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

SOLAR POWERING YOUR COMMUNITY:

A GUIDE FOR LOCAL GOVERNMENTS

JULY 2009

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SOLAR AMERICA CITIES™

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- California Center for Sustainable Energy (http://energycenter.org)
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- 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)
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- 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. DSIRE 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). DOE 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 rises, so does the necessity of producing clean, safe, reliable energy from renewable sources like the sun and the wind. Fortunately, many of the key technologies that can unlock the power of these renewable resources are already 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 creating a robust nationwide market for the currently available technologies.

Transforming the marketplace requires overcoming the remaining barriers to widespread adoption of solar energy technologies. These barriers include, among others, complicated procedures for permitting and connecting systems to the grid, financing challenges, and a lack of trained installers and inspectors. Local government officials are in a unique position 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 will be able to optimally position their communities in the emerging renewable energy economy.

To accelerate the nationwide adoption of solar energy, DOE created the Solar America Cities activity, which established partnerships between DOE and 25 cities around the country. Local planners 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.

DOE has developed this comprehensive resource—*Solar Powering Your Community: A Guide for Local Governments*—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 around the country. Many of the examples are direct results of DOE's Solar America Cities activity.

You can use this guide to stimulate ideas or as a framework for a comprehensive solar plan for your community. Each section is divided into topic areas—typically within the jurisdiction of local governments—that have been integral in 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 on benefits from 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 offer more information on the topic, where applicable.

Because DOE recognizes that there is no one path to solar market development, *Solar Powering Your Community: A Guide for Local Governments* introduces a range of policy and program options that can help a community build a sustainable solar infrastructure. DOE doesn't imply that you must undertake all of these activities; instead, you should tailor your approach to fit your community's particular needs and market barriers.

DOE considers this guide a work in progress and plans to continually revise and improve the content as new strategies arise for moving solar energy into the mainstream. Your comments and suggestions are welcomed at solar@ee.doe.gov.

You can download the entire guide at www.solaramericacities.energy.gov/resources.

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INTRODUCTION

With demand for energy continuing to rise, using renewable sources like the sun and the wind to produce clean, safe, reliable energy has taken on new urgency. Many of the key technologies that can unlock the power of these renewable resources are already on the market today. And policy changes like those contained in the 2009 *American Recovery and Reinvestment Act* (ARRA), combined with declining prices as the technologies continue to mature, will increasingly bring solar energy into the mainstream.

When ARRA was signed into law on February 17, 2009, it signaled the beginning of a new era of unprecedented levels of investment in renewable energy. The U.S. Department of Energy (DOE) is at the forefront of the effort to lower the cost of renewable energy. DOE has set a goal of reducing the cost of electricity from solar technologies to make it cost-competitive with conventional electricity sources by 2015. 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 Solar Energy Technologies Program (SETP) at DOE is focused on solar research and development (R&D) as well as grid integration of solar technologies and market transformation. DOE designed this guide—*Solar Powering Your Community: A Guide for Local Governments*—to assist local government officials and stakeholders in designing and implementing a strategic local solar plan. Providing solutions—like those suggested in this guide—to local governments is part of the mission of the market transformation effort.

Transforming the marketplace requires overcoming the barriers to widespread adoption of solar energy technologies. In addition to the high—though declining—up-front cost of installing solar energy systems, obstacles include confusing rules about permitting and connecting systems to the grid, a lack of consumer understanding of technologies and financing options, and a dearth of trained installers and inspectors. Mayors and other local government officials are in a unique position to remove many of these barriers, clearing the way for a solar industry to flourish. Local governments, residents, business owners, solar advocacy groups, and other stakeholders can take a multifaceted approach to promoting solar energy by purchasing solar energy systems directly, streamlining local regulations, and developing programs that make solar energy more accessible and affordable for consumers. By investing in solar energy, local governments can boost the local economy in addition to enhancing national energy security and improving the environment.

To accelerate the adoption of solar energy nationwide, DOE created Solar America Cities, which established partnerships between the Department and 25 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 from the ground up. The Solar America Cities vary by size, geographic location, and solar "maturity." Local planners 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. Many of the examples presented in this guide are direct results of the DOE Solar America Cities activity. Visit the program's website at www.solaramericacities.energy.gov to see what these cities have accomplished.

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. You don't have to undertake all of these activities; instead, you can tailor your approach to fit your community's 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 the following categories:

Benefits

Identifies benefits from implementing the policy or program.

Implementation Tips and Options

Outlines 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 additional reports, references, and tools that offer more information on the topic, where applicable.

Solar technologies fall into these main categories: **photovoltaics (PV)**, **concentrating solar power (CSP)**, and **solar water heating (SWH)** and **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 along with more in-depth information, please visit www.solar.energy.gov.

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

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

1.0

ORGANIZING AND STRATEGIZING YOUR 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 strategize your approach will help you make the best choices for your community.

This section introduces activities that have proven effective in the early planning stages of designing a sustainable local solar infrastructure. Information and resources to help you understand the local policy and economic contexts for solar energy technologies are also presented in this section.

Time spent planning and analyzing at the outset is well worth the effort when designing the policies and procedures to serve as the legal and economic framework for solar energy in your community. Undertaking these activities will lead to a well-conceived and comprehensive solar energy strategy for your community. After reading this section, you'll have a good idea of the time and effort necessary to create a sustainable solar market in your community. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

(photo above) This project paved the way for the City of Boston's Green Affordable Housing Program. In total, the City projects that roughly 900 kW of PV will be installed on affordable housing developments by 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 stakeholders in a given community. 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 at the local level. 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 will help facilitate the necessary buy-in to build a sustainable solar market.

Implementation Tips and Options

- ☐ Invite local solar industry and advocacy group leaders to participate in stakeholder meetings.
- ☐ Bring a local utility representative into the early stages of the planning process.
- ☐ Gather input from all the municipal or county departments involved with solar energy, including permitting, inspections, procurement, and outreach departments. Invite department representatives to participate in stakeholder meetings.
- ☐ Consider inviting local education and training institutions to get involved in the early stages of planning.
- ☐ Consider inviting local city council members, county supervisors, and tax board members, along with other government officials and decision makers.
- ☐ Be flexible so you can add to or segment the advisory committee members as needs arise.

Examples

Philadelphia, Pennsylvania: Establishing a Solar Partnership Advisory Board

As a Solar America City, Philadelphia is committed to increasing the amount of solar electricity and solar water heating used in the city. One of the first actions Philadelphia took after becoming a Solar

America City was to create a Solar Partnership Advisory Board to help round out the objectives of the program and subsequent action plans. The goal of the Solar Partnership Advisory Board is to support mid- to large-scale solar energy projects that will increase distributed generation in the city. Entities from both the private and public sector helped prepare a comprehensive yet manageable plan that includes a guidebook for solar developers. The guidebook contains the procedures and processes surrounding solar installations. Board members include representatives from the Philadelphia Industrial Development Corporation, the Delaware Valley Regional Planning Commission, the Philadelphia Planning Commission, the City of Pittsburgh, Ben Franklin Technology Partners, the Philadelphia City Council, the Energy Coordinating Agency, Villanova University, and the Smart Energy Initiative, along with multiple industry experts.

Houston, Texas: Creating an Advisory Council and Correspondence Group

The City of Houston selected the Houston Advanced Research Center (HARC) to manage the Solar Houston Initiative. HARC established an advisory council as well as a correspondence group. The 14-member advisory council, which consists of representatives from local businesses, universities, school districts, environmental organizations, and foundations, 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. In addition, correspondence group members can make suggestions to the advisory council about the direction and progress of the project through HARC.

Milwaukee, Wisconsin: Initiating the Milwaukee Shines Advisory Committee

In 2008, the City of Milwaukee created Milwaukee Shines, a citywide program designed to advance solar energy using the city's Solar America Cities grant. The city is working with a number of partner agencies that have 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 corporate and technology leader); and the Midwest Renewable Energy Association (site assessor and installer training agency). Other participants include the Milwaukee Area Technical College, which offers courses in renewable energy and hosts a large annual renewable energy summit, and the University of Wisconsin–Milwaukee's Center for Economic Development, which has a team entered in the 2009 **Solar Decathlon**. Many of the partners have provided in-kind or matching cash support for Milwaukee Shines. Each partner plays a distinct role and has appointed representatives to sit on the advisory committee. Milwaukee Shines relies on the advisory committee for technical assistance, market updates, and consultation on proposals and plans.

The Milwaukee Shines Advisory Committee has created subcommittees in the areas of finance, marketing and outreach, manufacturing, and training. Subcommittee members are volunteers. The Milwaukee team has found voluntary participation to be important because it ensures that tasks are approached with interest, enthusiasm, and buy-in. Subcommittee volunteers give sound advice and contribute to the creation of marketing materials. The formation of subcommittees has increased the ability of Milwaukee Shines to respond to the large and often daunting tasks involved in removing barriers to solar development.

Additional References and Resources

WEBSITES

Solar America Cities
www.solaramericacities.energy.gov/cities

The Solar America Cities activity is a partnership between DOE and a select group of 25 cities across the country. The activity and the cities are committed to accelerating the adoption of solar energy technologies at the local level. Each Solar America City has its own webpage that includes a list of project partners.

The 3.3-kW PV system on this Portland, Oregon, home soaks in the sun. The owners were able to take advantage of financial incentives offered through the Energy Trust of Oregon's solar incentive program.

1.2

Assess Current Policy Environment

Federal, state, and local policies, regulations, and incentives constitute the foundation upon which the solar energy industry can build. Policies that address the high up-front cost of installing solar energy systems, the intricacies of interconnecting photovoltaics, or PV, to the electricity grid, and the complexities of solar energy system permitting and inspection lay the groundwork for building a sustainable solar market. Federal and state policies address many of these issues. Local governments can support and expand a local solar market through complementary policies.

Jurisdictional authority over many of the policies that affect solar energy installations depends on whether your area 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**, **net metering**, and **interconnection**. State policy makers and regulators, though, often allow local governments to define 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.

Benefits

Identifying the regulatory, policy, and incentive framework that currently affects solar technology deployment in your community will help you accurately assess specific strengths and weaknesses related to advancing solar energy in your area. Understanding the local policy context will help you design, implement, and communicate a solar strategy tailored to meet local needs and goals.

Implementation Tips and Options

- ☐ Access the Database of State Incentives for Renewables & Efficiency (DSIRE) at www.dsireusa.org to identify federal, state, and local policies and programs currently in place to advance solar energy technologies.
- ☐ Identify the policy areas within your local government jurisdiction and the policy areas on which you might wish to collaborate with regional or state authorities. See Accelerating Demand through Policies and Incentives.
- ☐ Identify areas where local government can reduce the up-front cost for residents and business owners interested in installing solar energy systems. See Accelerating Demand through Policies and Incentives.

Examples

Austin, Texas: Evaluating Austin's Solar Policies and Programs

The City of Austin completed a policy benchmarking project to compare policies in place in the city to those considered to be important components for accelerating solar market development. A team of consultants analyzed Austin's status with regard to solar policy and regulation, financial incentives, training, and outreach. The objective of Austin's policy benchmarking project was to help the city assess its policy environment and identify areas for improvement. The analysis showed that Austin is excelling in most areas related to solar policy, but could improve in the areas of interconnection, **solar access**, and expedited permitting. Benchmarking and the associated gap analysis helped the city refine its strategic plan for a sustainable solar future.

New York City, New York: Developing NYC's Solar Energy Plan

In 2006, the City University of New York (CUNY) and the Center for Sustainable Energy at Bronx Community College teamed up to study the current status and future potential of solar energy in New York City. The group assessed the city's policy environment by reviewing existing policies that support PV development, identifying existing barriers to PV deployment, and outlining best-in-class programs and policies from other cities that are successfully building solar markets. In 2007, the group published results of the study in *New York City's Solar Energy Future, Part II: Solar Energy Policies and Barriers in New York City*, which draws on a background study published in 2006 (titled *New York City's Solar Energy Future, Part I: The Market for Solar Systems in New York City*). The 2006 report includes information on the city's electrical demand and power generation portfolio; the technical potential of PV to meet the city's future electricity demand; and a summary of the environmental, social, and economic benefits of solar energy deployment in the city. These studies give policy makers a comprehensive account of the policy environment in New York City and serve as the foundation for an informed plan of action to advance solar energy.

Additional References and Resources

WEBSITES

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. The database includes maps and tables that summarize state, local, and utility incentives available in each state. The financial incentives summary tables include federal policies that support renewable energy and energy efficiency. DOE funds this ongoing effort.

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. On its website, Solar Alliance provides the industry perspective on four areas critical for building a local solar market, which the group calls the "Four Pillars of Cost Effective Solar Policy."

Clean Energy States Alliance

www.cleanenergystates.org

The Clean Energy States Alliance (CESA) is a nonprofit organization run by the Clean Energy Group (CEG). CESA's members are from states with clean energy funds and state agencies. The group provides information and technical services to its members and works with them to build and expand clean energy markets in the United States.

PUBLICATIONS

U.S. Department of Energy 2007 Solar America City: City of Austin, Texas Benchmarking of Solar Energy Programs

The City of Austin, CH2M HILL, December 2008

The methodology and results of the Austin solar policy benchmarking project are published in this report, showing how the policies in place in Austin compare with those considered best-in-class for promoting solar energy.

Report: www.solaramericacities.energy.gov/City_Info/Austin/Austin_Benchmark_Study.pdf

Freeing the Grid

Network for New Energy Choices, Vote Solar Initiative, Interstate Renewable Energy Council, October 2008

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

Report: www.newenergychoices.org/uploads/FreeingTheGrid2008_report.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 (NNEC) 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

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

Clean Energy Group, April 2008

This publication provides a roadmap of actions for states to effectively mainstream solar electricity.

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 effectively developed robust solar markets. Model policies included in this report provide guidance to states interested in building thriving solar markets.

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 (SWH) technologies including financial incentives, installer training, and consumer education.

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

1.3

Survey Residents and Businesses to Identify Barriers

Local governments and organizations can identify market barriers to solar energy by engaging multiple stakeholder groups. Because each local community might face a different set of barriers to solar commercialization, it is important to identify the most significant barriers in your community through discussions with key city leaders, literature searches, reaching out to other local government representatives in your state and beyond, contacting your State Energy Office, and soliciting citizen or stakeholder feedback.

You can obtain stakeholder feedback in a number of ways, including online or mailed surveys, focus groups, town hall meetings, and workshops. Analyzing feedback from multiple stakeholders will help you identify real and perceived market barriers to the adoption of solar energy in your community. Common market barriers include complex and expensive solar installation permitting procedures; lack of financing mechanisms for solar projects; shortages of trained workers to support a growing market; minimal consumer awareness; and inconsistent interconnection standards, net-metering policies, and utility rate structures.

Benefits

Conducting surveys or holding stakeholder workshops will help uncover the factors that are important to residents and businesses when they decide to purchase solar energy systems, identify roadblocks for solar energy installations, and point out the areas where communication and outreach are needed.

Implementation Tips and Options

- ☐ Make a list of all stakeholder groups from which you would like input, including residents, businesses, nonprofits, utilities, and local solar installers.
- ☐ Invite stakeholders to complete a survey or participate in a face-to-face meeting.
- ☐ Determine whether you want to survey residents, businesses, utilities, and the solar industry separately or together.
- ☐ Ask questions about the demand for solar energy in your 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 you can take to overcome or diminish those obstacles.

Examples

Berkeley, California: Surveying Businesses and Residents to Identify Barriers

The City of 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 found that the most common obstacles are the cost, the hassle of the information search, financial uncertainties, and unequal access to information between consumers and equipment installers. The city designed the SmartSolar Program to directly address these barriers. SmartSolar furnishes access to accurate, trustworthy information through general education events, site-specific assessments, assistance in selecting products and installers, and quality control after solar system installation. The program, launched in April 2009, offers personalized consultations to home and business owners, guiding them through the various energy efficiency and solar energy options and incentives available in Berkeley. SmartSolar site assessors will take a comprehensive, whole-building approach that includes energy efficiency, solar water heating (SWH), and PV technology options.

Orlando, Florida: Identifying Barriers through Targeted Charrettes

The City of Orlando is conducting seven charrettes, or interactive workshops, to develop a list of solar policies and priorities that will help the city meet its aggressive solar installation targets. Each meeting will feature subject matter experts speaking on integrating solar technologies into key sectors like multifamily housing, new residential developments, utility programs, transportation hubs (such as bus stops and plug-in charging stations), and public spaces and buildings. Electronic polling equipment will allow the group members to submit immediate feedback, facilitating real-time consensus building on priorities and policies. After the workshops, a summary report will be prepared for city and county government leaders. The report will feature a list of recommendations in order of priority based on stakeholder feedback.

Additional References and Resources

PUBLICATIONS

Market Research: BerkeleyFIRST

University of California, Berkeley, Renewable and Appropriate Energy Laboratory, March 2009

This PowerPoint presentation highlights major findings from a survey conducted by the Renewable and Appropriate Energy Laboratory (RAEL) about the most important purchasing considerations for Berkeley residents and businesses that are thinking about installing solar energy technologies. The City of Berkeley used the results of this study to shape its BerkeleyFIRST financing program and its SmartSolar Program.

Presentation: www.solaramericacities.energy.gov/City_Info/Berkeley/Berkeley_Market_Research_Client_Survey.pdf

Berkeley Solar Initiative Business Plan

City of Berkeley, October 2008

This report contains a detailed account of the planning process Berkeley followed to design a local solar initiative. The plan also includes programmatic details for the Berkeley Solar Initiative.

Report: www.solaramericacities.energy.gov/City_Info/Berkeley/Berkeley_Solar_Initiative_Business_Plan.pdf

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 your community—called an **installation baseline**. This will help you understand your community's level of experience with solar energy and allow you to set realistic goals. Although this can be a time-consuming process, knowing where you started will be essential down the road when you assess progress, trends, and accomplishments.

Most installation baseline surveys include information about the type of solar technology installed (usually PV or SWH) and the sector in which the installation exists (commercial, residential, municipal, industrial, or agricultural). Information about the current installations in your city can reside within several organizations, including renewable energy programs, city permitting offices, and the local utility or utilities.

Benefits

Identifying the number of solar systems currently installed in your community creates a benchmark from which you can set realistic **installation targets**. An installation baseline also serves as an indicator of local market maturity, and the survey process gives solar energy system owners a venue for testimonials. This information can help you determine what policy decisions might be most beneficial in the future. Finally, quantifying the number of local solar systems can help determine the size of the local solar workforce.

Implementation Tips and Options

- ☐ Contact your state's public benefits fund manager or solar rebate program administrator to find out if installation statistics are tracked. If you're not sure how to reach these sources, start with your state energy office (visit www.naseo.org/members/states/default.aspx for contact information).
- ☐ Identify the permits required for installing PV and SWH systems in your community and contact the appropriate departments to find out how many permits have been approved. In areas that don't require permits designated specifically for solar systems, permits may fall under electrical for PV systems or plumbing for SWH systems. Or they may fall under building permits for either technology.

- ☐ Contact your local utility to request information on PV interconnections. Utility representatives might be hesitant to give detailed information on installations because of concerns about the privacy of their customers (or for other business-sensitive reasons). If the utility representative is hesitant to provide detailed information, you can 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 installers and gather their installation statistics to help quantify the total number of installations.
- ☐ Determine the number of solar energy systems installed to date as well as the actual **installed capacity** of PV and SWH systems.
- ☐ Consider developing a website where residents and businesses can submit details, photos, and testimonials about their solar energy systems.

Examples

Boston, Massachusetts: Quantifying the City's Installation Baseline

The City of 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). In addition to these sources, the team gathered information from installer directories at www.findsolar.com and the Solar Business Association of New England website, and then they compiled a list of installers operating in the Boston area. Next, the team interviewed staff members at each of these organizations to identify the number of PV and SWH systems installed in the Boston area since 2007. The team collected information on the type of solar technology (PV or SWH) installed, system size, installation date, and location. Since 2007, 22 PV systems (totaling 1 megawatt) and five SWH systems have been installed in the Boston area. Through a similar iterative interview process, the City of Boston had identified approximately 421 kilowatts of PV installed between 1985 and 2007. The city had three SWH installations on record before 2007. As of May 2009, the Boston area has 1.4 megawatts of PV and eight SWH systems installed.

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 to date, the city will work with Focus on Energy (Wisconsin's energy efficiency and renewable energy program), We Energies (a 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. This information includes the type of solar energy technology installed, the system size, the installation company, and the amount of the rebate granted along with estimated energy production over the life of the system. 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 that are performed in the Milwaukee area.

An intern with the City of Milwaukee will work with all of these entities to identify the number of solar site assessments that have been conducted and the number of PV and SWH systems that have been installed in Milwaukee. This information will help the city make accurate projections for solar energy installations and set appropriate solar installation targets for the Milwaukee area. It will also help the city quantify the number of installers and site assessors operating in the region. The city will compile detailed data on each installed solar energy system in a database and create a web-based map that will catalog all Milwaukee-area installations.

The catalog and map will help the city manage its solar program and serve as a public outreach tool. The catalog will help the city recognize installation trends, identify neighborhoods that are well suited for solar energy systems, and track installations to determine if a change in strategy is needed to stimulate demand to meet the city's installation goals. And the publicly available resources resulting from this work will help raise public awareness.

PV panels on Milwaukee, Wisconsin's Urban Ecology Center. (Photo credit: Urban Ecology Center)

1.5

Establish Solar Installation Targets

You can use current data on solar installations in your community as the baseline for projecting targets for the number of installations or amount of **installed capacity** you want to reach by a specific date. These targets are often set to achieve broader environmental, climate change, or sustainability goals. Several key factors influence the reasonable installation target range for a given community, including the policy environment, the amount of available solar resources (the amount of sunlight the area receives), the market maturity, the local cost of electricity, and the availability of objective information in the marketplace.

Federal, state, and local policies will have a tremendous effect on your community's level of solar energy adoption. Local governments can introduce incentives into the marketplace through a variety of tools like expedited permitting, loan programs, and solar rebates. Where 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.

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

And communities with higher electricity and gas prices will have a greater incentive to install solar systems because solar energy will be more cost competitive than it might be in areas with low electricity and gas prices.

Benefits

Setting solar installation targets will help clarify the role solar energy will play in achieving your 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 your strategy for increasing solar installations in your community and allows you to track progress against a published goal.

Implementation Tips and Options

- ☐ Use the results of the installation baseline survey to identify your starting point. See Conduct an Installation Baseline Survey.
- ☐ Identify programs and policies that currently support solar energy in your state, which will give you an overview of the current policy context. See Assess Current Policy Environment.
- ☐ Determine local market barriers to solar adoption. See Survey Residents and Businesses to Identify Barriers.
- ☐ Gauge the robustness of the solar industry in terms of the number of solar installers, the number of 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 adequate roof space or land area available in your community.
- ☐ Identify the role solar energy can play in meeting your region's broader environmental objectives.
- ☐ Evaluate the political will for rapid change in your community. If the political will to set stretch goals exists, your community might 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 your installation targets to those of other communities in the region or in other cities or counties similar to yours. Many Solar America Cities list installation targets on the individual city pages at www.solaramericacities.energy.gov.
- ☐ Set milestones for achieving solar installation targets and measure your 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 2008, Boston Mayor Thomas Menino announced 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 carried out by Navigant Consulting, the New York State Energy Research and Development Authority (NYSERDA), and Columbia University, Solar Boston staff concluded that city roofs could conservatively support between 670 and 900 megawatts of PV.

The analysts determined that available roof space would not be the limiting factor in setting an installation target. After calculating the rough technical potential, the city projected its target by taking the baseline of installed capacity at that time (435 kilowatts installed plus another 900 kilowatts planned by the end of 2008) and analyzing historical PV market-growth rates at the municipal, state, national, and international levels. Based on these growth rates, Solar Boston staffers developed three potential market-growth scenarios: (1) a conservative case, assuming a 25% compound annual growth rate; (2) a business-as-usual case, assuming a 35% growth rate; and (3) an aggressive policy scenario, assuming a growth rate of 45% and higher. Solar Boston selected the 35% growth rate as a defensible projection, and the mayor based his target on this rate. The target was further validated by a comparison with state solar goals. In 2007, Governor Deval Patrick announced a statewide target of 250 megawatts by 2017 under the Commonwealth Solar Program. Because Boston houses approximately 10% of the state's population, 25 megawatts would be the city's proportional contribution to the state target. As a result, Boston growth projections are consistent with both historical growth rates and state funding commitments.

Additional References and Resources

WEBSITES

Solar America Cities
www.solaramericacities.energy.gov/cities

The Solar America Cities activity is a partnership between DOE and a select group of 25 cities across the country. The activity and the cities are committed to accelerating the adoption of solar energy technologies at the local level. Each Solar America City has its own webpage that includes a list of project partners.

National Renewable Energy Laboratory, Renewable Resource Data Center
www.nrel.gov/rredc

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

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 your specifications of system size, location, and other variables.

PUBLICATIONS

PV Grid Connected Market Potential under a Cost Breakthrough Scenario
The Energy Foundation, Navigant Consulting, Clean Power Research, September 2004

This report discusses market potential and barriers to the widespread deployment of rooftop PV in the United States, including information about states that are well positioned for rooftop PV deployment.

Report: www.ef.org/documents/EF-Final-Final2.pdf

Analysis of Web-based Solar Photovoltaic Mapping Tools
National Renewable Energy Laboratory, June 2009

A solar PV mapping tool visually represents a specific site and calculates PV system size and projected electricity production. This paper identifies the commercially available solar mapping tools and provides a thorough summary of 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://solaramericacities.energy.gov/PDFs/Analysis_of_Web_Based_Solar_PV_Mapping_Tools.pdf

1.6

Include Solar in Broader Planning Efforts

Integrating a solar plan into broader local or regional planning efforts affirms your community's commitment to solar energy and can help secure resources and political will to accomplish solar goals.

Solar power is a reliable energy option that can help urban planners manage growth and natural resources. In addition to generating clean power, solar technologies extend the life of your community's conventional energy supplies, create jobs, and enhance economic development. Solar energy can also help your community reach its climate change, environmental, and sustainability goals. When you incorporate solar into the community master plan, as well as into these complementary planning endeavors, coordinating the community's efforts and reaching common goals will be easier.

Benefits

Integrating the solar plan into broader local and regional planning efforts will firmly establish solar as a viable energy option and support a growing market in your community.

Implementation Tips and Options

- ☐ Consider how your solar goals can assist your community in reaching its broader climate change, environmental, and sustainability goals.
- ☐ Identify how solar energy can contribute to economic development and community revitalization. See Creating Jobs and Supporting Economic Development.
- ☐ Work with the local planning department and utility to integrate solar energy into your community's infrastructure and resource planning activities.
- ☐ Clearly define roles for each organization involved once you've determined where you can integrate your comprehensive solar plan into broader planning efforts.

Examples

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

The City of 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 complete a draft *Greater Tucson Solar Development Plan*. The PAG vetted the plan through the Southern Arizona Regional Solar Partnership, whose members will present it to the regional planning association for formal approval. 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. The city is incorporating solar into urban planning on the local level by installing PV at bus stops, water facilities, and parking garages in Tucson. The PAG website features case studies with details on these applications. Since 1990, the City of Tucson and Pima County have tapped the Tucson-Pima County Metropolitan Energy Commission as a solar (and energy) advisory committee.

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

The City of Berkeley's action plan, now on its third update, 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 the requirements of Measure G, the city aims to eliminate 11,600 **metric tons of carbon dioxide equivalent ($MtCO_2e$)** per year by 2020 through decentralized solar installations on residential and nonresidential buildings. Decentralized solar electric 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 is implementing 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 in new building energy use standards by calling for all new construction to meet zero net-energy performance standards by 2020.

Additional References and Resources

WEBSITES

Pima Association of Governments Strategic Plan
www.pagnet.org/Programs/EnvironmentalPlanning/SolarPartnership/StrategicPlan/tabid/723/Default.aspx

This website includes information about the PAG and Southern Arizona Regional Solar Partnership's regional plan for developing solar energy. The site outlines the plan's mission, vision, philosophy, goals, and strategies.

City of Berkeley Climate Action Plan (3rd draft archive)
www.berkeleyclimateaction.org/Content/10056/Climate_Action_Plan.html

Berkeley's plan, updated in April 2009, is available for download in its entirety or by chapter.

2.0

ACCELERATING DEMAND THROUGH POLICIES AND INCENTIVES

Although the cost of solar energy systems is expected to decrease significantly over the next decade, financial incentives and policies that stimulate demand still drive solar energy purchases in local markets today. Developing financial incentives and policies to bolster local market demand will attract solar businesses and establish your community in a growing industry. Financial incentives reduce the up-front cost of solar energy systems, making them more affordable for residents and businesses. State and local governments can address high up-front costs through many means such as rebates, loans, and tax incentives. Popular mechanisms for stimulating demand, such as **feed-in tariffs (FITs)** and **renewable portfolio standards (RPS)**, are also described in this section.

This section explores the various types of financial incentives and policies that are being used in communities around the country and points you toward additional resources where you can explore these incentives. State and local governments may have overlapping authority to implement some of the policies and incentive programs outlined here; others may fall exclusively under local jurisdiction. Many state and local incentives are designed to complement the current 30% **federal investment tax credit (ITC)** for solar energy systems.

Although the private sector has developed innovative business models to reduce the up-front cost of solar, such as **power purchase agreements** and leasing arrangements, these models generally still require state or local incentives to make the economics work. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

(photo above) The 95 energy-efficient homes in the Premier Gardens subdivision in Sacramento, California, incorporate solar-electricity generating roof tiles as standard features. These homes combine state-of-the-art, energy efficient construction and appliances with a commercially available solar-electric system to create a home that saves up to 60 percent in electricity costs.

2.1

Offer Direct Incentives

Direct cash incentives give consumers cash back for a qualified solar installation. Direct incentives include rebates, grants, and production-based incentives that complement other incentives like tax credits.

- **Rebates** are cash incentives issued to a purchaser after the system has been installed.
- **Grants** are state and local funds awarded to solar installation projects.
- **Production-based (or performance-based) incentives** are cash payments distributed to project owners over several years based on the amount of energy the 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 may be distributed in a lump sum but are calculated based on the expected energy output of the system.

Rebate and grant amounts are often based on system size or system cost and the funding is typically awarded at the time of installation. Payments based on performance or expected performance instead of capital investments are gaining prominence among program administrators because they lead to optimized system design and installation.

Many states and local governments now offer bonus incentives for building affordable housing; using in-state manufactured components; 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. Currently, approximately 20 states and 100 utilities offer direct incentives for solar installations. 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**.

Benefits

Up-front cash incentives encourage customers to install renewable energy technologies by helping reduce high equipment costs. Although production-based incentives 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 and installed capacity, along with 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 high enough to stimulate adequate demand to meet your community's installation targets.
- Consider setting 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. See Promote Installer Licensing and Certification.
- Support installer training and certification programs to meet the demand for trained technicians that is likely to result from launching an incentive program.
- Design an easy and concise application process.
- Allow flexibility for program modifications.
- Develop a coordinated package 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, and environmental benefits and energy cost-savings resulting from solar energy installations. This allows you to evaluate and improve your program along the way.

Examples

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 targets **environmental justice** areas and encourages residents to hire installers who employ graduates of the city's workforce development program or whose headquarters are within city limits. Residents of the City and County of San Francisco can apply for a basic incentive ($2,000), the workforce development incentive ($3,500), or the environmental justice incentive ($4,000). Applicants can receive additional incentives if their installer qualifies as a city installer ($1,000) or if the household qualifies as low income ($7,000). For-profit businesses can apply for incentives of $1,500 per kilowatt up to $10,000. Higher incentives are available for nonprofits and affordable housing units.

Boulder, Colorado: Supporting the ClimateSmart Solar Grant Fund

The City of Boulder offers grants for the installation of PV or solar water heating (SWH) systems on housing for low- to moderate-income families and on the facilities of nonprofit entities. The 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 that the Boulder City Council approved 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 to those who pay solar sales taxes in the form of a sales tax rebate.

Additional References and Resources

WEBSITES

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. The U.S. Department of Energy (DOE) funds this ongoing effort.

PUBLICATIONS

Developing an Effective State Clean Energy Program: Clean Energy Loans
Clean Energy States Alliance, March 2009

The Clean Energy Group (CEG) runs the Clean Energy States Alliance (CESA), which is a nonprofit organization with members from states with clean energy funds and state agencies. CESA provides information and technical services to its members and works with them to build and expand clean energy markets in the United States. This paper summarizes innovative grant-making approaches and practices that have worked effectively for clean energy programs at the state level.

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

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

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. The full range of cash payments, bill savings, and tax incentives is covered, as well as potentially available solar attribute payments. Traditional financing is also compared with innovative solutions, many of which are borrowed from the commercial sector. Unfortunately, these programs are limited to select locations around the country. 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 solar lease programs already in place. As a result of the $2,000 cap on the residential ITC being lifted in 2009, the expansion of the solar lease model across the United States may be slower than anticipated. The lease model, though, still offers homeowners some distinct advantages. This publication helps homeowners revisit the comparison between the solar lease and home-equity financing in light of the change to the ITC.

Publication: www.nrel.gov/docs/fy09osti/43572.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) performance-based incentives (PBI) used in 32 states across the country.

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

In this first-of-its-kind application, low cost, thin-film PV panels (210 kW) were combined with clear glass in custom glazing units to provide the right balance of shelter, lighting, and electricity generation at Coney Island's Stillwell Avenue Terminal in New York. (Photo credit: Adam Friedberg)

2.2

Understand RPS's, Solar Set-Asides, and Multipliers

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, a certain amount of **generating capacity** within a specified time frame. A similar policy is a renewable portfolio goal, similar to an RPS but not legally binding or nearly as effective in driving renewable development. To date, 33 states and the District of Columbia have a mandatory RPS.

Although the intent and design of the RPS is to promote the broad deployment of renewable energy technologies, in practice it's the projects that cost the least¬—primarily wind—that have benefited from these policies. To offset this effect, a number of states have designed their RPS to augment support to promising technologies that currently cost more, typically solar energy and **customer-sited distributed generation**. This additional support comes in the form of a **credit multiplier**, which gives favored technologies additional credits toward meeting the RPS, or a set-aside (sometimes referred to as a carve-out), which requires some fraction of the RPS to be met with these targeted technologies. Currently, set-asides and/or multipliers exist within 19 states and the District of Columbia; 4 of the 19 states use a combination of the two; another 4 of the 19 use only a multiplier; and 12 of the 19 use only the set-aside mechanism.

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 RPS, and some jurisdictions have included a solar set-aside that primarily applies to their own municipal utility.

Benefits

When designed well, 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 brings significant ancillary benefits to the table, including enhanced economic development and environmental improvements.

Implementation Tips and Options

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

- ☐ Consider 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.
- ☐ Identify the various types of solar electricity installations that will be eligible (such as customer-sited installations, utility-scale installations, in-state installations, and out-of-state installations).
- ☐ Determine how you'll track solar energy generation.
- ☐ Establish clear guidelines on whether the utility, customer, or solar provider owns the RECs. To realize the monetary value of small quantities of RECs, like 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.
- ☐ Consider whether the RPS is consistent with other renewable policies and programs in place at the local and/or state level.

Examples

Austin, Texas: Including a Solar Set-Aside in Austin Energy's RPS

In Texas, municipal utilities and cooperatives aren't subject to the state's RPS but were given the choice of opting in. Austin chose to develop its own RPS policy instead of opting into the state standard. The Austin City Council approved a resolution in September 2003 directing Austin Energy, the municipal utility, to enter into a memorandum of understanding (MOU) with the World Wildlife Fund that includes, among other objectives, a goal to achieve a 20% renewable energy component in the utility's energy mix. In December of that same year, the city council approved Austin Energy's 10-year strategic plan, which included a 20% RPS by 2020. The plan also contains a commitment to develop 15 megawatts of solar generating capacity by 2007, increasing to 100 megawatts 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.

Columbia, Missouri: Establishing a Solar Set-Aside in Columbia Water and Light's RPS

In November 2004, the voters of Columbia, Missouri, approved a proposal to adopt an RPS. Under the proposal, the city's municipal utility, Columbia Water and Light, is required to generate or purchase electricity generated from eligible renewable energy resources at increasing levels, resulting in a 15% requirement by 2022. Columbia established an additional goal of using solar energy to meet 1% of its RPS requirement. To help achieve this solar requirement, the utility developed a new rebate program called Solar One.

Following the creation of the Columbia Water and Light RPS, Missouri voters passed a ballot initiative establishing a statewide RPS in 2008, which applies only to investor-owned utilities.

Additional References and Resources

WEBSITES

Austin Energy Strategic Plan
www.austinenergy.com/about%20us/newsroom/Reports/strategicPlan.pdf

The municipal utility in Austin, Texas, Austin Energy, developed a 20-year strategic plan that focuses on its mission to deliver clean, affordable, reliable energy and excellent customer service in a rapidly changing environment for utilities.

Columbia Water and Light: Solar One program
http://gocolumbiamo.com/WaterandLight/Electric/SolarOne.php

Columbia Water and Light, Columbia, Missouri's municipal utility, offers Solar One, an innovative community solar program, to its customers. Solar One energy, generated through local solar systems located on city-owned property or at Columbia businesses, will be sold to customers in 100-kilowatt-hour blocks through a small added charge on the customer's bill. Its original 140 available subscriptions sold out, and there's currently a waiting list.

Publications

State of the States 2008: Renewable Energy Development and the Role of Policy
National Renewable Energy Laboratory, October 2008

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/fy09osti/43021.pdf

Renewable Portfolio Standards in the United States: A Status Report with Data through 2007
Lawrence Berkeley National Laboratory, April 2008

This report—the first in a regular series—contains information on design, early experience, and projected impacts of RPS policies in the United States.

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

2.3

Understand Feed-In Tariffs

Another popular mechanism for stimulating the market is the feed-in tariff (FIT). 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 15–20 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.

When considering a FIT policy, decision makers have several options. You can implement a FIT as a stand-alone policy or as a means of meeting an RPS. For example, a FIT may 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.

You 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 utilities must purchase electricity from large utility-scale project developers as well as from individuals who generate electricity from renewable sources on their private property.

As a result of the success of the FIT in Europe, two states have passed FIT policies: the California Public Utilities Commission (CPUC) approved a FIT policy for seven of the state's utilities in February 2008, and Vermont passed a FIT in May 2009. Legislators in numerous other states—Hawaii, Illinois, Indiana, Maine, Massachusetts, Michigan, Minnesota, New Jersey, New York, Rhode Island, Virginia, Washington, and Wisconsin—have introduced FIT legislation; although, they haven't yet been successful in getting it passed. Additionally, three California cities—Los Angeles, Palm Desert, and Santa Monica—have proposed FIT policies. In February 2009, the municipal utility in Gainesville, Florida, implemented a FIT policy.

Although a FIT results in guaranteed revenue streams for developers, which assists in securing long-term financing, it doesn't lower 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 periodically to reflect these shifts. Because these implementation changes are critical to FIT success, 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 also bring significant ancillary benefits to the table, including enhanced 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. And for states that don't have an RPS in place, the FIT can jump-start the renewable energy market.

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 until now, 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 and/or the utility of producing electricity from renewable sources.
- Consider 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 your jurisdiction's policy objectives.
- Consider differentiating FIT payment levels based on factors like technology type (wind, solar, biomass, and geothermal), the quality of the resource at the particular site (to encourage broad deployment of renewable energy projects), and the specific location of the project.
- If your jurisdiction has an RPS in place, consider how the FIT will interact with that policy.
- Decide what the acceptable cost burden might be for your jurisdiction and how to weigh that impact relative to resulting job creation and economic benefits.
- Determine who will own the 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

Gainesville Regional Utilities (GRU) implemented a FIT in March 2009. The Gainesville tariff mechanism is modeled after Germany's FIT. GRU will purchase energy from qualified PV systems via a standard offer contract at set rates for 20 years. Both residential and commercial generators are eligible; however, commercial generators will no longer have the option to net meter once the FIT takes effect. Residential customers with systems under 10 kilowatts, though, will have the option to either net meter or opt into a FIT agreement. The fixed rate starts at $0.32 per kilowatt-hour or $0.26 per kilowatt-hour depending on the size and application of the systems for contracts executed in 2009 and 2010. The general manager of GRU can stop offering new contracts after a total of 4 megawatts of PV has been connected to the utility per year. This decision is subject to review by the Gainesville City Commission. All RECs stemming from customer generation belong to the utility.

California: Approving a Feed-In Tariff for Seven State Utilities

The CPUC has approved long-term prices for the state's utilities to buy renewable energy from their customers. For seven of the state's utilities, a FIT—approved on February 14, 2008—applies to renewable energy systems located at public water and wastewater facilities. For Pacific Gas and Electric Company (PG&E) and Southern California Edison (SCE), a separate FIT applies to any customer-located renewable energy system up to 1.5 megawatts in capacity. The tariff requires signing a long-term contract for 5, 10, or 15 years, but the price is adjusted based on the time of day when the power is generated. For instance, for a system that produces power throughout the day, a 15-year contract signed with SCE in 2008 would earn about 15 cents per kilowatt-hour on a summer weekday. A system generating power from 8 a.m. to 6 p.m. (like a solar power system) would earn about 22 cents per kilowatt-hour under the same circumstances. Overall, the tariffs range from 8 to 31 cents per kilowatt-hour. Facilities earning the tariff can't participate in other state incentive programs.

Other countries, like Germany, have used FITs to encourage rapid growth in customer-located renewable energy systems. The CPUC, though, has set limits on the current tariffs, which may have an impact on the growth rate for renewables in California. For systems at public water and wastewater facilities, the statewide capacity limit is set at 250 megawatts and is distributed among the seven utilities according to their size. For other customer-located facilities, the capacity limit is about 104.6 megawatts for PG&E and about 123.8 megawatts for SCE. PG&E, SCE, and a few other California utilities offer their tariffs through two options: the customer can sell the utility only their excess power, or they can arrange to sell the utility all the power from their facility.

Additional References and Resources

PUBLICATIONS

State Clean Energy Policies Analysis (SCEPA): An Analysis of Renewable Energy Feed-in Tariffs in the United States
National Renewable Energy Laboratory, May 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. An overview of FIT impacts (jobs and economic development) in Europe is included.

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 feed-in tariff 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, 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

2.4

Offer Loans for Solar Energy Systems

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. About one-third of the 41 existing state loan programs target solar installations for nonprofit and public buildings, including local government buildings and schools. State loan programs that target renewable energy exclusively, such as the Vermont and Connecticut programs, tend to target commercial buildings. Maximum loan amounts are typically about $1 million, and interest rates and repayment terms usually vary by project. Residences—where the emphasis is on efficiency and conservation projects—are eligible for nearly half of the existing state loan programs. States typically collaborate with private lenders in administering the program. The maximum loan for residential projects generally ranges from $10,000 to $30,000 with varying interest rates and repayment terms ranging from 3 to 20 years.

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**.

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 may be more politically viable than cash incentives, and they can even become self-sustaining through a revolving fund mechanism.

Implementation Tips and Options

- Explore multiple options for funding loan programs, including
  - **Revolving loan funds**
  - **Public benefits funds**
  - RPS **alternative compliance payments**
  - Environmental noncompliance penalties
  - Sale of bonds
  - Annual appropriations
- Incorporate key features of effective loan programs, including
  - 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 to educate 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
- Consider a long-term assessment on the customer's property tax bill as an alternative way to structure a loan program. See Create a Property Assessed Clean Energy Financing Program.

Examples

Orlando, Florida: Offering a Low-Interest Utility Loan Program

The Orlando Utilities Commission partners with the Orlando Federal Credit Union to offer its customers low-interest loans for 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 three to seven years. Customers can borrow up to $20,000 for a PV system at an interest rate of 2.0% to 5.5% over a term ranging from 2 to 10 years. Loans are repaid over time as fixed payments on customers' monthly utility bills. This program complements the utility's production-based incentive program for PV and SWH.

Maui County, Hawaii: Establishing Zero Percent Interest Loans for SWH Systems

In September 2002, Maui Electric Company (MECO) and the County of Maui teamed up to launch the Maui Solar Roofs Initiative to increase the use of renewable energy in the county. Under the initiative, MECO offers zero percent loans for SWH as well as a $1,000 rebate for installations completed by one of its approved solar contractors.

Resident homeowners with existing electric water heaters are eligible and must make a down payment equal to 35% of the system cost after MECO's rebate. This loan program also accepts applications from renters who have the property owner's permission to install an SWH system. The County of Maui supplies the funds, and MECO administers the loans. To date, the county has invested a total of

$700,000 in a revolving fund to support 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 at or below the area median income.

Hamilton County, Ohio: Reinstating the Home Improvement Program

The Hamilton County, Ohio, Home Improvement Program (HIP) was originally initiated in 2002 and then reinstated in May 2008. A HIP loan allows homeowners in Hamilton County communities to borrow money to repair or remodel homes or rental property at interest rates 3% below the lowest rate a bank would normally offer. The loan is usually structured as a home equity loan secured by a second mortgage on the property. Credit requirements apply. Since 2002, HIP has extended 2,200 loans.

Eligible residential (one- or two-family homes) and commercial properties must have an assessed value of less than $350,000 and must be current on property tax payments. There's no property value limit on multifamily dwellings (three or more units). Loans may be used for alteration, repair, maintenance, or improvements, including renewable energy and energy efficiency improvements. Funds can't, however, be used for luxury projects (like swimming pools and hot tubs) or for free-standing appliances. Appliances that are permanently installed are permissible.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org

This website 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 IREC, is the only comprehensive, regularly updated database of state renewable energy incentives in the United States. DOE funds this ongoing effort.

Orlando Utilities Commission Green
www.ouc.com/green

The Orlando Utilities Commission's (OUC) Green website contains the details of the utility's low-interest loan programs.

Maui Electric Interest-Free Loans for Solar Water Heaters
www.mauielectric.com

This website describes the utility's interest-free loan program for SWH.

Hamilton County Home Improvement Program
www.hamiltoncountyohio.gov

The Hamilton County loan program is described on this site.

PUBLICATIONS

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

2.5

Create a Property Assessed Clean Energy Financing Program

One of the main barriers to widespread solar adoption is the initial cost of a solar system. And most people aren't aware that financial structures are available to spread that cost across many years, making the system more affordable. Many people are familiar with financing the purchase of a home using a mortgage or a vehicle using a loan. The same type of financing is necessary for widespread solar deployment so consumers can pay for their solar energy over time on a monthly or semiannual bill instead of one lump sum.

To address this barrier, municipalities and counties across the country are launching innovative public/private financing programs that allow property owners to spread the cost of renewable energy systems and energy efficiency upgrades over a long-term contract. Property owners borrow money from the local government and repay the loan obligation through a long-term special assessment on their individual property tax bill.

Property assessed clean energy programs are typically 100% opt-in, and property tax expenses remain unchanged for those who choose not to participate. If a participating owner sells the property, the repayment obligation typically transfers to the new owner.

For this type of financing to work, local jurisdictions must have authorization to create a special assessment district or other mechanism that allows repayment via property tax bills. Most states already authorize municipalities and counties to create special districts to finance "public goods" projects like street beautification or sewer system upgrades. If special district authority exists, the statute can usually be broadened to allow clean energy projects to be similarly financed. If authority does not exist, new legislation must be passed at the state level.

Local governments commonly use bonding authority to finance these types of programs. General, municipal, or revenue bonds can be used to pay capital costs. The type of bonding authority available to a municipality or county, though, can limit available funding options. In states that allow only local governments to authorize revenue bonds, an amendment that recognizes special assessment payments from borrowers as revenue may be necessary.

The passage of the 2009 *American Recovery and Reinvestment Act* removed the federal government's "anti-double dipping" rule introduced in the Energy Policy Act of 2005. Property owners are now allowed to claim the 30% federal ITC and take advantage of "subsidized energy financing" like that provided by a property assessed clean energy program.

Benefits

This approach to financing offers a number of benefits to solar energy system owners including a long-term, fixed-cost financing option; a loan tied to the property (instead of the system owner's credit standing); a repayment obligation that transfers 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.

For local governments the benefits are also clear. This financial model can help local governments meet 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 the bond issuance and be repaid by program participants. Because the program can be structured to fully leverage private investment, a municipality or county can implement a property assessed clean energy program with almost zero budget impact.

Implementation Tips and Options

- ☐ Determine whether your local jurisdiction is authorized to create a special district within an existing state statute and whether an amendment to broaden the statute is necessary. Alternately, you may be able to circumvent 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, as the city of Annapolis, Maryland did in November, 2008.
- ☐ Identify whether existing bonding authority is adequate to support a property assessed clean energy program in your community. Other funding sources, including federal tax credit bonds like **clean renewable energy bonds (CREBs)** or **qualified energy conservation bonds (QECBs)** and public–private partnerships may be available.
- ☐ Design a financing structure that yields enough revenue to cover the principal and interest payments to the investors/bondholders, program administration costs, and a reserve fund to cover participant delinquencies.
- ☐ Limit the special assessment to participating property owners.
- ☐ Consider the scope of work involved in the program and determine whether an internal or external organization is better suited to administer the program. At least one company has emerged that offers local governments a turnkey solution to property assessed financing, handling program administration, financing, application processing, and customer service.
- ☐ 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.
- ☐ Consider financing energy efficiency as well as renewable energy projects and prioritize property owners who have received energy audits or have otherwise made informed decisions about the most cost-effective improvements for their property.

Examples

Berkeley, California:
Developing BerkeleyFIRST (Financing Initiative for Renewable and Solar Technology)

Berkeley approved a financing program in September 2008 to allow residential and commercial property owners to pay for energy efficiency improvements and solar system installations as a voluntary, long-term special assessment on their individual property tax bills. Under the BerkeleyFIRST program, the city furnishes the funding for the project from bonds it repays through special assessments on participating property owners' property tax bills. Berkeley contracted with Renewable Funding, LLC, to maintain turnkey program administration. Renewable Funding created an information and application website linked to a database to facilitate program operation and evaluation. Berkeley is running a 40-home PV pilot project before it launches the full program, which will include energy efficiency improvements. Dozens of other cities around the United States are beginning to emulate this model.

Sonoma County: Implementing an Energy Independence Program

The Energy Independence Program gives residential and commercial property owners the option of financing energy efficiency, water efficiency, and renewable energy improvements through a voluntary assessment on their property tax bills. The program is similar to others in California authorized by the 2008 *Assembly Bill 811* but is the first to include water efficiency measures. Eligible equipment must be permanently attached to existing buildings; new construction does not qualify. The special assessments are attached to the property, not the property owner. If the property is sold, the assessment stays with the property.

Sonoma County expects to offer fixed rates that are at or below the rates participants could otherwise receive on home-equity loans from financial institutions. An exact interest rate will be determined at the time the contract is signed. Once the contract is signed, the interest rate will be fixed for the life of the assessment; although, the county may reduce the rate if it can after negotiating long-term financing for the program. The Energy Independence Program can be combined with utility and state rebates, but financing will be available only for the post incentive cost. Tax credits, on the other hand, will not affect the amount of financing available.

Loans are repaid through a special assessment on property tax bills. Loans between $2,500 and $5,000 will be set for repayment in 5 or 10 years. Projects costing more than $5,000 can be repaid over 10 or 20 years at the property owner's discretion. Projects ranging from $60,000 to $500,000 will require approval by the program administrator. Projects valued over $500,000 will require specific approval by the Sonoma County Board of Supervisors.

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

Voters in Boulder County approved *Ballot Issue 1A ClimateSmart Loan Program* in November 2008, authorizing Boulder County to issue up to $40 million in bonds to provide special financing options for renewable energy and energy efficiency improvements to property owners in the county. This program differs from the "Berkeley model" in several ways. First, the repayment period is shorter; loans

to homeowners are repaid over 15 years as a special assessment on the homeowner's property tax bill. Second, Boulder County is the first local government to issue federally tax exempt as well as taxable bonds to finance a property assessed clean energy program. Third, Boulder County decided to aggregate applicants and then issue a large bond based on demand instead of issuing individual "mini-bonds" for each project as Berkeley is doing. Interest rates for Boulder County participants will not exceed 6.75% for income qualified loans (115% or less of area median income) and 8.75% for open loans.

Applicants must attend an educational 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. In March 2009, more than 1,700 people attended program workshops. Boulder County held its first application round for the ClimateSmart Loan Program from April 1 to April 10, 2009. The county plans to issue approximately $6.6 million in bonds to finance the renewable energy and energy efficiency projects of approximately 400 approved participants.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US45F&State=federal&currentpageid=1&ee=1&re=1

This website contains useful information about congressional authorizations of CREBs and QECBs in 2008 and 2009. 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. DOE funds this ongoing effort.

Treasury Direct
www.treasurydirect.gov/govt/apps/slgs/slgs_irstax.htm

This website includes rates posted for QECBs, qualified tax credit bonds (QTCBs), new clean renewable energy bonds (New CREBs), qualified zone academy bonds (QZABs), and qualified school construction bonds (QSCBs).

The Vote Solar Initiative
www.votesolar.org/city-initiatives/municipal-property-tax-financing.html

Vote Solar is working with state and local governments around the country to pass enabling legislation to clear the way for property assessed clean energy financing programs. This website features case studies, legal analyses, and model requests for proposals (RFPs).

BerkeleyFIRST: Financing Initiative for Renewable and Solar Technology
www.berkeleyfirst.renewfund.com

This website was developed specifically for applicants to the BerkeleyFIRST solar financing program and is operated by Renewable Funding, LLC, under contract with the City of Berkeley.

Sonoma County's Energy Independence Program
www.sonomacountyenergy.org

This website describes Sonoma County's Energy Independence program, which allows property owners to finance energy efficiency, water efficiency, and renewable energy improvements through a voluntary assessment on their property tax bill.

Boulder County ClimateSmart Loan Program
www.climatesmartloanprogram.org

This website describes the ClimateSmart Loan Program requirements and application process in Boulder County, Colorado.

PUBLICATIONS

RAEL Financing Seminar

University of California, Berkeley, April 2009

The Renewable and Appropriate Energy Laboratory (RAEL) Financing Seminar held in Berkeley, California, in April 2009 featured experts on municipal financing of clean energy. Program managers from Berkeley, Palm Desert, Sonoma County, and Boulder discussed their experiences with implementing clean energy financing programs, including property assessed clean energy financing programs.

PowerPoint Presentations: http://sites.google.com/site/raelfinancingseminar/Home/ppts

ClimateSmart Loan Program: Proposal to Boulder County Board of Commissioners

Boulder County, February 2009

Boulder County's proposal to its Board of Commissioners contains information about the background of the ClimateSmart Loan Program, outlines key elements of the program, and requests direction from the board on specific program design features.

Report: www.cvehoa.com/documents/CSLP_Program_Outline.pdf

Sonoma County Energy Independence Program: Appendix E—Summary of Financing Process

Sonoma County Energy Independence Program, 2009

This six-page summary explains the financing process for participants in the Sonoma County Energy Independence Program (SCEIP).

Report: www.sonomacountyenergy.org/pdf/SCEIP%20financing%20process%20summary.pdf

Municipal Property Tax Assessment Financing: Removing Key Barriers to Residential Solar

Vote Solar Initiative, October 2008

This report describes the Berkeley model for property tax assessment financing, noting its benefits and potential pitfalls, and serves as a primer for policy makers for implementing this option in their communities.

Report: www.solaramericacities.energy.gov/PDFs/Municipal_Property_Tax_Finance.pdf

2.6

Offer Property Tax Incentives

Property tax incentives for solar energy systems include exemptions, **tax abatements**, and tax credits. Although property taxes can be levied at the state, county, municipal, or school district level, nearly all 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 that install solar energy systems from higher property taxes that may result from the solar installation being added to the property. Local governments can provide an additional incentive for solar installations by offering a significant property tax abatement or credit.

Property taxes vary widely by county, municipality, and state. Most states calculate taxes as a percentage of the assessed value of the property. Property tax rates range from 0.14% to 1.7%.

Most property tax incentives follow a simple model that excludes the added value of solar energy equipment in the tax valuation of the property. Although the duration of most property tax incentives is indefinite, a handful of 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 SWH and 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 policies for utility-scale renewables. These policies are designed to preserve at least a portion of property tax revenue for local governments or to assess them at a value comparable to that of a nonrenewable energy facility.

Benefits Property tax incentives for solar projects can encourage customers to install renewable energy technologies by reducing overall project costs.

Implementation Tips and Options

- ☐ Determine whether your local jurisdiction is authorized to offer property tax incentives.
- ☐ Evaluate the impact that property tax incentives will have on your community. Because property tax incentives are typically not significant enough to reduce solar project costs drastically, these

types of incentives work best in places where property tax rates are high and complementary policies are in place to reduce the costs of solar equipment and installation.

- ☐ Consider separate property tax incentives for small- and large-scale solar installations.

Examples

New York City, New York: Offering Property Tax Abatement for PV 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 four years with a total tax benefit of up to 35% of the installed system cost. The maximum abatement is $62,500 or the amount of real property taxes owed during the year. In effect, this incentive is similar to an ITC; it differs because the tax benefits are recouped through reduced property taxes on the host property instead of through reduced income taxes.

Harford County, Maryland: Offering Residential and Commercial Property Tax Credits for Solar Energy Systems

Harford County offers a credit against real property taxes imposed on residential or commercial buildings or other structures that use solar for heating, cooling, or generating electricity for on-site consumption. The credit amount is equal to one year of total real property taxes or $2,500, whichever is less.

Montgomery County, Maryland: Offering Residential Property Tax Credit for Energy Efficiency and Renewable Energy Projects

Montgomery County offers residents property tax credits for energy efficiency and renewable energy projects implemented at home. Property tax credits up to $250 are available for installing eligible energy efficient devices. The county offers a credit for up to 50% of the installed cost for PV or geothermal systems. All property tax credits are limited to the amount of Montgomery County property taxes paid over three years.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org.

The Renewable Energy Financial Incentives Summary Table section of this website lists all property tax incentives in the United States. 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. DOE funds this ongoing effort.

States Advancing Solar—An Initiative of the Clean Energy Group
www.statesadvancingsolar.org

The Clean Energy Group is a nonprofit advocacy group working on clean energy and climate change issues. The States Advancing Solar website explains many financial incentives including sales and property tax incentives.

2.7

Provide Sales Tax Incentives

Sales tax incentives include exemptions from—or refunds of—sales tax for purchasing and installing solar energy components and systems. The goal is to reduce the investment costs associated with solar systems. Because sales tax 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 solar equipment and installation costs. Although state legislatures have the authority to implement state sales tax policy, local governments may control a portion of sales taxes.

Sales tax rates vary by state, ranging from 2.9% to 7.0%. Most state rates fall 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 the purchase of a solar energy system. Colorado, for example, recently authorized 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.

Several states—Kentucky, Ohio, Utah, and Wyoming—restrict the 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

Sales tax incentives can encourage the installation of renewable energy technologies by reducing equipment costs. When a local sales tax exemption is combined with state sales tax exemptions, a solar energy system becomes even more affordable for home and business owners.

Implementation Tips and Options

- ☐ Determine whether your local jurisdiction is authorized to offer sales tax exemptions.
- ☐ Evaluate the impact sales tax exemptions will have on your community. 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.
- ☐ Consider sales tax exemptions for all solar technology equipment.
- ☐ If you decide to continue 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 allows solar energy system owners to receive a rebate (a tax refund) on the sales tax paid on solar energy equipment. Per a solar rebate ordinance approved by the city council in 2006, the city collects tax on the sale of solar equipment and uses 35% of the revenue to fund the tax rebate program. The remaining 65% of the fund is reserved for the ClimateSmart Solar Grant Fund, a fund that supports PV or SWH systems on housing for low- to moderate-income families and on the facilities of nonprofit entities operating in Boulder.

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

New York state allows both homeowners and those renting a home, including apartments and condominiums, to apply for a sales tax exemption for solar energy systems. In addition, the state 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.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org

The Renewable Energy Financial Incentives Summary Table section of this website gives a full listing of property tax incentives in the United States. 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. 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 website explains many financial incentives, including sales and property tax incentives.

2.8

Consider Permit Fee Waivers or Discounts

Permitting incentives reduce or waive local building permit fees, plan-checking fees, design review fees, or other such charges that residents and businesses normally incur when installing a solar energy system. Permits are required to ensure that a solar installation meets engineering and safety standards. For example, a building permit validates that the roof can support the weight of a solar system. An electrical permit is typically required for PV installations to make sure the system does not pose fire, electrocution, or power surge hazards. Permit fees are set locally, but states can establish standards for permit fees for municipalities and counties. Although permitting incentives alone will not drive solar development, you can use this important local policy option to complement other federal, state, local, or utility policies.

Permit fees imposed by local jurisdictions vary widely—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.

Benefits

By reducing or eliminating local permit fees and adopting fast-track permitting for solar projects, local governments can demonstrate their support for community investment in solar and ensure that local government policies don't put up barriers to achieving solar energy goals.

Implementation Tips and Options

- ☐ Waive or discount permit fees to demonstrate support for community investment in clean energy. The revenue can potentially be replaced by increasing permit fees on other less-desirable projects.
- ☐ Consider instituting a flat-fee method that reflects the actual costs of issuing the permit.
- ☐ Publicize the fee structure on the permitting agency's website along with the required procedures explained in the simplest possible terms.
- ☐ Fast-track solar permits to the extent appropriate, such as for standard residential installations or those from contractors with a reliable track record. See Streamline and Improve Solar Permitting Processes.
- ☐ In its *Inspector Guidelines for PV Systems*, Pace University Law School (2006) 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.

- 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 Utility Consumers' Action Network recommends that permit fees not exceed $100.

Examples

Portland, Oregon: Offering Solar Permits under $100

In May 2008, the city released updated solar permitting guidelines. In the past, solar installers and the permitting office were confused about the type and cost of the required permit. The new process requires building and electrical permits for a PV system, and building and plumbing permits for an SWH system. The combined permitting price for a residential system is less than $100, which is less than a conventional building permit based on the total project cost. Solar systems can use a prescribed standard mounting technique and receive a same-day permit. Larger systems and unique mounting techniques still require engineering review by the city.

Tucson, Arizona: Providing a Solar Permit Fee Credit Incentive up to $1,000

A solar fee credit incentive will credit (or waive) a portion of or all permit fees on a new building or when retrofitting existing buildings with a qualifying solar energy system. For the installation of a qualifying solar energy system, the program will credit the amount an applicant pays for a building permit up to a maximum of $1,000 or the actual amount of the permit fee, whichever is less.

Additional References and Resources

PUBLICATIONS

Solar Electric Permit Fees in Northern California: A Comparative Study
Sierra Club, Updated December 2008

This study compares the progress of 131 municipalities in Northern California striving to make permit fees for 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 (NNEC) 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

Guidelines included in this report form a framework for inspecting and permitting PV systems. Guidelines 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

2.9

Organize a Customer Aggregation Program

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 support programs run by third parties with funding. In most cases, an entity will group members of a community interested in installing solar into one purchasing pool and then negotiate a reduced rate from a solar provider for the cost of the systems and the installation.

Various organizations offer solar group purchases to city residents, and these types of purchases are growing in popularity. Some organizations, like 1 Block Off the Grid (1BOG) in San Francisco, got started in 2008, and others, like the Great Lakes Renewable Energy Association (GLREA), have facilitated group purchases for several years. 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 aggregate purchasing program, interested buyers of solar energy systems can obtain lower up-front purchase costs. These 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 an aggregate purchasing program.
- ☐ Assist the community group or purchasing pool with preparation of an RFP for solar vendors.
- ☐ Review proposals from solar vendors and determine which one best meets the needs of the aggregate purchasing pool (factors to consider include best cost, system type, and quality assurance).
- ☐ Select a reputable vendor with a track record of high-quality installations and clarify the terms of the contract.

Examples

Michigan: Implementing the Go Solar Michigan Bulk Purchasing Program

The Go Solar Michigan Program, administered by the GLREA, helps Michigan businesses and residents obtain discounted pricing for installing PV or SWH systems in Ann Arbor, Grand Rapids, Kalamazoo, and Oakland County. GLREA initiated the program in 2004 in Ann Arbor and expanded it to include Grand Rapids in 2005, Oakland County in 2006, and Kalamazoo in 2007. To obtain discount pricing, GLREA issued a separate RFP for each area and convened an independent selection committee of utility and solar industry experts to evaluate bids and select vendors.

Program participants receive discounts on pricing between 5% and 10% for PV and SWH installations. As of spring 2009, 24 program participants had installed 22 PV systems and 14 SWH systems.

Marin County, California: Developing the GoSolarMarin Volume Discount Program

GoSolarMarin began in 2007 as a coalition of Marin County homeowners negotiating a group price for installing solar energy systems. Since then, the organization expanded its services to assist all individuals, organizations, and businesses considering solar energy installations in Marin County. To obtain discounted pricing for Marin County property owners, GoSolarMarin issued RFPs to solar installers over two years. SPG Solar was selected from 15 vendors who responded to the RFP issued for the 2007–2008 program. SolarCity was selected from the seven vendors who responded for the 2008–2009 program. GoSolarMarin obtained discount pricing of approximately 15% during the 2007–2008 program for properties that met basic requirements for simple installations. The GoSolarMarin discount coupled with the federal ITC of 30% lowered the installed cost to approximately $3.50 per watt in 2009.

The program registered approximately 1,000 participants between the two enrollment periods (November 2007 to March 2008 and October 2008 to February 2009). Approximately 140 program participants purchased and installed solar energy systems during the 2007–2008 program. As of spring 2009, 32 program participants had installed systems, and approximately 18 have contracts pending under the 2008–2009 program.

San Francisco, California: Assisting Neighborhood Group Purchases

In addition to its work with 1BOG, the City of San Francisco's Department of the Environment is working directly with local communities to facilitate solar group purchases, including Precita Valley Neighbors (100 households), Cathedral Hill (4 multitenant buildings), and St. Francis Woods (30 households). Organizers in each neighborhood approached the city for assistance in obtaining preferential pricing from solar installers. The city has given these communities information on solar aggregation and has assisted them in preparing RFPs for solar installers.

Additional References and Resources

WEBSITES

GoSolarMarin
www.gosolarmarin.com/index.html

The GoSolarMarin website is a one-stop shop for learning about the program and taking advantage of the group discount for solar energy installations on Marin County properties.

3.0

UPDATING AND ENFORCING LOCAL RULES AND REGULATIONS

The legal and regulatory framework in your community provides a foundation for building a sustainable solar infrastructure. Local rules and regulations can help reduce installation costs and significantly improve the market environment for solar energy technologies.

State and local governments may have overlapping authority in some regulatory areas outlined in this section; others 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. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

3.1

Develop or Improve 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 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 run up against local ordinances or homeowners' association rules that prohibit or restrict the installation of solar systems. And owners of existing systems can face challenges when their solar equipment is shaded by growing trees or new structures on neighboring properties.

Currently, 34 states protect solar access or solar rights to some extent. 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 refers to the ability of one property to 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 conditions of the easement. Solar easements are usually voluntary, which limits their effectiveness because solar system owners have no guarantee of an agreement with a neighbor whose property could interfere with sunlight falling on the solar system.

Local governments can create more proactive solar easement processes that help protect solar access, such as a **solar access permit** structure in which 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.

Solar rights laws limit or prohibit restrictions (like neighborhood covenants and bylaws, or local government ordinances and building codes) on the installation of solar energy systems. About a dozen states have passed solar rights laws that limit the restrictions neighborhood covenants or local ordinances can impose on solar installations. The laws vary in the types of buildings covered, applicability to new versus existing construction, and 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 more widespread 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 local ordinances posing unintended obstacles. Well-intentioned ordinances such as building height restrictions or aesthetic requirements can inadvertently restrict installation of solar energy systems. In many cases, these ordinances can be modified 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 complements solar energy systems, and dedication of solar easements for newly constructed buildings.
- ☐ Consider solar access protections for commercial properties in addition to residential buildings.
- ☐ Require solar easement agreements to be in writing and adhere to the same recording and indexing requirements as other property interests.
- ☐ Conduct outreach and provide an information center to educate residents and businesses 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 (i.e., PV, SWH, and solar space heating and cooling).
  - ☐ Set a clear and quantifiable standard for what constitutes an unreasonable restriction on solar energy systems; for example, a restriction that increases the cost of a system by 25% could be considered unreasonable.
  - ☐ Define the types of structures covered by the law (i.e., commercial buildings; residences, including single-family homes and multitenant complexes; and 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

Boulder, Colorado: Establishing "Solar Fences" to Protect Access to Sunlight

The City of Boulder enforces an ordinance to protect solar access for residential properties. The ordinance guarantees access to sunlight for homeowners and renters in the city by limiting the amount of shade resulting from new construction and requiring that new developments be sited to receive adequate sunlight for future solar energy production. A hypothetical solar fence creates a setback around a structure to ensure as much uninterrupted sunlight as possible will reach the rooftop. Depending on the zoning district, structures receive a 12-foot (Solar Access Area I) or 25-foot (Solar Access Area II) solar fence designation. The fence is essentially a horizontal setback from the base of the structure. Structures located outside the designated solar fence zoning areas, or those in need of a larger protected area, can request a solar easement through the city's solar access permit process. When applying for a solar access permit, applicants must include detailed information describing the solar energy system, existing structures and vegetation, and the location and dimensions of the solar easement requested.

Ashland, Oregon: Protecting Solar Access through Setbacks and Permits

In 1981, the City of 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 the north 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 to the setback provision that protects properties from shading by buildings, property owners can apply for a solar access permit for protection of shading by vegetation.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org/summarytables/index.cfm?ee=1&RE=1

This database includes tables that summarize state, local, and utility policies, including solar access laws. 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. 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 (CEG) initiative funded by DOE. The initiative's objective is to provide information and assistance to state policy makers and renewable energy programs in the development of effective solar programs. The website contains a section on solar policies, rules, and regulations, including solar access laws.

PUBLICATIONS

Solar Access: Recommendations for the City and County of Denver

DOE Solar Energy Technologies Program, March 2009

This five-page report gives an overview of solar access and solar rights issues and recommends ordinances and enforcement mechanisms for the City of Denver.

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

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

Solar ABCs, October 2008

The Solar America Board for Codes and Standards (Solar ABCs) is one of the major projects of the DOE Solar Energy Technology Program's (SETP) market transformation efforts. Solar ABCs was created as a central body 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

The Brewery Blocks, located at the former site of the Blitz-Weinhard Brewery, is a five-block project in Portland, Oregon's Pearl District neighborhood. The building includes a rooftop PV array, in addition to building-integrated PV modules that are mounted on the southern façade between each of the window panels. Combined, the PV systems produce 21,600 kWh) of electricity annually. (Photo credit: C. Bruce Forster)

3.2

Improve Building Energy Codes

Buildings in the United States use one-third of the nation's total energy and two-thirds of the electricity, making adopting and implementing energy efficient building codes critical from both economic and environmental perspectives. Improving the energy efficiency of buildings is important for solar energy deployment because a more efficient building requires a smaller solar energy system that an old, leaky building that uses lots of energy. By mandating energy efficiency improvements, local governments can promote smart investments in solar energy systems.

States, cities, and the federal government can lead by example by requiring that new public buildings meet strict energy standards. These standards can include commitments to buy electricity from renewable resources, develop solar and green building design standards, and meet stringent energy efficiency requirements for materials and equipment.

Green building standards for new construction and renovations are gaining popularity at the state and local level. More than half the states in the nation now integrate one or more green building rating systems into state building policies. One such green building certification program is the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED). The USGBC lists 172 local jurisdictions that have some type of LEED initiative. About ten states and dozens of cities already require a certain percentage of energy purchased for government buildings come from renewable resources. Government agencies typically install renewable energy technologies, such as photovoltaic (PV) or solar water heating (SWH) systems, or purchase **renewable energy certificates** (RECs) to comply with a renewable energy mandate.

Local governments can encourage or require homebuilders and developers to design and build **solar-ready** homes and commercial buildings so architects and builders can ensure viable sites for solar technologies. This step saves significant time and money later when building owners decide to install solar equip¬ment. Installing solar equipment on an existing building is easier and less disruptive if the original builder makes the structure solar-ready.

Benefits

Improving building energy codes for public and private buildings helps achieve community-wide energy-reduction, environmental, and sustainability goals, and results in significant near- and long-term energy cost-savings. Building codes that mandate certain levels of energy efficiency help ensure that solar systems will be used most cost-effectively. And building codes that require renewable energy production can directly boost the solar market.

Implementation Tips and Options

- ☐ Review national, state, and local building energy codes.
- ☐ Consider adopting standards that exceed national building energy codes.
- ☐ Consider integrating one or more green building rating systems into local building policies.
- ☐ Consider adopting **residential energy conservation ordinances (RECOs)** or **commercial energy conservation ordinances (CECOs)** to require residents and commercial building owners to implement energy and resource conservation measures.
- ☐ Encourage or require builders and developers to design solar-ready homes and buildings.
- ☐ Improve building energy standards and policies for local government facilities by requiring the following:
  - ☐ Equipment procurement policies that mandate using the most energy efficient equipment available, such as devices meeting the federal ENERGY STAR requirements.
  - ☐ Life-cycle cost analysis for all materials and equipment.
  - ☐ Green building and solar-ready design for all new buildings and renovations.
  - ☐ Installing PV or SWH systems on suitable municipal facilitates. See Leading by Example with Installations on Government Properties.

Examples

San Diego, California: Promoting Aggressive Building Energy Standards

San Diego County requires all new city facilities and major building renovation projects to achieve the LEED Silver certification. Newly constructed city facilities must also generate a minimum of 10% of the facility's electricity on site using renewable technologies. The policy also directs the city to design buildings to take advantage of passive and natural sources of heat, cooling, ventilation, and light when possible. The city has adopted a goal of 50 megawatts of renewable energy on all public and private buildings by 2013.

Tucson, Arizona: Requiring All New Residences to be Solar-Ready

In June 2008, the Mayor and City Council unanimously voted to require all new residences in Tucson be solar-ready for PV and SWH systems. The new rules for SWH went into effect March 1, 2009. 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 to receive a building permit. Arizona tax code allows developers to take a state tax rebate of $75 or the actual cost of the stub-out. Code changes to reflect the new rules for PV-ready homes will go into effect later in 2009.

Additional References and Resources

WEBSITES

County of San Diego—The Green Building Program

http://www.sdcounty.ca.gov/dplu/greenbuildings.html

The County of San Diego has established incentive programs, policies, ordinances, and guidelines to promote green building design and construction.

Building Codes Assistance Project

www.bcap-energy.org/node/5

The Building Codes Assistance Project Code Status serves as a one-stop shop for keeping up to date on residential and commercial building codes. The website includes helpful information about designing advanced building codes and staying current on code changes. A database summarizes residential and commercial building codes by state.

U.S. Green Building Council

www.usgbc.org/DisplayPage.aspx?CategoryID=19

USGBC is composed of more than 19,500 organizations from across the building industry that are working to advance environmentally responsible, profitable, and healthy places to live and work. The website includes information about the USGBC's LEED Rating System and certification process.

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org/library/includes/type.cfm?Type=Constr&Back=regtab&CurrentPageID=7&EE=1&RE=1&Search=TableType

This database features tables that summarize state, local, and utility policies, including green building mandates currently being implemented throughout the United States. 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. DOE funds this ongoing effort.

PUBLICATIONS

A Homebuilder's Guide to Going Solar

U.S. Department of Energy, December 2008

The DOE Building Technologies Program and the National Renewable Energy Laboratory (NREL) published this guide to assist homebuilders contemplating solar-ready or solar homes. This guide helps homebuilders gather the information necessary to determine whether to install solar energy systems on homes or to make homes solar-ready and helps quantify the benefits for home buyers.

Report: www1.eere.energy.gov/solar/pdfs/44792.pdf

3.3

Streamline and Improve Solar Permitting Processes

To install a grid-connected PV system, the property owner must obtain an electrical permit and in some cases a building permit from the local government followed by an inspection of the installation. Solar thermal or SWH systems require a plumbing permit and sometimes a building or mechanical permit, or both.

These processes exist for good reason and are legally required. At the same time, obtaining these local permits can substantially increase the time and cost of installing a solar system and can often be a major obstacle to solar market development. Permitting requirements and processes can vary greatly between jurisdictions, presenting informational and logistical challenges to installers working across those jurisdictions. And in some areas, it can take months or even more than a year to obtain a permit and complete the plan review process.

This inefficiency can add considerable costs to any installation and has kept some solar projects from moving forward. For SWH systems particularly, in many areas the standard operating procedure appears to be to avoid the permitting process altogether—which does not satisfy the basic interests of either the customer or the local jurisdiction. In some states, permits for SWH systems fall entirely under plumbing codes. In others, they fall under mechanical codes.

Several cities have streamlined the permitting process with clearly defined requirements, expedited processing for standard installations, and the option to submit paperwork online. Some local governments have gone a step further and worked with other jurisdictions in their region to make the permitting requirements and process consistent across jurisdictions and throughout the state.

Benefits

Simplifying permitting requirements and processes can increase the likelihood of successful solar installations and save a significant time and money. 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.

Implementation Tips and Options

- ☐ Understand the entire permitting and inspection process for PV and SWH systems and the dynamics between the entities involved (installers, consumers, various city departments and inspection officials, and the local utility).
- ☐ Identify barriers to installing systems quickly and cost-effectively.
- ☐ Establish a clear path for communications between code enforcement offices and the local utility provider to expedite the interconnection and inspection processes.
- ☐ Allow over-the-counter building permits for standard roof-mounted solar energy systems that don't exceed the roof support capabilities of a structure meeting minimum building code requirements.
- ☐ 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 Conduct Code Official Training.
- ☐ Adopt flat fees or fee waivers for permitting small commercial and residential solar energy systems because these systems require comparable time and attention from inspectors. Fees based on the cost of the project can discourage investment in larger systems.

Examples

San Jose, California: Streamlining the Permitting and Inspection Process

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

- The total panel weight (including frame) is greater than five pounds per square foot.
- The maximum concentrated load at each point of support exceeds 40 pounds.
- The maximum height above the roof surface exceeds 18 inches.

San Jose also schedules the post-installation inspection by appointment, usually within a two-hour window. In some jurisdictions, only a day is specified, and contractors are sometimes expected to wait for eight hours for the inspector to arrive.

Portland, Oregon: Processing Permit Applications Electronically

The city's Bureau of Development Services (BDS) has developed a new electronic permit submittal process for solar installers, making it easier than ever to get residential solar building permits. For qualified projects, installers can now e-mail their permit application to the city and expect a review within approximately 24 hours. The city has also trained staff at the permitting desk as solar experts and has set aside weekly times for solar contractors who need help filing their permits in person. In addition, the Bureau of Planning and Sustainability (BPS) is working 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.

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 has amended the legislation to allow solar installations in historic districts and created a permitting process for solar installations in these districts and on landmark properties.

New Orleans, Louisiana: Establishing a Formal Communications Protocol between the City and Utility

To streamline the permitting and interconnection process, the New Orleans Office of Safety and Permits worked with Entergy, the local utility company, to establish a formal communications protocol. The utility created a new category in its call center dedicated to grid-tied PV system work orders. Now, when a PV system passes city inspection, Safety and Permits notifies Entergy via the call center that a PV system is ready for interconnection. This not only shortens the time between inspection and interconnection but also ensures that the proper inspection has been done and the appropriate paperwork is complete.

Additional References and Resources

WEBSITES

SolarTech
www.solartech.org

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

City of San Jose, Department of Planning, Building, and Code Enforcement
www.sanjoseca.gov/building/

The City of San Jose provides valuable information on obtaining permits and scheduling inspections on this website. You can look up property information, past permit history, and zoning information on any property in San Jose as well as apply for permits and schedule inspections.

City of Portland, Bureau of Planning and Sustainability
www.portlandonline.com/OSD/index.cfm?c=47394&

This website includes the latest updates to Portland's residential and commercial permitting process for solar energy installations. The City offers electronic permitting for residential projects that meet certain requirements. This website explains the program and offers information about the training contractors must complete before participating in the electronic permitting program.

PUBLICATIONS

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 (NNEC) 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

3.4

Promote Installer Licensing and Certification

State regulation and licensing of solar contractors continues to evolve as the industry matures. Typically, states require SWH installers to hold a plumber's license and PV installers to hold an electrical license. More than a dozen states require contractors to obtain a separate, specialized solar contractor's license.

Solar expert Jim Dunlop, P.E., an independent consultant 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. (Excerpt from J. Dunlop, "Installations Licensure and Qualifications for Solar Energy Systems." *IAEI News*, September–October 2008).

For PV systems installed in the United States, nearly all aspects of licensing are governed by the North American Electrical Safety System. Many organizations, however, are involved in developing product codes and standards, testing, and approvals.

- Standard Practices: The IEEE/American National Standards Institute (IEEE/ANSI) develops standards and recommended practices for installing PV systems.
- Installer Certification: The National Fire Protection Association (NFPA) publishes the *National Electrical Code*® (NEC; also called NFPA 70), which is the U.S. standard for the safe installation of electrical wiring and equipment. The NEC (along with the Occupational Safety and Health Administration [OSHA] and the U.S. Department of Labor) establishes the qualifications of those who are allowed to work on electrical systems, including their experience and training on the associated safety hazards.

Certification typically adds a layer of quality to existing licensure or sets a baseline level of quality in locations where a solar contractor's license is not required to install systems. Encouraging or requiring national certification is recommended if local governments wish to keep pace with national standards developed by a large base of stakeholders.

The most widespread certification program for PV and solar thermal system installers is operated by the North American Board of Certified Energy Practitioners (NABCEP). NABCEP's program is a national,

independent, voluntary industry certification program. Candidates for this certification qualify based on documented PV systems training and installation experience (there is a prerequisite for at least one year of installation experience). Candidates must pass a written examination, sign a code of ethics, and maintain continuing education for recertification every three years. Installer certification through NABCEP is intended for experienced installers to demonstrate a high level of installation knowledge and commitment to excellence.

The NABCEP board developed job task analyses, which define the general set of knowledge, skills, and abilities typically required of PV system and solar thermal installers. 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.

In addition, NABCEP offers an entry-level certificate of knowledge, designed for students and job-seekers new to the field. The certificate does not certify an individual as a solar installer; it simply shows potential employers that job-seekers have obtained a basic knowledge of PV system design and installation. The certification courses have no prerequisites and are open to anyone interested in learning about solar energy systems installations.

Although intended as a voluntary, value-added credential, NABCEP certification is now becoming mandatory for contractors who wish to participate in many state incentive programs. In a few states, the certification is tied to qualifying for a state license. For example, if solar installation company owners want to be eligible for state rebate funds in Maine and Ohio, their PV systems must be installed by a professional with a NABCEP certification. Similarly, in Utah state, solar contractor licenses are awarded only to NABCEP-certified installers.

Because not all NABCEP certificants are duly licensed contractors in any jurisdiction, the NABCEP website 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."[2]

Benefits

Consumers, local governments, and the solar industry should all benefit from a solar market that encourages high-quality installations through licensing and certification. Consumers benefit when contractors are essentially "prescreened" according to government standards. The expectation is that encouraging licensing and certification will result in baseline standards being met, which will in turn lead to higher 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. Licensing and certification benefits local governments by promoting high-quality installations and building a skilled workforce. Using nationally recognized programs relieves municipalities of the need to create their own certification standards.

[2] See www.nabcep.org/about-us.

Implementation Tips and Options

- ☐ Assess the solar technician training available in your area. The rate at which installers receive training and certification will largely depend on the existence of locally available instruction. See Survey and Understand the Local Training Landscape.
- ☐ Consider building a training program from scratch with local or regional solar experts if such a program does not exist in your region. See Develop Local Workforce Training and Education Programs.
- ☐ Educate consumers about the value of installer licensing and certification.
- ☐ Consider requiring consumers to document hiring a licensed and certified contractor in order to participate in a local incentive program or receive a solar permit.

When you're developing incentive programs and crafting policy language, consider the following:

- ☐ Assess the industry in your area. If your 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 you can about the type of license, certification, or training required for your program.
- ☐ Avoid creating loopholes for unqualified contractors but balance the need for certification with the need to jump-start the local industry.
- ☐ Consider including an insurance requirement for installers in your incentive program.

Examples

Louisiana: Establishing a Solar Classification and Certificate of Training

Led by the Louisiana CleanTech Network (LCTN), the state's solar industry lobbied successfully for the Louisiana Department of Revenue to include a clause requiring consumers to hire licensed and trained contractors in order to receive state solar tax credits. Owners must supply the contractor's license number and other documents with their tax filing in order to receive the state's significant 50% tax credit. Specifically, the tax rule states that "all installations must be performed by a contractor duly licensed by and in good standing with the Louisiana Contractors Licensing Board with a classification of Solar Energy Equipment [SEE] and a certificate of training in the design and installation of solar energy systems from an industry recognized training entity, or a Louisiana technical college, or the owner of the residence." [3]

When the tax rule was put into place, the industry intentionally did not specify which certificate of training would be required because at that point not enough contractors had any single type of training. The advantage of this approach was that contractors were not restricted to a point that hindered the growth of the young industry. The local solar industry in Louisiana, however, views the SEE classification, an add-on that any licensed contractor of any trade can easily obtain, as

[3] See http://revenue.louisiana.gov/forms/lawspolicies/NOI_LAC61_I_1907.pdf, p. 5.

problematic because the classification lacks a rigorous training requirement. To further protect the consumer and safeguard the reputation of the growing industry, the Louisiana solar industry plans to request that any contractor wishing to obtain the SEE classification must first pass an exam, perhaps at the difficulty level of the NABCEP entry-level certificate of knowledge exam.

Austin, Texas: Requiring Installers to Demonstrate Qualifications

To participate in Austin's solar PV rebate program, the municipal utility (Austin Energy) requires at least one employee of an installation firm to be eligible for NABCEP certification and to pass an exam on local codes and ordinances developed and administered by Austin Energy. To prove NABCEP eligibility, the prospective contractor must have either a letter from NABCEP stating his or her qualifications to sit for the NABCEP test or hold a certificate verifying that he or she has passed the NABCEP test. All registered solar contractors must obtain NABCEP certification within two years of being added to Austin Energy's registered PV contractor list.

All solar installers participating in Austin Energy's Solar PV rebate program must possess a currently valid certificate of insurance proving the following coverage: $500,000 Combined Single Limit; Bodily Injury and Property Damage/$500,000 General Aggregate; Austin Energy must be listed as the Certificate Holder.

Additional References and Resources

WEBSITES

North American Board of Certified Energy Practitioners
www.nabcep.org

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

3.5

Conduct Code Official Training

Code officials are primarily responsible for the safety of individuals or property that might be harmed when structural, building, electrical, plumbing, or other codes required by the city or the **Authority Having Jurisdiction (AHJ)** are not followed. Solar systems that aren't code compliant could present a risk to building occupants, system owners, solar technicians, electrical line workers, rooftop workers, and others who come in contact with these installations.

Cities or AHJs generally require solar systems to be installed in a two-step process. First, installers must receive a permit from the local government to begin the installation. Permits are issued based on information required by the local government, such as engineered designs, equipment specifications or electrical or structural schematics. Then, once the installation is completed, the code official inspects the system for code compliance based on the information submitted in the permitting application. Because code officials are primarily responsible for ensuring safety, they must understand how solar systems work. Because many code officials are unfamiliar with solar energy technologies, however, solar systems might be installed improperly or the inspection process might be unnecessarily delayed. Fortunately, training can demystify solar systems, streamline the installation process, and ensure safety.

Educational institutions such as FSEC at the University of Central Florida, the North Carolina Solar Center, and New Mexico State University have developed courses for code officials to serve local, regional, and national needs for training.

Benefits

The main benefit of training code officials is that it enhances safety in the installation process. Besides enforcing installation codes and standards, officials often determine whether permit applicants and contractors are properly licensed or otherwise qualified to perform the work. In some cases, inexperienced individuals who are unfamiliar with the codes, practices, materials, and equipment used by electricians are installing PV systems. This problem arises more often with smaller systems in the residential sector with homeowners often agreeing to the unlicensed work to cut costs. Having knowledgeable, trained, and available code officials on board helps ensure the safety of all involved.

A secondary benefit is that trained officials can expedite the permitting and installation process. This means savings in time and money for the system owner, the solar contractor, and the authorities who have jurisdiction over code compliance.

Implementation Tips and Options

- ☐ Identify the various permitting and inspection departments that issue building, electrical, and plumbing permits for solar thermal and PV systems.
- ☐ Make sure you understand the permitting and inspecting process in your community.
- ☐ Contact organizations that conduct training and education in solar or related trades and get in touch with local universities, colleges, and training institutions to inquire about code official training.
- ☐ Collaborate with local solar industry representatives, code officials, and training institutions to identify gaps, needs, and barriers to developing an efficient permit and inspection process.
- ☐ Set up training courses for code officials. Collaborate with other nearby jurisdictions to leverage resources where appropriate.

Examples

Salt Lake City, Utah: Organizing a PV/ 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 Trainings (hosted by national expert John Wiles) for solar installers, city/county code officials, electricians, and building inspectors. One workshop, held in Salt Lake City (in northern Utah), attracted more than 300 participants, and the other, held in St. George (in southern Utah), had nearly 100 attendees. The Solar Salt Lake Leadership Team facilitated the events by coordinating the speakers and site activities; designing the registration forms and advertising materials; coordinating continuing education credits with the Utah Division of Occupational and Professional Licensing; and coordinating registrations, marketing, and press communications.

New Orleans, Louisiana: Hosting a Training Workshop on PV / National Electric Codes

Dave Click, a trainer with FSEC, conducted two Solar PV/NEC Code Trainings in the city of New Orleans in March 2008. City code officials, county plan reviewers, building and electrical inspectors, local solar installers, trainers, and utility personnel attended the trainings. Nearly 50 people attended the two workshops.

Additional References and Resources

PUBLICATIONS

Inspector Guidelines for PV Systems

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

Guidelines included in this report provide a framework for inspecting and permitting PV systems. Guidelines are divided into two stages: plan check 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

4.0

ENGAGING YOUR UTILITY

Utilities are important partners for advancing solar adoption in a local community. Now that utilities are eligible for the 30% federal investment tax credit for solar systems, utilities are well positioned to develop large-scale or distributed PV and CSP facilities and sell the solar electricity to their customers. In addition, because utilities must approve the interconnection of photovoltaic (PV) systems to the electricity grid, they play a fundamental role in facilitating customers' solar installations.

Such "grid-tied" PV systems represent the largest growth area for the PV industry in recent years because consumers have chosen to rely on grid electricity for power when the PV system isn't producing power. The alternative, which was popular in past decades and remains a large market opportunity, is to purchase, store, and maintain an energy storage system, such as a battery bank that can supply power during periods of little or no sunlight.

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 to exert influence on 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, can work to improve utility policies that affect the adoption of solar energy technologies. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

4.1

Streamline or Improve 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 PV system to the grid (or **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 territory.

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.

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 (i.e., typically less than 10 kilowatts) to interconnect systems more quickly and inexpensively without having to endure a process designed for larger (i.e., 5- to10-megawatt utility-scale systems. In addition, some jurisdictions have 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 may have standards in place for small systems only. 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") may require more extensive review by the utility 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 your 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:

- ☐ Make all utilities within a state or local jurisdiction subject to the interconnection standards, not just investor-owned utilities.
- ☐ Make all utility customers (i.e., residential, commercial, 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 (for example, $50 per application plus $1 per kilowatt).
- ☐ Adopt and enforce reasonable, punctual procedural timelines.
- ☐ Use a standard form agreement that's easy to understand.
- ☐ Establish clear, 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.
- ☐ Eliminate any requirement for liability insurance (above and beyond the coverage in a typical property owner's insurance policy). In addition, don't allow utilities to require 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 inspection and interconnection processes.

Examples

New Jersey: Implementing Strong Interconnection Rules

In September 2007, the New Jersey Board of Public Utilities (BPU) approved an order to redesign the state solar energy program. As a result, the New Jersey Office of Clean Energy (OCE) was directed to develop modified interconnection, net-metering, and renewable portfolio standard (RPS) rules consistent with the program transition. The BPU's final rules for interconnection include the following provisions:

- There are three different levels of review procedures for applications. Level 1 applies to inverter-based systems of 10 kilowatts or less. Level 2 applies to systems with a maximum capacity of 2 megawatts that are certified by a nationally recognized testing and certification laboratory as meeting IEEE 1547 and Underwriters Laboratories (UL) 1741 compliance standards. Level 3 applies to systems with a maximum capacity of 2 megawatts that don't qualify for either the Level 1 or Level 2 interconnection review procedures.
- Fees vary by level. There is no fee for Level 1 interconnection. Level 2 interconnection may include a fee of $50 plus $1 per kilowatt of capacity (not to exceed $100). Level 3 may include a fee of $100 plus $2 per kilowatt of capacity as well as charges for actual time spent on any impact and/or facilities studies.
- Utilities may not require Level 1 and Level 2 system owners to install additional controls or external disconnect switches not included in the equipment package to perform or pay for additional tests or to purchase additional liability insurance.
- Interconnection to networks is permitted.

New York City, New York: Interconnecting PV on the NYC Network

New York City is home to the most expansive set of secondary network distribution systems in the country. The technical aspects of interconnecting PV on the city's networked grid are beginning to be understood, thanks to a study undertaken by the New York City Solar America City team. 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 and around New York City and to analyze the impact of that large 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 ten sample networks around the city were covered with PV **arrays**. IMBY uses a map-based interface that allows you 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 you can expect from the system. IMBY's estimates of hourly PV power generation were compared with actual hourly **load** levels on each network to show how full PV deployment would affect each network.

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

The study, included in an NREL report titled *Photovoltaic Systems Interconnected onto Secondary Network Distribution Systems*—Success Stories, concluded that low levels of PV penetration on networks are generally acceptable. Based on the results of this study, ConEdison now allows PV systems under 200 kilowatts to connect to networks without a comprehensive engineering review. The utility does, however, reserve the right to conduct engineering reviews of larger PV systems as necessary to prove that a given installation will not adversely affect the safety or reliability of a network.

Additional References and Resources

WEBSITES

Solar America Board for Codes and Standards

www.solarabcs.org

Solar ABCs is one of the major projects of the U.S. Department of Energy's (DOE) Solar Energy Technologies Program's (SETP) market transformation efforts. Solar ABCs was created as a central body to address solar codes and standards issues and has published reports on interconnection issues.

Database of State Incentives for Renewables & Efficiency

www.dsireusa.org/summarytables/rrpre.cfm

This website 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. DOE funds this ongoing effort.

IEEE

http://grouper.ieee.org/groups/scc21/1547/1547_index.html

The IEEE name was originally an acronym for the Institute of Electrical and Electronics Engineers, Inc. Today, the organization's scope has expanded into so many related fields that it is simply referred to by the letters I-E-E-E ("I triple E"). The IEEE website includes information on standard criteria and requirements for interconnection of distributed resources (DR) with electric power systems (EPS).

The Solar Alliance

http://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. On its website, the Solar Alliance provides the industry perspective on four areas critical for building a local solar market, including interconnection standards.

PUBLICATIONS

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, New York.

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

Freeing the Grid

Network for New Energy Choices, Vote Solar Initiative, Interstate Renewable Energy Council, October 2008

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

Report: www.newenergychoices.org/uploads/FreeingTheGrid2008_report.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

IREC Model Interconnection Standards and Procedures for Small Generator Facilities

Interstate Renewable Energy Council, November 2006

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: www.irecusa.org/fileadmin/user_upload/ConnectDocs/IREC_IC_model_Nov06.pdf

205 kW PV system installed on the U.S. Department of Energy Forrestal Building in Washington, D.C. (Photo credit: SunPower Corporation)

4.2

Improve Net-Metering Rules

Net metering is a billing mechanism that credits solar system owners for electricity exported onto 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. At the end of a billing period, a utility customer receives a bill for net electricity, which is the amount of electricity consumed less the amount of electricity produced and exported by the utility customer's 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 alternate billing policy, sometimes called "dual 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 produced 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 several options: (1) sell all solar-generated electricity to a utility at wholesale rates and buy all electricity consumed at retail rates; (2) send excess solar electricity back to the grid without compensation; or (3) purchase a battery storage system to capture excess electricity and store it for future use. Because none of these options are particularly attractive financially, many customers might choose to forego the solar installation altogether or might install only a small system that would produce 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, though, may 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. Some states, expanding on this approach, 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 of all properties with PV systems on the properties that are best suited for solar installations, regardless of each facility's electricity load.

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. Currently, more than 40 U.S. states and the District of Columbia have a net-metering policy in place. But a number of nuances and rules vary by state and/or by utility. For example, some state policies 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 **renewable energy certificates (RECs)** associated with customer-owned generation.

Municipalities with jurisdiction over a utility are well positioned to improve net-metering rules. Even in areas served by investor-owned utilities, though, local governments can exert influence over net-metering rules by collaborating with state and regional governing bodies.

Benefits

Net metering encourages customer investment in solar energy by allowing customers who install PV systems to receive credit for excess electricity generation, which improves their return on 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 federal or state renewable energy requirements.

Implementation Tips and Options

The following implementation tips and options include many of IREC's best practices for net-metering policies:

- ☐ Make all utilities subject to state or local net-metering policies, not just investor-owned utilities.
- ☐ 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 for at least a 12-month period.
- ☐ Don't require an application fee for net metering.
- ☐ Don't add extra charges or fees for net metering.
- ☐ Don't switch net-metering customers to different utility rates or tariffs unless they choose to do so.
- ☐ Allow meter aggregation so customers can use a centrally located solar system to offset electricity load measured by multiple meters on the same property.
- ☐ Establish clear guidelines on whether the utility, customer, or solar provider owns the RECs associated with the solar energy generation.

Examples

New Orleans, Louisiana: Enacting Citywide Net-Metering Rules

In May 2007, the New Orleans City Council adopted net-metering rules that are similar to those adopted by the Louisiana Public Service Commission (PSC) in November 2005. The council's rules require 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 New Orleans City Council's rules apply to residential facilities 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 provide **customer generators** with a meter capable of measuring the flow of electricity in both directions but may charge customers a one-time fee for installing the meter. Net excess generation is credited at the utility's retail rate and carried over to the customer's next bill indefinitely.

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

Utah law 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 up to 25 kilowatts in capacity and nonresidential systems up to 2 megawatts in capacity. In 2008, Solar Salt Lake, a group of organizations implementing Salt Lake City's Solar America City initiatives, advocated for improvements to Utah's net-metering policy. With support from the legal team of Keyes & Fox, IREC, NREL, and numerous Utah solar advocates, Solar Salt Lake succeeded in its mission to improve net-metering rules in Utah. In February 2009, the Utah Public Service Commission ruled that PV system owners will retain the RECs associated with electricity produced by a customer's PV system; customers will receive full retail credit for every kilowatt-hour of excess electricity generated; and RMP must allow aggregate interconnection of PV systems up to 20% of the utility's 2007 peak demand.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org/summarytables/rrpre.cfm

This website 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. DOE funds this ongoing effort.

The Solar Alliance
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. On its website, the Solar Alliance 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

Freeing the Grid

Network for New Energy Choices, Solar Alliance, Vote Solar Initiative, Interstate Renewable Energy Council, October 2008

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

Report: www.newenergychoices.org/uploads/FreeingTheGrid2008_report.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 (SEPA) 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/media/84144/sepa%20pv%20metering.pdf

4.3

Optimize Rate Structures for Solar

Electricity rates include fixed charges and variable charges, and vary by location and customer class (i.e., residential, commercial, and industrial). Rates always include a charge per kilowatt-hour of electricity consumed and sometimes include **demand charges** for the **amount of electric capacity** needed by a facility over a given period. Electricity rate structures determine the value of the power produced by a PV system and the cost of additional electricity purchased from the utility. Rate structures affect the overall economics of a PV system, sometimes significantly. Because electricity produced by PV systems always offsets variable charges and sometimes offsets fixed demand charges, rates with high variable charges (per kilowatt-hour) and low fixed charges (demand) enhance the economic benefit of solar electricity generation.

In addition to determining fixed and variable rates, rate structures may assign different values to variable electricity use based on how the customer uses the electricity. For example, some rate structures are tiered depending on the volume of electricity used. Rate tiers can be beneficial for solar if the tier inclines with higher usage and detrimental if the tier price declines with higher usage. Another rate structure model is dynamic pricing, in which utility customers are charged different amounts for power based on when the power 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.

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 optimized 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** by producing electricity at the point of consumption.

A detailed understanding of each rate, combined with electricity load data from particular facilities, is a solid basis for analysis that allows facility energy managers to make sound energy management decisions.

Benefits

Working with your utility to create rate structures optimized for solar technologies will improve the economics of solar energy in your community.

Implementation Tips and Options

- ☐ Identify the rate structures offered by your local utility.
- ☐ Understand the net-metering rules in place in your community and how they interact with the available rates. See Improve Net-Metering Rules.
- ☐ To understand how electricity rates affect the economics of energy use at a given facility, gather electricity load data from the facility and analyze the electricity bill based on the rates available to the facility.
- ☐ Research dynamic rate structures and encourage your utility to consider rates optimized for solar energy technologies.
- ☐ Collaborate with regional or state authorities as needed to improve rate structures.

Examples

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 multiple years. NREL, the City of San Diego, and the Center for Sustainable Energy California analyzed 2007 PV system data from two city facilities to illustrate 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. The study concluded that by having PV systems in place, the City of San Diego is saving about 50% of electricity costs of the buildings the respective systems serve. Experts plan to expand this study to include more rate structures and more municipal locations.

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

The Minneapolis– Saint Paul Solar America Cities team partnered with NREL analysts to develop a PV valuation tool that quantifies the value of PV-generated electric power for both the PV owner and utility. The primary capabilities of the tool are simulations of annual and hourly energy production, coincident demand, and revenue. This tool is a standard method for evaluating the energy, demand, and revenue values of PV systems ranging in size from small-scale residential and medium-scale commercial to large-scale utility systems. This tool incorporates a variety of energy and demand rate structures, including TOU and wholesale rates. The tool's ability to run multiple rate structures and locations simultaneously and display detailed results gives users comprehensive side-by-side comparisons for identifying the optimum location, configuration, and rate structure for a PV system. Further information and resources will be available in the summer of 2009.

Additional References and Resources

WEBSITES

The Solar Alliance
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 website gives the industry perspective on areas critical for building a local solar market, including utility rates and revenue policies.

SunEdison Energy Cost Calculator
http://monet.sunedison.com/

SunEdison is a solar energy service provider that develops, finances, operates, and monitors solar plants around the globe. The link takes you to an application that calculates the cost of energy on an interval basis for specific utility tariffs. You may upload up to one month's worth of interval data in .csv format. Results will be e-mailed to you the next day. If solar production data are uploaded, results will include solar savings.

PUBLICATIONS

Solar San Diego: The Impact of Binomial Rate Structures on Real PV Systems
National Renewable Energy Laboratory, May 2008

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

Report: 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 have a significant impact on the future viability of customer-sited commercial PV markets.

Report: http://repositories.cdlib.org/cgi/viewcontent.cgi?article=5510&context=lbnl

4.4

Encourage Solar in Green Pricing Programs

Utility customers participating in a green pricing program pay a premium on their electric bills to support the utility's investments in renewable energy technologies. Green pricing programs can include multiple types of clean energy resources such as wind, solar, biomass, hydro, and landfill gas. The renewable energy projects supplying green power can be located within the local utility territory, elsewhere in the country, or even elsewhere in the world. Utilities can sell the environmental benefit from generating electricity from clean renewable resources separately from the electricity through a mechanism known as a **renewable energy certificate (REC)**.

A REC represents the environmental attribute associated with generating electricity from clean renewable energy resources rather than from polluting fossil fuels. In green pricing programs, a REC is usually sold separately from the electricity with which it's associated. To date, approximately 850 out of the more than 5,000 investor-owned, municipal, and cooperative utilities in the United States offer a green pricing option to their customers.

Many green pricing programs voluntarily certify the renewable energy they sell through certification programs. Certification ensures the renewable energy being sold to utility customers meets certain standards established by the certifying organization. Although there is no regulatory oversight involved in the certification, national standards have emerged from certification programs such as Green-e Energy. The Green-e Energy National Standard defines eligible renewable resources and product specifications. To obtain Green-e Energy certification for their RECs, **project developer**s must demonstrate that their projects meet the Green-e Energy standards, abide by a code of conduct and customer disclosure agreement, and follow strict guidelines for using the Green-e Energy logo and trademark.

Solar technologies that produce electricity are increasingly being added to green pricing programs. By offering solar as a green pricing option, utilities allow customers who are interested in solar—but aren't able to install a PV system of their own—to support solar energy in their community. This means that any utility customer, including renters, property owners with considerable site-shading issues, or occupants of multi-unit buildings, can purchase solar electricity by paying a premium to support their utility's investment in solar electricity. Utilities have many options for offering solar energy in green pricing programs. They can invest in a PV installation or purchase solar RECs from a solar energy developer, a **REC marketer**, or from individuals who install solar energy systems on their properties.

Market research has identified a number of possible motives for customers to participate in green pricing programs, many of which are related to health and the environment. Among these motives are promoting new technologies, providing for future generations, protecting human health, and just "doing the right thing." Local governments, especially those with jurisdiction over utilities, can help build solar markets by encouraging utilities to include solar energy in green pricing programs.

Benefits

Generating electricity from renewable sources is an effective means of reducing carbon dioxide (CO_2) emissions, lowering environmental impact, and enhancing energy security. When a utility chooses to locate renewable energy projects near population centers, the utility avoids electricity losses over long transmission lines, and the local community realizes economic benefits. In addition to the benefits received from all renewable energy resources, including solar electricity in green pricing programs promotes awareness of and builds demand for solar energy installations in your community.

Implementation Tips and Options

- ☐ Work with your utility to understand any existing green pricing programs and whether they include solar.
- ☐ If you are starting a green pricing program from scratch, identify the program features that are important to the local consumer base before designing the pricing program. One way to gather this information is through focus groups or surveys.
- ☐ Identify and communicate the tangible environmental benefits resulting from investments in renewable energy technologies.
- ☐ Carefully consider product pricing and set premiums for green electricity at a level deemed acceptable by local utility customers and regulators.
- ☐ Aggressively market the program to consumers.

Examples

Orlando, Florida: Offering Solar in a Green Pricing Program

Through its green pricing program, the Orlando Utilities Commission (OUC) sells RECs from renewable energy projects to its customers. OUC customers have a choice between two green pricing products, a blended landfill gas, solar, and wind product and a 100% solar product. The blended green power product costs $5 per 200-kilowatt-hour block and contains RECs from a mixture of landfill gas (75%), solar (20%), and wind (5%) projects. Local PV, SWH, and landfill gas projects generate RECs for the blended product. Wind developers outside the Orlando region furnish OUC with RECs from wind projects. The 100% solar product costs $10 per 200-kilowatt-hour block of electricity and includes a mix of PV and SWH RECs from OUC customers who own PV and SWH systems. Each month, OUC purchases energy generated by 55 SWH systems and 13 PV systems owned by OUC customers. As of spring 2009, the program sells approximately 8,600 kilowatt-hours of the blended product and 1,200 kilowatt-hours of the 100% solar product.

Sacramento, California: Subscribing to "Shares" in a Utility-Scale PV 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 utility-scale PV installation in Sacramento County. SolarShares is designed to enable SMUD's consumers to tap into solar power by subscribing to shares—in one-half-kilowatt increments up to 4 kilowatts—in a large utility-scale PV system. For a fixed monthly fee based on customer electricity usage, participants can invest in green power generated by a portion of the local PV installation. SMUD credits the value of that generation to the participant's energy bill.

The program sold out the initial 1-megawatt PV system in the first six months. The 692 program participants currently spend an extra $4 to $50 on their electric bill each month depending on the customer's energy use and amount of solar energy purchased, but the net bill impact will decrease as electricity rates increase.

Additional References and Resources

WEBSITES

Orlando Utilities Commission's Green Pricing Program
www.ouc.com/green/green-pricing.htm

This website explains the program and also contains a "Green Guide" section for further reading on energy efficiency and renewable energy.

Sacramento Municipal Utility District
www.smud.org/en/community-environment/solar/pages/solarshares.aspx

This website provides details on the district's SolarShares Program.

The Green Power Network
http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml?page=0

The Green Power Network (GPN) offers news and information on green power markets and related activities. The site contains up-to-date information on green power providers, product offerings, consumer protection issues, and policies affecting green power markets. It also includes a reference library of relevant papers, articles, and reports. NREL operates and maintains the GPN for DOE.

Green-e Energy
www.green-e.org/getcert_re.shtml

This website contains information about Green-e Energy's voluntary certification programs for renewable energy, including detailed information about the certification process and application instructions.

PUBLICATIONS

Green Power Marketing in the United States: A Status Report (11th Edition)
National Renewable Energy Laboratory, October 2008

This report documents green power marketing activities and trends in the United States, focusing on consumer decisions to purchase electricity supplied from renewable energy sources.

Report: www.nrel.gov/docs/fy09osti/44094.pdf

Renewable Energy Price-Stability Benefits in Utility Green Power Programs

National Renewable Energy Laboratory, August 2008

This paper examines utility experiences when offering the fixed-price benefits of renewable energy in green pricing programs, including the methods used and the impact on program participation.

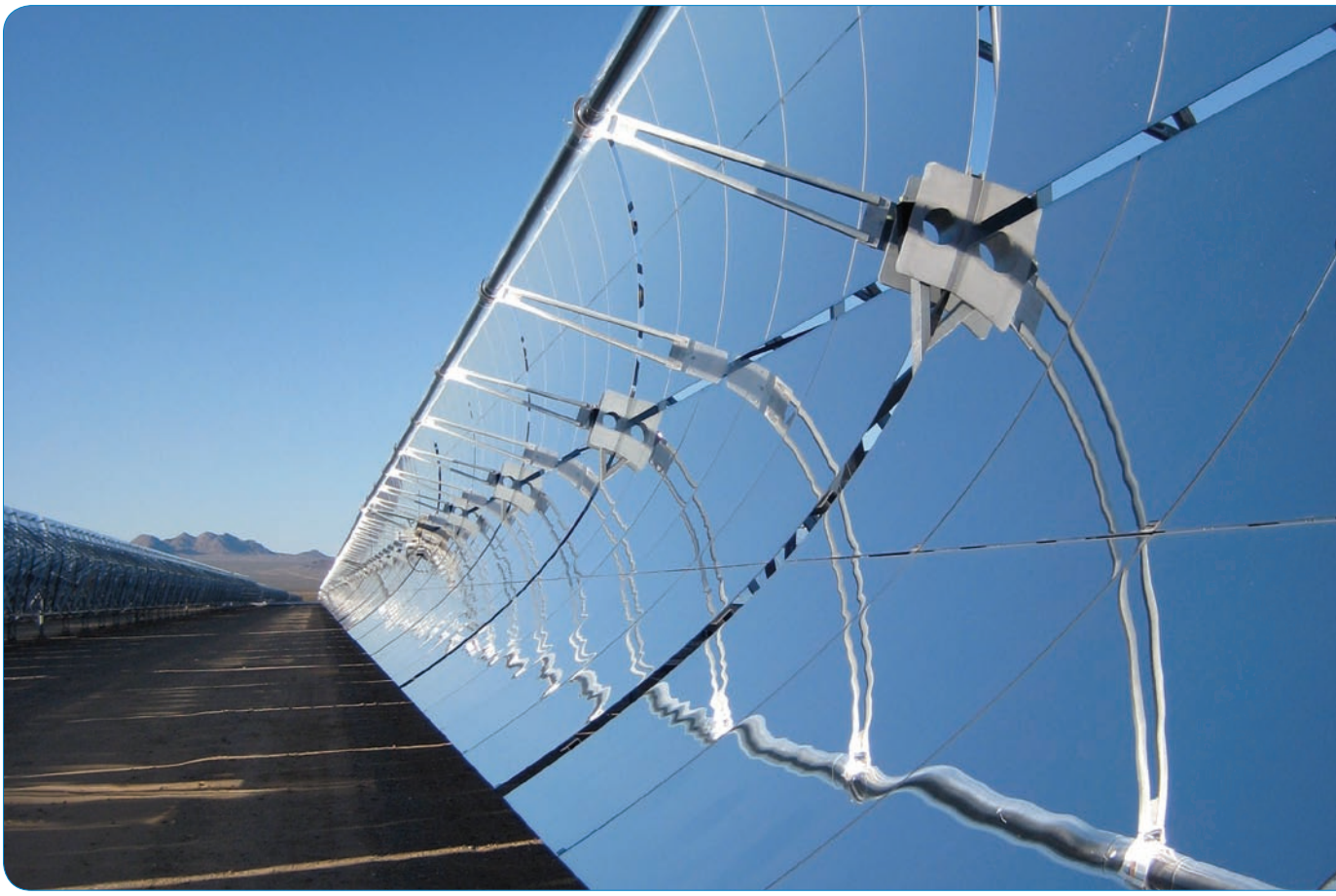
Report: www.nrel.gov/docs/fy08osti/43532.pdf

Trends in Utility Green Pricing Programs

National Renewable Energy Laboratory, October 2006

This report documents trends in green power marketing activities in the United States. The report presents aggregated sales data from all voluntary green power programs in the United States and contains summary data on utility green power programs and green power marketing activities.

Report: www.nrel.gov/docs/fy07osti/40777.pdf



Nevada Solar One, developed by Acciona, is the first utility-scale CSP plant to be built in the United States in 17 years and is the third largest of its kind in the world. This 64-megawatt (MW) parabolic trough plant near Boulder City, Nevada, contains 182,000 curved mirrors spread over 400 acres.

5.0

CREATING JOBS AND SUPPORTING ECONOMIC DEVELOPMENT

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 fields such as solar training and system financing. Local governments can contribute to the growth of a domestic renewable energy industry and boost their local economies by partnering with solar market participants and supporting education and training programs.

This section is intended to give you a good understanding of the variety of solar-related economic opportunities and suggest how you can support a trained workforce. The examples throughout this section offer insight into how communities are leveraging the solar industry to create green jobs and support economic development. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

(photo above) The Florida Solar Energy Center offers a number of PV training programs and workshops.

5.1

Recruit the Solar Industry

Local development agencies, sometimes with support from state contributions, can use a variety of financial incentives to encourage clean energy businesses to locate or expand in their areas. Financial incentives that promote the establishment or expansion of manufacturing operations typically take the form of tax incentives, loans, and grants. In addition to promoting manufacturing, local governments can design these incentives to support research, development, and commercialization efforts; partnerships with private venture capital funds; and marketing and business development activities for distributors and installers.

Recruiting private industry requires focused and sustained efforts by local governments backed by a stable and mature economic development organization. Corporate investments can range from small (a local sales office) to significant (a 1,000-acre manufacturing site). Private companies typically base decisions on where to locate a new facility on the inherent advantages of the site, proximity to their clients, and any local economic incentives that can help offset their operations costs.

More than a dozen states and local governments offer incentives designed to recruit the renewable energy industry. Ten years ago, incentives consisted primarily of tax credits for new manufacturing facilities. Over the past decade, incentives have evolved to attract a wide range of industry players through grants, loans, property tax abatements, marketing support, corporate tax exemptions, and tax credits as well as bonus incentives for consumers who purchase solar equipment manufactured in the state.

Government offerings can range from a $10,000 grant to a small business with a promising precommercial technology to $20 million in tax credits to a company that builds a new manufacturing facility. Most grants and loans are for approximately $1 million, and tax credits for solar equipment manufacturers range from 5% to 50% of construction or other eligible costs. State **public benefits funds** support many of the loan and grant programs.

Local governments incorporate various provisions into funding agreements or tax credit eligibility rules to encourage project success and to protect their investment in new or expanding business ventures. For example, recruitment programs 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 milestones the company reaches. In addition, loan and grant programs typically require substantial cost sharing. Failure to meet project goals and terms, such as moving out of the facility early, can necessitate repayment of the incentive in some cases. Achieving specific job creation or economic development targets, on the other hand, can result in more favorable loan terms.

Benefits

Securing new investments from solar energy companies helps local governments diversify their green-collar workforce, generate new sources of revenue, and build a renewable energy infrastructure that's not easily outsourced. Tangible advantages obtained through solar-related economic development include higher property tax revenues that accrue from fixed investments in property and equipment, sales tax revenues from goods and services sold, and payroll taxes from a well-paid workforce.

Several intangible benefits derive from economic development activities involving solar energy manufacturers. First, partnerships between industry and academia in renewable energy technologies can create a productive cycle of research–invention–production–research, often leading to substantial federal or state investment in academic research facilities and staff. Second, the local government can assist industry by serving as a real-world test environment for new or current products. Collateral benefits include increasing public awareness of efforts to reduce pollution and actually reducing fossil fuel use. Third, supply chain manufacturing partners often site their facilities close to their primary customers to reduce material transportation costs and management communication time. In many cases the number of suppliers to a large solar energy manufacturer can double or triple the tangible economic benefits obtained from the manufacturer because of the investment multiplier effect of staff, facilities, and equipment.

According to a Navigant Consulting report, *Economic Impacts of Extending Federal Solar Tax Credits*, in 2010 there will be nearly seven direct installation jobs per megawatt of installed photovoltaic (PV) capacity. For manufacturing, there will be eight direct jobs per megawatt for wafer and cell production and approximately three direct jobs per megawatt for PV modules and other equipment manufacturing. In all, the extension of the federal investment tax credit (ITC) to 2016 (which was passed by Congress in October 2008) could result in more than 276,000 jobs created in the U.S. solar industry between 2009 and 2016. In addition, the Renewable and Appropriate Energy Laboratory (RAEL) at the University of California, Berkeley, found that, when compared with using fossil fuels, generating electricity from renewable energy results in more jobs. This holds true for both jobs per megawatt and jobs per dollar invested.

Implementation Tips and Options

- Attract the maximum number of investments possible by matching your inherent geographic, labor force, and infrastructure advantages to the requirements considered critical by most solar equipment manufacturers. Requirements often cited include
  - Ability to reuse existing structures or facilities to reduce construction costs
  - Access to infrastructure utilities (gas, power, water) at low usage costs
  - Adequate space for planned operations and future growth
  - Proximity to interstate highways, railroad tracks, and possible suppliers
  - A skilled or trainable labor force nearby
  - A reasonable regulatory authority familiar with manufacturing organizations
- Proactively promote existing local government attributes by sending a formal package of marketing materials to investment candidates and prospective manufacturers. Packaging the information reduces investors' evaluation time and selection cost.
- Offer financial incentives that reduce taxes; cover employee training costs; and abate utility costs, fees, and taxes.
- Consider including solar as one targeted sector for economic development efforts if financial resources are not adequate to develop programs specifically for the solar industry.
- Commit to purchasing a specified amount of solar equipment from manufacturers locating in your city as an added incentive.

In addition, municipalities that oversee the local electric utility can attract solar businesses to the area by establishing a goal to produce a portion of the municipal utility's electrical load with PV, committing to install a certain capacity of solar energy technologies, and offering a higher incentive for installing locally manufactured solar equipment as part of the utility's rebate program.

Examples

Austin, Texas: Supporting Local Industry through Renewable Portfolio Standards (RPS) and Rebate Programs

The City of Austin established a 30% RPS by 2020 for Austin Energy, a municipal utility. The RPS includes a goal of 100 megawatts of installed solar energy systems. To further support a local solar industry, Austin Energy bumps up its $4.50-per-watt incentive to $5.60 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) provides financial incentives for select industries—including 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 ten new jobs, and expanding companies must create either at least five new jobs or at least 10% of the company's workforce at the time of application, whichever is greater. Miami-Dade County will give a qualifying company up to $9,000 per new job in TJIF incentives.

Oregon: Offering Incentives for Renewable Energy Equipment Manufacturers

The State of Oregon provides a tax credit of 50% of the construction costs of a new or expanded renewable energy manufacturing facility, up to $20 million. The incentive is taken over the course of five years at 10% of eligible costs each year. Established in 2007, the program complements the long-standing business and residential energy tax credits available to Oregonians who install solar and other clean energy projects.

New York: Attracting Renewable Energy and Energy Efficiency Product Manufacturers

Using funds from the New York System Benefits Charge (SBC), the New York State Energy Research and Development Authority (NYSERDA) furnishes incentives to businesses that develop or expand facilities to manufacture renewable energy products. There is a limit of $1.5 million per project with a total of $10 million available under the program through 2011. Incentives are provided in milestone phases. Phase I supplies up to $75,000 for facility and site characterization activities with 50% cost share required. Phase II covers preproduction development funding. No more than 20% of the total funds requested may be for preproduction development, up to a maximum of $300,000. This phase also requires a 50% cost share. Phase III is a production incentive in that the payment is based on the sale of products manufactured at the facility for up to five years. At least 75% of the funding requested must be derived from this third phase, which is subject to a 75% cost share.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org

This website 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. The U.S. Department of Energy (DOE) funds this ongoing effort.

American Solar Energy Society
www.ases.org

The American Solar Energy Society (ASES) is the nonprofit organization dedicated to increasing the use of solar energy, energy efficiency, and other sustainable technologies in the United States. This website includes a green jobs section complete with studies and reports about the potential for green collar jobs in the United States, a job board, and career advice about working in the solar energy industry.

PUBLICATIONS

Green Collar Jobs in the U.S. and Colorado, Economic Drivers for the 21st Century

American Solar Energy Society, Management Information Services, January 2009

This report includes industry data through 2007 to forecast job growth in the renewable energy and energy efficiency industries throughout the United States using a case study from experiences in Colorado.

Report: www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Rpt_Jan2009_summary.pdf

EERE Network News: U.S. Solar Power Manufacturing Growing Dramatically

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, October 2008

EERE Network News covers national and international energy efficiency and renewable energy news and events. This article contains information about recent growth in U.S. manufacturing of solar cells and modules.

Article: http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=12065

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.

Report: 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

5.2

Survey and Understand the Local Training Landscape

Understanding local training opportunities and the organizations that offer them is a crucial step in creating a support structure for solar workforce development. Training programs come in all shapes and sizes, and trainers have varying degrees of expertise. City representatives should familiarize themselves with the types of training providers that the solar workforce encounters.

Individuals involved in the site audit, installation, repair, or maintenance of solar power systems can be broadly referred to as solar technicians. The skills needed by solar technicians vary by technology. Installing PV systems or **building integrated PV (BIPV)** requires the conventional trade skills of electricians, roofers, and builders. Solar water heating (SWH) system installations require plumbing skills. The skills and procedures involved also vary according to the size of the solar installation and the specific product being installed.

Education and training of solar technicians runs the gamut from intensive weekend courses through multicourse certificate programs to two-year degree programs. A typical community college course or set of courses is between 40 to 120 hours, lasting from several months to a year. Critical skills such as the ability to perform proper electrical work or sophisticated plumbing may require extensive formal training or work experience. Less critical skills such as the ability to work on a roof and mount modules or other hardware require less training and are usually designated responsibilities of entry-level employees.

Brief training sessions like weekend courses attended by students with little or no experience should be viewed as introductory instruction for prospective technicians. These courses do allow inexperienced job-seekers to gain a foothold in the job market, but they don't adequately prepare job-seekers to immediately start work as installers. Unless students are experienced construction tradesmen, such as journeymen electricians or plumbers, graduates of short courses will most likely require extensive, on-the-job training and possibly more institutional education as well.

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.

Virtually all colleges, universities, and community colleges in the United States 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: electrical, roofing, iron works, 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, PV installers need both electrical and roofing training, and 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 four-year program such as a bachelor of science in engineering technology. These programs are well suited for curriculum enrichment for students who might want to pursue PV system design or energy management.

All solar education and training programs should have the facilities, curricula, and materials to prepare students for jobs in the solar industry once they graduate. IREC offers Institute for Sustainable Power Quality (ISPQ) training accreditation, an internationally recognized standard for renewable energy training programs. The ISPQ standard 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 the following: ISPQ Accreditation for Training Programs, Accreditation for Continuing Education Providers, Certification for Independent Master Trainer, Certification for Affiliated Master Trainers, and Certification for Instructors.

Benefits

By understanding the local training opportunities for solar installers, you can identify areas where government support and involvement is most needed. Well-trained solar technicians are essential for a robust local solar market: A community needs enough solar technicians to support consumer demand. And to ensure the smooth installation processes and high-quality work that will engender high consumer confidence, those technicians must be well-trained.

Implementation Tips and Options

- ☐ Identify organizations and institutions in your community that are conducting training and education in solar energy.
- ☐ Collaborate with local education and training institutions to identify gaps, needs, and barriers to developing a robust solar workforce.

- Encourage training institutions to achieve accreditation through ISPQ. The ISPQ requirements are designed to
  - Prepare individuals with 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

Examples

For examples of how cities are engaging training providers, see Develop Local Workforce Training and Education Programs.

Students from the University of Colorado add PV panels to their 2005 Solar Decathlon house. The team carefully selected the home's rooftop PV system and building-integrated PV awnings, which provide shade as well as electricity. "Our rooftop PV system is made of 32 SunPower 200-watt panels; they're around 16%-17% efficient," said Jeff Lyng, student project manager. The 2005 team wants its home to compare favorably with the university's 2002 Solar Decathlon entry, which took top honors. The University of Colorado, Denver and Boulder, is one of 18 colleges and universities from the United States, Canada, and Spain competing in the event. The Solar Decathlon is an intercollegiate competition to design, build, and operate the most attractive and energy-efficient solar-powered home. (Photo credit: University of Colorado)

5.3

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 by offering financial incentives to people who call on graduates of local training programs to install a solar energy system. Local governments can further support local training programs by aligning a solar workforce training program with other municipal workforce and economic development initiatives and facilitating partnerships between training organizations. Workforce education and training is essential to increase local solar energy adoption. Local governments can play an important supporting role for education and training organizations.

Solar technician training can be offered at community colleges, vocational and technical schools, electrical trade unions, nonprofit organizations, and through specialized training at small independent centers. Solar product manufacturers and distributors also conduct installer training; although, the training is often for product-specific applications. See Survey and Understand the Local Training Landscape for detailed information on types of available training programs.

Benefits

Supporting a robust solar workforce education and training program in your community helps establish a strong foundation on which the local solar energy industry can grow. Local training programs prepare students for home-grown jobs that will invigorate the local economy. 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

- ☐ Connect organizations with experience in solar training to local organizations with an interest in developing a solar training program.
- ☐ Collaborate with local education and training institutions to identify gaps, needs, and barriers to developing a robust solar workforce.

- ☐ Work with local education and training institutions to develop solar curricula that match learning objectives with skill sets required by local employers.
- ☐ Consider how a local solar training program can help meet broader municipal economic development or workforce training objectives.
- ☐ Implement local government programs that encourage the use of locally trained solar installers.

Examples

Los Angeles, California: Creating Partnerships to Train a Solar Workforce

The Los Angeles Department of Water & Power has partnered with the Los Angeles Unified School District and the International Brotherhood of Electrical Workers (IBEW) to fund training for both solar thermal and PV installers at the East Los Angeles Skills Center. This program offers training and retraining for low-income residents. The staff at the skills center is also developing a train-the-trainer program to help expand the number of training programs available at other schools.

San Francisco, California: Increasing Incentives for Using Graduates of GoSolarSF Programs

GoSolarSF offers rebates of up to $4,000 to local residents and up to $10,000 for local businesses to install solar energy systems on their properties. An added incentive of $3,500 is available for buyers who choose an installation company that employs graduates of San Francisco's Workforce Development Program. Certified GoSolarSF contractors must establish eligibility and maintain certification with the Department of Economic and Workforce Development to perform solar installations that qualify for the workforce development incentive.

Minneapolis–Saint Paul, Minnesota: Offering Training with the Joint Apprenticeship and Training Committee

In the Twin Cities, the local Joint Apprenticeship and Training Committee (JATC) offers two solar training courses to licensed electricians—a certificate of knowledge course and a solar installer course. After completing both courses, electricians are considered adequately trained to install and repair PV systems. These courses also prepare students for the corresponding entry-level certificate of knowledge and NABCEP PV certification exams. The certificate of knowledge course involves 56 hours of lectures, demonstrations, and experiments. Most of this time is spent in the classroom. After they complete the first course, students can register for the solar installer course, which involves 64 hours of in-class training and 32–40 hours of field installations. The second course emphasizes extensive laboratory and field work. The students install different types of PV panels, racking systems, and inverter connections.

The Minneapolis–Saint Paul Solar America Cities team is supporting the development of an additional PV and solar thermal training facility at Saint Paul College with classes beginning in summer 2009. The courses will be open to all licensed electricians and plumbers and will lead to eligibility for NABCEP PV and SWH certification exams. The noncredit courses are offered through the business development program.

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

A large part of the city's 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's (LTC) Jefferson campus, offers a solar technology installation course that gives students hands-on experience. The first course, which began in June 2008, produced 20 graduates (at the time, only 5 individuals in the state were solar installers), and a class in September 2008 produced 16 additional graduates.

The training course is a combination of lecture and hands-on 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 presented in two 3-day sessions. This course teaches the learning objectives for NABCEP's entry-level certificate of knowledge in PV and has been approved by NABCEP. The LCTN certificate of training, which all course graduates receive, will satisfy one of the requirements needed to be a solar system installation contractor in Louisiana.

Additional References and Resources

WEBSITES

Solar Energy International
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 website lists the SEI training courses available online and in 22 locations around the world.

Florida Solar Energy Center: Education
www.fsec.ucf.edu/en/education/cont_ed/bldg/index.htm

The center's building research division offers a large number of training and certification courses directed toward a variety of practitioners and professionals, as well as the public. The website lists PV and solar thermal course offerings.

NC State University Renewable Energy Technologies Diploma Program
www.continuingeducation.ncsu.edu/RenewableEnergy.html

This series is a continuing education program geared especially for electrical contractors; building and electrical inspectors; builders and architects; small business owners; land owners; plumbers; heating, ventilating, and air conditioning (HVAC) firms; and other interested individuals who want to gain a higher level of professional training and understanding in the field of renewable energy. The website includes course and workshop listings and registration information.

The Southwest Technology Development Institute
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.

Interstate Renewable Energy Council Training Catalog

www.irecusa.org/trainingCatalog/

IREC, formed in 1982 as a nonprofit organization, 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 website contains information about renewable energy courses at universities, a training catalog, resources for curriculum development, and information about becoming ISPQ accredited.

North American Board of Certified Energy Practitioners

www.nabcep.org

The North American Board of Certified Energy Practitioners (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 and certificate programs to renewable energy professionals throughout North America along with information on NABCEP-certified installers in your area.

Partnership for Environmental Technology Education

www.nationalpete.org

The Partnership for Environmental Technology Education (PETE) is a nonprofit organization that helps facilitate, augment, and broker partnerships with educational institutions, industry, and government. The PETE network includes approximately 400 community and technical colleges in six regions in the United States and Puerto Rico. The website features resources for establishing strong environmental practices and programs at educational institutions.

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 website. The website includes details of the incentive program and a list of workforce development program installers.

PUBLICATIONS

Renewable Energy Training: Best Practices & Recommended Guidelines

Interstate Renewable Energy Council, September 2008

This report provides 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/fileadmin/user_upload/WorkforceDevelopmentDocs/Training-BestPractices_Sept_2008_FINAL_01.pdf

Photovoltaic Systems

National Joint Apprenticeship and Training Committee

Developed in partnership with American Technical Publishers, the National Joint Apprenticeship and Training Committee (NJATC) created a comprehensive textbook about the design, installation, and evaluation of residential and commercial PV systems. It covers the principles of PV and describes how to effectively incorporate PV systems into stand-alone 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.licensedelectrician.com/Store/AT/Photovoltaic_Sys.htm

6.0

ACCELERATING DEMAND THROUGH OUTREACH AND EDUCATION

Local governments can engage their communities through a variety of outreach activities that promote solar energy technologies. These activities increase the public's knowledge about solar energy, promote consumer confidence, and help consumers decide whether to install solar energy systems on their homes or businesses.

This section introduces a wide array of outreach activities that promote solar energy. Solar outreach efforts can target numerous audiences, including residents and businesses, financial institutions, and educators and students. Potential providers of solar outreach services include state and local governments, community organizations, colleges and universities, nonprofit organizations, utilities, and industry associations. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

(photo above) The Sacramento Municipal Utility District (SMUD), the city's publicly-owned electric utility, provides grants to educators and students for solar projects that help teach about solar technology and practical applications. Will Rogers Middle School, the first recipient of the SMUD grant, broke ground in June 2007 on a new 144-square-foot, solar-powered broadcasting studio. The students will educate classrooms across the country about solar technology and environmental sustainability through podcasts and live radio and television broadcasts. (Photo credit: Russell Harper, Jr.)

6.1

Create a Consumer Outreach and Education Program

As with any relatively new technology on the market, consumers need to understand how solar technologies work as well as their benefits. Lack of communication, information dissemination, and consumer awareness can limit the potential for solar deployment. Media campaigns, workshops, educational displays, events, competitions, and highly visible demonstration projects are just 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 an outreach mechanism that's growing in popularity. These efforts can help build the solar market by furnishing credible information that will increase public awareness and interest in solar technologies.

Benefits

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

Implementation Tips and Options

- ☐ Create an informational website or social marketing site.
- ☐ Use web-based solar mapping as an outreach tool.
- ☐ Publish case studies on existing solar installations.
- ☐ Create educational displays explaining the basics of solar energy and consider making it a mobile exhibit.
- ☐ Train neighborhood solar champions.
- ☐ Hold a solar fair.
- ☐ Secure sufficient resources to support all aspects of a robust consumer education campaign. This can be accomplished by partnering with other organizations such as nonprofits, universities, utilities, and industries. Depending on the scope of your program, the necessary resources could include
  - ☐ Adequate space to hold workshops or fairs
  - ☐ Trained instructors to lead consumer education workshops
  - ☐ Staff to update an educational website
  - ☐ Solar mapping software

Examples

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 through a solar map application. The solar map includes information on the type of solar energy system installed, system size, and location. Visitors to the website can estimate the solar potential of their own property by entering their address. A GIS-based software program will estimate 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. From this screen, visitors can access California's database of installers, retailers, and contractors. The solar map is housed on SMUD's Green Community website under the Live Green tab at http://smud.solarmap.org/map.html.

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

The first of four major goals set by the City of Portland's Solar Now! Program is to increase market demand among local residents and businesses. The city's Bureau of Planning and Sustainability (BPS), previously the Office of Sustainable Development, 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 makes Portland one of the most sustainable cities in the nation.

In 2006, 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 agreed to come together under the Solar Now! brand and work together 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 monthly workshops
- Advertising campaigns to attract attendance to workshops and raise awareness of the Solar Now! Program
- Educational brochures for residential and commercial audiences
- Informational website at www.solarnoworegon.org
- 1-800 call center
- E-mail reminders and notifications to workshop attendees
- Table presence at local farmers' markets, fairs, and festivals
- On-site presentations at workplaces.

The partnership has allowed the city to leverage finances as well as skills, resulting in a well-coordinated campaign that's becoming increasingly recognized by the public.

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 simply that most citizens lack information about and experience with solar technology. To help educate its citizens, the city is hosting a series of workshops on solar energy. The workshops are free and open to the public, and attendance is averaging more than 50 people. Participants in the solar workshops 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, such as residents, businesses, and utilities. The city of Knoxville works with the Knoxville Utility Board, the Tennessee Valley Authority, Ijams Nature Center, the Southern Alliance for Clean Energy, and the Knoxville Chamber of Commerce to tailor each workshop for the appropriate audience. Although the workshops so far have been focused on big-picture basics of solar technology, workshops with a more focused agenda and greater detail are planned on solar water heating (SWH) and grid-connected photovoltaic (PV) systems.

Sonoma County, California: Organizing a Solar Fair

On June 20, 2009, the summer solstice, Solar Sonoma County in partnership with Pacific Gas & Electric Corporation (PG&E) and SunPower hosted a Solar and Clean Energy Fair in Santa Rosa. Sessions at the fair focused on financing solar energy and energy efficiency installations for homes or businesses through many means, including the Sonoma County Energy Independence Program, a property assessed clean energy financing program. Featured speakers included state senators and representatives, local government officials and representatives from the California Energy Commission, PG&E, and Global Exchange.

San Francisco, California: Training Neighborhood Solar Champions

The San Francisco Department of Environment has partnered with PG&E Corporation's Pacific Energy Center to develop a solar training program for neighborhood "solar champions." The free courses train volunteer leaders from each of San Francisco's neighborhoods on giving a basic solar presentation and on becoming a solar advocate for their neighborhood. The training courses present basic information about how solar technologies work, how to site and size a residential PV system, and how to estimate system outputs and savings. The course also addresses installation costs, incentives, and financing options, including direct ownership, power purchase agreements (PPAs), and leasing. Participants also learn about communities that have pooled their solar installation projects to attract preferential installation pricing from installers. Solar champions must commit to promoting solar energy and giving at least two presentations in their neighborhood each year.

San Francisco, California: Targeting Businesses for Solar Installations

The San Francisco Department of the Environment worked with a team of national laboratory and industry experts to identify 1,500 of the largest rooftops in the city using aerial imagery and GIS software. Once the buildings were identified in fall 2008, Mayor Gavin Newsom challenged the property owners to join the Mayor's Solar Founders' Circle by installing a solar energy system before September 2009. The city offers an extra $1.50 per watt rebate and a free solar site survey to businesses who respond to the challenge. Independent experts working with the San Francisco Department of the Environment perform a site survey to confirm the solar potential of the roof, estimate how much the installation will cost, and identify the incentives available to the building owner. A press release issued by the Mayor's office says the 1,500 rooftops identified have the potential to supply 170 megawatts of solar energy, more than 30 times the amount installed in San Francisco at the launch of the program. Funding to support the Mayor's Solar Founders' Circle comes from a Solar America Cities grant from the U.S. Department of Energy (DOE) and SF Environment's existing SF Energy Watch Program.

Additional References and Resources

WEBSITES

ASES National Solar Tour
www.ases.org/index.php?option=com_content&view=article&id=158&Itemid=16

The American Solar Energy Society (ASES) National Solar Tour is the largest grassroots solar event in history. In 2008, nearly 140,000 attendees visited some 5,000 buildings in 3,000 participating communities. 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 during the first Saturday in October in conjunction with National Energy Awareness Month.

Florida Solar Energy Center: Consumer
www.fsec.ucf.edu/en/consumer/solar_electricity

The Florida Solar Energy Center's (FSEC) Solar Energy Department has been researching PV for more than 30 years. The consumer's section of the website has been designed to help consumers understand how to use PV in their homes or businesses.

California Solar Center
http://www.californiasolarcenter.org

Californiasolarcenter.org is designed to be a prime source of information on solar energy activity in California, but much of the information is applicable to every state. The website 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, along with information on financial incentives in California, legislation, and more. 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.

PUBLICATIONS

Clean Energy State Guide: Marketing Strategies to Increase Solar Demand

Clean Energy Group, July 2009

Effective marketing guides how, when, and where product information is presented to consumers, with the ultimate goal to persuade consumers to purchase a particular brand or product. This guide explains the classic elements of marketing—the 4 Ps (Product, Price, Place, Promotion—and the lens they provide for assessing programs that support solar technology deployment. Additionally, the guide identifies market barriers facing solar and how marketing strategies can be used to address these obstacles.

Report: www.cleanegroup.org/Reports/CEG_Solar_Marketing_Report_July2009.pdf

Analysis of Web-based Solar Photovoltaic Mapping Tools

National Renewable Energy Laboratory, June 2009

A solar PV mapping tool visually represents a specific site and calculates PV system size and projected electricity production. This paper identifies the commercially available solar mapping tools and provides a thorough summary of 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://solaramericacities.energy.gov/PDFs/Analysis_of_Web_Based_Solar_PV_Mapping_Tools.pdf

This 540-kW PV system at the Cal Expo in Sacramento, California, produces enough energy to power about 180 homes. The solar arrays serve as an oasis of shaded parking for 1,000 cars in a desert of scorching blacktop. Cal Expo is the site of many events, including the California State Fair. (Photo credit: Kyocera Solar)

6.2

Install Demonstration Projects with an Educational Component

Demonstration projects are important because they increase local awareness of solar energy and its applications. By seeing solar energy technologies operating first-hand, citizens can 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 by the public will maximize the project's impact in your community. Local governments can install demonstration projects on government property such as a park or city hall, or they can partner with local companies and organizations to complete demonstration projects on private property.

An educational component of a demonstration project could include an educational kiosk at the site location, an informational website, live tours at the demonstration project location, and printed information. These materials could disseminate information about how solar energy technologies work, the energy output of the installation, and carbon emissions reductions and other environmental benefits resulting from the installation. The materials could also direct people to additional resources for more information. 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 will yield valuable data on the production of the solar system that can be used for various financial or technical studies.

It's important to emphasize the benefits resulting from each demonstration project installation and to include information about how solar energy benefits the community, the municipality, and the utility. Showing how the solar technology might be applied at a home or business and communicating the benefits of solar energy to individual home or business owners goes a long way toward promoting solar.

Benefits

Local governments increase awareness of solar energy technologies in their communities by installing demonstration projects that include an educational component. Citizens 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 will increase local demand for solar energy and help support a local solar industry. Demonstration projects can also be a good training opportunity for installers.

Implementation Tips and Options

- ☐ Choose a highly visible, easily accessible location for your demonstration project.
- ☐ Showcase solar energy technologies that community members are likely to install at their own homes or businesses, or, as an alternative, 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.
- ☐ Monitor the demonstration both online and on site so visitors can see how the technology performs in real time and 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 PV installation consisting of 256 BP solar panels and a three-collector SWH system that preheats the water for a restaurant at the park. A flat-screen 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 in Houston is located at the Green Building Technology Resource Center. The center enables residents and business owners to learn about green building technologies and features a 6.6-kilowatt PV system that's easily visible from street level.

Knoxville, Tennessee: Demonstrating PV Technologies

The City of Knoxville's Solar America Cities grant will help fund the installation of a solar array on Knoxville's new downtown transit center. The 4.8-kilowatt PV system will be Knoxville's first municipally owned PV system and is being designed to demonstrate the practical and attractive use of PV to the public. The PV array, positioned to receive maximum sunlight on the transit center rooftop, will be highly visible from multiple angles on the ground. The PV system will feature transparent and semitransparent panels and an aesthetically pleasing mounting structure that will enhance the overall aesthetic qualities of the transit center building.

An educational 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 will be located inside the transit center. Exhibit highlights include a real-time display of the electricity generated by the PV system and informational displays about how renewable energy is part of a healthy, sustainable community. The transit center PV system will be completed by May 2010.

The Solar America City project team is also helping create an educational exhibit to accompany an existing 15-kilowatt PV array at Ijams Nature Center. A new interactive and informative educational

exhibit will enhance existing indoor and outdoor displays. Designed to engage and educate both children and adults, the exhibit will highlight various types of solar technologies, summarize how solar works, provide a step-by-step guide for navigating the installation process, and feature a variety of solar-powered toys that demonstrate solar electricity in action. An existing interactive computer kiosk that shows the electricity generated by the PV system will be enhanced with new interpretive signs.

Pima County, Arizona: Publishing Solar Case Studies Online

The Pima Association of Governments (PAG) and the Southern Arizona Regional Solar Partnership published 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.

Additional References and Resources

WEBSITES

Pima Association of Governments Solar Case Studies
www.pagnet.org/Programs/EnvironmentalPlanning/SolarPartnership/SolarCaseStudies/tabid/757/Default.aspx
This website features case studies on solar installations in the Tucson area.

6.3

Develop a Customer Assistance Program

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 providing basic education about solar energy, these programs can include a comprehensive site analysis performed 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 permitting process information.

As more and more people 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 are all potential providers of customer assistance programs.

Benefits

By furnishing objective information, customer assistance programs increase consumer education, confidence, and protection. 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.
- ☐ Assess the knowledge base of local residents and business owners to determine the scope of services your program should offer.
- ☐ Design the program with local solar industry input to ensure your program helps facilitate installations and doesn't introduce unintended complications for the industry.

- Separate basic consumer education from site surveys or more specific project assistance. Because some customers will need only a basic level of assistance, you'll maximize the impact of limited resources by offering varying levels of service.
- Carefully consider when the program hands off prospective solar system owners to the solar industry.
- Build flexibility into the program design to account for higher-than-expected demand.
- If your program will assist customers with choosing an installation company, be sure to set up a transparent process for contractor selection.
- Secure sufficient resources to support all aspects of a robust customer assistance program. Depending on the scope of your program, these resources could include
  - 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

Madison, Wisconsin: Helping Prospective Solar Owners Decide

Through the Solar America Cities grant, the City of Madison contracted with a Midwest Renewable Energy Association (MREA)-certified consultant to guide home and business owners through the process of going solar in Madison. The objective of the Prospective Solar Owner Agent (PSOA) Program is to increase the knowledge, understanding, and confidence about purchasing a solar system by offering a free site survey to Madison residents. The contracted PSOA consultant works out of city offices, lending credibility to the program and giving the PSOA consultant direct access to city departments to work through any procedural or permitting issues.

The PSOA performs remote site surveys using aerial photography and GIS mapping, discusses ballpark installed-cost figures, and arranges on-site assessments to determine if the property is suitable for a solar energy system. After an assessment, the PSOA prepares a financial analysis using a third-party template from Focus on Energy, an independent organization that promotes renewable energy and energy efficiency projects in Wisconsin. The PSOA offers an independent analysis of the specific customer site; he or she doesn't design the solar system or make recommendations about specific installation companies. The PSOA will assist residents in gathering and understanding quotes from certified contractors within the city limits. This PSOA service has proved to be extremely popular among Madison residents, eliciting more than 350 inquiries in the first year of operation.

Austin, Texas: Ensuring High-Quality Installations

Austin Energy supplies quality control on PV and SWH installations by pre-approving solar installation sites before awarding a rebate. A six-hour window of uninterrupted sun that will remain reasonably shade-free for five years is required to qualify for an Austin Energy PV rebate. A majority (70%) of sites

are approved remotely by using GIS mapping software. The remaining (30%) are either disqualified because of shading or require an in-person site assessment. During an in-person assessment, an Austin Energy employee performs a rooftop shade study and electrical panel assessment and notes whether the roof is in good enough condition for a solar energy installation. Once a PV system is installed, Austin Energy monitors the system with a PV meter (in addition to a meter that measures delivered and received electricity) to warn customers and contractors of system failure. Austin Energy owns the PV meter and does not charge the customer for its installation or maintenance. Austin Energy doesn't require an independent site survey for SWH applications, but the utility confirms site drawings before construction.

San Francisco, California: Assisting Businesses through the Mayor's Solar Founders' Circle

In September 2008, San Francisco Mayor Gavin Newsom challenged the owners of the 1,500 largest rooftops in the city to join the Mayor's Solar Founders' Circle by installing a solar energy system by September 2009. Businesses that respond receive free energy efficiency and solar site assessments from the San Francisco Department of the Environment in addition to an extra $1.50-per-watt rebate toward a solar energy installation.

Between October 2008 and May 2009, more than 100 building owners responded with requests for assessments. Experts from the National Renewable Energy Laboratory (NREL) and Sandia National Laboratories traveled to San Francisco to perform the surveys and train city employees and contractors to do the same. A qualified site assessor analyzes the roof space to measure the available roof area and estimate the solar energy system's production, cost, and payback for each building. This information helps building owners decide whether to move forward with a solar energy system.

The 1,500 rooftops are believed to have the potential to supply 170 megawatts of solar energy, more than 30 times the amount installed in San Francisco when the program began. Funding to support the Mayor's Solar Founders' Circle comes from a Solar America Cities grant from DOE and SF Environment's existing SF Energy Watch Program.

Additional References and Resources

WEBSITES

Midwest Renewable Energy Association Certification Programs: Site Assessor Certification Programs
www.the-mrea.org/course_certifications.php

MREA certifies site assessors in three technologies: PV, SWH, and wind (small wind systems). The site assessment service involves calculations, clear communication, and succinct writing skills. Certification requires the successful completion of course work, skills testing, a written exam, and a certification fee. The organization has trained site assessors in Wisconsin, Illinois, Iowa, Michigan, New Jersey, Indiana, Colorado, and Texas.

PUBLICATIONS

Use of Municipal Assistance Programs to Advance the Adoption of Solar Technologies
American Solar Energy Society, May 2009

This report serves as a tool for municipalities and organizations that are exploring programs to facilitate the installation of solar energy technologies at the local level. The report discusses programs being implemented in Berkeley, San Francisco, and Madison. Program design considerations, lessons learned from program administrators, and recommendations to consider when designing a municipal assistance program are included, but no program design is prescribed. Recommendations should be customized to serve the needs of a specific market.

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

6.4

Incorporate Solar into K-12 Curriculum

Many solar educational materials for incorporation into school curricula—from kindergarten to high school (K-12)—have been developed around the country. If your state has already integrated solar-related K-12 curriculum into its education requirements, use this accredited curriculum as a starting point. If there isn't an approved curriculum, you can work with your local and state educational boards to create approved teaching materials and help teachers use them effectively.

To integrate solar energy into the K-12 curriculum in your community, you'll need to work within established state and local curricula guidelines, set up a mechanism for training teachers to deliver the information, and consider how you can show students a solar energy system in action. It's important to work with teachers and school administrators to understand any constraints on teaching materials and 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 not only teaches children, but also educates the community.

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 the educational materials meet local and state standards for education.
- ☐ Offer the curriculum to local educators and train them how to use it properly within the classroom. Involving teachers early on will help build support for getting the curriculum adopted.
- ☐ Develop a "solar for schools" program that includes not only curriculum, but also subsidies for installing solar systems, monitoring their energy production, loading the data onto a website, 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 kicked off its Solar for Schools Program, which includes installing PV systems at 11 schools—9 in Austin and 2 in Round Rock. 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 Solar for Schools Program installed PV systems at 42 schools across Texas.

Each of the 3.4-kilowatt PV systems installed at Austin-area schools is mounted on poles that stand 10 feet tall and are enclosed by a fence. Each system is capable of producing about 5,450 kilowatt-hours of electricity annually about half the electricity needed to power the average-sized home in Austin year-round. Students can monitor energy production from the solar installations via a website. Staff from Austin Energy, the local utility, worked with Austin Independent School District science teachers to develop a curriculum to teach students about solar energy.

Mahwah, New Jersey: Teaching Students through the Sharp Solar Academy

Sharp, a leading solar manufacturer, introduced an environmental education program called the Sharp Solar Academy at Joyce Kilmer Elementary School in Mahwah. Sharp worked with education experts to develop curriculum that meets state standards and covers multiple environmental topics, including recycling, renewable energy, and climate change. Classroom materials include PowerPoint presentations, videos, and hands-on experiments. The company operates a similar program in Japan, where they have presented to 700 schools. In the United States, the Sharp Solar Academy is beginning with a handful of pilot schools on both coasts. The company plans to expand the program next year to include more schools in the New York metro and southern California areas.

Additional References and Resources

WEBSITES

National Renewable Energy Laboratory Education Programs
www.nrel.gov/education/k12_students.html

NREL's programs seek to promote science, mathematics, and technology education using renewable energy as the vehicle to capture student interest. The programs range from one-on-one tutoring to in-class and bowl-style competitions.

Florida Solar Energy Center: Education
www.fsec.ucf.edu/en/education/k-12/curricula/index.htm

FSEC has designed numerous sets of curriculum materials for K-12 teachers and schools in accordance with state standards. This website briefly describes these materials and features links to useful websites. FSEC also administers the SunSmart Schools Program, through which up to 25 elementary, middle, or senior high schools, along with vocational schools, colleges, and universities in Florida, will be competitively selected to receive a 1- or 2-kilowatt demonstration system or a 10-kilowatt emergency shelter PV system.

Southface Solar Curriculum for Teachers

www.southface.org/solar/solar-roadmap/institutional%20solar/solar-tech-success_curriculum.htm

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 (EPA), and numerous industry and community organizations. The website contains a comprehensive list of educational resources and curriculum materials for teachers interested in incorporating solar energy into their lesson plans. The information emphasizes solar energy but also contains activities and lessons that encompass other forms of renewable energy and energy conservation.

Interstate Renewable Energy Council's *Schools Going Solar News*

www.irecusa.org/index.php?id=36

The Interstate Renewable Energy Council (IREC), formed in 1982 as a nonprofit organization, 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. IREC publishes *Schools Going Solar News*, a running news feed that tracks and archives solar school happenings locally and across the country

Texas State Energy Conservation Office: Renewable Energy Lesson Plans

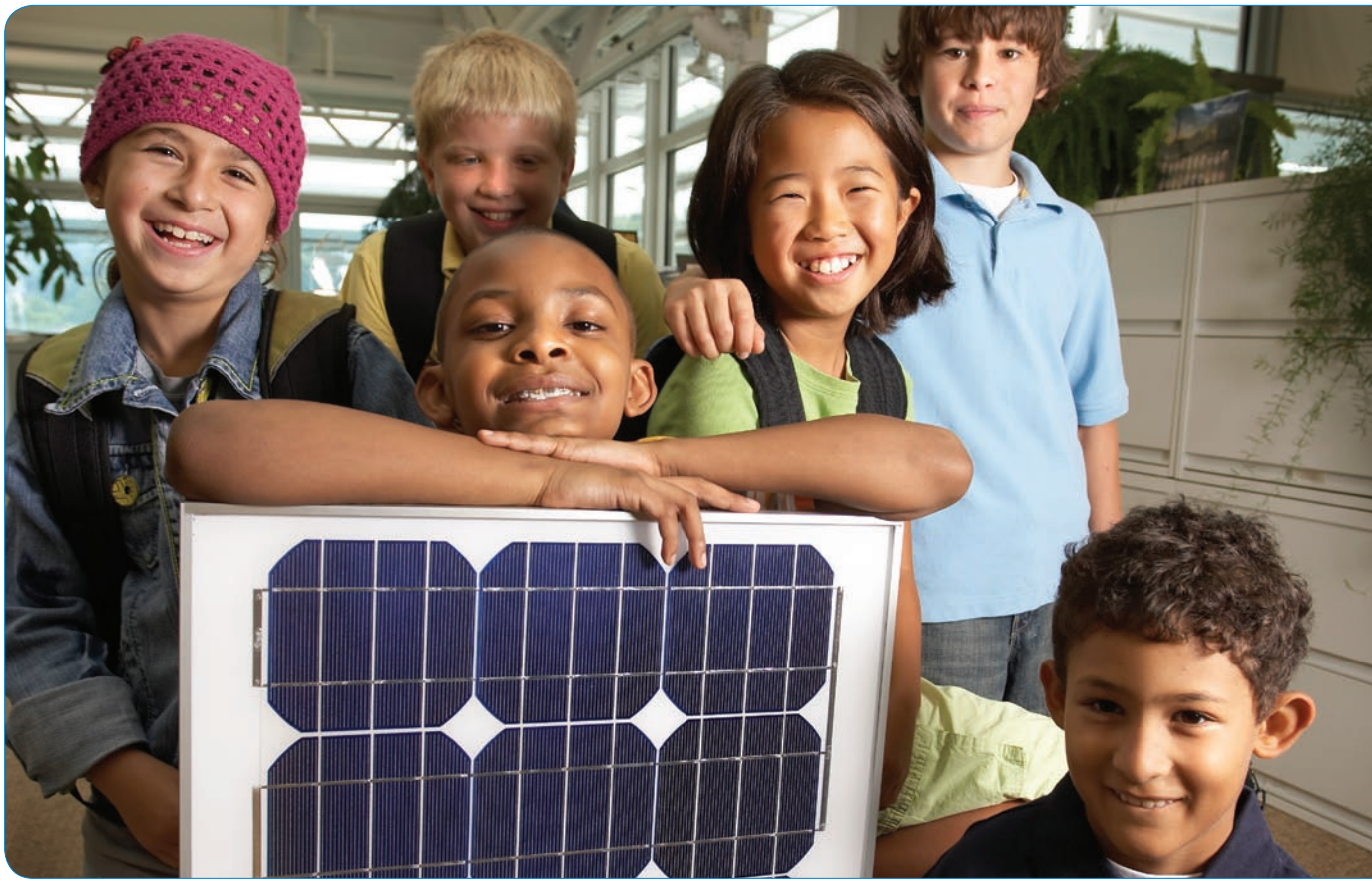
www.infinitepower.org/lessonplans.htm

The Texas State Energy Conservation Office (SECO) created the Infinite Power of Texas Renewable Energy Educational Campaign to accelerate the acceptance of renewable energy resources in the state. The lesson plans on this website were revised in 2004 and 2005 by a team of professional educators and renewable energy experts and now include teacher resource guides, reading passages for students, student worksheets, and many other helpful improvements in an easy-to-download format.

U.S. Department of Education, Education Resources Information Center

http://eric.ed.gov

The Education Resources Information Center (ERIC) offers unlimited access to more than 1.2 million bibliographic records of journal articles and other education-related materials with hundreds of new records added twice weekly. The website contains a search function for finding articles related to solar energy.



7.0

LEADING BY EXAMPLE WITH INSTALLATIONS ON GOVERNMENT PROPERTIES

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, from determining which locations are best suited for solar to choosing the appropriate financing mechanism and commissioning the system. Each topic area includes additional resources and information to help you through the process.

After reading this section, you'll have a good understanding of the process for procuring solar energy equipment for government-owned property and the various financing mechanisms that are available. As with all suggested activities described in this guide, you should tailor your efforts to meet local needs and objectives.

(photo above) PV installation on the rooftop of the Orange County Convention Center

7.1

Assess Solar Potential and Prioritize Installation Locations

The first cut at assessing the solar energy potential of government-owned rooftops and property 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. Once the sites with the most potential are identified, a trained site surveyor should perform a detailed on-site assessment of municipal buildings and property. Such assessments should include technical analyses of a building's energy load; available roof space (or ground space in the case of 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

Site assessments allow you to understand the economics, technical issues, and energy production potential for specific solar installations. This exercise is a necessary first step in determining which buildings are most suitable and desirable for solar installations.

Implementation Tips and Options

- ☐ Begin by using mapping software and solar resource calculators to identify the most feasible of your potential installation sites.
- ☐ Arrange professional site assessments through a solar developer, trained in-house employee, or qualified independent third party.
- ☐ Include facilities managers in the on-site assessment to keep them informed and tap into their knowledge.
- ☐ Identify the objectives for installing solar energy systems on municipal properties and list locations in order of priority based on your objectives. Some factors to consider are
  - ☐ Roof replacement: It's generally best not to install solar systems on roofs that need to be replaced soon because the solar panels will need to be removed and reinstalled during the roof replacement, increasing costs. An ideal approach is to coordinate timing so the solar system is installed along with a new roof; this allows you to integrate the technology into the structure instead of penetrating an existing roof.

- Location visibility: If your objectives include raising public awareness of solar technologies or offering educational tours of the facility, you might wish to rank installation sites in order of priority by visibility and accessibility.
- Solar technology value: The value of the solar technology is based on the facility's energy consumption profile, the solar 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 Optimize Rate Structures for Solar.

- Consider this an opportunity for hands-on training of additional in-house facilities personnel and site assessors.

Examples

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

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

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 SWH and PV potential of each facility. The evaluation considered criteria including 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, potential solar thermal applications, and other criteria necessary for a successful solar installation.

The feasibility study and associated report serves as a framework for evaluating and reporting on the solar potential of other facilities in the City of Ann Arbor. Washtenaw County and the Ann Arbor Downtown Development Authority plan to conduct solar feasibility studies at more city facilities.

During the site evaluations, national laboratory and CH2M HILL experts trained a representative from Recycle Ann Arbor to conduct future scoping visits to other potential sites in the city independent of the experts. Recycle Ann Arbor is working to include solar feasibility studies in the 100 energy audits

that Recycle Ann Arbor will be conducting with funding from the Michigan Public Service Commission. Through these audits, Recycle Ann Arbor is developing the Home Energy Performance Certificate. The certification process is expected to include a solar feasibility component, which may ultimately lead to a required solar feasibility study for every Ann Arbor home that goes up for sale.

Additional References and Resources

WEBSITES

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 solar PV mapping tool visually represents a specific site and calculates PV system size and projected electricity production. This paper identifies the commercially available solar mapping tools and provides a thorough summary of 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://solaramericacities.energy.gov/PDFs/Analysis_of_Web_Based_Solar_PV_Mapping_Tools.pdf

U.S. Department of Energy 2007 Solar America City: City of Ann Arbor, Michigan—Solar Energy Site Assessments and Training
CH2M HILL, September 2008

The City of Ann Arbor, CH2M HILL, Sandia National Laboratories, and NREL conducted solar site evaluations and trainings at five municipal properties in Ann Arbor. This report includes a detailed report from each site evaluated, financial analysis for the three best sites for solar, recommendations on a framework for future site evaluations, and summary of the training that occurred during the site evaluations.

Report: www.a2gov.org/government/publicservices/systems_planning/energy/solarcities/Documents/AnnArbor_SolarSiteAssessments.pdf

7.2

Standardize Solicitations for Solar Installations

Soliciting bids for solar energy installations and subsequently choosing a developer can be time consuming and complex. Streamlining the decision-making process by creating standard solicitation forms and setting the evaluation process and criteria up front can save time and money. Choosing a solar developer usually involves releasing a request for proposals (RFP) or request for qualifications (RFQ) to solicit bids for PV or 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. They can also include information needed to submit a proposal, such as the facility's energy load data, electrical or water heating schematics, building plans, and permitting requirements. After a predetermined solicitation period, a committee typically evaluates bids and chooses a developer that meets the specified requirements.

Benefits

By using a standard RFP template and evaluation process, you can streamline the RFP/RFQ design process and evaluate proposals from multiple solar developers. Standardizing these processes makes it easier to solicit industry proposals for future installations and work with various city or county departments on solicitations.

Implementation Tips and Options

- ☐ Identify the city or county departments that you'll be working with and understand their RFP/RFQ processes.
- ☐ Determine whether changes can be made to the existing RFP process to create a solar-specific RFP/RFQ.
- ☐ Develop a template for solar RFP/RFQs using the necessary boilerplate information from city or county departments. Sample RFPs—like those available at http://votesolar.org/?s=SAMPLE+RFP&x=0&y=0 —can serve as a helpful starting point.
- ☐ Develop the criteria and process for evaluating bids.
- ☐ Consider which elements should be specified by the RFP issuer and which should be left to responders to specify. Here are some general recommendations for PV system RFPs:
  - ☐ Require companies submitting proposals use a nationally recognized modeling tool to estimate the energy output of the system. This allows for an equitable comparison of bids.

- ☐ Require a shading analysis report for each proposed location so you understand the potential system output at each proposed location.
- ☐ Require a minimum annual energy production for the system based on solar resource availability. If the system doesn't meet that minimum requirement, penalize the installer for every kilowatt-hour not produced.
- ☐ Require companies submitting proposals to demonstrate financing ability.
- ☐ Require the installer take full responsibility for obtaining permits from the appropriate government agencies. This should include meeting all local building codes as well as the *National Electrical Code®*.
- ☐ Require the installer to take full responsibility for obtaining the interconnection agreement with the utility, including all drawings, schematics, and other required technical documentation.
- ☐ If the system is installed on the roof of a building, require the installer to be responsible for the integrity of the roof after the installation is completed. This may require working with the contractor that originally installed the roof to determine if the solar energy system installation will affect the roof warranty. Depending on the installation site, you may also wish to require a ballasted system, which requires little or no rooftop penetration.

- ☐ Be conscious of the quantity and sophistication of likely respondents and, if your intent is to support the local market through municipal installations, design the solicitation to be compatible with local industry.
- ☐ Post the solicitation publicly.
- ☐ Use qualified, independent technical reviewers to help evaluate the proposals.

Examples

San Antonio, Texas: Attracting International Respondents to Solar RFP

CPS Energy, San Antonio's municipal utility, released an RFP in October 2008 seeking up to 100 megawatts of solar energy resources to be supplied under a long-term arrangement no later than December 31, 2010. CPS Energy solicited companies nationwide through an advertising campaign that resulted in 36 proposals from 24 companies by the end of November 2008. 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*. Companies based in Europe and the United States submitted proposals. The winning developers will install, own, and operate the solar power plants, and sell the output to CPS Energy at wholesale prices. The utility expects the project to be completed in late 2010 or early 2011.

Milwaukee, Wisconsin: Redesigning a Solar RFP Based on Lessons Learned

The City of Milwaukee has limited experience contracting for solar installations, and individual departments use different procurement processes, so there is no standard template. 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 the RFP varies across departments. The city's solar program worked with the Department of Public Works to release an RFP for nine SWH installations on municipal firehouses in November 2007. When the bids came in, they were much higher than anticipated, and the city was unable to contract with an installer.

The primary lesson learned was that this particular project was overdesigned, which made it difficult for local solar thermal installers to respond in a cost-effective manner. The 40-page RFP contained prescriptive technical and equipment specifications. In an effort to ensure only quality parts were used, the RFP contained details about equipment and hardware instead of specifying desired hot water production. This made it difficult for the solar industry to leverage supplier relations or respond with innovative designs.

The City of Milwaukee is rewriting the RFP to be more flexible and outcome-based. The new RFP will specify production requirements and installation locations but leave much of the design and equipment details to the firms responding to the RFP. Designing the RFP in this manner should ensure that bids come in within the designated budget and indicate the experience level of each respondent.

Additional References and Resources

WEBSITES

Vote Solar Initiative Sample Requests for Proposals
http://votesolar.org/?s=SAMPLE+RFP&x=0&y=0

The Vote Solar website provides several sample RFPs for direct purchases as well as power purchase agreements.

7.3

Choose the Appropriate Financing Mechanism

Once you've identified promising solar projects in your community, you must determine how to finance these projects. With the emergence of third-party finance models, local governments do not necessarily have to invest extra money up front to complete solar projects.

Depending on the size of the project and the availability of public funds, how a local government chooses to finance the installation of a solar energy system will vary. Direct ownership of the system can be financed in a number of ways, including traditional municipal finance mechanisms and more recently created federal tax credit bonds. When bundled with energy efficiency measures, using an energy services performance contract to finance a solar energy system may be appropriate. For large solar energy projects or a bundle of many small- and medium-size installations, you'll want to consider third-party finance models. These models eliminate the up-front capital cost and ongoing operations and maintenance (O&M) responsibilities while incorporating the benefits of tax credits.

If you decide to directly finance and own your local solar energy systems, you have several tax-advantaged instruments at your disposal. Direct ownership does mean, however, that you forfeit some tax incentives available for commercially financed solar projects. To compensate, some state and utility programs offer higher cash incentives for non-taxpaying, public sector, and nonprofit entities.

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 will not be large enough for a dedicated issuance but will instead be bundled into a larger bond.

The 2009 *American Recovery and Reinvestment Act* (ARRA) created another source of municipal debt called Build America Bonds (BAB). BABs may be a mechanism for public entities to issue taxable bonds at a lower cost than more conventional tax-exempt bonds. This is possible because the U.S. Treasury will grant either a subsidy to the issuer equivalent to 35% of the interest rate of the BAB or a tax credit of 35% to the bondholder. A number of public agencies have already issued BABs. Similar to tax-exempt bonds, it is unlikely that a single solar project will be 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 refinance this obligation with a long-term bond issuance. Or the TECP can be refinanced at maturity.

Tax-exempt leasing of equipment instead of purchasing it is a common way for cities to finance certain capital investments (i.e., vehicles, software, computers, and office equipment). But using a tax-exempt lease to finance a solar energy installation for a public sector entity is uncommon. If the municipality uses a tax-exempt lease to finance a solar installation, the lessor (owner of the system) cannot take advantage of the federal investment tax credits because the user of the system (the city) has to be subject to U.S. income taxes to do so. As a result, cheaper sources of public financing for the project are most likely available.

ARRA 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 benefit from the tax credits available for solar, including the 30% federal investment tax credit, the Modified Accelerated Cost Recovery System (MACRS), and state tax credits. The bonds are intended as interest-free debt; investors who purchase a CREB or QECB receive a federal tax credit instead of interest payments from the issuer. In practice, these bonds often require the issuer to make a supplemental interest payment or issue at a discount. Nonetheless, the cost can still be attractive compared to straight tax-exempt debt. ARRA increased the allocation of new CREBs from $800 million to $2.4 billion and from $800 million to $3.2 billion in new QECBs. A city or county agency applies to the IRS for an allocation of CREB tax credits. The QECB Program will be managed at the state level because the U.S. Treasury has already allocated QECB tax credit allocations to the states based on population. If an allocation is received, a CREB or QECB can be issued to finance a renewable energy project. The most notable difference between CREBs and QECBs is that the eligible uses for QECBs are much broader, allowing renewable energy *programs* to be financed in addition to renewable energy *projects*.

A solar installation can be bundled into an **energy service performance contract (ESPC)**. In the ESPC model, an energy services company (ESCO) makes energy efficiency investments on behalf of the city and then gets 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 will have a much shorter payback term than that of a solar energy system. Combining these shorter payback ECMs with solar technologies, then, ideally creates a package of energy efficiency and renewable energy investments with a total payback period that's attractive to the municipality.

Many local governments are moving away from direct ownership of PV systems and are partnering with third-party owners. Currently, third-party ownership structures are used only to finance PV systems, not SWH systems. Although common in the private sector, using third-party ownership structures is an emerging phenomenon in the public sector. 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, more efficiently allocate public funds, and accelerate the deployment of PV. Instead of owning the PV system, a city or county agency would host a system that has been purchased and is owned by a third party, usually a limited liability corporation (LLC). The city enters into a long-term contract, or **power purchase agreement (PPA)**, with the LLC to purchase the electricity generated from the PV system on city property. The electricity price can be 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%–5%) per year over the life of the contract. As an alternative, a fixed rate can be agreed on for the entire length of the contract. 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 (>300 kilowatts); although, a series of smaller projects can be bundled under one PPA.

A general comparison of all of these financing options results in a number of conclusions. When compared with general obligation or revenue bonds, a tax-exempt lease is easier to both originate and terminate. For this reason, the effective interest rate on the lease is likely to be higher than the yield on municipal bonds, which are more secure and therefore cheaper. TECP might be a low-cost interim financing mechanism for solar installations. Issuing a CREB might be an attractive source of alternative financing for the city given the federal tax credit, but transaction costs may still be high. Service contracts (i.e., 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 in the form of lower 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. In addition, entering into a service contract arguably incurs fewer transaction costs than issuing tax-advantaged debt or entering into a tax-exempt lease. Finally, performance contracting is a good solution when considering energy efficiency investments in addition to solar energy installations.

Benefits

Analyzing various financing options will allow you to choose the alternative with the best value for your community. Project objectives, costs, available resources, and host preferences all figure into the most beneficial financing structure.

Implementation Tips and Options

Once you've identified a site for a solar energy system and carried out a site assessment to confirm the feasibility of the project, you should walk through the following steps:

- ☐ Determine whether your city or county wants to own and operate the system or finance it through a third-party structure and outsource the O&M. In general, financiers are only interested in PPAs for projects of 200 kilowatts and above, but some companies are providing third-party financing for smaller projects.
- ☐ If the project is too small for the third-party model, or you'd prefer to directly own the solar system for other reasons, select the most appropriate way to finance it from the options described. This approach will be similar to the way you approach other capital investments in terms of issuing an RFP to generate multiple bids and awarding the contract to install the system. To reduce the installed cost of the system, you should make sure you've identified and applied for all available grants, incentives, and subsidies.
- ☐ If you decide the third-party model is an appropriate option, you can then issue an RFP soliciting bids from solar developers. Among other things, the proposals should be evaluated based on the experience of the solar developers and the terms of the proposed PPA.
- ☐ The third-party power purchase agreement model is a legally intensive process. Expect the negotiations with the solar developer to be time consuming. Also, consider how state and local laws (i.e., the local authority to sign a long-term contract if considered debt) may affect your ability to successfully negotiate a PPA.
- ☐ As more local governments install solar energy systems, more individuals gain experience with the financing process. Consulting with energy managers and city and county lawyers who have been through the process can be very useful in terms of interpreting state laws, accessing language to insert in contracts, and candidly appraising solar developers.

Examples

San Diego, California: Financing PV through a Power Purchase Agreement

San Diego's Water Department contracted SunEdison to install 1 megawatt of PV at the city's Alvarado Water Treatment Plant. SunEdison built, owns, and operates the system and sells the electricity produced to the city under a PPA at rates below those of the local utility, San Diego Gas & Electric (SDG&E). Had the city purchased the system outright, it would have cost approximately $6.5 million to install. The PV system generates approximately 20% of the plant's power needs, saving the city up to $40,000 per year on its electricity bills. The 6,128 PV panels are located on the concrete rooftops of all three water storage reservoirs and cover approximately 4.33 acres. The PV system produces enough electricity to power between 500 and 1,000 homes and has the capacity to reduce carbon emissions equal to those of 219 cars driving 12,500 miles a year.

Tucson, Arizona: Issuing Clean Renewable Energy Bonds

In February 2009, 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 pay back over 13 years using funds from energy savings and solar rebates from Tucson Electric Power. The bonds were issued without any supplemental interest charge. The solar projects, ranging in size from 24 to 473 kilowatts, are expected to produce a cumulative total of 1,851,000 kilowatt-hours in the first year of operation. The electricity produced will offset approximately 18% of the facilities' aggregate electricity demand and reduce carbon emissions by 1896 tons per year. The projects are expected to net the city over $3.4 million over the 25-year life of the solar equipment. SPG Solar of Novato, California, is installing the solar systems and will maintain them for 10 years under a service contract.

Additional References and Resources

WEBSITES

Database of State Incentives for Renewables & Efficiency
www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US45F&State=federal&currentpageid=1&ee=1&re=1

This website presents useful information about congressional authorization of CREBs and QECBs in 2008 and 2009. 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. The U.S. Department of Energy (DOE) funds this ongoing effort.

Treasury Direct
https://www.treasurydirect.gov/tdhome.htm

This website includes rates posted for qualified tax credit bonds (QTCBs). Rates are listed that apply to new clean renewable energy bonds (new CREBs), QECBs, qualified zone academy bonds (QZABs), and qualified school construction bonds (QSCBs).

PUBLICATIONS

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 looks at how financing structures currently being 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 assisting participants in numerous PV projects covering a diverse range of sizes and installations, as well as from 15 years of experience serving the U.S. renewable energy industry.

Report: www.stoel.com/lawofseries.aspx

The Customer's Guide to Solar Power Purchase Agreements

Rahus Institute, October 2008

This is a guide for organizations interested in purchasing solar electricity without buying the solar 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: http://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 with deploying PV on public-sector buildings and lands.

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

San Diego Alvarado Water Treatment Plant
(Photo credit: SunEdison)

7.4

Commission the Solar Energy System

Commissioning a solar energy system refers to the act of testing the system after installation and certifying that it operates as expected and is installed according to the design plans. After a solar energy system is installed, it can be difficult for the customer to determine if the system is working correctly. For example, PV systems have few moving parts, and if the PV system is connected to the utility grid, the electricity supplied to the building will not be interrupted whether the PV system is working correctly or not. For these reasons, you should hire an independent consultant to verify the system for performance and safety. Because few technical experts within local governments have the expertise to properly inspect and commission large solar systems, hiring an independent consultant with good credentials will ensure that the system meets code, will perform as expected, and will pose no safety risks.

Benefits

Commissioning a solar energy system through an independent consultant ensures the system is installed properly and protects your investment.

Implementation Tips and Options

- ☐ Identify an independent solar consultant with a sufficient background and experience to inspect your solar system properly.
- ☐ Work with the Solar America Board for Codes and Standards to get help determining the important criteria for your commissioning.

Examples

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

In 2009, a 1-megawatt rooftop 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 (FSEC) and CH2M HILL partnered to establish a project-specific commissioning protocol and will work together on site 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 will publish a commissioning report that will include checklists of inspection points and tables for logging the relevant field data.

Additional References and Resources

PUBLICATIONS

Inspector Guidelines for PV Systems

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

Guidelines included in this report form a framework for inspecting and permitting PV systems. Guidelines 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

GLOSSARY AND RELATED SOLAR TERMINOLOGY

A

Alternative compliance payment
In lieu of standard means of compliance with renewable portfolio standards, electricity suppliers may make alternative compliance payments to make up for deficiencies (in megawatt-hours) between the amount of electricity from renewable resources mandated and the amount actually supplied. Payment amount varies 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 a utility would have incurred by supplying electricity generated from its traditional generation sources.

B

Behind the meter
Refers to 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 change 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 heating is commonly measured in Btus.

Building energy code
Establishes minimum energy performance features in buildings.

Building integrated PV (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 purchasers.

C

Capacity limit for individual systems
A limit placed on the capacity of individual PV systems, usually set to a certain percentage (for example, 125%) of a customer's energy load. 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. It is formed by the combustion of carbon and carbon compounds (such as fossil fuels and 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 where 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 their federal income taxes instead of an interest payment from the bond issuer.

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

Local government employee who enforces codes and standards, ensuring that solar energy system installations meet applicable safety, building, electrical, and plumbing codes in a region.

Commercial energy conservation ordinance (CECO)

A CECO requires commercial property owners to complete certain energy conservation measures in their 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 who generates electricity on his or her property using a distributed generation technology such as PV.

Customer-sited distributed generation

Refers to distributed generation technologies such as PV installed on the property of a utility customer.

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 (like a manufacturing plant) to operate at its maximum capacity.

Direct incentive

Cash 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

Electricity production that occurs 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 electric energy for use primarily 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, such as CO_2, methane, and oxides of nitrogen.

Energy audit

A survey that determines how much energy is 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 ESCO 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

Cash incentive based on the expected energy output from a solar energy system over a given period of time.

External utility-accessible AC disconnect switch

A hardware feature that allows 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 is set to expire 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 over a fixed amount of time (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 that is 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.

Green pricing

A mechanism for utility customers to support their utility's investments in renewable energy projects through direct charges on their monthly utility bills. Green pricing is a market-based solution to account for the nonmarket (meaning environmental) benefits of renewable energy.

Greenhouse gas

Atmospheric gasses 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.

I

IEEE 1547

IEEE was originally an acronym for the Institute of Electrical and Electronics Engineers, Inc. Today, the organization's scope has expanded into so many related fields that it is simply referred to by the letters I-E-E-E ("I-triple-E"). IEEE 1547 refers to the *Standard for Interconnecting Distributed Resources with Electric Power Systems*.

Interconnection

The process of connecting an electricity-producing technology (like a PV system) to the electricity grid.

Interconnection agreement
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 abide by when a customer wishes to connect a PV system to the grid.

Installation baseline
An accounting of all solar energy installations currently in place.

Installation target
A set goal for future solar installations in a community by a specific date. A solar installation target is often set to achieve broader environmental, climate, or sustainability goals.

Installed capacity
The total amount (usually measured in terms of size; in kilowatts or megawatts for PV) of solar energy systems operating in a given region or sector.

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 one hour.

L

Levelized cost (of energy) (LCOE)
A means of calculating the cost of generating energy (usually electricity) from a particular system that allows one to compare the cost of energy across technologies. LCOE takes into consideration the installed solar energy system price and associated costs such as the cost of financing, land, insurance, operation and maintenance, and other expenses.

LEED
Leadership in Energy and Environmental Design is a voluntary, consensus-based national rating system for developing high-performance, sustainable buildings operated by the US Green Building Council.

Load
Describes the amount of power (amps) consumed by an electrical circuit or device. Loads are usually expressed in amps but sometimes in watts.

M

Megawatt (MW)
Standard measure of electric power plant generating capacity equal to 1,000 kW or 1 million watts.

Megawatt-hour (MWh)
1,000 kWh or 1 million watt-hours.

Metric ton of carbon dioxide equivalent ($MtCO_2e$)
Standard measurement of the amount of CO_2 emissions reduced or secluded from the environment.

Municipal bond
Bond issued by state and local governments generally to finance capital improvement projects.

N

Net metering
Net metering is a billing mechanism that credits solar system owners for the electricity exported onto 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

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 other such charges consumers and businesses may incur when installing a solar energy system.

Photovoltaic (PV) system

A set of components for converting sunlight into electricity. Comprises the solar modules or array that captures the sunlight along with balance-of-system (BOS) 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

Cash payment to project owners based on electricity production on a dollar-per-kilowatt-hour basis over a specified duration.

Project developer

A company that provides services for solar installations including planning, organizing, executing, and managing resources for installation projects.

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 due to the added value from solar energy installations, or provides an additional incentive to invest in a solar installation.

Power purchase agreement (PPA)

A legal contract between an electricity generator and 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 such as legislative appropriations are possible.

Q

Qualified energy conservation bond (QECB)

A qualified tax credit bond that is similar to a new CREB. A QECB may 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* (ARRA) 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 where 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 is used by a utility customer. RTP rates are volatile and are generally very high when demand for electricity is high.

Rebate

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 non-power 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.

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 much like the New York Stock Exchange for trading shares in companies.

Renewable energy

Energy from resources that naturally replenish themselves and are virtually inexhaustible. Renewable energy resources include biomass, hydropower, geothermal, solar, wind, ocean thermal, wave action, 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 or RES.

Residential energy conservation ordinance (RECO)

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 to other entities.

S

Sales tax incentive

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. These systems contain multiple feeders and transformers to provide excellent service reliability and the capacity to serve large loads, such as 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 aggregation purchasing program

See customer aggregation programs.

Solar bulk purchasing

See customer aggregation programs.

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, which is sponsored by the U.S. Department of Energy, takes place every two 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 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 kWh.

Solar installer licensing

Licensing requiring a baseline of quality below which it is illegal to operate.

Solar permitting process

To install a grid-connected PV system, the homeowner or builder must obtain an electrical permit and in some cases a building permit from the local government, followed by an inspection of the installation. Solar water heating systems require a plumbing permit and sometimes a building or mechanical permit, or both.

Solar-ready

A solar-ready home or building is designed as if a solar energy system were going to be installed during construction. Architects and builders take precautions to ensure a viable site for solar technologies by leaving adequate roof space 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 (for example, 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/or plumbing configuration, and shading on the site location.

Solar farm

Refers to a large-scale solar installation.

Solar thermal

Solar energy conversion technologies that convert solar energy to thermal energy (heat) used to heat water or provide energy for space heating and cooling in active solar space heating or cooling systems.

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 at a future date. For solar water heating systems, open-ended pipes are placed in an accessible location to connect solar collectors to hot water storage in the future.

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 the bill of utility customers to support public policy initiatives such as renewable energy and energy efficiency programs.

System capacity

The maximum expected energy production from a PV system.

System rating

A rating of the maximum power a solar energy system will produce under standard test conditions (STCs). STCs are a solar irradiance of 1000 watts per square meter, a temperature of 77 degrees 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 approved by the responsible regulatory agency that lists the terms and conditions—including a schedule of prices—under which utility services will be provided.

Tax abatement

A stay of tax payment granted by a taxing authority for a short 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
Type of municipal bond that is a source of capital for solar projects; 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 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 of electricity consumption (homes and businesses).

True up
When a utility calculates the "net" consumption versus generation over a given time period (month or year). Compensation for net excess generation is often limited to the amount of electricity used during the true-up time period. Monthly true-up cycles don't capture the true 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.

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APPENDIX: ABBREVIATIONS AND ACRONYMS

1BOG	1 Block Off the Grid
AAS	associate in applied science (degree)
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ARRA	2009 *American Recovery and Reinvestment Act*
AS	associate of science (degree)
ASES	American Solar Energy Society
AzRISE	Arizona Research Institute for Solar Energy
BABs	Build America Bonds
BDS	Bureau of Development Services (Portland, Oregon)
BIPV	building integrated photovoltaics
BISWH	building integrated solar water heating
BOS	balance-of-system (components)
BPS	Bureau of Planning and Sustainability (Portland, Oregon)
BPU	Board of Public Utilities (New Jersey)
Btu	British thermal unit
CEC	Clean Energy Corporation
CECO	commercial energy conservation ordinance
CEG	Clean Energy Group
CESA	Clean Energy States Alliance
CO_2	carbon dioxide
CPUC	California Public Utilities Commission
CREB	clean renewable energy bond
CSP	concentrating solar power
CUNY	City University of New York
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
EPA	U.S. Environmental Protection Agency
EPS	electric power systems
ERIC	Education Resources Information Center
ESCO	energy services company
ESPC	energy service performance contract
FERC	Federal Energy Regulatory Commission
FIT	feed-in tariff
FSEC	Florida Solar Energy Center
GHG	greenhouse gas
GLREA	Great Lakes Renewable Energy Association
GPN	Green Power Network
GRU	Gainesville Regional Utilities
GW	gigawatt
HARC	Houston Advanced Research Center
HIP	Home Improvement Program
HVAC	heating, ventilating, and air conditioning
IBEW	International Brotherhood of Electrical Workers
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IMBY	In My Backyard (software program)
IREC	Interstate Renewable Energy Council
ISPQ	Institute for Sustainable Power Quality
ITC	investment tax credit
JATC	Joint Apprenticeship and Training Committee (Twin Cities)
kW	kilowatt
kWh	kilowatt-hour

LBNL	Lawrence Berkeley National Laboratory
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
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®*
NFPA	National Fire Protection Association
NJATC	National Joint Apprenticeship and Training Committee
NNEC	Network for New Energy Choices
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
OCE	Office of Clean Energy (New Jersey)
OSHA	Occupational Safety and Health Administration
OUC	Orlando Utilities Commission
PAG	Pima Association of Governments
PBI	performance-based incentive
PETE	Partnership for Environmental Technology Education
PG&E	Pacific Gas and Electric Company
PPA	power purchase agreement
PSC	Public Service Commission (Louisiana)
PSOA	prospective solar owner agent
PV	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
RECO	residential energy conservation ordinance
RFP	request for proposal
RFQ	request for qualifications
RMP	Rocky Mountain Power
RooSTer	[Solar] Roadmapping and Simulation Tool
RPS	renewable portfolio standards
RTP	real-time pricing
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
SEPA	Solar Electric Power Association
SETP	Solar Energy Technologies Program
SMUD	Sacramento Municipal Utility District
SRCC	Solar Rating and Certification Corporation
STC	standard test conditions
SWH	solar water heating
TECP	tax-exempt commercial paper
TJIF	Targeted Jobs Incentive Fund (Miami-Dade County, Florida)
TOU	time-of-use (tariff)
UL	Underwriters Laboratories
USGBC	U.S. Green Building Council

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