy systems and other forms of distributed generation. Part of the IREC Web site serves as an information clearinghouse on interconnection and net-metering issues.

The Solar Alliance: Net Metering

www.solaralliance.org/four-pillars/net-metering.html

The Solar Alliance is a state-based advocacy group of companies involved in the design, manufacture, construction, and financing of PV systems. Its Web site presents the industry perspective on four areas critical for building a local solar market: interconnection, net metering, utility rates and revenue policies, and market design.

PUBLICATIONS

The Impact of Rate Design and Net Metering on the Bill Savings from Distributed PV for Residential Customers in California

Lawrence Berkeley National Laboratory, April 2010

Researchers at the Lawrence Berkeley National Laboratory attempted to calculate the bill savings from net-metering tariffs for PV for residential customers of California's two largest utilities, Pacific Gas and Electric (PG&E) and Southern California Edison (SCE).

Report: http://eetd.lbl.gov/ea/EMP/reports/lbnl-3276e.pdf

Freeing the Grid: Best and Worst Practices in State Net-Metering Policies and Interconnection Procedures, 2010 Edition

Network for New Energy Choices, Vote Solar Initiative, Interstate Renewable Energy Council, November 2010

This report outlines the best and worst practices in state net-metering and interconnection policies.

Report: www.newenergychoices.org/uploads/FreeingTheGrid2010.pdf

Net-Metering Model Rules: 2009 Edition

Interstate Renewable Energy Council, October 2009

The IREC rules incorporate best practices and compile them into a template that regulators and utilities can use as a starting point when drafting local rules.

Report: http://irecusa.org/wp-content/uploads/2009/10/IREC_NM_Model_October_2009-1.pdf

Residential Photovoltaic Metering and Interconnection Study: Utility Perspectives and Practices

Solar Electric Power Association, March 2008

Working with IREC, the Solar Electric Power Association surveyed 63 utilities about interconnecting and metering residential PV systems. The study explains how utilities with many PV systems operating in their territories are treating metering, interconnection, documentation, and fees.

Report: www.solarelectricpower.org/resources/reports.aspx

4.3

Rate Structures that Appropriately Value Solar

Electricity rates include fixed and variable charges, and vary by location and customer class (residential, commercial, and industrial). Rates always include a charge per kilowatt-hour of electricity consumed and sometimes include **demand charges** for the maximum **amount of electric capacity** (usually based on 15-minute peak power demand for each month) a facility needs at a given point in time. Electricity rate structures determine the value of the power produced by a **photovoltaic** (PV) system and the cost of additional electricity purchased from the utility. Rate structures affect the overall economics of a PV system—sometimes significantly. By generating electricity from a PV system instead of purchasing electricity from the grid, the economic value of the system is comparable to the cost of avoided utility electricity over time. In addition to determining fixed and variable rates, rate structures can assign different values to variable electricity use based on how the customer uses the electricity. Some rate structures, for example, are tiered depending on the amount of energy used. Rate tiers can be beneficial for solar if they're set up so that consumers pay higher electricity rates when they use more electricity, because solar is offsetting those higher rates. Rate tiers don't work in solar's favor if consumers pay lower electricity rates during high usage, because solar is offsetting those lower rates and therefore increasing payback time. Another rate-structure model is dynamic pricing, in which utility customers are charged different amounts for electricity based on when the electricity is used; **time-of-use** (TOU) and **real-time pricing** are two examples of dynamic pricing structures. Dynamic pricing often provides the most value for PV systems, depending on the site load profile and coincidence with PV output. With dynamic pricing, electricity rates typically peak in the afternoon with increased demand, so PV installations (which generate electricity during the day) can offset those higher rates, thereby increasing the value of the PV system's energy production.

Many proponents of solar energy note that conventional utility rate structures fail to compensate PV system owners for the full value of the electricity they generate. Conventional rate structures don't account for the benefits to the electricity grid realized by generating electricity from solar energy technologies. For example, in many regions of the United States solar electricity production is highest during sunny afternoons when the electricity grid strains to meet peak electricity demand. Most rate structures fail to recognize the value of PV in lessening the strain on the electricity grid during peak demand times. Most rate structures also don't take into consideration the value of avoided **transmission and distribution losses** that distributed PV systems provide by producing electricity at the point of consumption.

BENEFITS Working with the utility to create rate structures that appropriately value PV will improve the economics of solar energy in a community.

Implementation Tips and Options

- ☐ Identify the rate structures offered by the local utility.
- ☐ Understand the net-metering rules in place in the community and how they interact with the available rates. See 4.2, Improve Net-Metering Rules.
- ☐ Gather electricity load data from a facility of interest and analyze the electricity bill based on the rates available to the facility. This will help reveal how electricity rates affect the economics of energy use at a given facility, whether a home, a business, or a government building.
- ☐ Research dynamic rate structures and encourage the utility to consider rates optimized for solar energy technologies.
- ☐ Collaborate with regional or state authorities to improve rate structures.

Examples

Minneapolis–Saint Paul, Minnesota: Developing a Photovoltaic Valuation Tool

The Minneapolis–Saint Paul Solar America Cities team partnered with the National Renewable Energy Laboratory (NREL) to develop a tool that quantifies the value of PV-generated electric power for both the PV owner (retail level) and the utility (wholesale level). This tool evaluates the energy, demand, and revenue values of PV systems ranging in size from small-scale residential and medium-scale commercial systems to large-scale utility systems. It can incorporate a variety of energy and demand rate structures, including TOU tariffs and wholesale market prices (with coincident wholesale market prices and solar radiation data). The tool's ability to run multiple scenarios gives users the ability to estimate revenue for alternative configurations, contract provisions, market conditions, and local solar resources.

San Diego, California: Studying Rate-Design Impacts on the Value of Solar Electricity

San Diego has extensive, real-time electrical metering on most of its municipal buildings and PV systems, which has resulted in a comprehensive set of overall consumption and PV electrical production data collected in 15-minute increments over years. An analysis of PV system data from two city facilities illustrates the effects of rate designs. The analysis estimated the energy and demand savings that the PV systems are achieving relative to a base case of no PV systems. The data revealed that actual demand and energy use benefits of **binomial tariffs** (those that include both fixed demand and variable energy charges) increased in summer months when solar resources allow for maximized electricity production. Further, a comparison of different electricity rate options for these facilities revealed savings that differed significantly; that is, the benefits of PV vary substantially depending on the choice of the utility electric rate schedule applied. Therefore it is critical for larger facilities—those subject to binomial rates—to perform a structured analysis, using interval consumption data if at all possible, to forecast the economic benefits of each PV installation. Such an analysis will inform not only the choice of rates where there are multiple options from the utility, but also the sizing of the PV system itself to maximize the annual benefit and/or return on investment (ROI), in alignment with the specific goals and available resources of the facility owner. Local governments considering various bond or third-party financing instruments will decrease risk significantly by implementing such a measured analytical approach. Finally, in the facilities examined in San Diego, the study determined that the PV systems save the city about 50% in electricity costs for the buildings the systems serve.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

OpenEnergyInfo

http://en.openei.org/wiki/Gateway:Utilities

The Open Energy Information initiative (OpenEI) is a linked data platform on which the world's energy data can be collected and connected. It brings energy information together, allowing for improved analyses, unique visualizations, and real-time data access. OpenEI strives to open access to this energy information, with the ultimate goal of spurring creativity and driving innovation in the energy sector. OpenEI users can browse, edit, and add new electric utility rates to OpenEI's repository.

The Solar Alliance: Utility Rates and Revenue Policies

www.solaralliance.org/four-pillars/utility-rates-revenue-policies.html

The Solar Alliance is a state-based advocacy group of companies involved in the design, manufacture, construction, and financing of PV systems. The Solar Alliance Web site gives the industry perspective on areas critical for building a local solar market, including utility rates and revenue policies.

PUBLICATIONS

The Impacts of Commercial Electric Utility Rate Structure Elements on the Economics of Photovoltaic Systems

National Renewable Energy Laboratory, June 2010

This analysis uses simulated building data, simulated PV data, and actual electric utility tariff data from 25 cities to better understand the impacts of different commercial rate structures on the value of PV systems. By analyzing and comparing 55 unique rate structures across the United States, this study seeks to identify the rate components that have the greatest effect on the value of PV systems.

Report: hwww.nrel.gov/docs/fy10osti/46782.pdf

Solar Real-Time Pricing: Is Real-Time Pricing Beneficial to Solar PV in New York City?

Bright Power, Inc., July 2009

The goal of this study is to evaluate the validity of this concept: The coincidence of high electric energy prices and peak PV output can improve the economics of PV installations and facilitate the wider use of hourly pricing. The study focuses on Con Edison's electric service territory in New York City.

Report: www.nycedc.com/NewsPublications/Studies/Documents/SolarRealTimePricing.pdf

Solar San Diego: The Impact of Binomial Rate Structures on Real PV Systems

National Renewable Energy Laboratory, May 2008

This paper uses 2007 PV system data collected from two city facilities in San Diego to illustrate the effect of binomial rate designs. It includes a financial analysis of PV-system output under various utility rate structures.

Paper: www.nrel.gov/docs/fy08osti/42923.pdf

The Impact of Retail Rate Structures on the Economics of Commercial Photovoltaic Systems in California

Lawrence Berkeley National Laboratory, July 2007

This report uses electricity load data and PV production data from 24 commercial PV installations to compare the value of the electric bill savings across 20 commercial-customer retail rates available in California. The report findings suggest that choices made by utility regulators when determining or revising retail rates can significantly affect the future viability of customer-sited commercial PV markets.

Report: http://eetd.lbl.gov/ea/EMS/reports/63019.pdf

Mercury Solar Systems installed this 6 kW installation in the Lower Kensington neighborhood of Philadelphia. (Mercury Solar Systems/PIX18065)

5.0

CREATING JOBS AND SUPPORTING ECONOMIC DEVELOPMENT

One of a number of PV manufacturers in the United States, Global Solar Energy is a Tucson-based producer of thin-film PV copper indium gallium (di) selenide (CIGS) solar cells. (Global Solar Energy/ PIX15764)

Opportunities for creating green jobs exist all along the solar industry supply chain, from solar component manufacturing through to sales, installation, and maintenance. Other opportunities exist in solar training, system financing, energy-use management, and solar program management. Local governments can contribute to the growth of a domestic renewable energy industry and boost their economies by partnering with solar market participants and supporting education and training programs.

This section can help community leaders understand solar-related economic and job creation opportunities and learn how local governments can support a trained workforce. The examples offer insight into how communities are leveraging the solar industry to create green jobs and support economic development.

	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St.Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tuscon
5.1 Recruit the Solar Industry			●	●	●	●		●	●	●		●		●	●			●	●	●	●	●	●			●
5.2 Develop Local Workforce Training and Education Programs			●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	●	●	●

Data current as of August 2010

5.1

Recruit the Solar Industry

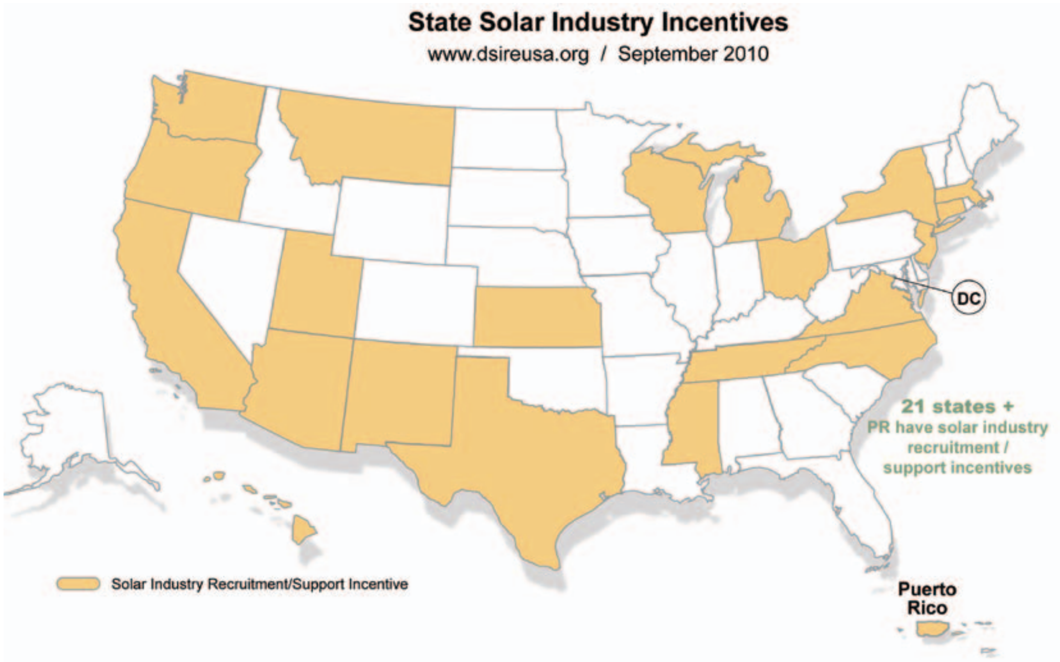
According to a landmark study released in October 2010 by The Solar Foundation, as of August 2010, the U.S. solar industry employed 93,502 solar workers—and research has shown that this number will continue to grow in the coming years. A Navigant Consulting report, for example, indicated that there will be nearly seven direct installation jobs per megawatt of installed **photovoltaic** (PV) capacity by 2016 (see Publications at the end of this topic area). Manufacturing will have eight direct jobs per megawatt for wafer and cell production, and approximately three direct jobs per megawatt for PV modules and other equipment manufacturing And, according to an EuPD Research report, the U.S. solar industry will support more than 450,000 jobs in 2016 (see Publications).

Recruiting solar manufacturing companies, including their manufacturing supply chain, requires focused and sustained efforts by local governments backed by a stable and mature economic development organization. Solar companies are keenly aware of the importance of local policies in creating favorable business environments. Corporate investments can range from small (a small assembly operation) to significant (a 1,000-acre manufacturing site). Manufacturing companies typically base decisions on where to locate a new facility on the inherent advantages of the site, proximity to clients, and any local economic incentives that can help offset operations costs. To be successful in attracting investments, community leaders need to understand clearly the requirements of the industry and the advantages and disadvantages of their area as they relate to those requirements. Generally, the critical requirements of solar manufacturers include the following:

- Availability of “ready to go” sites or existing facilities that meet the companies’ size requirements, have access to required utilities and infrastructure, and have or can easily acquire necessary operating permits
- Availability of utilities in adequate quantities and at a competitive cost; low-cost electricity is usually of particular importance to manufacturers
- Financial and nonfinancial incentives that reduce development costs or long-term operating costs or both
- A business environment (taxes and regulations) that supports manufacturing in general and solar and renewable energy in particular
- Public policies that support solar and renewable energy development (**renewable portfolio standard** [RPS], **feed-in tariffs** [FITs], **net metering**)
- Proximity to interstate highways, railroad lines, international airports, and in some cases port facilities

- Proximity to raw material suppliers such as glass and industrial gas suppliers
- Existence of a skilled or trainable labor force nearby
- Availability and access to higher education, research institutions, and skill training programs
- Public entities and utilities that are experienced in siting manufacturing facilities
- Access to a viable solar market.

Local development agencies, generally with support from states, use a variety of financial and nonfinancial incentives to encourage clean energy businesses to locate or expand in their areas. In addition to directly supporting manufacturing operations, local governments can design these incentives to support research, development, and commercialization; partnerships with financial institutions and private venture-capital funds; and marketing and business development. Over the past decade, incentives for manufacturing facilities have evolved and include grants, loans, tax credits, income and property tax abatements, marketing support, corporate tax exemptions, tax credits, and bonus incentives for consumers purchasing solar equipment manufactured in a state. Most recently, many states and local areas are offering tax credits that can be monetized up-front to provide development capital and negotiating buy-back agreements with manufacturers to purchase a portion of their product. As of September 2010, 21 states and Puerto Rico offered incentives targeting recruiting or developing the solar energy industry.



Most local governments incorporate various provisions into incentive agreements or rules. To encourage project success and to protect investment in new or expanding business ventures, most communities use formal performance agreements between the community and the company. Recruitment programs, for example, can contain minimum job creation, product output, and investment thresholds. Incentives can also be based on product sales from the manufacturing facility. Some programs disburse incentives in a phased approach based on company milestones. Additionally, loan and grant programs typically require substantial cost sharing. Not meeting project goals and terms (e.g., vacating the facility early) sometimes requires repaying the incentive. Conversely, achieving specific job creation or economic development targets can mean more favorable loan terms.

BENEFITS

Securing new investments from solar energy companies helps a community diversify the economy, expand the workforce, and generate new sources of revenue. It also contributes to building a renewable energy infrastructure that reduces carbon and is not easily outsourced. Additionally, a local government can provide a real-world test environment for locally manufactured solar products on public facilities.

Implementation Tips and Options

- ☐ Fully understand solar manufacturers' requirements for selecting a new location and the assets and liabilities of a community as they relate to the requirements, because not all communities have the same potential for success. Many communities spend significant amounts of time and energy pursuing projects for which they are not competitive.
- ☐ Know and understand the community's competitive position for recruiting these companies. Develop strategies and programs that strengthen advantages and overcome weaknesses. Short-term success is often expected, but successful communities have long-term commitments, strategies, and programs.
- ☐ Ensure an investment environment that supports manufacturing in general—this will probably be good for PV manufacturers as well.
- ☐ Develop a comprehensive incentive and assistance program with both financial and nonfinancial programs that assist in project development and maintain competitive operating costs. These can include tax, fee, and utility cost reductions, grants and loans, free land, employee training, research collaboration, product buy-back agreements, and expedited permits and approvals.
- ☐ Pursue a marketing program, but only after the community has assessed its competitive position and established long-term strategies. Target marketing to the needs of the industry with factual, easily understood information. These companies are being recruited by communities throughout the world and can easily tell if a community understands the company's needs and has the attributes it requires.

Examples

Austin, Texas: Supporting Local Industry Through Renewable Portfolio Standards and Rebate Programs

The city of Austin established an RPS of 35% by 2020 for municipal utility Austin Energy. The RPS includes a goal of 200 megawatts of installed solar energy systems. To further support a local solar industry, Austin Energy increases its incentive of $2.50 per watt to $3.125 per watt for customers who install PV systems that include equipment manufactured in Austin.

Miami-Dade County, Florida: Creating New Jobs Through the Targeted Jobs Incentive Fund

The county's Targeted Jobs Incentive Fund (TJIF) offers financial incentives for select industries—solar thermal and PV manufacturing, installation, and repair companies—that wish to relocate or expand within Miami-Dade County. To be eligible, companies relocating to Miami-Dade County must create at least 10 new jobs, and expanding companies must create either at least 5 new jobs or at least 10% of the company's workforce at the time of application, whichever is greater. Miami-Dade County gives qualifying companies up to $9,000 per new job in TJIF incentives.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org

This Web site contains summary tables of local, state, and utility financial incentives, including industry recruitment and support. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with the Interstate Renewable Energy Council (IREC), is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. DOE funds this ongoing effort.

Jobs and Economic Development Impact Models

www.nrel.gov/analysis/jedi

Developed by the National Renewable Energy Laboratory (NREL), the Jobs and Economic Development Impact (JEDI) models are user-friendly tools that estimate the economic impacts of constructing and operating power generation and biofuel plants at the local and state levels.

PUBLICATIONS

U.S. Solar Policy Impact Analysis: Economic Impact of Extension of the Treasury Grant Program (TGP) and Inclusion of Solar Manufacturing

Equipment in the Investment Tax Credit (MITC), EuPD Research, May 2010

This study, prepared for the Solar Energy Industries Association (SEIA), includes forecasts on the number of jobs and solar installations resulting from an extension of the TGP and inclusion of the MITC.

Report: www.seia.org/galleries/pdf/EuPD_Research_Solar_Report.pdf

EESI Fact Sheet: Jobs from Renewable Energy and Energy Efficiency

Environmental and Energy Study Institute, October 2008

The Environmental and Energy Study Institute (EESI) is a nonprofit organization established in 1984 by a bipartisan, bicameral group of members of Congress. The institute's charter is to disseminate timely information and develop innovative policy solutions that set the United States on a cleaner and more secure and sustainable energy path. This fact sheet reports the major findings from job-creation studies in the renewable, fossil, and nuclear energy industries.

Fact sheet: www.eesi.org/files/green_jobs_factsheet_102208.pdf

Economic Impacts of Extending Federal Solar Tax Credits

Navigant Consulting, September 2008

This report, prepared for the Solar Energy Research and Education Foundation, includes forecasts on the number of jobs resulting from an extension of the federal solar tax credit.

Report: www.seia.org/galleries/pdf/Navigant%20Consulting%20Report%209.15.08.pdf

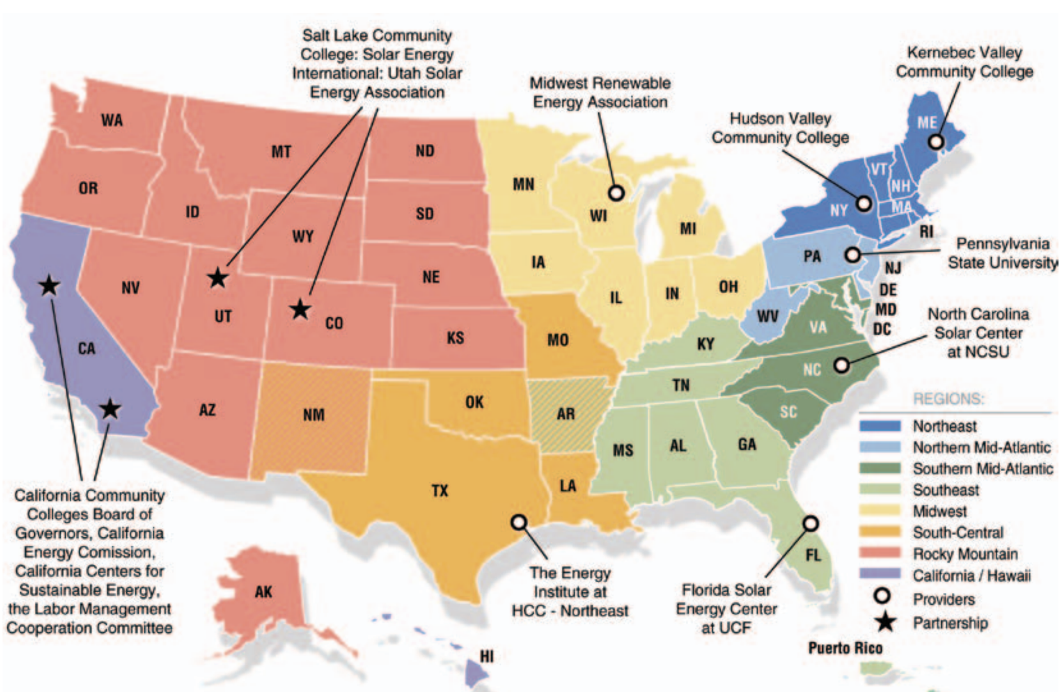
This 12 kW PV array is the largest system entirely owned by the City of Portland. (City of Portland/PIX18048)

5.2

Develop Local Workforce Training and Education Programs

Although the automation of some tasks is increasing efficiency in the solar industry, employment in the field will continue to grow, and solar energy projects will continue to require skilled domestic workers to install, maintain, and service solar energy systems. One way local governments can support solar training programs is to offer financial incentives to people who hire graduates of local training programs to install a solar energy system. They can also help align local solar workforce training programs with other municipal workforce and economic development initiatives and facilitate partnerships between training organizations. Local governments can also play an active role by informing local educational institutions about the benefits of participating in the U.S. Department of Energy's (DOE) Solar Instructor Training Network. The nine Regional Training Providers within the network develop best practices and sponsor local instructors with lab equipment, model curricula, and train-the-trainer workshops.

Solar Instructor Training Network



Source: U.S. Department of Energy/Energy Efficiency & Renewable Energy.

Educating and training solar technicians runs the gamut from intensive weekend courses through multicourse certificate programs to 2-year degree programs. Community colleges, vocational and technical schools, electrical trade unions, and nonprofit organizations offer training, and specialized training is available at small independent centers. Solar product manufacturers and distributors also conduct installer training, although the training is often for product-specific applications. The type and length of training required depend entirely on the prerequisite skills, abilities, and experience of the individual as well as the job requirements of the desired occupation. Critical skills such as the ability to do proper electrical work or sophisticated plumbing could require extensive formal training or work experience. Tasks that require fewer critical skills can be performed by entry-level employees or through on-the-job training opportunities such as apprenticeships under the direct supervision of experienced journeymen workers. Brief training sessions such as weekend courses for people with little or no experience should be viewed as introductory instruction for prospective technicians. These courses don't adequately prepare job-seekers to immediately start work as installers. Unless students are experienced construction tradesmen, such as journeyman electricians or plumbers, graduates of short courses will most likely require extensive on-the-job training and possibly more institutional education.

Established education and training institutions can add solar courses to existing curricula, develop specialized solar training programs, or offer continuing education courses to address solar energy workforce employment opportunities. The amount of practical or work experience an individual has is an important part of any technology program that prepares participants for immediate entry into the workforce. Virtually all U.S. colleges, universities, and community colleges offer continuing education courses. Solar technology permitting and inspection is an example of an appropriate solar-related topic for a continuing education course. Such a course would help installers and inspectors understand local variations in code requirements. Construction trade apprenticeship programs at community colleges or vocational tech institutions are offered in many trades, including electrical, roofing, ironworks, carpentry, air conditioning, plumbing, sheet metal, surveying, welding, and swimming pool construction. Community colleges and vocational tech institutions have the opportunity to introduce cross-disciplinary training into the curriculum. For example, **photovoltaic** (PV) installers need both electrical and roofing training, and **solar water heating** (SWH) technicians need both plumbing and roofing skills.

Associate in applied science (AAS) degree programs stress technology to prepare students for employment in a specific occupation such as a PV technician. AAS programs don't require general education credits and aren't generally intended to prepare pupils for an undergraduate degree. Two-year associate of science (AS) degree programs are intended for career preparation. An AS degree can also be transferred from the community college to a 4-year program such as a bachelor of science in engineering technology. These programs are well suited for students considering pursuing PV system design or energy management.

All solar education and training programs should have the facilities, curricula, and materials to prepare students for postgraduation jobs in the solar industry. The best programs offer internship, apprenticeship, or cooperative on-the-job training opportunities, leveraged with resources of the local industry and government. Solar installation jobs call for mechanical abilities that require "learning by doing" outside the classroom. As an example, The Interstate Renewable Energy Council (IREC) offers Institute for Sustainable Power Quality (ISPQ) training accreditation. The ISPQ standard—which is internationally recognized for renewable energy training programs—specifies requirements for competency, quality systems, resources, and qualification of a curriculum against which trainers and training programs can be evaluated. ISPQ-accredited programs rely on extensive, hands-on work that can be performed only in adequate training facilities. IREC currently offers ISPQ accreditation for training programs, accreditation for continuing education providers, certification for independent master trainers, certification for affiliated master trainers, and certification for instructors.

BENEFITS

A robust solar workforce education and training program is a critical pillar in developing a local solar energy industry. Training programs help ensure consistent installer competency and, through increased consumer satisfaction, can help drive additional growth in local demand for solar installations. In addition, in many cases, solar energy training can transform the careers of individuals formerly employed in the electronics, construction, and manufacturing industries.

Implementation Tips and Options

- ☐ Identify organizations and institutions in the community that are conducting training and education in solar energy.
- ☐ Collaborate with local education and training institutions to identify gaps, needs, and barriers in the development of a robust solar workforce.
- ☐ Encourage training institutions to achieve accreditation through ISPQ. The ISPQ requirements are designed to accomplish the following:
  - Teach individuals the knowledge and skills required for a professional trade.
  - Ensure that graduates have a predictable level of expertise.
  - Make sure that facilities are adequate and safe for training.
  - Ensure that the training organization has appropriate financial resources and that administrative and management procedures and policies are in place and practiced.
- ☐ Contact local training providers to ensure that they know about the activities sponsored by DOE’s Solar Instructor Training Network. Local instructors might be eligible to receive specialized training, equipment upgrades, model curricula, and other assistanc.
- ☐ Work with local institutions to develop solar curricula that match learning objectives with skill sets required by local employers.
- ☐ Encourage local training institutions to offer nationally recognized licensing/certification programs (see 3.5, Installer Licensing & Certification).
- ☐ Evaluate how a local solar training program can help meet broader municipal economic development or workforce-training objectives.
- ☐ Implement local government programs that encourage using locally trained solar installers.

Examples

New Orleans, Louisiana: Facilitating the Louisiana CleanTech Network–Louisiana Technical College Partnership

A significant part of New Orleans' comprehensive plan for the expansion of solar technology is educating and training a solar energy workforce. Nonprofit Louisiana CleanTech Network (LCTN), in partnership with Louisiana Technical College (LTC), offers a solar technology installation course that gives students hands-on experience. The course is a combination of lecture and training covering real-world solar applications, *National Electrical Code* (NEC) information, explanations of state and federal tax credit incentives, and Louisiana solar installation contractor requirements. The class includes 48 hours of professional training in two 3-day sessions and covers the learning objectives for NABCEP's entry-level PV program. All course graduates receive the LCTN certificate of training, which satisfies one of Louisiana's solar system installation contractor requirements.

San Francisco, California: Developing Community Workforce Development Training Programs

The San Francisco Office of Economic and Workforce Development (OEWD) has been working with City College of San Francisco to develop a Green Skills Academy that will offer vocational skills training and placement services; create and implement a targeted outreach strategy to recruit participants from four neighborhoods in the highest-poverty areas in the city; and design and implement an intensive and long-term job readiness training program that will help enrolled participants from targeted communities succeed in the Green Skills Academy and ultimately find their way to economic self-sufficiency through employment in green industry.

OEWD has also developed the TrainGreenSF (www.traingreensf.org) program to connect community-based organizations offering green training for low-income residents and worker referrals from their programs with the solar, energy efficiency, recycling, and green transportation employers who want to hire from the pool of workforce development graduates.

Beginning on July 1, 2010, residents wanting to receive San Francisco's GoSolarSF incentive (www.solarsf.org) for installing a PV system were required to use a contractor who employs staff from city workforce development training programs and is certified by OEWD.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Florida Solar Energy Center: Education

www.fsec.ucf.edu/en/education/cont_ed/bldg/index.htm

The center's building research division offers numerous training and certification courses for a variety of practitioners and professionals as well as the public. The Web site lists PV and solar thermal course offerings.

GoSolarSF: Solar Energy Incentive Program

www.sfwater.org/mto_main.cfm/MC_ID/12/MSC_ID/139/MTO_ID/361

The San Francisco Public Utilities Commission administers the GoSolarSF Program and maintains the GoSolarSF Program Web site. The Web site includes details of the incentive program and a list of workforce development program installers.

Interstate Renewable Energy Council University Courses & Training Providers Directory

www.irecusa.org/irec-programs/workforce-development/education-information

IREC supports market-oriented services targeted at education, coordination, procurement, workforce development, and consumer protection, along with the adoption and implementation of uniform guidelines and standards. The Web site contains information about renewable energy courses at universities, a training catalog, resources for curriculum development, and information about ISPQ accreditation.

National Partnership for Environmental Technology Education

www.nationalpete.org

The National Partnership for Environmental Technology Education is a nonprofit organization that helps facilitate, augment, and broker partnerships with educational institutions, industry, and government. The Web site includes resources for establishing strong environmental practices and programs at educational institutions.

North American Board of Certified Energy Practitioners

www.nabcep.org

NABCEP is a volunteer board that includes representatives of the solar industry and the trades, NABCEP certificants, renewable energy organizations, state policy makers, and educational institutions. NABCEP offers certifications to renewable energy professionals throughout North America, and information on NABCEP-certified installers in the area.

North Carolina State University Renewable Energy Technologies Diploma Program

www.continuingeducation.ncsu.edu/RenewableEnergy.html

This continuing education program is geared toward electrical contractors; building and electrical inspectors; builders and architects; small business owners; landowners; plumbers; heating, ventilating, and air conditioning (HVAC) firms; and other entities interested in gaining a greater level of professional training and understanding in renewable energy. The Web site includes course and workshop listings and registration information.

Solar Energy International: Solar Training & Renewable Energy Education

www.solarenergy.org

Solar Energy International (SEI) is a nonprofit organization based in Colorado with a mission to help others use renewable energy and environmental building technologies through education. The SEI Web site lists the training courses available online and at locations worldwide.

The Southwest Technology Development Institute: Education & Training

www.nmsu.edu/~tdi/Photovoltaics/EducAndTraining/EducTrain.html

This institute is one of the key renewable energy educational organizations in the United States, producing trained project developers, electrical inspectors, engineers, homeowners, and bankers, among others. Courses range from practical, hands-on courses to detailed engineering, financing, and economic development courses.

U.S. DOE Solar Instructor Training Network

www.eere.energy.gov/solar/instructor_training_network.html

The Solar Instructor Training Network addresses the need for high-quality, local, and accessible training in solar system design, installation, sales, and inspection. The network leads an effort to create a geographic blanket of training opportunities in solar installation across the United States. Instructors have access to a variety of training resources and could be eligible for sponsored professional development.

PUBLICATIONS

Renewable Energy Training: Best Practices & Recommended Guidelines

Interstate Renewable Energy Council, February 2010

This report is an update to the September 2008 edition, and contains recommended training guidelines, training criteria, assessment tools, task analyses, credentialing programs, and other related resources for renewable energy training programs. The report includes recommended facilities, hardware, and materials for PV and SWH training programs.

Report: www.irecusa.org/wp-content/uploads/2009/10/BestPracticesFormatted2010Final2410.pdf

Photovoltaic Systems

National Joint Apprenticeship and Training Committee, 2010

In partnership with American Technical Publishers, the National JATC (NJATC) created a comprehensive textbook on designing, installing, and evaluating residential and commercial PV systems. It covers the principles of PV and describes how to effectively incorporate PV systems into standalone or interconnected electrical systems. The content includes system advantages and disadvantages, site evaluation, component operation, system design and sizing, installation requirements, and recommended practices.

Textbook (available for purchase): www.JimDunlopSolar.com

6.0

EDUCATING AND EMPOWERING POTENTIAL CUSTOMERS

Community activities such as tours, solar fairs, and other events can reach different audiences and increase potential customers' knowledge and confidence in solar energy as an option for their own properties. (Robin Read/ PIX09676)

Local governments can engage their communities using a variety of outreach activities that promote solar energy technologies. These activities can augment the public's knowledge about solar energy, promote consumer confidence, and help consumers decide whether to install solar energy systems on their properties. This section introduces some of the many outreach activities that promote solar energy. Efforts can target numerous audiences, including residents and businesses, financial institutions, and students. Potential solar outreach service providers include state and local governments, community organizations, colleges and universities, nonprofit organizations, utilities, and industry associations.

This section can help community leaders track their knowledge about the solar outreach and education activities available in their community, and see what activities are in place in the 25 Solar America Cities.

	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St.Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tuscon
6.1 Create a Consumer Outreach and Education Program		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●
6.2 Install Demonstration Projects with an Educational Component		●	●	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●
6.3 Develop a Customer Assistance Program				●					●	●				●			●	●			●	●	●			
6.4 Use Solar Mapping as an Outreach Tool				●	●		●			●							●	●	●		●	●	●	●		●
6.5 Incorporate Solar into K-12 Curriculum		●	●	●		●				●		●		●		●		●			●	●	●		●	●

Data current as of August 2010

6.1

Consumer Outreach and Education Programs

As with any relatively new technology on the market, consumers must understand how solar technologies work and what their benefits are. Lack of communication, information dissemination, and consumer awareness can prevent residents and businesses from taking advantage of solar energy. To successfully "sell" solar energy in a community, community leaders must understand consumer perceptions about solar and work to overcome any negative or inaccurate ideas or views. They also need to determine the price or value equation that will have the most appeal, find out who consumers view as credible sources of product information, and decide where to place this information so that it reaches the target audience. Media campaigns, workshops, educational displays, events, competitions, and highly visible demonstration projects are a few examples of outreach activities that can be implemented at the local or regional level to help educate the public about solar technologies. Showcasing existing solar energy installations through an online solar mapping tool is a mechanism that's growing in popularity (see 6.4, Solar Mapping as an Outreach Tool). These efforts can help build the solar market by furnishing credible information to increase public awareness and interest in solar technology and financing options.

BENEFITS

Citizens who are educated about the benefits of solar energy and understand financing options and the installation process are more likely to be interested in purchasing and installing solar technologies at their homes or businesses, which increases local demand for solar energy and helps local governments meet solar energy goals.

Implementation Tips and Options

To broaden the market for solar, a community's marketing strategy should accomplish the following objectives:

- ☐ Check if the state energy office or equivalent state agency has a central consumer information Web portal for residents and businesses. Although local leaders may wish to tailor messages to their local community, they can save money and promote standardization across jurisdictions by building on efforts the state has already undertaken.
- ☐ Explain the value proposition for solar.

- ☐ Reinforce in marketing materials the reliability of solar technologies.
- ☐ Reduce the complexity of explanations of solar concepts and technologies.
- ☐ Include a message that resonates with members of the target audience.
- ☐ Reach new customer markets.
- ☐ Use the following outreach tactics to accomplish the objectives just listed:
  - Create an informational Web site or a social marketing site.
  - Use Web-based solar mapping as an outreach tool (see 6.4, Solar Mapping as an Outreach Tool).
  - Publish case studies on existing solar installations.
  - Create educational displays explaining the basics of solar energy (consider making it a mobile exhibit).
  - Train neighborhood solar champions.
  - Organize a solar fair.
- ☐ Secure sufficient resources to support all aspects of a robust consumer education campaign. To do this, partner with organizations such as nonprofits, universities, utilities, and companies. Depending on the scope of the program, the necessary resources could include the following:
  - Adequate space to hold workshops or fairs
  - Trained instructors to lead consumer education workshops
  - Staff to update an educational Web site
  - Solar mapping software.

Examples

Knoxville, Tennessee: Educating the Community Through Consumer Workshops

One of the biggest obstacles to the growth of the solar market in the city of Knoxville is that most citizens lack information about, and experience with, solar technology. To help educate its citizens, the city hosts a series of free solar energy workshops that are open to the public. Participants learn about different solar technologies, the various incentives for purchasing solar systems, and how to find qualified installers such as those certified by the North American Board of Certified Energy Practitioners (NABCEP). Individual workshops focus on different segments of the population (e.g., residents, businesses, utilities), and each workshop is tailored for the appropriate audience. Workshops have been taught in the past by faculty at Pellissippi State Community College (PSCC) and faculty from the Southern Alliance for Clean Energy (SACE). SACE generally teaches informational workshops and PSCC has given a few classes that qualify participants for continuing education credits and preparation for the NABCEP entry level exam. The workshops and related consumer information are promoted through the city's Solar Knoxville Clearinghouse, available online at www.solarknoxville.org.

Portland, Oregon: Reaching the Community Through the Solar Now! Campaign

One of the four major goals set by the city of Portland's Solar Now! program is increasing market demand among local residents and businesses. The city's Bureau of Planning and Sustainability (BPS) has a long history of supporting community outreach, education, training, technical assistance, and customer service, and engaging in creative public–private partnerships that further the mission. Its outreach efforts have played an important role in fostering the sort of community-wide behavior change that has made Portland one of the most sustainable cities in the nation.

The city of Portland identified the Oregon Department of Energy, Energy Trust of Oregon, and Solar Oregon as critical partners in achieving the city's goal of increasing market demand for solar. Each partner plays an important and distinct role in the existing solar market. BPS became involved to help better facilitate and unify the independent efforts. The organizations all came together under the Solar Now! brand, and work to educate the residential and commercial public to market the benefits of solar energy. The Solar Now! campaign has used the following outreach methods:

- Free workshops
- Advertising campaigns to attract attendance to workshops and raise awareness of the Solar Now! program
- Educational brochures for residential and commercial audiences
- Informational Web site (www.solarnoworegon.org)
- A toll-free call center
- E-mail reminders and notifications sent to workshop attendees
- Table presence at local farmers' markets, fairs, and festivals
- On-site presentations at workplaces.

The partnership has enabled Portland to leverage finances as well as skills, resulting in a well-coordinated campaign that's increasingly recognized by the public. As of July 2010, residential solar had grown dramatically, with a 325% increase in the number of systems installed since the campaign started in 2006.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

ASES National Solar Tour

www.nationalsolartour.org

The American Solar Energy Society (ASES) National Solar Tour is the world's largest grassroots solar event. This event offers participants the opportunity to tour homes and buildings to see how neighbors are using solar energy, energy efficiency, and other sustainable technologies to reduce their monthly utility bills and help tackle climate change. It takes place each year in conjunction with National Energy Awareness Month.

California Solar Center

www.californiasolarcenter.org

Californiasolarcenter.org is a prime source of information on solar energy activity in California, and much of the information is applicable to every state. The Web site is managed by The Rahus Institute, a nonprofit organization working to promote greater use of renewable energy through education, research, and program and policy development. This site includes chat rooms, educational resources, and information on financial incentives in California and legislation. The goal is to disseminate timely and accurate information to help develop the market for solar energy technology and design practices in California and to encourage consumers, businesses, and policy makers to move toward a clean energy future without compromising the environment or the economy.

EnergySavers.gov: Exploring Ways to Use Solar Energy

www.energysavers.gov/renewable_energy/solar/index.cfm/mytopic=50011

The U.S. Department of Energy's Energy Savers Web site provides information for consumers on how to leverage energy efficiency and renewable energy to save money on household energy bills. In this section, Energy Savers explains how consumers can harness solar energy for various applications around the home.

Florida Solar Energy Center: Consumer

www.fsec.ucf.edu/en/consumer/solar_electricity

The Florida Solar Energy Center (FSEC) Solar Energy Department has researched PV for more than 30 years. The consumer's section of the Web site helps consumers understand how to use PV in their homes and businesses.

PUBLICATIONS

Smart Solar Marketing Strategies: Clean Energy State Program Guide

Clean Energy Group and SmartPower, August 2009

Effective marketing guides the presentation of product information consumers, with the ultimate goal of persuading consumers to make a particular purchase. This guide explains the classic elements of marketing and the lens they offer for assessing programs that support solar technology deployment. It also identifies market barriers facing solar and how marketing strategies can be used to overcome them.

Report: www.cleanegroup.org/Reports/CEG_Solar_Marketing_Report_August2009.pdf

6.2

Demonstration Projects with an Educational Component

Demonstration projects are important because they increase local awareness of solar energy and its applications. Seeing solar energy technologies operating firsthand enables citizens to better understand the technology. Demonstration projects can include small or large installations of any type of solar energy technology. Positioning demonstration projects in highly visible locations that are easily accessible to the public maximizes the project's impact in a community—a community could install them on government property like a park or in city hall, or partner with local companies and organizations to place them on private property.

The educational component of a demonstration project could include a kiosk at the site location, an informational Web site, live tours at the demonstration project location, and printed information. These types of tools help people understand how solar energy technologies work and can showcase the installation's energy output and associated energy cost savings, as well as its carbon emissions reductions and other environmental benefits.

Several companies offer equipment and software that portray the energy output of a solar system through a user-friendly display. These displays can be incorporated into kiosks and made available online. In addition to the educational benefits, this monitoring equipment yields valuable data on the production of the solar system that can be used for various financial or technical studies.

BENEFITS

Local governments increase awareness of solar energy technologies in their communities by installing demonstration projects that include an educational component. Those who are educated about the benefits of solar energy and see the technology in action are more likely to purchase and install solar technologies at their homes or businesses. This increases local demand for solar energy and helps support a local solar industry. Demonstration projects can also furnish good training opportunities for installers.

Implementation Tips and Options

- ☐ Choose a highly visible, easily accessible location for the demonstration project.
- ☐ Showcase solar energy technologies that community members are likely to install at their homes or businesses.

- Partner with solar companies to host a test site and a showcase for cutting-edge technologies.
- Create educational components such as an on-site educational kiosk or published case studies to accompany demonstration project installations. Ensure that educational materials include information on where to learn more about installing a solar system on one's own property.
- Emphasize the benefits resulting from each demonstration project installation and include information about how solar energy benefits the community, the local government, and the utility.
- Monitor the demonstration both online and on site so visitors can see how the technology performs in real time; save these data for use in financial or technical analyses.

Examples

Houston, Texas: Showcasing Solar Energy Technologies

The city of Houston is home to Discovery Green, a 12-acre park located in a former brownfield site in the downtown area. The park features a 49-kilowatt **photovoltaic** (PV) installation and a three-collector **solar water heating** (SWH) system that preheats water for a restaurant at the park. A display gives live updates of climate conditions, shows how much electricity the PV system is producing, and calculates the associated carbon offsets. A second demonstration project is located at the Green Building Technology Resource Center. The center teaches about green building technologies and features a 6.6-kilowatt PV system that's easily seen from street level.

Knoxville, Tennessee: Demonstrating Photovoltaic Technologies

The city of Knoxville's Solar America Cities grant helped fund the installation of a solar **array** on Knoxville's downtown transit center. Through a cost-share agreement, the Tennessee Valley Authority fully funded a 4.68-kilowatt PV system, Knoxville's first municipally owned PV system, which was designed to demonstrate the practical and attractive use of PV to the public. The PV array, which is positioned to receive maximum sunlight on the transit center rooftop, is visible from multiple angles on the ground. The PV system design features transparent and semitransparent panels and an aesthetically pleasing mounting structure to enhance the overall aesthetic qualities of the building. An exhibit to educate transit users about solar energy, the building's PV system, and **Leadership in Energy and Environmental Design** (LEED) characteristics of the building is inside the transit center. The exhibit includes informational displays about how renewable energy is part of a healthy, sustainable community. The Solar America City project team also helped create an interactive educational exhibit to accompany an existing 15-kilowatt PV array at Ijams Nature Center. Designed to engage and educate both children and adults, the exhibit highlights various types of solar technologies, summarizes how solar works, gives a step-by-step guide for navigating the installation process, and features a variety of solar-powered toys that demonstrate PV in action.

Pima County, Arizona: Publishing Solar Case Studies Online

The city of Tucson prepared, and the Pima Association of Governments and the Southern Arizona Regional Solar Partnership posted online, a series of case studies about solar energy installations throughout the region. Highlighted installations include Sun Tran Solar Bus Shelters, Pennington Street Garage, Hayden/Udall Tucson Water Site, Thornydale Reclaimed Water Reservoir, Clements Fitness Center PV Project, El Rio Adult Education Center, Patrick K. Hardesty Midtown Multi-Service Center, and Zoo School (Conservation Learning Center). Each case study includes a project description, photos, technical specifications, and financial details. Seven new city sites were recently added. Case studies can be viewed at www.pagnet.org/Programs/EnvironmentalPlanning/SolarPartnership/SolarCaseStudies/tabid/757/Default.aspx The city now also has three kiosks in building lobbies that offer basic information about solar and display current and historical solar production on the city buildings.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

6.3

Customer Assistance Programs

Customer assistance programs help residents and business owners better understand the process and implications of purchasing and installing a solar energy system. In addition to offering basic education about solar energy, these programs can include a comprehensive site analysis by a trained professional. Site surveys give prospective solar system owners objective information specific to the installation site. Customer assistance programs can go further by offering specific project financial analysis, product and vendor evaluations, and **solar permitting process** information. As more and more entities become interested in solar energy, these types of programs are increasing in popularity across the country. Their purpose and scope, along with the type of entity that administers the program, vary according to the needs of residents and business owners in a given community. A program's scope depends on its objectives, which can range from increasing consumer confidence to ensuring the judicious use of publicly funded rebate programs. Local governments, nonprofit organizations, and utilities all are potential providers of customer assistance programs.

BENEFITS

Customer assistance programs increase consumer education, confidence, and protection by furnishing objective information. These programs benefit local governments and utilities by promoting high-quality installations and ensuring judicious use of rebate funding (where applicable). The solar industry also benefits from these programs because prospective buyers are better educated about solar and understand the intricacies of owning a solar system. These prospects are closer to a buying decision, so the industry spends less time educating the public and more time selling, designing, and installing systems.

Implementation Tips and Options

- ☐ Convene a broad stakeholder group to identify the customer assistance needs of consumers and the local solar industry to determine the scope of services the program should offer.
- ☐ Design the program with local solar industry input to ensure that it helps facilitate installations and doesn't introduce unintended complications for the industry.
- ☐ Separate basic consumer education from site assessments or more specific project

assistance. Some customers need only a basic level of assistance; maximize the effect of resources by offering varying service levels.

- ☐ Build flexibility into the program design to account for greater-than-expected demand.
- ☐ Create a transparent process for contractor selection if the program assists customers with choosing an installation company.
- ☐ Secure sufficient resources to support all aspects of a robust customer assistance program. Depending on the scope of the program, these resources could include the following:
  - Trained site assessors to perform the site surveys
  - A shade analysis tool
  - Aerial photography or mapping equipment
  - Financial and environmental analysis spreadsheets for project analysis.

Examples

Berkeley, California: Assisting Homeowners and Businesses in Going Solar Through the SmartSolar Program

Berkeley's SmartSolar program offers free information and technical assistance to encourage Berkeley property owners to install solar energy to power homes and businesses. SmartSolar supplies consultants to act as independent solar advisors to help Berkeley property owners assess the solar potential of property, conduct site visits and site-specific analysis of optimal solar solutions, offer lists of local contractors, and give assistance throughout a project, from bid proposal to installation. As of August 2010, SmartSolar had conducted 85 residential site assessments, which had led to 11 installations totaling 50 kilowatts; it also conducted 24 commercial site assessments and reviewed a request for proposals that was put out for bid for installing a 500-kilowatt system. In June 2010, the program expanded to include the East Bay communities of Oakland, El Cerrito, Emeryville, Albany, and Richmond. More information about Berkeley's SmartSolar residential and commercial programs can be found online at www.ebenergy.org/smartsolar-residential and www.ebenergy.org/smartsolar-commercial.

Madison, Wisconsin: Helping Prospective Solar Owners Make Decisions

Through the Solar America Cities grant, the city of Madison contracted with a Midwest Renewable Energy Association (MREA) certified consultant to guide Madison homeowners and business owners through the process of "going solar." The objective of the solar agent program is to increase knowledge, understanding, and confidence about purchasing a solar system by offering a free site survey to Madison residents. The solar agent works directly for the city, lending credibility to the program and giving the consultant direct access to city departments to work through any procedural or permitting issues. The agent performs remote site surveys using aerial photography and Google Street View. If the property received a favorable rating regarding the solar resource, the solar agent discusses general installed-cost figures and arranges on-site assessments. After an on-site assessment, the agent prepares a financial analysis using a template from Focus on Energy, an independent organization that promotes **renewable energy** and energy efficiency projects in Wisconsin. The solar agent does not design the solar system or recommend specific installation companies. Instead, the agent assists residents, nonprofit organizations, and businesses in gathering and understanding quotes from certified contractors located within the city limits.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Midwest Renewable Energy Association Certification Programs: Site Assessor Certification Programs

www.the-mrea.org/course_certifications.php

The MREA certifies site assessors in three technologies—PV, SWH, and small wind systems. Certification requires the successful completion of course work, skills testing, and a written exam, along with the payment of a certification fee.

PUBLICATIONS

Use of Municipal Assistance Programs to Advance the Adoption of Solar Technologies

American Solar Energy Society, May 2009

This report is a tool for municipalities and organizations interested in assisting residents and businesses in going solar. It includes program design considerations, lessons learned from program administrators, and recommendations to consider when designing a municipal assistance program.

Report: www.solaramericacommunities.energy.gov/PDFs/Solar_Municipal_Assistance_Programs.pdf

6.4

Solar Mapping as an Outreach Tool

Interactive solar maps are a powerful tool to raise awareness of and interest in solar energy in a community. An interactive Web-based solar map engages local residents and businesses and is a central portal for sharing other relevant solar information. Most solar maps available today contain information on existing solar installations. Many also include built-in tools that allow local community members to assess the solar potential on their own properties. Some tools even offer information on financial incentives and the rate of return on investment, enabling users to assess the estimated cost and financial feasibility of a solar installation they may be considering. Other solar maps have links to local solar installers or customer assistance programs and information on local permitting procedures and financing options. Although this section focuses on solar mapping's outreach component, solar mapping can also be used in a more analytical way by installers, geographic information system (GIS) analysts, and city planners to assess installation potential within a community. See 7.1, Identify Optimal Installation Locations.

BENEFITS

A Web-based solar map can serve as the first stop for a community for obtaining solar-related information. Displaying solar installations throughout the community in a compelling, user-friendly geospatial format can easily engage local residents and businesses and encourage them to learn more about solar. Using existing GIS data layers can allow the maps to help users "connect the dots," through finding similarly sized installations in a community, determining the available **solar resource** and shading levels, discovering available state and local incentives, finding local contractors, and more.

Implementation Tips and Options

- ☐ Identify which type of mapping software to use based on local needs and the level of detail that needs to be captured.
- ☐ Identify a provider that can develop the map, whether it be in-house staff, an outside consultant, or an organization with solar mapping expertise.
- ☐ Inventory existing solar installations in the community to make the map as robust as possible. See 1.4, Conduct an Installation Baseline Survey.

- ☐ Link from the solar map to case studies of local solar installations to help explain various applications of solar and the process used to install systems.
- ☐ Use the solar map as a central portal to link to other information to educate residents and businesses about solar energy and the process for installing a system, including the following:
  - Information on the various types of solar energy technologies, their uses, and benefits
  - Solar financing options, including available federal, state, local, and utility incentives and finance programs
  - Permitting procedures for installing solar energy systems
  - Lists of solar installation contractors.
- ☐ Obtain Web tracking software to see how people are using the site and survey users about the map's usefulness.
- ☐ Link the map with the National Renewable Energy Laboratory's (NREL) Open PV Project (see http://openpv.nrel.gov), which tracks solar installations throughout the country.
- ☐ Consider using the map Web site to publicly track progress toward a stated **installation target**.

Examples

Houston, Texas: Mapping Houston's Solar Installations Online

The city of Houston's interactive solar map (see www.solarhoustontx.org/Experience/ASESAnnualHoustonSolarTour/Tour2010/tabid/1805/Default.aspx) gives visitors a virtual tour of solar installations throughout the city. The map is currently used for the annual Houston solar tour to display the sites selected for the tour (www.houstonsolartour.org). The city also expects installers and solar system owners to participate and add sites to the map as well. The map maintains a database of solar installations around Houston that's particularly useful because this information has never been tracked before. It has photos and case-study snapshots of the individual solar installations, which include a description of the system, installation type (**photovoltaic** [PV] or **solar hot water**), approximate energy and cost savings, name of the installer, install date, and location. The solar map also is source for local solar information and event information, and includes a list of local solar installers. The city plans to add information on best practices and incentives for solar projects.

Sacramento, California: Showcasing Installations Through Solar Mapping Software

The Sacramento Municipal Utility District (SMUD) maintains an inventory of its existing solar installations and, with the consent of the owners, publishes these locations online via a solar map application. The map includes information on the type of solar energy system installed, system size, and location. The Web site enables users to estimate the solar potential of their own properties by entering their address. A GIS-based software program estimates the amount of space available for a PV installation, the amount of electricity the system will produce annually, and the associated financial and carbon savings. Users also can access California's database of installers, retailers, and contractors. The solar map resides on SMUD's Green Community Web site at www.smud.org/en/community-environment/our-green-community/tools/solarmap.html.

San Francisco, California: Assessing Solar Potential with the San Francisco Solar Map

The San Francisco Solar Map (see http://sf.solarmap.org) is a Web-based tool for assessing the solar potential of rooftops on buildings located in the city and the related economic and environmental benefits of using solar at specific sites. It allows users to see how many solar systems have been installed in San Francisco and where they're located, as well as information about a system's performance, the company that installed each system, and photos and quotes from the owners, if this information has been supplied. The map ensures easy access to all the information and resources needed to understand and pursue a solar project in San Francisco, such as permitting procedures and incentives if available, and includes San Francisco solar data and links to local solar news stories. Attracting an average of 1,300 visitors each month, the San Francisco Solar Map has shown itself to be a valuable tool for residents looking for more information about solar energy use in the city.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

National Renewable Energy Laboratory, In My Backyard

www.nrel.gov/eis/imby

The In My Backyard (IMBY) tool estimates PV array and wind turbine electricity production based on specifications of system size, location, and other variables. The tool uses the user-friendly Google maps platform to allow users to locate their property and "draw" the planned installation on their rooftop or other desired location.

The Open PV Mapping Project

http://openpv.nrel.gov

The Open PV Mapping Project is a collaborative effort between government, industry, and the public that is compiling a comprehensive database of PV installation data for the United States. Data for the project are voluntarily contributed from a variety of sources, including utilities, installers, and the general public. The data collected are actively maintained by the contributors and are always changing to provide an evolving, up-to-date snapshot of the U.S. solar power market.

PUBLICATIONS

Analysis of Web-Based Solar Photovoltaic Mapping Tools

National Renewable Energy Laboratory, June 2009

A PV mapping tool visually represents a specific site and calculates PV system size and projected electricity production. This report identifies several commercially available solar mapping tools and gives a thorough summary of the source data type and resolution, the visualization software program used, user inputs, calculation methodology and algorithms, map outputs, and development costs for each map.

Report: http://solaramericacommunities.energy.gov/PDFs/Analysis_of_Web_Based_Solar_PV_Mapping_Tools.pdf

6.5

Solar in K-12 Curriculum

Around the country, solar educational materials have been developed for incorporation into school K-12 curricula. If the state has already integrated a solar-related K-12 curriculum into its education requirements, use the accredited curriculum as a starting point. If there is no approved curriculum, work with local and state educational boards to create appropriate materials and help teachers use them effectively. To integrate solar energy into the K-12 curriculum in a community, community leaders must work within established state and local curricula guidelines, create a mechanism for training teachers to deliver the information, and consider how teachers can show students a solar energy system in action. It's important to understand any constraints on teaching materials and determine how solar information can be included to maximum effect.

BENEFITS

Solar technologies installed at schools are excellent showcases for displaying the benefits of solar and other forms of **renewable energy**. Incorporating solar energy science into the K-12 curriculum and installing solar technologies at local schools educates not only children but also the community. And because the students of today will become the workforce of tomorrow, instilling interest in solar energy at a young age can help prime a future solar workforce.

Implementation Tips and Options

- ☐ Identify and draw from curricula that have been developed in other areas.
- ☐ Work with local and state curriculum developers to ensure that the materials meet the standards for education.
- ☐ Offer the curriculum to local educators and train them to use it properly. Involving teachers early on helps build support for adopting the curriculum.
- ☐ Develop a "solar for schools" program that includes not only curriculum but also incentives for installing solar systems, monitoring their energy production, loading the data onto a Web site, and using those data as a tool within the curriculum.

- ☐ Work with owners of existing solar energy systems in the area to create a list of solar **arrays** that are available as field-trip destinations for students. Distribute this list to teachers, particularly those at schools that lack an on-site solar energy system.

Examples

Austin, Texas: Promoting Solar in Schools

In 2006, Austin Energy launched its Solar for Schools program, which offers **photovoltaic** (PV) installations to area schools. Austin's program is part of the broader Texas Solar for Schools program, sponsored by the Texas State Energy Conservation Office. By 2009, the Texas program installed PV systems at 42 schools across the state. As of spring 2010, Austin had installed 32 systems at area schools. This represents 81.8 kilowatts of total capacity with an estimated annual production of 136,004 kilowatt-hours. Students can monitor energy production from the solar installations via a Web site. Staff from Austin Energy worked with Austin Independent School District science teachers to develop a solar energy curriculum. On May 13, 2010, the Austin City Council entered into a 2-year agreement with the school district to install solar panels and solar outdoor learning centers at up to 21 schools. The solar installations will generate power for the schools and give children an opportunity to participate in interactive lessons on solar energy.

New Orleans, Louisiana: Launching the Solar Schools Initiative

The city of New Orleans is working with the local utility Entergy New Orleans and the U.S. Green Building Council to implement a solar schools initiative. Through a Solar America City grant, a U.S. Department of Energy (DOE) technical team was brought to New Orleans to analyze new construction and major renovations of municipal buildings and schools for applicability of energy efficiency and solar technologies. Four schools were selected for the installation of solar arrays: Warren Easton Senior High School, Joseph A. Craig Elementary, William Frantz Elementary, and Henry Allen Elementary. As of October 2010, all but Henry Allen had been completed and are being used as models for solar installations on municipal buildings. In conjunction with the installations at these schools, New Orleans is developing a solar curriculum for implementation during the 2011–2012 school year that will be used to teach students about energy efficiency and renewable energy. **Energy audits** of the New Orleans schools are included in the curriculum, which allows students to gain "hands-on" experience with tracking actual building energy consumption.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Florida Solar Energy Center: Education

www.fsec.ucf.edu/en/education/k-12/curricula/index.htm

The Florida Solar Energy Center (FSEC) has designed many curriculum materials for K-12 teachers and schools, in accordance with state standards. This Web site describes these materials and features links to useful Web sites. FSEC also administers the SunSmart Schools Program.

The NEED Project: Putting Energy into Education

www.need.org/curriculum-guides

The National Energy Education Project (NEED) developed a K-12 solar curriculum that can be downloaded from this Web site.

National Renewable Energy Laboratory Education Programs

www.nrel.gov/education/k12_students.html

The National Renewable Energy Laboratory's (NREL's) programs promote science, mathematics, and technology education using renewable energy to capture student interest.

Southface: Building Know-How for a Sustainable Future

www.southface.org/

Southface Institute, a nonprofit organization governed by a volunteer board of industry experts, has been recognized for excellence by DOE, the U.S. Environmental Protection Agency, and numerous industry and community organizations. The Web site contains a comprehensive list of educational resources and materials for teachers interested in incorporating solar energy into their curriculum. The information emphasizes solar energy and also describes activities and lessons encompassing other forms of renewable energy and energy conservation.

Texas State Energy Conservation Office: Renewable Energy Lesson Plans

www.infinitepower.org/lessonplans.htm

The Texas State Energy Conservation Office created the Infinite Power of Texas Renewable Energy Educational Campaign to accelerate the acceptance of renewable energy resources in the state. The lesson plans available on this Web site were developed by a team of professional educators and renewable energy experts, and include teacher resource guides, reading passages for students, student worksheets, and many other helpful improvements in an easy-to-download format.

A 3kW rooftop PV was installed in the Center City District of Philadelphia. (Mercury Solar Solutions/PIX18063)

7.0

LEADING BY EXAMPLE WITH INSTALLATIONS ON GOVERNMENT PROPERTIES

The Williams Building in downtown Boston, Massachusetts, location of the United States Coast Guard, has a 28 kW AC PV system integrated into the roof consisting of 372 panels. (SunPower/ PIX08466)

Local governments can show leadership by integrating solar energy technologies into government facilities and properties. Leading by example is an excellent way to ignite a local solar energy industry and encourage area residents and business owners to adopt solar energy systems. This section describes the process for government entities to procure solar energy systems, including determining which government-owned locations are best suited for solar,

	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St.Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tuscon
7.1 Identify Optimal Installation Locations		●		●	●	●		●	●		●		●				●	●	●		●	●	●	●		●
7.2 Standardize Solicitations for Solar Installations				●	●							●			●	●	●	●		●	●					
7.3 Select the Appropriate Financing Mechanism: Utilize Tax-Exempt Financing																							●			
7.3 Select the Appropriate Financing Mechanism: Utilize Tax Credit Bond Financing																						●				●
7.3 Select the Appropriate Financing Mechanism: Utilize Third-Party Finance Models			●			●	●	●						●				●			●	●	●			●
7.3 Select the Appropriate Financing Mechanism: Use Local Funds in Combination with Third-Party Finance Models											●			●	●		●		●							
7.3 Select the Appropriate Financing Mechanism: Utilize Performance Contracting								●						●			●		●							
7.4 Commission the Solar Energy System and Ensure Quality Operations		●	●		●	●			●		●			●		●		●	●		●	●		●		●
7.5 Host Wholesale Power Generators on Local Government Land or Facilities																	●								●	●

Data current as of August 2010

choosing the appropriate financing mechanism, procuring equipment, and commissioning the system.

Read the following topic areas to gain a comprehensive understanding of the solar procurement process and options available, and see what activities are in place in the 25 Solar America Cities.

Nearly 2,000 solar panels installed at the Veterans' Affairs Regional office and Insurance Center in Philadelphia produce over half a million kilowatt-hours of solar electricity annually. (The U.S. General Services Administration/PIX18066)

7.1

Identify Optimal Installation Locations

The first cut at assessing the solar energy potential of government-owned sites can be made remotely using aerial or satellite images in combination with solar mapping and resource-assessment software. These tools can estimate the amount of space available for an installation, identify shading issues, and estimate how much energy a particular solar technology will produce at that specific location. After the sites with the most potential are identified, a trained site surveyor should perform a detailed on-site assessment of municipal buildings and property. **Solar site assessments** give insight into the economics, technical issues, and energy production potential for specific solar installations. This is a necessary first step in determining which buildings are most suitable and desirable. The assessments should include technical analyses of a building's energy load; roof age, type, and warranty; weight load limitations; available roof space (or ground space for a ground-mounted system); slope, shading, and orientation; optimal conduit paths; and electrical or water heating configuration. A solar developer, trained in-house employee, or qualified independent third party can perform site assessments.

BENEFITS

Whatever a community's strategic plan and goals for solar energy installations include, identifying the best locations and prioritizing sites for solar technology installations will optimize the community's investment and ensure the community gets maximum benefit from a limited pool of resources.

Implementation Tips and Options

- ☐ Identify the objectives for installing solar energy systems on municipal properties, such as getting the best return on investment, optimizing solar energy production and **greenhouse gas emissions** reduction, or raising public awareness of solar, and list locations in order of priority based on these objectives.
- ☐ Rank installation sites in order of priority by visibility and accessibility, if the objectives include raising public awareness of solar technologies or offering educational tours of the facility. See 6.2, Demonstration Projects with an Educational Component.
- ☐ Use mapping software and solar resources calculators to identify the most feasible potential installation site. The economic value of installing solar at a particular site is based on the

facility's energy consumption profile, the system's expected energy production, and the electricity rate charged by the utility at the facility. Start by gathering at least 12 months of historical energy usage data for each facility. See 4.3, Rate Structures that Appropriately Value Solar.

- [ ] Consider ground-mounted as well as roof-mounted systems.
- [ ] Identify buildings with upcoming roof replacement scheduled and consider coordinating solar technology and roof installations. It's best not to install solar systems on roofs that need to be replaced in the near future because the solar panels must be removed and reinstalled on the new roof, increasing costs. An ideal approach for installations where roof penetrations are required is to integrate the technology into the structure during roof replacement instead of penetrating an existing roof.
- [ ] Arrange professional site assessments by a solar developer, trained in-house employee, or qualified independent third party.
- [ ] Include facilities managers in the on-site assessment early on to integrate them into the process and use their knowledge of the building's energy use and schematics.
- [ ] Utilize this as an opportunity for hands-on training of additional in-house facilities personnel and site assessors.

Examples

Ann Arbor, Michigan: Using a Solar Feasibility Study as a Training Opportunity

As part of Ann Arbor's Solar America City project, city staffers, a representative from Sandia National Laboratories, and a representative from CH2M HILL visited five municipal buildings to evaluate the **solar water heating** (SWH) and **photovoltaic** (PV) potential of each facility. The evaluation criteria included available roof area, roof age and condition, shading factors, electrical **interconnection** access, conduit routing, facility energy consumption, electrical meter location, potential inverter and disconnect mounting locations, structural roof issues, and potential SWH applications. The feasibility study and associated report serve as a framework for evaluating and reporting on the solar potential of other facilities in Ann Arbor. The report, available at www.a2gov.org/government/publicservices/systems_planning/energy/solarcities/Documents/AnnArbor_SolarSiteAssessments.pdf, includes detailed information from each site evaluated, financial analysis for the three best sites for solar, recommendations on a framework for future site evaluations, and a summary of the training given during the site evaluations. Washtenaw County and the Ann Arbor Downtown Development Authority plan to conduct solar feasibility studies at more city facilities. During the site evaluations, the experts trained a representative from Recycle Ann Arbor, a local, nonprofit, citizen-driven conservation organization, to conduct scoping visits. This small add-on investment to the city site evaluations is now being leveraged by Recycle Ann Arbor to evaluate other potential sites in the city, independent of the experts. Recycle Ann Arbor will also leverage this training to include solar feasibility studies in 100 **energy audits** that it will be conducting to develop a Home Energy Performance Certification. The certification process includes a solar feasibility component, which ultimately could lead to a required solar feasibility study for every Ann Arbor home that's put up for sale.

Pittsburgh, Pennsylvania: Assessing Solar Potential Through the Solar Roadmapping and Simulation Tool (RooSTer)

As part of its Solar America City project, the city of Pittsburgh and a team of technical experts led by Sandia National Laboratories are developing a computer application called RooSTer. With this tool, users can select a set of city properties, specify the solar technologies for application to those properties (i.e., SWH, PV), and choose a funding mechanism for procuring each installation. RooSTer then calculates the year-by-year and cumulative energy production capability of the entire set of installations and projects changes in costs for conventional energy over a given installation period. The tool also calculates carbon offsets, total costs, and payback periods. RooSTer will allow city planners to experiment with different configurations of solar development in Pittsburgh and to quantify the variables associated with that development. City planners then can use the results to demonstrate to city policy makers and donor institutions the thorough preparation and rigor behind the development plan, and to justify any loans or grants required to complete the solar projects.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Midwest Renewable Energy Association Site Assessor Certification Program FAQs

www.mreacsa.org/index.php?option=com_content&view=article&id=51&Itemid=98

This Web page provides answers to frequently asked questions about the Midwest Renewable Energy Association's (MREA's) site assessor certification program and the site assessor process.

National Renewable Energy Laboratory, In My Backyard

www.nrel.gov/eis/imby

The In My Backyard (IMBY) tool estimates PV array and wind turbine electricity production based on specifications of system size, location, and other variables.

PUBLICATIONS

Analysis of Web-Based Solar Photovoltaic Mapping Tools

National Renewable Energy Laboratory, June 2009

A PV mapping tool visually represents a specific site and calculates PV system size and projected electricity production. This report identifies the commercially available solar mapping tools and gives a thorough summary of the source data type and resolution, the visualization software program used, user inputs, calculation methodology and algorithms, map outputs, and development costs for each map.

Report: http://solaramericacommunities.energy.gov/PDFs/Analysis_of_Web_Based_Solar_PV_Mapping_Tools.pdf

San Francisco Solar Site Assessor Training

National Renewable Energy Laboratory, January 2009

This slide deck was developed by NREL to train site assessors for the City and County of San Francisco. The presentation includes information on how to perform a site assessment for PV and SWH technologies, how to size a system, roof and electrical safety, and tools to use on a site assessment.

Presentation: http://solaramericacities.energy.gov/pdfs/San%20Francisco%20Solar%20Site%20Assessor%20Training%20Slides.pdf

The solar array rooftop system on the South Concourse of the Orange County Convention Center in Orlando, Florida, was completed last year as a DOE Solar America Showcase. (Orange County Convention Center/PIX18077)

7.2

Standardize Solicitations for Solar Installations

Soliciting bids for solar energy installations and then choosing a developer can be time consuming and complex. Streamlining the decision-making process by creating standard solicitation forms and establishing the appropriate evaluation criteria and process up front saves time and yields a better result. Choosing a solar developer usually involves releasing a request for proposals (RFP) to solicit bids for **photovoltaic** (PV) or **solar water heating** (SWH) installations. These documents typically specify the requirements for the installation, such as system size or energy output, technology type, installation location, and cost range. The proposal requirements will vary if they are for a **power purchase agreement** (PPA) rather than a design-and-build contract. With a PPA, prices for the electricity output (in kilowatt-hours) are proposed with a contracted annual increase (escalator) for a system that's placed on the site but owned by the PPA developer as a commercial project. For a design-and-build contract, many agencies are required to evaluate on a low-bid basis for defined specifications. This creates the need to incorporate **levelized cost of energy** as the key metric for comparing quotes from different vendors rather than total project costs to ensure that the system is well designed for maximum output.

With any type of project, the information in the RFP will affect the response rate and quality and should include all available information needed to submit a proposal, such as the facility's energy load data, electrical or water heating schematics, building plans, **solar site assessment**, and system specifications. After a predetermined solicitation period, a committee typically evaluates bids and chooses a developer that meets the specified requirements and costs. Some private-sector companies work with local governments to help draft and review RFPs and bids when a process has been established. Also, local agencies can pool sites to achieve lower costs and greater market interest while reducing overall transaction costs by using a standardized process.

BENEFITS

By using a well-crafted RFP and evaluation process, a community can streamline the procurement effort and generate interest from multiple solar developers. Standardizing these processes makes it easier to solicit industry proposals for future installations and work across various city or county departments.

Implementation Tips and Options

- ☐ Identify the city or county departments involved and learn about their RFP processes.
- ☐ Determine whether changes can be made to the existing RFP process to create a solar-specific RFP.
- ☐ Develop a template for a solar RFP using the necessary boilerplate information from city or county departments. Sample RFPs can serve as a helpful starting point (see, for example: http://votesolar.org/resources/sample-rfp.
- ☐ Develop the criteria (e.g., lowest cost, most qualified) and process for evaluating bids.
- ☐ Evaluate the quality and sophistication of likely respondents, and if the intent is to support the local market, design the solicitation to be compatible with local industry.
- ☐ Supply adequate information for developers to respond with an accurate estimate of costs. Some general guidelines follow:
    - Compile any roof or as-built drawings of the buildings that are being considered in the RFP. For ground-mounted solar systems, include a topographical map of the location.
    - Include a structural and electrical analysis for each site to determine if upgrades may be necessary and to reduce the uncertainty in the bidder proposals.
    - Include a shading analysis report for each proposed location so that the bidders understand the potential system output at each site.
- ☐ Determine which elements should be specified by the RFP issuer and which should be left to responders to specify. Following are some general recommendations for PV-system RFPs:
    - Create outcome-based RFPs that require minimum production output rather than equipment and design specifications, so responders are free to offer their system option.
    - Require that companies submitting proposals use a nationally recognized modeling tool such as the National Renewable Energy Laboratory's PVWatts (www.nrel.gov/rredc/pvwatts/) to forecast annual energy production for each system for each month over a 20-year period (at minimum).
    - Ensure that companies submitting proposals demonstrate financing ability and product availability to reduce drop-out risk.
    - Require installers to take full responsibility for obtaining permits from the appropriate government agencies. Installations should meet all local building codes and the *National Electrical Code*.
    - Require installers to take full responsibility for obtaining the **interconnection agreement** with the utility, including providing all drawings, schematics, and other required technical documentation.
    - Mandate submission of a project plan with detailed information on each milestone's completion date. Projects that are not completed on time can be subject to liquidated damages or payments for each day that the system is not complete or a major milestone is not met.

- Require the installer of any roof-mounted solar system to be responsible for the integrity of the roof after the installation is completed and ensure that the existing roof warranty is maintained. This could require working with the contractor that originally installed the roof to determine whether the solar energy system installation affects the roof warranty. Depending on the site, a local government could also choose to require a ballasted system (which requires little or no rooftop penetration).
- Require pricing for all-inclusive up-front costs and average costs over the production lifecycle to be sure bid reviewers can evaluate comparable bids.
- Ask for potential buyout options in addition to requiring price per kilowatt-hour and annual escalators in PPA proposals, in order to determine the best long-term scenario for the community.

- ☐ Post the solicitation publicly and advertise broadly to encourage vendor participation.
- ☐ Use qualified, independent technical reviewers to help develop the RFP criteria and evaluate the proposals.
- ☐ Work together and pool sites through a collaborative procurement in the public or private sector to generate better responses, attract national system integrators, and reduce installed system costs.

Examples

Milwaukee, Wisconsin: Redesigning a Solar Request for Proposals Based on Lessons Learned

The city of Milwaukee has limited experience contracting for solar installations. When soliciting solar installation bids, the Milwaukee Solar Program uses the template and boilerplate language of the department with which it's working; the level of detail written into an RFP varies across departments. After the bids for nine SWH installations on municipal firehouses came in and were much higher than anticipated (more than double), the city was unable to contract with an installer. The primary lesson learned was that this particular project had been overdesigned, which had made it difficult for local solar thermal installers to respond with cost-effective solutions. The specifications in the RFP made it difficult for the potential installers to leverage supplier relations or respond with innovative designs. The rewritten RFP and future requests are designed to be more flexible and based on outcome. Instead of specifying production requirements and installation locations, many of the design and equipment details are left to the firms responding to the RFP. The modified RFP has resulted in two separate systems being successfully put to bid, with a range of bids received within the designated budget.

San Antonio, Texas: Attracting International Respondents to Solar Request for Proposal

CPS Energy, San Antonio's municipal utility, released an RFP seeking up to 100 megawatts of solar energy resources to be supplied under a long-term arrangement. CPS Energy took a creative approach by soliciting responses through a national ad campaign with personal ad-type headlines such as "65-year Old Looking for a New Hot Partner." The ad campaign ran in regional and national publications such as the *San Antonio Express-News*, the *Houston*

Chronicle, the *Dallas Morning News*, and the *Wall Street Journal*. The campaign resulted in 2,500 Web page views, 610 RFP downloads, 36 proposals from 20 respondents in 2008, and 68 proposals from 30 respondents in 2009. Companies based in Europe and the United States submitted proposals. The winning developers agree to install, own, and operate the solar power plants, and sell the output to CPS Energy at wholesale prices. As of October 2010, CPS had agreements in place for more than 40 megawatts of solar power.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Vote Solar Initiative, Sample Requests for Proposals

http://votesolar.org/?s=SAMPLE+RFP&x=0&y=0

The Vote Solar Web site has several sample RFPs for direct purchases as well as PPAs.

World Resources Institute, Best Practices Guide for Buying Solar Systems

www.wri.org/buying-solar

This Web site includes a recently developed best practices guide, case studies, and template documents for public and private groups who want to leverage their buying power to decrease costs and improve vendor performance.

PUBLICATIONS

SolarTech Project Finance Contract Templates, Power Purchase Agreements Accompanying Guide

SolarTech, November 2009

The PPA accompanying guide describes in layperson terminology the crucial clauses and terms and provides guidance on how to best use the PPA and Site Lease Contract Templates.

Report: http://solartech.org/index.php?option=com_st_document&view=general&Itemid=58

Power Purchase Agreement Checklist for State and Local Governments

National Renewable Energy Laboratory, October 2009

This fact sheet provides information and guidance on a PV PPA, a financing mechanism that state and local government entities can use to acquire clean, renewable energy.

Fact sheet: http://www.nrel.gov/docs/fy10osti/46668.pdf

7.3

Select the Appropriate Financing Mechanism

After identifying promising solar projects in a community, community leaders must determine how to finance them. With the emergence of third-party finance models, local governments might not have to invest extra money up front to complete solar projects. Depending on the size of the project and the availability of public funds, a local government's options for financing the installation of a solar energy system vary. Direct ownership of the system can be financed in a number of ways, including conventional municipal finance mechanisms and more recently created federal tax credit bonds. When bundled with energy efficiency measures, an **energy service performance contract** (ESPC) to finance a solar energy system might be appropriate. Consider third-party finance models for large solar energy projects or a bundle of many small- and medium-sized installations. These models eliminate the up-front capital cost and ongoing operations and maintenance (O&M) responsibilities, but incorporate the benefits of tax credits.

If a community decides to directly finance and own its local solar energy systems, several tax-advantaged instruments are at its disposal. Direct ownership does mean, however, that the community forfeits some tax incentives available for commercially financed solar projects. To compensate, some state and utility programs offer greater cash incentives for entities that do not pay taxes, such as the public sector and nonprofits. Additionally, availability of federal stimulus funds and other resources make unique financial arrangements possible, such as combining resources in partnership with a third party.

Tax-Exempt Financing

Local governments have the authority to issue **tax-exempt bonds**. These bonds typically fall into one of two categories: (1) general obligation bonds, which are backed by the full taxing authority of the local government and require voter approval; or (2) revenue bonds, which are backed solely by the revenue generated by the project being financed. Tax-exempt bonds can be a source of capital for solar installation projects. In many cases, a single solar project is not large enough for a dedicated issuance but will instead be bundled into a larger bond. The American Recovery and Reinvestment Act of 2009 (the Recovery Act) created another source of municipal debt called **Build America Bonds** (BABs). A BAB could be a mechanism for public entities to issue taxable bonds at a lower cost than more conventional tax-exempt bonds. Some public agencies have already issued BABs. As with tax-exempt bonds, it is unlikely that a single solar project is large enough for a dedicated BAB. Instead, it's likely to be part of a larger capital expenditure plan.

Tax-exempt commercial paper (TECP) can be issued for up to 270 days. This short-term, unsecured debt can be used to finance capital projects in between longer term **municipal bond** issuances. Depending on the project, local governments can purchase a solar energy system using TECP and then repay this obligation with a long-term bond issuance, or the TECP itself can be rolled over at maturity. Tax-exempt leasing of equipment (versus purchasing it) is a common way for cities to finance certain capital investments (e.g., vehicles, software, computers, and office equipment). Using a tax-exempt lease to finance a solar energy installation for a public-sector entity, however, is uncommon. If the municipality uses a tax-exempt lease to finance a solar installation, the lessor (system owner) can't take advantage of the **federal investment tax credits** (ITC) because to do so the user of the system (the city) must be subject to U.S. income taxes. As a result, cheaper sources of public financing for the project might be available.

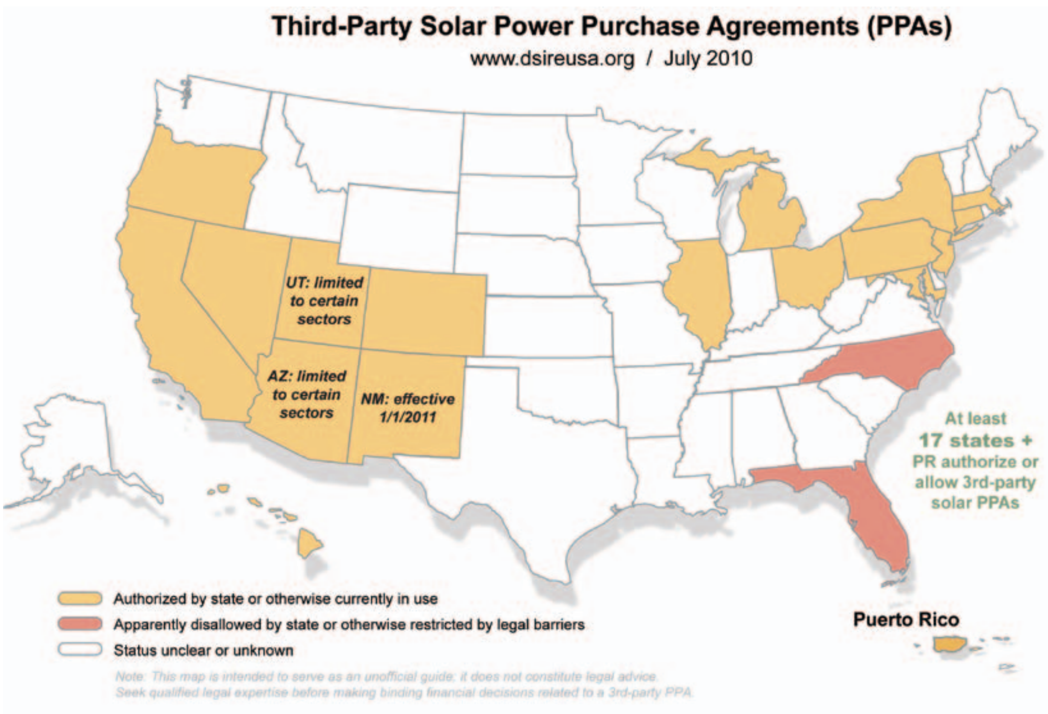
Tax Credit Bond Financing

The Recovery Act expanded two bonding mechanisms for financing renewable energy projects, **clean renewable energy bonds** (CREBs) and **qualified energy conservation bonds** (QECBs). CREBs and QECBs are an attempt to level the playing field for public entities that aren't in a position to take advantage of the tax benefits available to tax-paying entities who install solar projects, including the federal ITC, the Modified Accelerated Cost Recovery System (MACRS), and state tax credits. The tax credit bonds were intended to be interest-free debt—investors who purchased a CREB or QECB received a federal tax credit instead of interest payments from the issuer. In practice, the issuer was often required to make a supplemental interest payment or issue at a discount. With the passage of the Hiring Incentives to Restore Employment Act of 2010 (the "HIRE Act"), CREBs and QECBs can be issued with a direct subsidy feature similar to BABs. Now CREBs and QECBs can be issued as taxable bonds with the issuer receiving a subsidy from the federal government rather than the bond investor receiving a tax credit. This direct subsidy mechanism is more attractive to investors, which should lead to more QECBs and CREBs being issued to finance solar projects.

CREBs were fully allocated in 2009, so if a local government did not already receive an allocation, it is no longer an option. QECBs were allocated to states based on population. Inquire with the state energy office to determine the status of QECB availability.

Third-Party Finance Models

Local governments are moving away from direct ownership of **photovoltaic** (PV) systems and are partnering with third-party owners. Third-party ownership structures typically are used to finance PV systems, not **solar water heating** (SWH) systems. Cities and counties see the third-party ownership model as a way to effectively monetize federal tax benefits, avoid paying the up-front cost of solar, allocate public funds more efficiently, and accelerate PV deployment. Instead of owning the PV system, a city or county agency would host a system purchased by and owned by a third-party solar developer and its investors. The city enters into a long-term energy services agreement—commonly known as a **power purchase agreement** (PPA)—with this third party to purchase the electricity generated from the PV system on government property. The electricity price is usually set at a rate competitive with the host's current retail rate in the first year. The rate then typically escalates at some fixed percentage (2% to 5%) per year over the life of the contract. As an alternative, a fixed rate for the entire length of the contract could be negotiated. The developer manages all aspects of system financing, installation, and maintenance and bears all standard operating risks. Given high transaction costs and economies of scale, the third-party PPA model is best suited to larger projects (greater than 300 kilowatts), although a series of smaller projects can be bundled under one PPA. Commonly included in a PPA is the option for the host to purchase the system from the third party after a certain period has elapsed (buyout option), usually after year six. Exercising the buyout option enables the host to acquire a system at a much lower cost than if the host purchased it new in year one because the third-party financier/system owner has used the tax credits. Note that third-party financing is not legal in all states because of the perception that the third party would be acting as a utility. Several states have overcome this obstacle through legislation that enables renewable energy power producers to enter into PPAs in exchange for tax benefits and payments from customers, without being deemed to be a utility. As of July 2010, at least 17 states and Puerto Rico authorize or allow third-party PPAs.



For the most up-to-date numbers of states that support third-party financing, visit http://dsireusa.org/userfiles/image/summarymaps/3rdpartyppamap.gif

Using Local Funds in Combination with Third-Party Finance Models

Local governments might receive Recovery Act-related funding to purchase and install solar energy systems. They could also have **general funds** dedicated to renewable energy projects or be able to exercise bonding authority. Instead of using these funds to purchase and install a PV system, a community might be able to stretch these resources and install a larger project by partnering with a third-party solar developer. One structure is to make a loan to the developer using the funds available for solar. The developer can incorporate the loan into its project financing package. If the host decides to exercise its buyout option in the PPA, the outstanding loan can be netted against the purchase price. As a result, the public entity can end up owning a larger system than it would have if it simply had purchased one at the outset.

Performance Contracting

A solar installation can be bundled into an ESPC. In the ESPC model, an **energy services company** (ESCO) makes energy efficiency investments on behalf of the city and then is repaid out of the energy savings that result from these investments. Many **energy conservation mechanisms** (ECMs), such as upgrading a facility's lighting or installing a new boiler, have a much shorter payback term than that of a solar energy system. Combining these ECMs with solar technologies ideally creates a package of energy efficiency and renewable energy investments with a total payback period that's attractive to the municipality.

Summary

After comparing all these financing options, we can draw several conclusions. If immediate ownership of the solar energy system is important to a community, tax-exempt financing and tax credit bonds are likely the preferred sources of financing. PV system ownership offers the greatest electricity cost savings, yet financing costs are incurred. Additionally, system O&M is the responsibility of the local government. If the primary barrier is the up-front cost of the system, the third-party-financed PPA structure can be an effective solution. PPAs trade the advantages of being tax exempt for the potentially greater tax benefits available to the private sector. These tax benefits can be "monetized" and passed through to the site host as reduced payments for the solar energy generated. A service contract also shifts the risk that the system might not perform as expected to the service contract provider. The local government, however, continues to purchase 100% of its electricity, and the ability to make certain environmental claims about the clean power produced by the PV system is limited. Only one entity can make environmental claims, and it could be the system owner or the host, depending on how the contract is negotiated. Performance contracting is also a good solution when considering energy efficiency investments along with solar energy installations .

BENEFITS

Ideally, a number of financial options will be available, each having specific benefits. Analyzing these various financing options enables community leaders to choose the alternative with the best value for their community. Project objectives, costs, available resources, and host preferences all factor into selecting the most appropriate financing structure.

Implementation Tips and Options

After identifying a site for a solar energy system and performing a site assessment to confirm the feasibility of the project, take the following steps:

- ☐ Determine whether the city or county wants to own and operate the system or instead finance it through a third-party structure and outsource the O&M.

- ☐ If the project is too small for the third-party model or if the city or county prefers to directly own the solar system for other reasons, select the most appropriate way to finance it. This approach is similar to that used for other capital investments in terms of issuing a request for proposals (RFP) to generate multiple bids and then awarding a contract to install the system. To reduce the installed cost of the system, make sure all available grants, incentives, and subsidies have been identified and applications have been submitted.
- ☐ If community leaders decide the third-party model is appropriate, issue an RFP to solicit bids from solar developers. Evaluate the proposals (in part) based on the experience of the solar developers and the terms of the proposed PPA. Most local governments have a public procurement process, and sample RFPs are available on the Internet.
- ☐ The third-party PPA model is a legally intensive process. Negotiations with solar developers tend to be time consuming, and the local government should be prepared for a give-and-take negotiation process. Also consider how state and local laws could affect the local government's ability to successfully negotiate a PPA (i.e., can the local authority sign a long-term PPA contract if it's considered long-term debt?).
- ☐ Consult with energy managers and city and county attorneys who have been through the process. As more local governments install solar energy systems, more individuals gain experience with the financing process, and their insights can be very useful in terms of interpreting state laws, learning contract language, and candidly appraising solar developers.

Examples

Boulder County, Colorado: Bundling Multiple Smaller Projects into Single Power Purchase Agreements

Boulder County evaluated various financial options, including tax-exempt financing, CREBs, and a third-party PPA, and chose the third-party PPA model as the most cost-effective option. Nine separate solar installations on eight different buildings were combined into four PPAs for more than 754 kilowatts. Three of the sites, depending on the time of day and the weather, will be obtaining 100% of their electricity from solar power.

Denver, Colorado: Combining a Loan with a Third-Party Power Purchase Agreement for Denver International Airport

In December 2009, Denver International Airport (DIA) installed a $7 million, 1.6-megawatt PV system at the airport. DIA already had a 2-megawatt PV system on site, and an additional 4.4 megawatts will be installed in 2011. The unique aspect of this 1.6-megawatt project is that the airport is lending the solar developer $4 million as part of the transaction. The loan is collateralized by the PV system and **renewable energy certificates**, and is executed when the system is commissioned. This structure eliminates construction risk and reduces the performance risk associated with the transaction. The cost of the electricity in the PPA is less than what DIA pays its local utility provider, Xcel Energy, for conventional electricity from the grid. DIA is owned by the City and County of Denver, Colorado.

Tucson, Arizona: Issuing Clean Renewable Energy Bonds

The city of Tucson issued $7.6 million in CREBs to finance seven solar projects totaling 1 megawatt. Bank of America purchased the tax-credit bonds, which the city is to repay over 13 years using funds from energy savings and solar rebates from Tucson Electric Power. The bonds were issued interest free. The solar projects range from 24 to 473 kilowatts. The electricity produced will offset approximately 18% of the facilities' aggregate electricity demand and reduce carbon emissions by 1,896 tons per year. The projects are expected to net the city more than $3.4 million over the 25-year life of the solar equipment. The city selected SPG Solar of Novato, California, to install the solar systems and maintain them for 10 years under a service contract. The city is now moving forward to use a $14.2 million allocation of new CREBs, which could result in another 1.0–1.5 megawatts of PV on city locations.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org

This Web site presents useful information about all available incentives for solar at the federal, state, local, and utility level. DSIREusa.org, maintained by the North Carolina State Solar Center in partnership with the Interstate Renewable Energy Council, is the only comprehensive, regularly updated database of state renewable energy incentives in the United States, and also includes information on many local incentive programs. The U.S. Department of Energy funds this ongoing effort.

Renewable Energy Project Finance Webview

http://financere.nrel.gov/finance

The Renewable Energy Project Finance Webview has news, analysis, tools, and events related to renewable energy project financing in the United States. Policymakers, investors, and project developers (home, businesses, government) visit to learn about revenues, cost savings, incentives, and financing structures.

Treasury Direct: Qualified Tax Credit Bond Rates

www.treasurydirect.gov/GA-SL/SLGS/selectQTCDate.htm

This Web site includes rates posted for qualified tax credit bonds (QTCBs). Rates are listed that apply to new CREBs, QECBs, **qualified zone academy bonds** (QZABs), and **qualified school construction bonds** (QSCBs). The rates on the Clean Renewable Energy Bond Web page are valid only for pre-2009 CREBs allocations.

PUBLICATIONS

Power Purchase Agreement Checklist for State and Local Governments

National Renewable Energy Laboratory, October 2009

This fact sheet addresses the financial, logistical, and legal questions relevant to implementing PPAs for PV installations.

Fact sheet: www.nrel.gov/docs/fy10osti.46668.pdf

Qualified Energy Conservation Bond Allocations for 2009

Internal Revenue Service, April 2009

Report: www.irs.gov/pub/irs-drop/n-09-29.pdf

Financing Non-Residential Photovoltaic Projects: Options and Implications

Lawrence Berkeley National Laboratory, January 2009

This report examines the role of financial innovation in PV market penetration. It discusses how financing structures used to support nonresidential PV deployment have, in part, emerged and evolved as a way to extract the most value from a patchwork of federal and state policy initiatives.

Report: http://eetd.lbl.gov/EA/EMP/reports/lbnl-1410e.pdf

Lex Helius: The Law of Solar Energy

Stoel Rives LLP, 2008

This guide contains insights gained from practical experience in numerous PV projects covering a diverse range of sizes and installations, and from more than 15 years of experience serving the U.S. renewable energy industry. Available for free download after registering on the site.

Report: www.stoel.com/lawofseries.aspx

The Customer's Guide to Solar Power Purchase Agreements

The Rahus Institute, October 2008

This is a guide for organizations interested in purchasing solar electricity without buying the equipment. It explains this rapidly growing business model under which a solar services provider installs the solar equipment at a university, business, or other organization, and the organization pays only for the solar electricity.

Report: www.californiasolarcenter.org/sppa.html

Solar Photovoltaic Financing: Deployment on Public Property by State and Local Governments

National Renewable Energy Laboratory, May 2008

This report examines the opportunities and challenges faced when deploying PV on public-sector buildings and land.

Report: www.nrel.gov/docs/fy08osti/43115.pdf

7.4

Commission the Solar Energy System and Ensure Quality Operations

Commissioning a solar energy system refers to testing the system after installation and certifying that it operates as expected and is installed according to the design plans. For systems installed under **power purchase agreements** (PPAs), independent commissioning is typically not necessary because it is in the **project developers'** best interest to ensure optimal performance because they are selling the electricity to the host customer on a per-kilowatt basis. For systems that are owned directly by local governments, however, commissioning can be an important step in ensuring safety and performance. After a solar energy system is installed, it can be difficult for the local government to determine whether the system is working correctly. **Photovoltaic** (PV) systems have few moving parts, and if the PV system is connected to the utility grid, the electricity supplied to the building is not interrupted whether the PV system is working correctly or not. Because few technical experts within local governments have the expertise to properly inspect and commission large PV systems, hiring an independent consultant with good credentials ensures that the system meets code requirements, uses installation best practices, and demonstrates performance as expected. Additional attention should be paid to maintaining the integrity of existing structures, roof penetrations, and trenching and potential disruption of access to public facilities. As part of the commissioning process, facilities management staff should receive training for long-term operations and maintenance (O&M) activities to ensure maximum lifetime output.

Optimal operation of the PV system requires a real-time monitoring system, proactive maintenance, and site-specific cleaning and inspection procedures. Benchmarks for performance with alerts for output variances are part of best-in-class monitoring systems. Regional and seasonal differences in weather along with local environmental factors will dictate the optimal cleaning and maintenance schedules. These can be adapted from the manufacturer's or installer's general guidelines and should be given to the facilities staff as part of the commissioning process. Internal costs and staff time can be reduced through O&M contracts.

BENEFITS

Commissioning a solar energy system through an independent consultant ensures that the system is installed properly and protects a community's investment. Proactive monitoring and maintenance will prolong the system's lifetime and increase energy output to generate more savings and higher returns.

Implementation Tips and Options

- ☐ Identify an independent solar consultant with sufficient background and experience to inspect the solar system properly.
- ☐ Consider combining commissioning with local code enforcement (inspections). Some of the safety objectives are consistent, although code compliance does not evaluate performance.
- ☐ Ensure that the latest best practices are applied to the project through design and constructability reviews during the construction phase, which can dramatically increase performance without increasing cost. It is easier and cheaper to make adjustments during construction rather than after final inspection.
- ☐ Obtain O&M contracts from the system installer, reducing the need for on-site staff time and expertise to properly maintain system performance.
- ☐ Ensure access for both routine and emergency maintenance when PPAs include O&M activities.
- ☐ Furnish facilities and administrative training on the planned savings, costs, and monitoring systems to help ensure that the system is well understood and that ongoing rebates and savings are captured.

Examples

Orange County, Florida: Commissioning the Orange County Convention Center Photovoltaic System

In 2009, a 1-megawatt PV system and four smaller (6- to 10-kilowatt) PV systems were installed on the roof of the convention center. The Florida Solar Energy Center and CH2M HILL partnered to establish a project-specific commissioning protocol and worked together to conduct an acceptance test. The purpose of the work is to verify compliance with the project plans and specifications, review code questions or issues, and establish baseline performance data. The team's commissioning report will include checklists of inspection points and tables for logging the relevant field data.

Visit www.solaramericacommunities.energy.gov for more inspiring examples from communities across the United States.

Additional References and Resources

PUBLICATIONS

Photovoltaic Power Systems and the 2005 National Electrical Code: Suggested Practices

Southwest Technology Development Institute, New Mexico State University, Updated March 2010

This manual examines the requirements of the 2005 National Electrical Code (NEC) as they apply to PV power systems. It addresses the design requirements for the balance-of-systems components in a PV system, including conductor selection and sizing, overcurrent protection device rating and location, and disconnect rating and location. Standalone, hybrid, and utility-interactive PV systems are covered. References are made to applicable sections of the NEC.

Report: www.nmsu.edu/~tdi/Photovoltaics/Codes-Stds/PVnecSugPract.html

PV System Commissioning

Blake Gleason, Solar Pro Magazine, October/November 2009

This article defines in detail what is involved in a thorough commissioning process, describing different roles involved and the documentation, tasks, and tools required.

Magazine article: http://solarprofessional.com/article/?file=SP2_6_pg6_TOC

Namaste Solar was responsible for this 300 kw PV rooftop installation on top of the Colorado Convention Center in Denver, Colorado. (Namaste Solar Electric/PIX18044)

7.5

Host Wholesale Power Generators on Local Government Land or Facilities

As solar markets grow, many utilities are increasing their investments in solar energy, either by constructing their own solar generation facilities or purchasing wholesale solar energy from power plants constructed by third parties. An increasingly hot market segment is for midsized solar plants (under 25 megawatts), because these modular systems have enough scale to produce power at attractive prices, yet are small enough to interconnect to the existing distribution network and can come on-line quickly. Marginal land or rooftop space on low-load buildings (such as brownfields, road right-of-ways, barriers around wastewater treatment plants, or roofs of low-load buildings such as warehouses or transit centers) can make excellent sites for solar energy installations. Local governments can partner with solar developers or utilities to use municipal land or rooftops for solar power generation .

BENEFITS

Local governments own land and facilities in close proximity to electricity load centers, making them good hosts for urban power plants. Using marginal land or rooftop space has several benefits: it can produce a revenue stream for local governments; power is generated close to usage, minimizing losses over transmission lines and strengthening the grid; and it helps minimize the impacts associated with power plant siting.

Implementation Tips and Options

- ☐ Determine whether demand for large, wholesale solar projects exists in the community. A state **renewable portfolio standard** is a common driver for investment in large-scale solar projects.
- ☐ Identify suitable sites for large-scale solar installations such as large, flat rooftops (17,000+ square feet) or tracts of land (at least 3 acres) that can be dedicated to solar production for at least 20 years, and can be cost-effectively interconnected to the grid.
- ☐ Work with a consultant or solar developer to conduct a survey of suitable sites.
- ☐ Contact the local utility to determine if they are interested in adding descriptions of available property to any wholesale requests for proposals (RFPs) they are issuing.

- ☐ Once possible solar sites have been identified, consider posting a map online of available land or rooftop space for lease by solar developers.

Examples

Suffolk County, New York: Using County Parking Lots as Host to 17 Megawatts of Solar

Suffolk County is leasing out space at seven parking lots to host 17 megawatts of **photovoltaics** (PV). Solar developer enXco will install solar carports and sell the power they generate to the Long Island Power Authority. The county is expected to make $8.5 million over 20 years from lease payments.

Tucson, Arizona: Leasing Land for a 25-Megawatt PV Plant

The city of Tucson recently agreed to lease 305 acres of former agricultural land owned by Tucson Water to solar developer Fotowatio for a 25-megawatt PV plant, which will sell power to Tucson Electric Power under a wholesale **power purchase agreement**. The lease for the facility, determined after an independent appraisal, will provide Tucson Water with payments of $127,000 per year for as long as the plant operates. The site was screened to ensure there were no conflicts with habitat conservation goals or city water rights.

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Additional References and Resources

WEB SITES

U.S. Environmental Protection Agency RE-powering America

www.epa.gov/renewableenergyland/

The U.S. Environmental Protection Agency (EPA) encourages renewable energy development on current and formerly contaminated land and mine sites through its RE-Powering America initiative. This Web site offers tools to determine the renewable energy potential of these sites and contains other useful information for communities, developers, industry, state and local governments, and anyone interested in reusing these sites for renewable energy development.

GLOSSARY AND RELATED SOLAR TERMINOLOGY

A

Alternative compliance payment (ACP)

In lieu of standard means of compliance with renewable portfolio standards, electricity suppliers can make alternative compliance payments to compensate for deficiencies (in megawatt-hours) between the amount of electricity from renewable resources mandated and the amount actually supplied. Payment amounts vary among states.

Array

A group of photovoltaic (PV) modules (also called solar panels) or solar thermal collectors.

Authority having jurisdiction (AHJ)

A federal, state, or local entity having statutory authority for approving equipment, an installation, or a procedure.

Avoided-cost rate

The cost per kilowatt-hour that a utility would have incurred by supplying electricity generated from its traditional sources.

B

Behind the meter

The location where a generating technology (such as a PV system) is connected to the electricity grid. A behind-the-meter PV system is connected between the utility meter and the facility using the electricity, so all electricity generated by the PV systems that is not being used by the facility flows through the utility meter to the grid.

Binomial tariff

A utility rate structure that includes both a fixed demand charge and a variable (per kilowatt-hour) energy charge.

British thermal unit (Btu)

The amount of heat required to raise the temperature of one pound of water from 60°F to 61°F at a constant pressure of one atmosphere. Water heat is commonly measured in British thermal units.

Build America Bond (BAB)

Build America Bonds are taxable municipal bonds that carry special tax credits and federal subsidies for either the bond issuer or the bondholder.

Building energy code

Establishes minimum energy performance features in buildings.

Building integrated photovoltaics (BIPV)

Standard PV modules, transparent modules, and thin-film covers and tiles are used to replace or enhance conventional building materials such as roofs, walls, facades, awnings, and skylights. These materials generate electricity from sunlight and perform other functions integral to the building's design.

Building integrated solar water heating (BISWH)

Similar to BIPV, BISWH incorporates solar water heating materials into traditional building materials.

Buy-down

A reduction in costs to the purchaser.

C

Capacity limit for individual systems

A limit placed on the capacity of individual PV systems, usually set to a certain percentage of a customer's energy load (e.g., 125%). Capacity limits can vary by utility type, solar energy system type, or customer type.

Carbon dioxide (CO_2)

A colorless, odorless, noncombustible gas present in the atmosphere. CO_2 is formed by the combustion of carbon and carbon compounds (e.g., fossil fuels, biomass); by respiration, which is a slow combustion in animals and plants; and by the gradual oxidation of organic matter in the soil. Considered a greenhouse gas that contributes to global warming. *See also* emissions.

Charrette

An intensive planning session during which citizens, designers, and others collaborate on a vision for development. Provides a forum for ideas and gives immediate feedback to the designers. Allows everyone who participates to be a mutual author of a development plan.

Clean renewable energy bond (CREB)

Special-purpose tax credit bonds that provide the equivalent of an interest-free loan for certain qualifying energy facilities. Bondholders receive a tax credit on federal income taxes instead of an interest payment from the bond issuer.

Concentrating solar power (CSP) system

Technologies that use mirrors or other highly reflective materials to capture and concentrate sunlight onto receivers. The receivers convert the solar energy to thermal energy, which can then be used to generate electricity via a steam turbine or a heat engine that drives a generator. CSP systems fall into three basic categories—parabolic trough, dish-engine, and power tower.

Credit multiplier

A credit multiplier for solar offers additional credit toward compliance with a renewable portfolio standard for energy derived from solar resources.

Code official

A local government employee who enforces codes and standards, ensuring that solar energy system installations meet applicable safety, building, electrical, and plumbing codes.

Commercial energy conservation ordinance (CECO)

A regulation requiring commercial property owners to complete certain energy conservation measures in buildings upon transfer of property ownership or when additions or renovations are made.

Customer aggregation program

A program that coordinates group purchases of solar energy systems, helping defray some of the up-front costs of solar installations by giving aggregated individuals or businesses a discounted rate for bulk purchases of solar energy systems.

Customer generator

Utility customer that generates electricity on his or her property using a distributed generation technology such as PV.

Customer-sited distributed generation

Distributed generation technologies like PV installed on a utility customer's property.

D

Demand charge

A charge incurred by a utility customer in return for the utility having built adequate generating capacity to supply the power needed for a facility (e.g., a manufacturing plant) to operate at its maximum capacity.

Direct incentive

Cash given back to consumers for a qualified solar installation. Direct incentives include up-front rebates and grants and production-based incentives that are typically distributed over several years.

Distributed generation (DG)

Electricity production that takes place on site (or close to the load center) and is interconnected to the utility's electric distribution system.

E

Electric capacity

The amount of electricity-generating resources a utility must supply to meet the demands of a particular facility or region.

Electricity distribution system

The portion of the electricity grid that distributes lower voltage electricity from high-voltage transmission lines to individual homes and businesses.

Electric utility

A corporation, agency, authority, or other legal entity aligned with distribution facilities for delivery of electricity primarily for use by the public. Investor-owned electric utilities, municipal and state utilities, federal electric utilities, independent system operators, and rural electric cooperatives are included.

Emissions

In the context of global climate change, emissions refer to a release of greenhouse gases into the atmosphere (e.g., CO_2, methane, and oxides of nitrogen).

Energy audit

A survey that determines the amount of energy used in a home, which helps identify ways to use less energy.

Energy conservation mechanism (ECM)

A training program, facility improvement, or equipment purchase used to reduce energy or operating costs in a building.

Energy services company (ESCO)

A company that offers energy management services to reduce a client's utility costs. Cost savings are often split with the client through an energy performance contract or a shared-savings agreement.

Energy service performance contract (ESPC)

An agreement between a building owner (or facilities manager) and a private energy services company that uses future energy savings to pay for the entire cost of a building's electricity and energy efficiency retrofits.

Environmental justice

The fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Expected performance rebate

A cash incentive based on the expected energy output from a solar energy system over a given period.

External utility-accessible AC disconnect switch

A hardware feature that enables a utility employee to manually disconnect a customer-owned PV system (or other type of generation) from the electricity grid.

F

Federal investment tax credit

A credit against federal income taxes, usually computed as a percentage of the cost of investment in solar energy assets. The federal investment tax credit for installing solar energy systems is set at 30% of the installed system cost, and expires in 2016.

Feed-in tariff (FIT)

A renewable energy policy that typically offers renewable energy project developers a guaranteed payment for electricity produced by their renewable energy system over a fixed period, usually 15 to 20 years.

G

General fund

The primary operating fund of a governmental entity, usually in place to support operating expenditures.

Generating capacity

The amount of power-generating resources a utility can supply to meet the demands of a particular facility or region.

Geothermal system

Hot water or steam extracted from geothermal reservoirs in the earth's crust and supplied to turbines that drive generators to produce electricity.

Gigawatt (GW)

A unit of power equal to 1 billion watts, 1 million kilowatts, or 1,000 megawatts.

Greenhouse gas

Atmospheric gases that absorb and emit radiation. Common greenhouse gases in the earth's atmosphere include water vapor, CO_2, methane, oxides of nitrogen, ozone, and chlorofluorocarbons.

Green pricing

A mechanism for utility customers to support their utility's investments in renewable energy projects via direct charges on their monthly utility bills. Green pricing is a market-based solution to account for the nonmarket (environmental) benefits of renewable energy.

I

IEEE 1547

IEEE was originally an acronym for the Institute of Electrical and Electronics Engineers, Inc. Today, the organization's scope has expanded to include so many related fields that it's simply referred to as IEEE ("I-triple-E"). IEEE 1547 is the Standard for Interconnecting Distributed Resources with Electric Power Systems.

Interconnection

The process of connecting an electricity-producing technology (such as a PV system) to the electricity grid.

Interconnection agreement

An agreement between a utility and a customer that specifies the terms and conditions under which solar electric systems or other approved customer-owned generation will be connected and operated.

Interconnection standard

A technical, legal, and procedural requirement that customers and utilities must follow for connecting any customer's PV system to the grid.

Installation baseline

An accounting of all existing solar energy installations.

Installation target

A goal set for installing solar energy systems in a community by a specific date. A solar installation target often is set to achieve broader environmental, climate, or sustainability goals.

Installed capacity

Usually measured in terms of size (e.g., in kilowatts or megawatts for PV), the total capacity of solar energy systems operating in a given region or sector.

Investment tax credit (ITC)

A tax incentive that allows businesses or homeowners to deduct a specified percentage of investment costs for solar energy systems from their tax liability.

K

Kilowatt (kW)

A standard unit of electrical power equal to 1,000 watts.

Kilowatt-hour (kWh)

A unit of energy; 1,000 watts acting over 1 hour.

L

Levelized cost (of energy) (LCOE)

A means of calculating the cost of generating energy (usually electricity) from a particular system that allows comparison of the cost of energy across technologies. LCOE factors in the installed solar energy system price and associated costs like financing, land, insurance, and operations and maintenance.

Leadership in Energy and Environmental Design (LEED)

Operated by the U.S. Green Building Council, LEED is a voluntary, consensus-based national rating system for developing high-performance sustainable buildings.

Load

The amount of power (amps) consumed by an electrical circuit or device. Loads are usually expressed in amps, sometimes in watts.

M

Megawatt (MW)

The standard measure of electric power plant generating capacity equal to 1,000 kilowatts (1 million watts).

Megawatt-hour (MWh)

A unit of energy; 1,000 kilowatt-hours or 1 million watt-hours

Metric ton of carbon dioxide equivalent (MtCO_2e)

The standard measurement of the amount of CO_2 emissions reduced or secluded from the environment.

Municipal bond

A type of bond issued by state and local governments, generally to finance capital-improvement projects.

N

Net metering

A billing mechanism that credits solar energy system owners for the electricity exported to the electricity grid. Under the simplest implementation of net metering, a utility customer's billing meter runs backward as solar electricity is generated and exported to the electricity grid and forward as electricity is consumed from the grid.

P

Passive solar

Using building design elements and energy efficient materials to collect, store, and distribute solar energy. Unlike active solar systems, passive solar designs don't need mechanical or electrical devices to move the heated or cooled air. Passive solar features can be designed into new buildings or retrofitted onto existing structures.

Peak sun hours

The equivalent number of hours per day when solar irradiance averages 1,000 watts per square meter.

Permitting incentive

Incentive that reduces or waives local permit fees, plan check fees, design review fees, or similar charges that consumers and businesses could otherwise incur when installing a solar energy system.

Photovoltaic (PV) system

A set of components that converts sunlight into electricity. Comprises the solar modules or array that captures the sunlight, along with balance-of-system components such as the array supports, electrical conductors/wiring, fuses, safety disconnects and grounds, charge controllers, inverters, and battery storage.

Production-based (or performance-based) incentive (PBI)

A cash payment to project owners based on electricity production on a dollar-per-kilowatt-hour basis over a specified period.

Project developer

A company that provides services for solar installations including planning, organizing, executing, and managing resources for installation projects.

Property assessed clean energy (PACE)

PACE financing is a way to finance solar systems or energy efficiency retrofits, where the city offers property owners a loan and they pay it back through their property tax bills over 15 to 20 years. The amount borrowed is typically repaid via a special assessment on property taxes, or another locally collected tax or bill such as utility bills or water or sewer bills. If a property owner participating in a PACE program sells the property, then the repayment obligation will legally transfer with the property.

Property tax incentive

An exemption, abatement, or credit that mitigates or eliminates the increase in taxes owed resulting from an increase in assessed value of a property resulting from the value added by solar energy installations, or that provides an additional incentive to invest in a solar installation.

Power purchase agreement (PPA)

A legal contract between an electricity generator and an electricity purchaser. Solar PPAs typically provide a long-term contract to purchase electricity generated from a solar installation on public or private property. A type of third-party ownership model.

Public benefits fund

A fund dedicated to supporting renewable energy and energy efficiency projects. The fund is typically financed through a small charge on the bill of utility customers (sometimes referred to as a system benefits charge) or through specified contributions from utilities, although other means of funding like legislative appropriations are possible.

Q

Qualified energy conservation bond (QECB)

A qualified tax credit bond that is similar to a new CREB. Can be used by state, local, and tribal governments to finance certain types of energy projects.

Qualified school construction bond (QSCB)

Bonds authorized by the federal government through the American Recovery and Reinvestment Act of 2009. The bonds provide federal tax credits for bond holders in lieu of interest, to significantly reduce an issuer's cost of borrowing for public school construction projects.

Qualified zone academy bond (QZAB)

Financial instruments designed to help schools raise funds to renovate and repair buildings, invest in equipment and up-to-date technology, develop challenging curricula, and train quality teachers.

R

Radial electric distribution system

The dominant electric distribution system in the United States; electricity is supplied from a single source and there are no closed "loops" in the system.

Real-time pricing (RTP)

The instantaneous pricing of electricity based on the cost of the electricity at the time it's used by a utility customer. RTP rates are volatile and are generally very high when demand for electricity is high.

Rebate

A cash incentive issued to a purchaser of a solar energy system to help defray the up-front cost of installing the system.

Renewable energy certificate or credit (REC)

A REC represents the property rights to the environmental, social, and other nonpower qualities of renewable electricity generation. A REC and its associated attributes and benefits can be sold separately from the underlying physical electricity associated with a renewable-based generation source. Solar RECs are sometimes called SRECs.

Renewable energy certificate (REC) marketer or aggregator

A REC marketer or aggregator buys RECs at wholesale prices and sells RECs at retail; similar to a commodities dealer.

Renewable energy certificate (REC) trading mechanism

An exchange for trading RECs; similar to how the New York Stock Exchange is used for trading shares in companies.

Renewable energy

Energy coming from resources that naturally replenish themselves and are virtually inexhaustible. Such resources include biomass, hydropower, geothermal, solar, wind, ocean thermal, and wave and tidal action.

Renewable portfolio standard (RPS)

A mandate requiring that renewable energy provides a certain percentage of total energy generation. The mandate is sometimes referred to as a renewable electricity standard (RES).

Residential energy conservation ordinance (RECO)

A law that requires residential property owners to complete certain energy conservation measures in their buildings upon transfer of property ownership or when additions or renovations are made.

Revolving loan fund

A source of money from which loans are made. As loans are repaid, funds become available for new loans.

S

Sales tax incentive

An exemption from or refund of sales tax for purchasing and installing solar energy components and systems.

Secondary network distribution system

A type of electric distribution system that serves central business districts in many cities. Such systems contain multiple feeders and transformers to provide excellent service reliability and the capacity to serve large loads like high-rise buildings.

Service entrance capacity

The amount of power a building is designed to handle. A service entrance is the point at which electricity enters a building. A service entrance switchboard has metering equipment and devices for overcurrent protection and electrical control.

Set-aside

A mandate or goal for some fraction of a renewable portfolio standard to be met with designated technologies such as PV.

Solar access

The ability of one property or area to continue to receive sunlight without obstruction from a nearby home or building, landscaping, or other impediment.

Solar access permit

When a permit for installing a solar energy system is granted, a solar easement designed to protect a property owner's access to sunlight can be created. Local governments can also protect solar access by, for example, specifying certain setbacks in zoning ordinances that require buildings to be built far enough apart that they don't shade neighboring rooftops.

Solar aggregation purchasing program

See customer aggregation program.

Solar bulk purchasing

See customer aggregation program.

Solar Decathlon

An international competition between colleges and universities in which teams compete to design, build, and operate the most attractive, effective, and energy-efficient solar-powered house. The competition is sponsored by the U.S. Department of Energy and takes place every 2 years in Washington, D.C.

Solar easement

A type of solar access law that grants the owners of solar energy systems the right to continued access to sunlight without obstruction from a neighbor's property, and which limits future property developments that could restrict solar access.

Solar electricity

See photovoltaic system.

Solar energy

Electromagnetic energy transmitted from the sun (solar radiation). The amount that reaches the earth is equal to one billionth of total solar energy generated, or the equivalent of about 420 trillion kilowatt-hours.

Solar farm

A large-scale solar installation.

Solar installer licensing

Licensing requiring a baseline of quality below which operating as a solar installer is illegal.

Solar permitting process

A process for obtaining the appropriate permits to install solar. To install a grid-connected PV system, for example, the homeowner or builder must obtain an electrical permit and in some cases a building permit from the local government. The installation must also be inspected when complete. Solar water heating systems require a plumbing permit, and sometimes require a building or mechanical permit or both.

Solar-ready

A solar-ready home or building is designed as if a solar energy system were to be installed during construction. Architects and builders take precautions to ensure a viable site for solar technologies by leaving adequate roof space that is free from vents, chimneys, and equipment; planning landscaping to avoid shading the unobstructed roof space in the future; planning extra space for equipment in mechanical rooms; preinstalling roof-mounting systems and conduit; and labeling structural reinforcements and end points of wires or pipes.

Solar resource

The amount of sunlight a site receives, usually measured in kilowatt-hours per square meter per day. See also peak sun hours.

Solar right law

A law or ordinance that furnishes protection for homes and businesses by limiting or prohibiting restrictions (e.g., neighborhood covenants and bylaws, local government ordinances, and building codes) on the installation of solar energy systems.

Solar site assessment

An evaluation of a site being considered for a solar energy installation. A trained solar site assessor collects data such as roof or property orientation and slope, dimensions of available installation space, electrical and plumbing configuration, and shading on the site location.

Solar space heating and cooling

Using solar energy to heat or cool indoor building spaces. In an active heating system, solar energy is collected and stored, then circulated into the building using either fans or pumps. Passive heating systems rely on design features and special materials in the walls or floors that absorb heat during sunny periods and release that heat when it's needed. Active solar space cooling systems fall into two categories: absorption chiller and desiccant systems. An absorption chiller uses solar heat to evaporate a fluid that removes heat. In a desiccant system, air passes over a common desiccant like silica gel to remove moisture, cooling the air. Solar thermal energy regenerates the desiccant by drying it out.

Solar thermal

Solar energy conversion technologies that convert solar energy to thermal energy (heat) used to heat water or generate energy for space heating and cooling in active solar space heating or cooling systems.

Solar ventilation preheating (SVP)

A technology that uses a south-facing wall made of dark sheet metal and perforated with tiny holes. The wall acts as a solar energy collector, drawing outdoor air through the holes and heating it as it passes through and absorbs the wall's warmth. The heated air rises in the space between the solar wall and the building wall and moves into the air-duct system, usually propelled by a fan, to heat the building or supplement a conventional heating system.

Solar water heating (SWH)

A technology that uses the sun to heat water directly or via a heat-transfer fluid in a collector. The heat-transfer fluid is chosen based on the local climate to prevent freezing. Most SWH systems need a well-insulated storage tank, and systems can either be active, which have circulating pumps and controls, or passive, which do not.

Spot-market

A market in which commodities are bought and sold for immediate delivery.

Stub-out

The result of preparing a building for future equipment installations. To prepare for solar electric systems, conduits are run through the building so wires can connect a PV system to an electrical panel. For solar water heating systems, open-ended pipes are placed in an accessible location to connect solar collectors to hot-water storage.

Sustainable solar infrastructure

The social, economic, policy, and physical networks and institutions that enable solar energy to be used as a mainstream energy source even in the absence of significant government subsidies.

System benefits charge

A small charge on a utility customer's bill, which supports public policy initiatives such as renewable energy and energy efficiency programs.

System capacity

The maximum expected energy production from a photovoltaic system.

System rating

A rating of the maximum power a solar energy system can produce under standard test conditions (STCs). Conditions are a solar irradiance of 1,000 watts per square meter, a temperature of 77° Fahrenheit, and an air mass of 1.5. Solar irradiance is measured in watts per square meter of light incident on Earth.

T

Tariff

A document that lists the terms and conditions—including a schedule of prices—under which utility services will be provided. The document is approved by the responsible regulatory agency.

Tax abatement

A stay of tax payment granted by a taxing authority for a short term or long term, and for a total or percentage of the tax.

Tax exemption

An exemption from liability for taxes levied by a taxing authority.

Tax-exempt bond

A type of municipal bond that is a source of capital for solar projects. Can be either a general obligation bond, which is backed by the full taxing authority of the local government, or a revenue bond, which is backed by project revenue.

Tax-exempt commercial paper (TECP)

Short-term, unsecured debt that can be used to finance capital projects in between longer term municipal bond issuances.

Time-of-use (TOU) pricing (or tariff)

A rate schedule in which the utility customer is charged different amounts for power based on the time of day and the season. Typically, peak rates are during summer afternoons. Solar customers who generate power during peak rates are credited by the utility company at those peak rates.

Transmission and distribution loss

The energy lost when transporting electricity over long distances through the electricity grid's transmission and distribution systems from central generation plants to the point where electricity is consumed (homes and businesses).

True up

When a utility calculates the "net" consumption versus generation over a given period (month or year). Compensation for net excess generation often is limited to the amount of electricity used during the true-up time period. Monthly true-up cycles don't capture the actual value of a PV system's generation because excess generation in the summer (when PV is producing at its peak) is lost and consumption during winter (when PV systems are producing at their minimum) is charged.

V

Virtual net metering

An agreement under which dispersed individual ratepayers can draw electricity from a shared power grid. Allows all ratepayers to participate in renewable energy generation, no matter where the ratepayer's electric meter may reside.

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APPENDIX: ABBREVIATIONS AND ACRONYMS

1BOG	One Block Off the Grid
AAS	associate in applied science (degree)
ACP	alternative compliance payment
AHJ	authority having jurisdiction
ANSI	American National Standards Institute
AS	associate of science (degree)
ASES	American Solar Energy Society
AzRISE	Arizona Research Institute for Solar Energy
BAB	Build America Bond
BDS	Bureau of Development Services (Portland, Oregon)
Berkeley FIRST	Berkeley's Financing Initiative for Renewable and Solar Technology
BIPV	building integrated photovoltaics
BISWH	building-integrated solar water heating
BMP	best management practice
BOS	balance of system (components)
BPS	Bureau of Planning and Sustainability (Portland, Oregon)
BPU	Board of Public Utilities (New Jersey)
Btu	British thermal unit
BWSC	Boston Water and Sewer Commission
CALSEIA	California Solar Energy Industries Association
CCEF	Connecticut Clean Energy Fund
CEC	Clean Energy Corporation
CECO	commercial energy conservation ordinance
CEG	Clean Energy Group
CESA	Clean Energy States Alliance
CEU	continuing education unit
CIP	Capital Improvement Program (Boston)
CO_2	carbon dioxide
CPUC	California Public Utilities Commission
CREB	clean renewable energy bond
CSI	California Solar Initiative
CSP	concentrating solar power
CUNY	City University of New York
CWU	Central Washington University
DG	distributed generation
DND	Department of Neighborhood Development (Boston)
DIA	Denver International Airport
DOE	U.S. Department of Energy
DR	distributed resources
DSIRE	Database of State Incentives for Renewables & Efficiency
ECM	energy conservation mechanisms
EESI	Environmental and Energy Study Institute
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPS	electric power systems
ERIC	Education Resources Information Center
ESCO	energy services company
ESD	Environmental Services Department (San José, California)
ESPC	energy service performance contract
FDIC	Federal Deposit Insurance Corporation
FERC	Federal Energy Regulatory Commission
FHFA	Federal Housing Finance Agency
FIT	feed-in tariff
flaSEREF	Florida Solar Energy Research & Education Foundation
FSEC	Florida Solar Energy Center
GAHP	Green Affordable Housing Program
GHG	greenhouse gas
GIS	geographic information system
GLREA	Great Lakes Renewable Energy Association
GRU	Gainesville Regional Utilities (Florida)
GW	gigawatt
GWh	gigawatt-hour
HARC	Houston Advanced Research Center (Texas)
HVAC	heating, ventilating, and air conditioning
IBEW	International Brotherhood of Electrical Workers

IEEE Formerly, the Institute of Electrical and Electronics Engineers, Inc.; now "I triple E" is a stand-alone term and not an acronym.

IMBY In My Backyard (software program)

IOU investor-owned utility

IREC Interstate Renewable Energy Council

ISPQ Institute for Sustainable Power Quality

ITC investment tax credit

JATC [local] Joint Apprenticeship and Training Committee (Minneapolis-St. Paul, Minnesota)

JEDI Jobs and Economic Development Impact

kW kilowatt

kWh kilowatt-hour

LBNL Lawrence Berkeley National Laboratory

LCOE levelized cost of energy

LCTN Louisiana CleanTech Network

LEED Leadership in Energy and Environmental Design

LLC limited liability corporation

LTC Louisiana Technical College

MACRS Modified Accelerated Cost Recovery System

MADRI Mid-Atlantic Distributed Resources Initiative

MECO Maui Electric Company

MITC [solar] Manufacturing Equipment in the Investment Tax Credit

MOU memorandum of understanding

MREA Midwest Renewable Energy Association

$MtCO_2e$ metric ton of carbon dioxide equivalent

MW megawatt

MWh megawatt-hour

NABCEP North American Board of Certified Energy Practitioners

NARUC National Association of Regulatory Utility Commissioners

NEC National Electrical Code®

NEED National Energy Education Project

NFPA National Fire Protection Association

NJATC National Joint Apprenticeship and Training Committee

NNEC Network for New Energy Choices

Northwest SEED Northwest Sustainable Energy for Economic Development

NREL National Renewable Energy Laboratory

NYPA New York Power Authority

NYSERDA New York State Energy Research and Development Authority

O&M operations and maintenance

OCC Office of the Comptroller of the Currency

OCE Office of Clean Energy (New Jersey)

OEWD Office of Economic and Workforce Development (San Francisco, California)

OpenEI Open Energy Information Initiative

OSHA Occupational Safety and Health Administration

OUC Orlando Utilities Commission (Florida)

PACE property assessed clean energy (financing mechanism)

PAG Pima Association of Governments (Arizona)

PBI performance-based incentive (or production-based incentive)

PETE Partnership for Environmental Technology Education

PG&E Pacific Gas and Electric Company

PPA power purchase agreement

PSC Public Service Commission (Louisiana)

PSCC Pellissippi State Community College

PSOA prospective solar owner agent

PV photovoltaic or photovoltaics

QECB qualified energy conservation bond

QSCB qualified school construction bond

QTCB qualified tax credit bond

QZAB qualified zone academy bond

R&D research and development

RAEL Renewable and Appropriate Energy Laboratory

REC	renewable energy certificate (or credit)
RECO	residential energy conservation ordinance
RFP	request for proposal
RFQ	request for qualifications
RMP	Rocky Mountain Power
ROI	return on investment
RooSTer	[Solar] Roadmapping and Simulation Tool
RPS	renewable portfolio standard
RTP	real-time pricing
SACE	Southern Alliance for Clean Energy
SBA	Small Business Administration
SBC	System Benefits Charge (New York)
SCE	Southern California Edison
SCEIP	Sonoma County Energy Independence Program (California)
SCEPA	State Clean Energy Policies Analysis
SDG&E	San Diego Gas & Electric
SECO	State Energy Conservation Office (Texas)
SEE	Solar Energy Equipment (classification)
SEI	Solar Energy International
SEIA	Solar Energy Industries Association
SEPA	Solar Electric Power Association
SETP	Solar Energy Technologies Program
SFPUC	San Francisco Public Utilities Commission
SHW	solar hot water
SHWBC	Solar Hot Water Business Council
SMUD	Sacramento Municipal Utility District
Solar	ABCs Solar America Board for Codes and Standards
SRCC	Solar Rating and Certification Corporation
SREC	solar renewable energy certificate
STC	standard test conditions
SVP	solar ventilation preheat
SWH	solar water heating
TECP	tax-exempt commercial paper
TEP	Tucson Electric Power (Arizona)
TGP	Treasury Grant Program
TJIF	Targeted Jobs Incentive Fund (Miami-Dade County, Florida)
TOU	time-of-use (tariff)
UL	Underwriters Laboratories
USGBC	U.S. Green Building Council

Visit www.solaramericacommunities.energy.gov
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going solar in your community.

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