Solar Energy Articles and Reports

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Balancing the Solar Access Equation

By Gail Feldman and Dan Marks, AICP

States, cities, and counties across the country are moving quickly to improve the ability of their communities to "build green" and install solar energy systems on new and existing buildings.

Will solar panels on every rooftop replace the white picket fence as the icon of the American dream? That may depend on how well planners develop policies and permitting processes that encourage solar energy systems and at the same time mitigate inevitable conflicts, such as when policies that protect trees or encourage higher density development interfere with sunlight access. This article explores the growing trend to introduce solar energy in communities and how planners may need to guide land-use policy development to avoid unintended consequences.

SOLAR ENERGY SYSTEM BASICS

The most common solar technologies used on buildings in the United States are solar photovoltaic (PV) panels that generate electricity and solar thermal systems that heat water or air. Solar PV produces electricity through the conversion of direct sunlight. The semiconductor materials in the PV cell interact with the sunlight to generate electric current.

The most electricity is produced when the sun's rays are directly perpendicular to the PV panels. Since PV only works with sunlight, most systems are connected to the utility grid to guarantee around-the-clock electricity. The orientation of a PV system affects its performance; usually the best location is on a south-facing roof. Flat roofs allow the panels to be tilted toward the optimal direction.

PV systems work best without any obstructions from trees or structures. Because the sun may be higher in the summer or lower in winter, a placement of the PV involves an assessment of these factors. In any specific location, as the surface area of a PV system exposed to sunlight increases, the amount of electricity produced also increases. Depending on site conditions and economic constraints, residential-scale PV systems can range from 100 to 1,000 square feet.

Solar thermal systems use the sun to heat water or heat-transferring fluids, and each system is comprised of two parts: a solar collector (panel) and a storage tank. Systems that use active solar require the use of electricity for pumps and circulation and require flat-panel collectors similar to PV. Passive solar water heaters have no electrical components and rely on direct sun heating the collector panel. Storage tanks have now been developed to be recessed in into the roof, so they are not seen above the roofline. Solar collectors for solar thermal systems require less surface area than PV systems. In locations receiving an average amount of sunlight, flat-panel collectors require approximately one-half to one square foot of surface area per gallon of daily hot water use.

INCENTIVES FOR SOLAR ENERGY SYSTEMS

According to the Interstate Renewable Energy Council, Incentive Programs and Tax Credits resulted in over 26,000 new solar installations nationally in 2007. All but a handful of states now have incentive programs to add solar photovoltaic (PV) systems to residential or nonresidential buildings. These incentives range from $1 to $5 per kilowatt produced. Congress reauthorized the Renewable Energy Tax Credit in 2008 and increased the deduction to 30 percent of the cost of installation beginning in 2009. This makes solar substantially more cost-effective by providing an income tax deduction that, for an average $30,000 residential installation, would be $8,000 to $10,000 in a tax year.

Cities in northern California recorded more than 11,500 new solar PV systems between 1998 and 2007, with many of these

Paul Norton; courtesy DOE/NREL

Solar hot water collectors on a Habitat for Humanity house in Denver.

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About the Author

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installed in suburban communities and bigger cities. Over the last few years, the states of New Jersey, Nevada, and Colorado significantly increased PV generation because of state requirements for major utilities to include greater percentages of solar in their portfolios and rebate programs for commercial and residential buildings.

Many local governments now have renewable energy loan programs, and the numbers are expected to increase as more utilities and cities implement programs as part of their overall climate change plans. These programs typically have loan repayment times of between 10 and 30 years, through utility bill savings or property tax bills.

INCENTIVES FOR INSTALLATION

Examples of loan programs that provide financial incentives to lower the upfront cost for the installation of renewable energy systems, particularly solar, are briefly highlighted below. A comprehensive listing of incentive programs can be found through the Database of State Initiatives for Renewables and Efficiency (DSIRE), a website developed by North Carolina State University.

New York

The New York State Energy Resource and Development Authority offers the Energy $mart Loan Fund program, which provides an interest rate reduction off a participating lender's normal loan interest rate for a term up to 10 years on certain energy-efficiency improvements or renewable technology loans. The interest rate reduction for most of the state is up to four percent. Utility customers may be eligible to receive an interest rate reduction up to 6.5 percent off a participating lender's normal market rate. This program is funded by utility rates through a special benefits charge.

Local Leaders

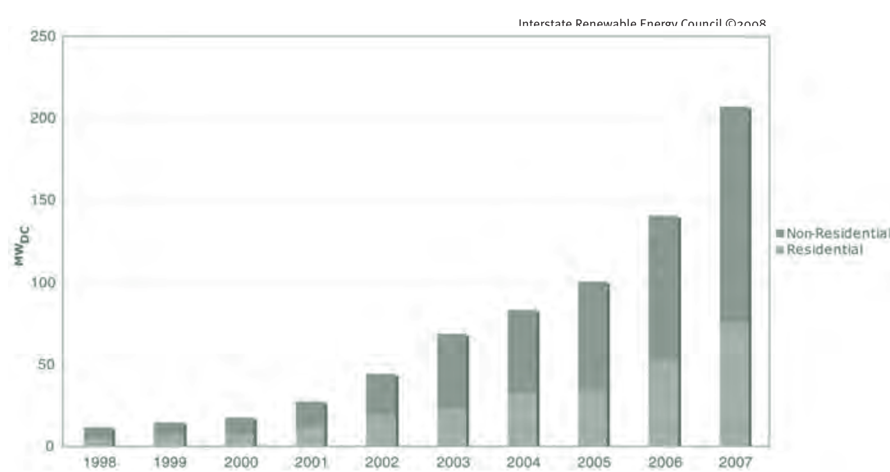
Berkeley, California, has recently established a Sustainable Energy Financing District that leverages private financing through bonds that fund solar photovoltaic systems for residential and commercial properties anywhere in the city. The bonds are repaid by a special tax that is added to the property tax bill of the participating property owner. While still in a small pilot phase of 40 installations, the program could allow up to 4,000 installations if expanded to the total bonding authority of $80 million. Boulder County in Colorado and the cities of San Diego and San Francisco are in the process of developing similar financing programs.

Palm Desert, California, has issued $2.5 million in solar energy and energy efficiency loans through contractual assessments on properties. This is one of few cities that has used its general fund surplus to finance private energy improvements. The city will earn seven percent interest on its investment for the 20-year assessment term.

Florida has at least two programs that provide financing. Tallahassee, through its municipal utility, offers loans of up to $20,000 at five percent interest to install solar photovoltaic systems. The Orlando Utilities Commission also has a loan program for its customers and will provide up to $15,000, which can be repaid through monthly utility bills with interest rates from two percent to 5.5 percent.

STATE AND LOCAL SOLAR ACCESS PROTECTIONS

The development of rights to solar access has basis in English common law. A judicially established doctrine of "ancient lights" provides that if a landowner had received sunlight across adjoining property for a specified period of time, the landowner was entitled to continue to receive unobstructed access to sunlight access across the adjoining property. The first state laws that specifically addressed access for operation of solar energy equipment were



introduced in the 1970s. While not comprehensive, the types of legal protections that developed include solar easements, solar shade prohibitions, and preemption of aesthetic controls for solar installations.

Solar Easements

Many states have enabled the use of solar easements to protect ambient lighting as well as light access for solar energy equipment. This type of easement is a private agreement between property owners that guarantees access to sunlight. Most solar easements are recorded as deed restrictions that run with the land, and procedures for relinquishing easements are generally set forth in state law. Some owners of residential solar energy systems use these easements to restrict any new construction or tree planting which could block light access to sunlight.

Among the many states with provisions for such easements are Alaska, Colorado, Idaho, Kansas, Maine, Montana, Rhode Island, and Virginia. Many of these laws were adopted as early as the 1970s and do not necessarily relate specifically to solar energy systems. Most recently the State of New Jersey (NJ Statute 46:3-24) enacted laws specially allowing solar easements for the purpose of exposure for a solar energy device.

Solar Access Protections

Some recent state laws go much further than voluntary easements. The California Solar Shade Control Act of 1979 as originally drafted prohibited shading of solar collectors that occurs due to tree growth after the solar system was installed. Under the law, no more than 10 percent of the collector can be shaded between 10 a.m. and 2 p.m. The 1979 law also included minimum location standards for the solar collectors, requiring that they be five feet from the property line and 10 feet from the ground.

California's law was amended in 2008 to address issues that stemmed from a court case discussed later in this article. These changes included an exemption to the act if the trees and shrubs were planted prior to the installation of the solar collector. The definition of solar collector was changed to include devices installed on the ground. Additionally the legislation changed a violation from a public nuisance violation to a private nuisance. In other words, under the revisions, enforcement of the law is now a matter between private parties, rather than a jurisdiction treating the matter as a public nuisance and acting to enforce the law.

Wisconsin law (Stat. § 700.41) allows for compensation when a solar energy system is shaded by development on an adjacent property, regardless of whether an easement was granted by the adjacent property owner. Another Wisconsin law (Stat. § 844.22) also states that any structure or vegetative growth that occurs after the installation of a solar or wind energy system and interferes with its function is considered to be a private nuisance.

New Mexico's Solar Recordation Act allows a property owner with a solar energy system to record an easement for sun access, defined by the statute as 9 a.m. to 3 p.m. on the winter solstice. While an adjacent property owner will be notified of the intent to record an easement, permission from the adjacent owner is not required. Under this law, solar easements run with the land and may be bought and sold. If an adjacent project shades the system by more than 10 percent, the owner of the project must purchase the solar easement right and extinguish it (NMSA 47-3-6 to 47-3-12).

At the local level, the County of Santa Cruz, California, has established strong solar access protection in its ordinances. It states that impacts on a solar collector "shall be mitigated to the maximum extent feasible during the view of any permit to construct a building" (12.28.040, Santa Cruz Building Regulations).

Amber Evans

This south-facing photovoltaic system would be shaded if the neighboring home owner added an additional story.

The City of Boulder, Colorado, has strong protections for solar access for the purpose of generating electricity and has divided the city into solar access areas based on zoning. This ordinance provides broad protections in less dense residential neighborhoods. Urbanized commercial districts have no guaranteed protections unless the property has a solar access permit. Solar siting requirements for all planned unit developments and subdivisions are required to ensure that roof surfaces can support 75 square feet of solar collectors for each dwelling unit.

Several other local jurisdictions have adopted guidelines or requirements for solar access in new residential subdivisions.

Preemptions of Local Design Standards

States that have addressed solar access have generally adopted laws preempting local zoning that might limit the installation of these devices based on aesthetic or other grounds. Many of these same laws also preempt private conditions, covenants, and restrictions that might limit a property owner's ability to install a system.

For example, California's Solar Rights Act (AB 2473) of 2004 prohibits provisions in local ordinances that create unreasonable barriers to the installation of solar energy systems, including design standards for solar installations. The law only allows local jurisdictions to require improvements for aesthetic purposes if the cost is less than $2,000.

SOLAR CONFLICTS

As one northern California newspaper framed a recent court case pitting the owner of a small grove of redwood trees and a neighboring property's solar PV system: "It can come down to a clash of cherished green values." The state law as written at the time placed higher value on the production of a solar energy system. The conflict grew when the two Sunnyvale property owners could not mediate successfully, and the district attorney filed the case as a criminal violation. The defendants in the case are quoted saying, "We are the first citizens in the state of California to be convicted of a crime for growing redwood trees."

The violation under the California Solar Shade Control Act identified the trees as a public nuisance (as misdemeanor) with a $1,000-per-day fine. However, in the final court ruling the judge determined that only two of the six trees required pruning or removal due to the shade obstruction.

In contrast, a few years earlier the Santa Clara County Court ruled that the trees at a home in another case were not the cause of a shading problem under the law. The trees at issue were on the property of the local government, which was exempt from the law.

In a 1982 case considered by the Wisconsin Supreme Court, the owner of a solar system sought relief from the construction of a residence that obstructed sunlight to his property. The court found in the favor of plaintiff, stating that the construction was a private nuisance, and remanded the case to a lower court. Immediately preceding the hearing, the state legislature enacted a law (WI Statute 700.41) to allow an owner of an active or passive solar energy system or a wind energy system to receive compensation for an obstruction of solar energy by a structure outside a neighbor's building envelope as defined by the zoning restrictions in effect at the time the solar collector or wind energy system was installed.


City of Berkeley

A PV system on the rooftops of Helios Corner, an 80-unit senior housing development in Berkeley, California.

CONSIDERATIONS FOR PLANNERS

To date, most state laws have focused on removing barriers to the installation of solar systems or have been permissive in allowing property owners to enter into solar access easements. As solar installations become more common—especially in urban areas—the potential for one neighbor to shade another's solar panels will occur more often and conflicts will become more common. Few state or local laws have addressed those potential conflicts.

At first, it may seem that encouraging solar energy systems that produce clean, local energy should be a very high priority, perhaps even preempting an adjacent property owner's right to build in ways that would affect an existing or potential solar system. However, we would caution that, even in the case of greenhouse gas (GHG) emission reductions, maintaining access to solar energy may not always be the most effective strategy.

Ten trees absorb about 0.25 tons of CO_2 per year, and a 300-square-foot solar array [solar panels] can save about three tons of GHG emissions. For comparison, a transit-oriented development (TOD) with a hundred units is estimated to save over 500 tons per year of GHG from reduction in auto use alone. From a GHG benefit point of view, the importance of promoting transit-oriented development cannot be overstated.

Ensuring that solar access protection regulations do not inadvertently prevent or discourage TOD is an important but complicated issue. To illustrate, Berkeley is a densely built community blessed with some of the best transit in the Bay Area. New transit-oriented development will generally occur along major transit corridors and in downtown. However, these transit corridors are immediately adjacent to much lower density residential neighborhoods.

In that way, Berkeley is typical of older cities. The city's General Plan calls for higher density development along these transit boulevards, which invariably means four- and five-story buildings up against neighborhoods with one- and two-story homes. Despite city policy, almost every new higher density residential or mixed use building is bitterly fought by the adjacent neighborhood. As in most communities, the residents of neighborhoods near these corridors are concerned with the traffic, parking, noise, privacy, and other impacts of a higher density, bulkier residential or mixed use project backing up to their neighborhood.

Inevitably, the issues around new construction and solar access will be tested. While Berkeley does not currently have any local ordinances specifically protecting solar energy systems, it does have a solar access ordinance. The current regulations are related to the impacts tree growth may have on the loss of sunlight to homes and are meant as a tool to address neighbor disputes. The law sets forth a process for resolving such disputes, beginning with voluntary mediation or arbitration followed by litigation However, no specific standards are set forth in the ordinance.

Berkeley also requires that the shading impacts on adjacent homes from new development be evaluated, but has no set standards for addressing those impacts. As the city considers the policy issues around solar access, it must also consider the likelihood that an ordinance protecting solar photovoltaic systems could easily give ammunition to those opposed to taller, more intense buildings in general.

If an ordinance establishes a strong right to solar access, or requires very high costs to mitigate impacts on existing or potential solar installations, such ordinances could discourage, delay, or prevent higher density transit-oriented development. Consider the potential conflict created by solar access ordinance in a downtown district that permits tall structures. If one low-rise commercial building puts a solar array on its roof, what happens when a taller building is proposed next door that would shade that panel? How do you value one property owner's access to the sun in relation to the benefits of a taller building that would reduce

> The fundamental goal of all zoning is to try and ensure that one owner's use of property does not have a significant detrimental impact on other owners' enjoyment of their property.

or eliminate that access but lead to significant reductions in vehicle miles traveled?

Communities considering a local solar access ordinance need to consider the following issues:

- Who is entitled to solar access?
- Does the local government have to play a role in protecting access?
- How should communities place a value on access?

Solar Access Entitlement

Is there an entitlement to solar access? Solar access is one more element to consider in the bundle of property rights that is the basis of land-use law. The fundamental goal of all zoning is to try and ensure that one owner's use of property does not have a significant detrimental impact on other owners' enjoyment of their property. A property owner does not have an absolute right to use property as he likes. Land-use attorneys talk about the bundle of rights that comes with property ownership, and those rights can be modified by local governments for the health, safety, and welfare of the community.

In Berkeley, as in every developed community, there is little agreement as to how much regulation of private property is acceptable. Is one person entitled to add a second floor to his home if it will shade the bedroom of his neighbor, or block his neighbor's panoramic views? These are fundamental zoning questions. Any solar access ordinance must decide whether access is a "right" that any property owner has, and it must state the degree to which that right may be impinged by the actions of his neighbor. In an urban setting, establishing any absolute right to solar access would clearly be counterproductive relative to other policy goals.

Hands-on or Hands-off

There is no reason why local government must define the terms of the solar access debate. It can, as several states and localities have done, decide that while there may be some level of solar access right, the impact that one property owner has on another and any compensation due as a result of that impact is a matter to be worked out between property owners. If owners fail to resolve their differences, the civil courts become the venue for making these determinations. Other states have allowed property owners to enter into private easements, and allow this matter to be addressed solely as a contractual matter between private property owners.

While this is certainly one approach, the courts are not generally considered the best place for resolving policy issues. The costs of private litigation can be very high and require years to resolve. Courts interpret and apply laws to the facts of a specific case. The legislature or city council is where competing policy objectives can be evaluated. Vague and unclear policies can result in interpretations of law that seem contrary to the intent of the law or result in unintended consequences counter to the underlying policy direction.

Regulating the impacts of one neighbor on another is exactly what zoning ordinances are intended to accomplish. The drafting of zoning ordinances allows for public policy objectives to be openly discussed and for reasonable compromises to be made through a public process. In regard to solar access, there are certainly competing public policy objectives, such as a desire to maximize the local generation and use of solar energy that is potentially in conflict with the desire to maximize development near transit.

SOLAR ACCESS MAPPING

Berkeley is in the development stage of creating a solar map of the city using Google Earth. San Francisco has also developed its own. The online map will allow anyone to view, down to the property level, the roof of any building and the impact of shading directly by another structure. While it won't consider shading impacts by nearby trees, the tools may aid planning efforts in areas where shading may become a conflict. San Francisco's map is available at http://sf.solarmap.org.

Placing Value on Solar Access

Should solar impairment be considered compensable, and how does a community determine the degree of compensation for such a loss? If that access is partially impaired, how does one measure the value of that impairment?

Cities constantly face the claim that the actions of one property owner will reduce the property value of a neighbor. Local governments have traditionally stayed away from trying to place a value on the impact of one neighbor's action on another's, so long as each property owner operates under a consistent underlying set of zoning regulations that apply to everyone. By establishing ground rules, it may be possible for local governments to set the framework for private negotiation, or it could embroil the government in a long, unproductive refereeing of solar rights determinations. At this time, we find little evidence that local or state governments have sought to address the conflicting policy goals of solar energy generation and shading by nearby higher density development. The New Mexico law allowing for recordation of solar easements may have taken this issue into partial account by not allowing an easement to be recorded against a property where the permitted development is taller than of 36 feet. However, local ordinances implementing this law can preempt this provision.

Given the potential impacts of solar access disputes on future development, state and local governments may want to establish guidelines for addressing situations where solar access is affected by adjacent development. Communities considering such guidelines should pay attention to the following variables:

The potential for an effective solar installation. Is backyard shading as important as roof shading? Is the roof orientation conducive to solar power, and how much of the roof is effectively available?

The existing site conditions. Do trees or other existing structures already shade potential solar locations?

The time of year and the time of impact. Is shade in December more detrimental to the operation of the system than shade in June? Is a 20 percent loss at 3 p.m. for an hour at midwinter considered compensable relative to a 30 percent loss for two hours at 9 a.m. in the summer? How do variations in system size affect this determination? Various state and local laws have established 9 a.m. to 3 p.m. on the winter solstice as the threshold for considering when a shadowing impact is occurring. Under the state and local access laws where a time of day or year are established, these times are thresholds below which no impact is assumed to occur, and above which an impact is assumed to occur.

However, the degree of impact and any compensation due are a matter for private negotiation. As a threshold for private party negotiation, such general determinations may be adequate. However, significant additional analysis would be needed if local governments wanted to provide guidelines for resolving disputes.

The percentage of impairment. How much of an existing or potential solar array would be in shadow and for how long? Ten percent at the assigned hour (see above) is a commonly established threshold for solar access impact. Similar to time of year and day, 10 percent may be a reasonable threshold for establishing when there is an impact for purposes of private negotiations, but this guideline is not sufficient if government wants to assist in resolving solar access disputes.

The type of installation. Some types of installations (e.g., a water heating system) may be more feasible in any given situation than another (e.g., solar power generation).

An additional critical issue is how to value potential solar energy relative to an existing solar array. This carries the compensability question to a much more concrete level. If someone has invested in a solar array for whatever purpose, the impacts of an adjacent property owner shading that array has a measurable and immediate impact. Again, we would argue that leaving this solely to private dispute resolution or establishing very high values on solar access may be counter to other policy goals. However, making one property owner responsible for compensating another's reduction in direct income seems an appropriate subject for an ordinance addressing solar access.

As with other ordinances related to compensation, government should probably seek to make determinations of compensation a private negotiation between property owners, bringing government into the picture only in the last resort when private agreement cannot be reached. However, because solar installations have a measurable cost and measurable returns on that investment, and there is usually data on the productivity of the system, there is much more concrete evidence to assist local governments in arbitrating between property owners. It can be expected that initial efforts to resolve these differences will be challenging as governments wrestle with the many variables that need to be considered, such as how to value energy over time or how to amortize the investment in a solar array. However, these determinations should become easier as there is a sufficient record of cases.

ADDITIONAL RESOURCES

Database of State Incentives for Renwables & Efficiency (DSIRE): www.dsireusa.org.

Sherwood, Larry. 2008. *U.S. Solar Trends Market 2007*. Latham, N.Y.: Interstate Renewable Energy Council (www.irecusa.org).

National Renewable Energy Laboratory, Department of Energy: www.nrel.gov.

CONCLUSIONS

The discussion above has focused on the trade-offs associated with taller transit-oriented development that shades potential solar access in adjacent neighborhoods. In that context, the trade-offs between preserving solar access and encouraging TOD are fairly clear. Based solely on a GHG assessment of relative benefit, TOD clearly should not be hostage to solar access protection. The benefit/cost equation is less obvious in a residential neighborhood context when one neighbor simply wants to build a taller house adjacent to a shorter neighbor. Solar access could be one more weapon in the never-ending neighbor wars that occur in some communities as people seek to preserve the perceived character of their neighborhood or simply don't want a taller building next to their home. Under a poorly worded solar protection ordinance, putting solar panels on a home could become a way of preventing a neighbor from adding a second story addition in a situation where it would otherwise be allowed. All of the issues described above need to be fully considered in an ordinance in any community, whether higher density development is part of the picture or not.

NEWS BRIEF

COURT DECIDES SIGN CASE

By Lora Lucero, AICP

In February, the Supreme Court of New Jersey concluded a township's sign code prohibiting a union from displaying a 10-foot-tall inflatable rat violates the First Amendment. "The rat has long been a symbol of labor unrest" and, as part of a labor protest, the union displayed the rat balloon on the sidewalk in front of the business where they were in a labor dispute. The sign code prohibits "balloon signs or other inflated signs (except grand opening signs) . . . displayed for the purpose of attracting the attention of pedestrians and motorists." A police officer warned the protestors to deflate the rat, but found it was reinflated when he returned an hour later and issued a summons. The union official was ultimately found in violation of the sign code and fined. The state's highest court set aside the conviction and held the sign code violates the First Amendment. The sidewalk is a traditional public forum where the government's ability to restrict expressive activity is very limited. The sign code is content-based because the sign code prohibits the union from displaying a rat balloon while allowing balloons as part of a grand opening. The township lacked a compelling governmental interest that justified the restriction. *State v. Wayne DeAngelo*, Supreme Court of New Jersey [highest court], Decided February 5, 2009, Case No. A-73.

Lora Lucero is editor of Planning & Environmental Law *and staff liaison to APA's Amicus Curiae Committee.*

Photo courtesy of groSolar. groSolar.com. Design concept by Lisa Barton.

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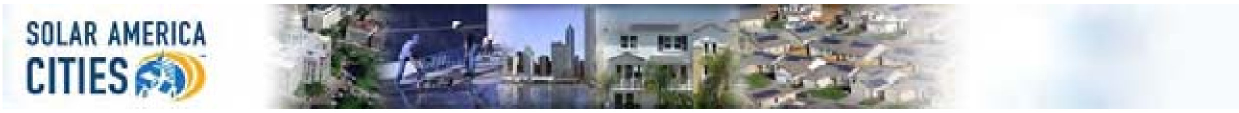

City of Seattle Code Review: Final Gap Analysis Report

Prepared for

U.S. Department of Energy

National Renewable Energy Laboratory

City of Seattle

Prepared by

HDR Engineering, Inc.

HDR

February 9, 2010

City of Seattle Code Review:
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Executive Summary

Purpose

The purpose of this report is to summarize Seattle Municipal Code (SMC) provisions as they relate to identified Best Management Practices (BMPs) for increased solar energy use. In addition, the report presents broader approaches and policies that could affect the successful implementation of new or updated solar energy use policy. The information in this report is intended for Seattle Department of Planning and Development (DPD) and Seattle City Light staff to use in improving policies and codes related to increased solar energy use.

Overview

The City of Seattle, Washington, was designated a Department of Energy Solar America City in 2008. Solar America Cities is a partnership between the U.S. Department of Energy (DOE) and 25 cities across the country that have committed to accelerating the adoption of solar energy technologies at the local level. As part of the program, the National Renewable Energy Laboratory (NREL) has provided assistance in identifying how current policies, practices, codes, and standards in Seattle related to solar energy installations compare with recognized best practices across the country.

DOE, NREL, and their partners have recently developed studies and guidelines for increased solar energy use, particularly as part of the Solar America Cities Program. BMPs and case studies related to increased solar energy use are summarized in most of the studies. Many of the BMPs focus on interconnection issues, financial incentives, and outreach. These areas, especially the absence of effective financial incentives, have been identified as the major barriers to increased solar energy use.

The literature also addresses the need to update and enforce local rules and regulations. While the literature encourages cities to address barriers in the codes, evaluation of specific code for solar energy use is only recently re-emerging since the 1970s and 1980s. Therefore, this analysis includes a review of specific codes to evaluate how solar energy use is addressed using the BMPs and available examples and case studies as guidelines. Policies and programs such as net metering, interconnection, and financial incentive programs that are managed at the utility, state, or federal level are not directly analyzed in this work.

Gap Analysis Summary

The City of Seattle addressed solar energy use in its code as early as 1980. The Seattle DPD and Seattle City Light (SCL), the City's publicly-owned electric power utility, have a supportive approach to renewable energy, sustainability, and solar energy installations. The City has technical resources including Green Building staff, an Innovation Advisory Committee, client assistance memos (CAMs), a Green Building library, and a "Green Q" and Priority Green Permitting that result in opportunities for expedited review of green development projects, and flexibility within the code to accommodate current common solar installations.

Overall, the SMC does not present barriers to solar installations. For areas of the code such as tree preservation, shoreline management, and historic preservation where conflicts could occur, no reports were found of code-related issues that prevented solar installations. As solar energy use increases, it will be important to track and monitor not only installations, but lessons learned from working within current policies and code.

Although the SMC does not present significant barriers to increased solar energy use, improvements in the City's approach to permitting and planning could provide benefits. The detailed gap analyses in Appendices A and B offer options for improving areas of the SMC, permitting processes, and policies, and the lists below summarize the main areas of the SMC and City policies where gaps may be minimized or removed. The BMP recommendations that are listed come from reports recently developed through the Solar America Cities Program. Reports such as *Solar Powering Your Community: A Guide for Local Governments* (Muller and Truitt 2009) and *City of Austin, Texas Benchmarking of Solar Energy Programs* (Jackson 2008) and related references provided the basis for BMP recommendations (see Appendix E, Best Management Practice Review).

Appendices A and B provide the detailed gap analysis tables that include the main areas below as well as other codes and policies that were reviewed.

Gaps that can be addressed in the Seattle Municipal Code

The following list summarizes selected gaps, recommendations, and examples from the detailed tables in Appendices A and B.

1. Increase/Improve Building Energy Standards

   ✓ Require a percentage of solar energy technology for public improvements.

   - The State of Oregon (House Bill 2620) requires that public entities spend 1.5% of the total contract price of public improvement contract for new construction or renovation of a public building on solar technology. Public entities include state agencies, universities, community colleges, school districts, and local government.

2. Require Solar Ready Construction

   ✓ Require developers to build solar-ready residential and commercial buildings.

   - The City of Tucson has an ordinance that requires all new homes to either have solar photovoltaic (PV) and solar hot water (SHW) heating systems installed or to have all of the necessary hardware installed so that a system can be easily installed at a later date. (See Appendix A for additional detail on solar-ready requirements).

- The City of Seattle should lead by example and require solar installations and/or solar-ready construction on new construction and major renovation of municipal buildings.

- A solar ready definition should include a recorded, structurally sound roof and a pre-engineered chase. Other considerations include orientation, wiring, and plumbing.

3. <u>Add Flexibility to Height Limits and Roof Coverage Limits</u>

- ✓ Issues with the current residential height restrictions of 4 feet have not been reported as barriers to solar installations to date. However, height restrictions may present a barrier to some solar hot water technologies which may need up to 7 feet for some current models. The City of Portland has proposed an amendment to waive an additional 5 feet of height for solar panels.

- ✓ The City of Seattle DPD should confirm a change in height in further coordination and tracking with contractors and "lessons learned" and/or with an interagency task force so that changes made to the code are sustainable over the long-term.

- ✓ While it is typical for engineers to assume a 60% coverage of rooftop when designing a solar PV system, the 20-25% limit in the SMC has not so far been reported as a barrier. A typical 60% solar PV coverage assumption allows space for rooftop-shading obstructions such as stairwells, walls, parapet walls, access walkways (for maintenance and fire access), and rooftop heating, ventilation, and air conditioning (HVAC) equipment. Seattle DPD should investigate the origin of the rooftop coverage limits and either eliminate or expand if possible.

- ✓ California Fire Code requires plan review if a system to be installed will occupy more than 50% of the roof area of a residential building.

4. <u>Develop or Refine Definitions</u>

- ✓ Update the Table of Uses to further ensure that solar energy projects are not unnecessarily prohibited.

  - In the municipal codes and plans, if a use is not included, it can be considered specifically prohibited. Be sure to distinguish small-scale facilities from power plants. Differentiate among types of energy based on sources, scale, technology, and neighborhood impact. The closest facility name found in the SMC is "power plant," which is specifically or conditionally permitted in most industrial zones. It is specifically prohibited in commercial zones, shoreline districts, and multi-family zones.

  - The suggested definition of "Energy Generation Facility" from *A Local Official's Guide to Zoning and Land Use for Renewable Energy* (Pioneer Valley Planning Commission n.d.) is "a generator unit that may use a variety of sources and/or products for the production of power:

a. For use on-site [and/or by non-commercial users], or

b. For sale to the grid, accessory to on-site use of power, or

c. For sale to the grid as a primary use."

- ✓ The City of Portland included Green Energy and Use in its Regulatory Improvement Workplan (May 2009). The City of Portland has proposed a green code amendment that will prevent certain types of basic utility uses from requiring a conditional use permit.

- ✓ Monitor definition of solar collector.

  - No issues reported or found with the current SMC definition of "solar collector". This should be monitored as technology evolves, along with a full monitoring or "lessons learned" tracking program.

5. Implement a Solar Access Ordinance

- ✓ Develop a solar access ordinance.

- ✓ An ordinance may be a long-term action item. In the meantime, provide clear guidance and tested examples for solar easements for owners to use in their own easements. Seattle DPD can create solar easement legal forms for residents and business to use and assist with solar easement negotiations.

6. Increase Focus on Commercial and Industrial Land Use/Development

- ✓ The City of Seattle DPD should work with Seattle City Light to address a 100-kW system size limit for net metering. A typical commercial PV system can be at least 200 – 300 kW. Coordination of planning, incentives, solar access, and codes can encourage increased solar energy use in commercial and industrial uses.

- ✓ As part of developing a solar access ordinance or as part of developing solar access materials for voluntary use, include information helpful to commercial, industrial, and downtown development. The information may have ranges of payback on investment, planning information to help determine if and when solar access may be threatened, and solutions for preventing and resolving solar access issues.

Gaps that can be Addressed by Policies, Permitting, and Review Processes

1. Develop an Interagency and Stakeholder Task Force

- ✓ Standing Task Forces can provide a useful forum for the ongoing monitoring of solar energy policies and programs and implementation of policies and strategies for increasing solar energy use. A larger task force can be broken up to address various issues like solar access, permitting, and certification.

- ✓ Create a renewable energy task force where solar energy can be further addressed. The City of Seattle has several Green Building programs and policies. An interagency task force could include a representative from each of those programs along with representatives for contractors, training programs and professional solar associations, communities interested in energy efficiency and solar energy, and surrounding jurisdictions.
- ✓ Include the fire department early and often.

2. Require Green Power

- ✓ Improve leadership-by-example by requiring purchase of green power and use of solar technologies on new municipal buildings or major renovations.

3. Expand Training for Contractors, Inspectors, Plan Reviewers, and Other City Departments

- ✓ Increase City-sponsored training. Enough training should occur so that contractors and inspectors can receive training in an open format in the same classroom as other stakeholders and reviewers.
- ✓ Partner with existing organizations that provide training and/or can further develop training like solarwashington.org, community colleges, universities, and technical colleges. These organizations should also have representation on the interagency task force mentioned above.
- ✓ Establish solar training centers or include them as another part of community centers.

Case Study Excerpt from Solar Powering Your Community: Milwaukee, Wisconsin

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
- 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.**

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.

4. Address Competing Code Requirements through Planning Process

- ✓ Renewable energy, including solar energy, should be considered as part of the planning process on equal ground with tree preservation, shoreline protection, and historic and landmark preservation.

    - While the SMC has no documented barriers or cases where solar installations were denied because of tree preservation and landmark and historic district requirements, it is likely these conflicts will become more prevalent as solar energy use increases. It is recommended that these issues be discussed as part of neighborhood planning, design guideline development, and other community planning processes.

    - If policy evolves to require solar energy use or solar readiness, develop those requirements to address the scale of the project: infill development, block or multi-block development, and neighborhood-wide.

    - Subdivision and short plat codes are currently silent and can be updated to include, or at least consider, right-of-way for renewable energy sources (no code examples found to date).

5. Develop and Implement a Solar Mapping and Tracking Program tied to the Permitting Process

- ✓ Create a solar mapping and tracking program that identifies solar PV and hot water heaters installations by location, type, land use/zoning, and ownership (public, private, institutional, etc.). As a central information resources, thetracking system can inform the enforcement of access laws, assist in assessing the impacts of neighboring development or where solar installations might gain the most overall value, and inform

- ✓ Solar mapping can also be beneficial in informing the local fire officials about types and locations of installations.

- ✓ Include King County in the solar mapping and tracking program since solar hot water permits come from King County and should also be tracked.

- ✓ Use the Los Angeles County and San Francisco examples to further encourage solar energy use through a one-stop Web site that can estimate solar potential and provide additional resources and information. The on-line tool can also be a component in recognizing solar access easements. Part of the catalogue could link to solar easements (which ideally were previously linked to the permitting process) so that examples could be available to planners and citizens. In addition, solar potential can be estimated by entering an address.

6. Allow or Streamline Negotiation for Downtown Interconnection

- ✓ As the downtown grid requires higher reliability than in surrounding areas, interconnection is not currently allowed. However, the more generation capacity in the downtown area the better, from a planning viewpoint, because this increases the likelihood that critical downtown electric loads will be met in the event of transmission and power plant outages. The potential for interconnection should be carefully evaluated, and such a process should address perceived and real issues with potential overload back to the grid, fire hazards, and other concerns.

- ✓ City of Seattle DPD, other departments, their stakeholders, and partners like Northwest Seed should provide resources to further investigate this issue and provide solutions in choosing the most feasible areas for solar energy use in downtown. For example, SCL is implementing a community solar project in Pike Place Market, and customers in the downtown network will want to take advantage of the community solar-related incentives.

Summary Remarks and Next Steps

The City of Seattle green building policies, Seattle DPD regulations and permitting, and Seattle City Light policies are supportive of solar energy use. The SMC addresses solar installations throughout the code, especially in Title 23 Land Use Code. However, to be more proactive in a renewable energy future and encourage increased solar energy use, current codes and processes can be updated, and programs that monitor and track progress can be instituted to ensure effectiveness and incremental improvement.

Embracing the City of Seattle as a Solar America City through internal and external education, outreach, and goal setting would provide a framework for a holistic approach to increasing solar energy use. A solar mapping and tracking program could help the City and contractors market the use of solar PV and solar hot water systems as well as assist in estimating solar potential. A solar tracking and mapping system could also assist in planning efforts for solar overlay zones or neighborhood level energy planning including the balance needed for other issues like view corridors and tree preservation. As economic, cultural, and national policies trend toward an increase in renewable energy, solar energy, along with wind power and other technologies, could be considered as a “line item” part of project and neighborhood planning.

Seattle DPD can use the information and recommendations in this report to refine, add, and implement code updates. The recommendations in this report could be accomplished through several first steps:

1. Begin coordination internally and with other City departments for education and outreach that communicates and refines goals for increased solar energy use.

2. Prioritize code updates, changes, and additions in a way that Seattle DPD can create an action plan to implement the changes in a successful manner with other tasks in the Solar America Cities Program and other relevant programs administered at the City (Green Building, for example).

3. Once internal coordination is underway, establish an interagency task force that can work with Seattle DPD to address issues like code updates and permitting as well as consistency among other local jurisdictions and solar access.

4. Coordinate with Seattle City Light to establish a solar mapping and tracking program that links to the permitting process.

5. Use pilot projects (like a pilot solar overlay zone) and an iterative process to align Seattle DPD tasks with overall City goals for renewable energy, specifically solar energy use, while implementing code changes, and while folding in training programs and updated planning processes to include renewable energy as part of goal setting.

Appendix A:
Best Management Practices Gap Analysis

Best Management Practices Gap Analysis

Appendix A includes several tables that compile the best management practices (BMPs) identified during the first task of the analysis to review of materials provided by the National Renewable Energy Laboratory (NREL) as well as some additional research. The tables list the BMP, the Seattle Municipal Code (SMC) that might be related, current policy, and notes and options to be evaluated for removing or reducing the gap, if applicable. After each of the tables, case studies and examples from other cities are summarized.

List of Tables and Case Study Summaries

Table 1. Building Energy Standards that Mandate Solar Use

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Purchase green power for all municipal buildings.	• No current City requirement; • Green power is available through the green up program. Green up is a voluntary green power program for residential and business customers. By enrolling in Green Up, customers purchase green power for a portion of their electricity use and demonstrate their support for wind power and other new renewable energy projects in the Northwest.	No code for purchase of green power. Net metering code under Utility code 21.49.	Yes. Currently voluntary.	• Require certain percentage of power for municipal buildings be purchased through the green up program. • Require purchase of green power for all municipal buildings.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Develop solar and green building design standards.	• This BMP is tangentially addressed in the Green Building Policy. It states that all City capital improvement projects over 5,000 square feet fall under the City's Green Building Policy, which sets Silver LEED certification as the goal. • Seattle Energy Code exceeds national standards by 20%.	Title 22, Building and Construction Code. Title 23, each land use code discusses height and setback for land use, which allows for solar access. Resolution 30121, resolution endorsing the City of Seattle Environmental Management Program's Sustainable Building Policy.	No. Green design is encouraged and specific guidelines and assistance is available through Codes, CAMs, Seattle DPD Green library, SCL outreach materials, and staff technical resources.	• Include solar energy installations in neighborhood design guidelines or other planning documents. • Recognize competing factors as part of the clean or renewable energy step in neighborhood planning: ○ Tree Preservation ○ Renewable energy with goals for solar energy. ○ Historic and Landmark District/Building Preservation
• For new construction or major renovation of municipal buildings, require a specific capacity or investment level for solar technologies.	• Partly addressed by Green Building Policy, but solar not required.	Resolution 30121, a resolution endorsing the City of Seattle Environmental Management Program's Sustainable Building Policy.	Yes.	• LEED silver may cover GHG goals, should City target solar within that goal that does not prohibit further innovation. ○ Example: 50% of Municipal LEED buildings will include solar. • Avoid new code that would cause more exceptions.

Best Management Practice	Current City Policy	Related Code	Gap	**Recommendations/Options** (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Standard solicitation process for municipal solar installations (RFP/RFQ Process).	• No standard RFP process.	N/A.	Yes.	• Implement a formal RFP/RFQ process for solar installations. • Provide template information to assist municipal departments and private residents and commercial building owners to use in contracting for solar installations.
• Encourage or require developers to build solar ready residential and commercial buildings.	• This practice is encouraged in outreach materials, but not required.	Title 21, Utilities, maybe. Title 22, Building and Construction Code, maybe. Title 23, Land Use.	Yes.	• Develop ordiance that requires solar installation or solar ready on new development and major renovation. • Be more specific about solar orientation and access for solar energy systems, not just access to streets and parks in design guidelines. • Evaluate incentives. Cost is still most prohibitive factor.

Building Energy Standards that Mandate Solar Use: Case Studies and Examples from BMP Review

- In the State of Oregon, House Bill 2620, which requires that public entities spend 1.5 percent of the total contract price of a public improvement contract for new construction or major renovation of a public building on solar energy technology, took effect January 1, 2008. Public entities include, but are not limited to, state agencies, universities, community colleges, school districts and education services districts, and local government (State of Oregon, 2010).

- Tucson, AZ City Ordinance No. 10549. The Mayor and City Council approved an ordinance in June of 2008 that requires all new single-family homes and duplexes in Tucson to be solar ready. The ordinance was developed by a stakeholder group which included Technicians for Sustainability, the Tucson Association of Realtors, the Sierra Club, the Southern Arizona Homebuilders Association, architectural professionals, solar energy companies and elements of the city government. The ordinance requires all new homes to either have a photovoltaic (PV) and solar water heating system installed or to have all the necessary hardware installed so that a system can easily be installed at a later date.

  The city of Tucson is still developing rules for PV solar readiness, but the rules for solar water heating readiness have been developed and are being enforced as of March 1, 2009. To comply with the solar water heater readiness requirements, new homes must either have a complete solar water heating system installed or comply with one of two solar stub out options. Option one requires the installation of two insulated pipes and a suitably sized conduit (for two pairs of monitoring and control wires) that run from the water heater area through the roof and are capped. Option two does not require the installation of pipes, but it does require the installation of a sleeve or conduit of sufficient size to hold the two insulated pipes and wires. To comply with option two there must be a straight line from the water heater area to the roof. Both options will greatly cut down on the cost of installing a system at a later date. These requirements may be waived if it can be demonstrated to the building official that compliance is not practical due to shading, building orientation, construction constraints, or the configuration of the parcel of land.

- On August 4, 2008, Mayor Newsom signed San Francisco's groundbreaking green building ordinance that imposes strict new green building requirements on newly constructed residential and commercial buildings, and renovations to existing buildings. The ordinance specifically requires newly constructed commercial buildings over 5,000 sq ft, all new residential buildings, and renovations to areas over 25,000 sq ft in existing buildings that are undergoing major structural upgrades and mechanical, electrical or plumbing upgrades to be subject to an unprecedented level of green building requirements. (http://www.sfdbi.org/ftp/uploadedfiles/dbi/downloads/AB_093.pdf

Table 2. Improve Permitting Requirements and Processes

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Parallel, consistent, clear and rapid Solar PV and SHW permitting procedures.	• If permit needed, must go to Seattle DPD for solar PV and King County Health Department for solar hot water (shw). • Solar installations currently permitted based on complexity (weight, structural complexity, commercial and industrial applications). • Permitting programs (Green Q and PriorityGreen) in place that incentivize green building techniques, although not exclusive to solar installations.	Title 23. Land Use King County Plumbing Permit.	Yes. Programs relatively new and untested; should be monitored. Installer interview noted that staff error on the conservative side of decisions when they do not understand solar installation issues. Also noted that electrical inspection led to two changes in meters, eventually back to the original meter base which was costly and time-consuming (this was the Pemtec Project). In the follow up interview, contractor stated that since SCL made a pamphlet available about the process, there were absolutely no issues with the next project (Samaki).	• Implement a "lessons learned" procedure among staff and departments to improve Green Q and other expedited and traditional permitting procedures in a timely manner with the goal of efficiency and clarity. • Work with other local governments in the SCL Territory to make requirements consistent. • Tracking through permitting and mapping could enable staff to more efficiently look at other examples and permits as example and to improve procedures.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Provide standard over-the-counter permits for solar energy systems that do not exceed weight threshold on buildings meeting minimum code requirements.	• Solar installations currently permitted based on complexity (weight, structural complexity, commercial and industrial applications). • Expedited review is on case-by-case basis and determined by the complexity of structural zoning elements at the intake appointment.	Plumbing and electrical. General. In addition to the requirements of Section 302 (A), two sets of plans and specifications shall be submitted with each application for an electrical permit for an installation of the following: (a) services or feeders of 400 amperes or over; (b) all switches or circuit breakers rated 400 amperes or over; (c) any proposed installation the scope of which covers more than 2,500 square feet; (d) any proposed installation which cannot be adequately described on the application form; and (e) installations of emergency generators.	Yes. Structural concerns are evaluated by the review staff and are not hindered by the building code at this time.	• There is now an over-the-counter permit for simple installations, but it is not yet widely understood. Additional outreach internally and externally and continued clarifaction of process is recommended. • In addition to options listed in the previous row, Seattle DPD could provide focused training for staff, including inspector and contractor input, so that installations that are not considered complex can be reviewed quickly and on-line. • Include wind load rating requirements in permit information. • Adoption of an expedited process for solar PV using information like that developed by Brooks Engineering can offer a framework useful to reveiwers and contractors (Brooks Engineering, May 2009).

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Flat fees or fee waivers for small solar installations.	None.	Title 22. Building Code Title 23. Land Use Code.	Yes.	• Seattle DPD should be included in a process to evaluate incentives to better cover cost, the most prohibitive factor in most cases. This would need to include SCL and likely other departments; it would require ongoing coordination since availble incentives change over time. • Assuming the overall City policy continues to encourage green building techniques and use of renewable energy sources, City of Seattle DPD can propose a program to implement flat fees or fee waivers for permit review to further incentives solar installations if feasible.

Best Management Practice	Current City Policy	Related Code	Gap	**Recommendations/Options** (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Exempt PV from building height limitations, building permit and design review requirements.	• PV installations are exempt and allowed additional height. • 23.44.046 Director may permit the installation if it is non-conforming and meets certain other structural and siting conditions; although there are no departures from height restrictions or the additional height criteria based on land use.	Title 23. Land Use	No. 4-foot height limit in code (low-rise zones) was likely based on other national standards for height in the 1980s, not necessarily for solar technologies. If a 60 degree tilt is assumed, some common solar collectors will be ok with this height limit. A typical rack-mounted solar hot water heater, the Heliodyne GOBI flat plate solar collector would not fit within the 4-foot height restriction. Most solar collectors would fit within the 7-foot height restriction (no more than 39 feet above grade), although the rooftop coverage of 20-25% may be limiting.	• 20-25% rooftop coverage is limiting. • While current exemptions and limitations have not been reported to prohibit a solar installation to date, continuted coordination with contractors, reviewers, fire department, and other departments should occur as renewable energy policies are implemented and codes are updated.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Standard permitting procedures among and between surrounding jurisdictions.	• None. • Other programs have historically tried to work with the other communities. Nothing definitive found close to this purpose.	N/A.	Yes.	• Work with all jurisdictions in SCL territory to establish parallel permitting standards and procedures. • As a first step, include representatives in a Task Force effort. • Shoreline, Lake Forest Park, Lake City, Burien, SeaTac, Tukwila, Normandy Park, Renton.
• Electrical permitting checklist based on common standards (for example UL 1741 and IEEE 1547).	• Yes, with some amendments.	Title 22. Building Code	No.	• See electrical permit on-line.
• Permit requires minimum check of mounting system plus weight and electrical review.	• Yes.	Title 22. Building Code	No.	• See electrical permit on-line.

Best Management Practice	Current City Policy	Related Code	Gap	**Recommendations/Options** (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Codes and ordinances restricting solar not based on purely aesthetic or historical reasons.	• Historic/landmark districts go through certification application. • There are "New Pathways" programs looking into rehabilitation in coordination with achieving LEED/green building. • Need to find out process criteria	Title 25. Environmental Protection and Historic Preservation.	No.	• Code is not a barrier. Review boards work through issues. • Although code does not specifically show preference for solar installation, there have been no issues. • A purpose statement encourageing solar energy use in the comprehensive plan and other planning documents would guide resolution as issues arise.

Improve Permitting Requirements and Process: Case Studies and Examples from BMP Review

- Brooks Engineering has developed a detailed guide on an expedited permitting process which could be adapted and adopted for SCL Territory, first in Seattle DPD. Brooks Engineering periodically provides training to contracts and inspectors and may be a good resource for the City of Seattle for training staff in permitting process improvements (See Brooks Engineering, May 2009).
- San Jose, CA schedules post-installation inspections by appointment with a two-hour window so the contractor does not have to wait all day.
- Portland, OR 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. Portland allows installers to email permit application for qualified projects. The City has also trained staff to review the applications within approximately 24 hours.

- 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.

- 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.

Table 3. Technical Training

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Training and marketing assistance opportunities for installers.	• SCL has list of contractors that have completed at least three PV installations. No SHW. • SCL does periodic training for inspectors and installers. For example, Brooks Engineering gave two training sessions in January 2010 for installers and contractors (separately).	N/A.	No.	• Option to increase City-sponsored training. Enough training should occur so that contractors and inspectors can receive training in an open format in the same classroom as well as other stakeholders and reviewers.
• Establish accredited solar training centers and continuing education programs.	• There are training opportunities from SCL, from outside sources like solarwashington.org , findsolar.com, and outreach materials.	N/A.	Yes.	• Research what training is available through solarwashington.org, City of Portland, and n eastern Washington. • Could add solar to existing training centers. • Research what is available through community colleges and university. Establish partnership or regular coordination.
• Utilize opportunities for training and certification like those offered through North America Board of Certified Energy Practioners (NABCEP) for PV and solar thermal installers.	None.	N/A.	Yes.	• City could use this as training and recommendation for installers. • City could recommend that residents and businesses check for certification like NABCEP PV Installer Certification.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Add solar PV and solar thermal education to building and electrical inspector training.	• SCL has list of contractors that have completed at least three PV installations. No SHW. • SCL does periodic training for inspectors and installers.	N/A.	No.	• There are training opportunities from SCL, from outside sources like solarwashington.org and findsolar.com, and outreach materials. • Option to increase City-sponsored training, like the Brooks Engineering training for contractors and inpsectors. Training should eventually have the different disciplines together rather than separate for additional cross-coordination and understanding.

Technical Training: Case Studies and Examples from BMP Review

- 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 equivalents (MtCO2e) 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.

- 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.

- 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.

Table 4. Solar Access Laws and Policies

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Explicitly recognize solar easements.	None.	23.22.052 – Subdivision Dedications 23.24.035 – Short Plats Access Land Use Code setbacks	Yes.	• Solar easements could be recognized as part of a broader inclusion of a solar and renewable energy component of the city's comprehensive plan. • Include guidelines for solar easements in land use code.
• City or county should record solar easements and ensure they are transferred with the title.	None.	Title 23. Land Use Code	Yes. Recording private solar easement in property title not mandatory.	• Pass county ordinance requiring solar easements to be recorded in land title.
• Ensure solar access provisions are available to all property types.	Yes, but only for existing state solar easement law.	RCW 64.04.140: Washington Solar Easement Law	Yes.	• Consider solar access provisions for low-rise, mid-rise and high-rise multifamily and commercial zones that are different than single family requirements.
• Develop suggested guidelines for Home Owners Association's based on state solar rights law to help avoid litigation.	No. State law but no local guidelines.	RCW 64.38.055	Yes.	• Include information on RCW 64.38.055in Seattle DPD Solar Energy Systems Client Assistance Memo (CAM). • Develop easily accessible guide for potential solar collector owners on state homeowner association restrictions.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Create standard forms and procedures to assist property owners in establishing solar easements.	No.	N/A.	Yes. No standard form for property owners.	• Create standard solar easement forms and guidelines for solar owners.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Established additional solar access policy: solar access permits or solar zoning with or without Transfer of Devopment Rights (TDR) option.	None.	RCW 35.63.080 and 64.040.140: Allows local jurisdictions to create their own solar access ordinance.	Yes. Solar easements only option for protecting solar access.	From Section 7 of Final Report: • Recognize solar easements as part of a broader inclusion of a solar and renewable energy component of the City's comprehensive plan. • Determine whether a solar easement ordinance should be created. If increased solar energy use is prioritized as part of City of Seattle policy, an ordinance should be created. • Create incentives for new area development and construction that is willing to include solar access regulations. (This may overlap with an option to further encourage renewable energy sources/solar installations in the land use code for short plats and subdivisions.) • Create a formal policy that considers solar access along with potentially conflicting policies like the tree preservation ordinance. • Instead of creating a solar easement ordinance, create a registration process to allow owners to put adjacent properties on notice that a solar system is in place. Provide necessary forms, examples, and easy access to the information for voluntary registration and voluntary easements. • Establish renewable energy overlay zones for the pre-approval of solar siting in designated areas.
• Solar Access regulations for new area development and construction (Planned	None.	Title 23.22 Subdivisions Title 23.24 Short	Yes. No criteria in existing development ordinances or an	• Establish alternatives to Planned Development code including provisions for East West streets and dedication of new park or school space as solar easements, as well as parking lots and drainage

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
Unit Development & subdivisions).		Plats Title 23.24.045 Unit lot subdivisions	alternate development ordinance including solar access requirements.	basins where feasible.
• Procedures to balance solar access with tree canopy protection and growth.	None.	Title 23.44.008 – Residential, Single Family Development Standards for uses permitted outright	Yes. No consideration of solar access in lot landscaping requirements.	• Address solar access in city/utility tree planting guides – for on site and neighbors solar access. • Consider changing new development landscaping requirements to encourage tree planting that does not interfere with solar access. • Address competing values at neighborhood and project level. Allow flexibility to maximize goals in tree preservation, solar access, historic preservation, and critical areas.
• Provide registration process that would allow owners to put adjacent properties on notice that a solar system is in place.	None.	N/A.	Yes.	• See Ashland, OR example. Notify each owner and lessee (need to inquire about adjacent properties); if it meets ordinance requirements and no objections within 30 days, then staff issues a solar access permit.
• Establish renewable energy overlay zones that would result in the pre-approval of solar siting in designated areas.	None.	Title 23 Land Use. Title 25. Environmental Protection and Historic Preservation.	Yes.	• See Boulder, CO example. • Would likely need to combine with mapping, tracking, and planning efforts before implementation of this type of measure. • Developers and residents bring “deep green” projects to the City, and it may not be as valuable to develop designated areas without understanding of value.

Solar Access: Case Studies and Examples from BMP Review

Summarized from Section 7 of Final Report and from Appendix C:

- ***Ashland, OR.*** The 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.
- **Boulder, CO.** The City of Boulder, CO takes an overlay approach to solar access. The code has siting requirements to encourage installation where investments can be more successful. Boulder includes protection for vegetation that is existing at the time of the permit application. Boulder also specifically mentions city-owned property as part of purpose of solar access requirement. There are three Solar Access Areas in the City of Boulder. A solar access permit is available to those who have installed or who plan to install a solar energy system and need more protection than is provided automatically in Solar Access Areas I and II.
- ***Clackamas County, OR.*** Clackamas County developed a solar access ordinance that with separate sections for different purposes. Section 1017 is an ordinance for new development. Section 1018 addresses a solar balance point and infill development. Section 1019 addresses the solar access permit. The purpose is to authorize the owners of certain properties to apply for a County permit that prohibits shade caused by certain vegetation on neighborhing properties from being cast on a solar feature(s) on the property of the permitee.

Table 5. Lead by Example

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Create an interagency task force or committee to focus on solar installations.	None.	None.	Yes. No task force currently exists.	• Create a renewable energy task force. Task force assists with aligning City policies, SPU goals, and community and business involvement.
• Create green building and solar-ready standards for all new municipal buildings and renovations.	Green design is encouraged and specific guidelines and assistance is available through Codes, CAMs, Seattle DPD Green library, and staff technical resources. This BMP is tangentially addressed in the Green Building Policy. It states that all City capital improvement projects over 5,000 square feet fall under the City's Green Building Policy, which sets Silver LEED certification as the goal. The City also has several solar demonstration projects including Woodland Park Zoo and nine school projects.	Title 22, Building and Construction Code. Title 23, each land use code discusses height and setback for land use, which allows for solar access. Resolution 30121, resolution endorsing the City of Seattle Environmental Management Program's Sustainable Building Policy.	Yes.	• Require solar-ready standards for municipal buildings, construction and major renovation. • Include solar energy installations in neighborhood design guidelines. It may make more sense to discuss renewable energy, in general, but currently there is a lot of existing solar installation information that could be coordinated with design guidelines to see what makes sense for that district. • Recognize competing factors as part of the clean or renewable energy step in neighborhood planning: ○ Tree Preservation ○ Renewable energy with goals for solar energy. ○ Design, solar access for public space. ○ Historic and Landmark District/Building Preservation • Continue developing demonstration projects.

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Install PV and/or SHW systems on suitable municipal facilities.	None. (confirm)	N/A.	Yes.	• Specifically include consideration of solar installations as part of "checklist" or process in Green Building Policy to see if it makes sense. • Caution in "green window dressing". Encourage integrated approach. • Arrange professional site assessments, include facilities managers. • Identify objectives. • Consider this a hands-on training opportunity for in-house personnel and site assessors.
• Create a Comprehensive Community Energy Plan.	SCL has most of the basic information and outreach materials.	N/A.	Yes.	• Use existing materials, data, and targets to begin a comprehensive community energy plan process. • Process includes mobilizing a steering committee, creating task force to address municipal, residential, and commercial energy issues, workshops, outreach, plan development and implementation.

Lead by Example: Case Studies and Examples from BMP Review:

- 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.

  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.

Table 6. Solar Tracking

Best Management Practice	Current City Policy	Related Code	Gap	Recommendations/Options (In some cases no gap was listed, but additional options or research notes includes for informational purposes.)
• Conduct an installation baseline survey	None.	None.	Yes.	• Create a list or map using the solar permits that shows where solar has been permitted and approved in the City. (SCL has a tracking spreadsheet that may be used as a starting point.)
• Create a solar system registry	None.	None.	Yes. No registry exists.	• Allow people to self-register through an online system.
• Develop solar tracking website (see Los Angeles County and San Francisco examples).	None.	None.	Yes.	• Develop a tracking website through stimulus or other funding. • Conduct a solar/rooftop analysis to identify areas with most solar potential through stimulus or other funding.

Solar Tracking: Case Studies and Examples from BMP Review:

- 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.
- Los Angeles County and San Francisco both have a solar map that shows some or all of the following information: location, land use, type of installation, cost of installation, cost savings, emissions reduced, and name of installer. In addition, solar potential can be estimated by entering an address. For Los Angeles County, the estimate uses a 2006 solar radiation model that calculates and ranks solar radiation every 25 square feet in the County. It assumes a system size and calculates potential annual output, cost savings, and emissions savings. Both Web sites also have tips, incentives, and other resources and information to encourage solar energy use. Appendix D includes graphics from the Los Angeles County and San Francisco examples.

Solar Access: Using the Environment in Building Design

By Mary-Margaret Jenior, AICP

More new buildings are energy efficient that at any time in our history.

Yet most do little to use the environment in order to reach their real performance potential.

About 40 percent of our end-use energy demand and over two-thirds of electricity demand is for buildings. A significant portion of that demand can be met using the sun if we learn to design and renovate buildings to take advantage of access to solar energy. Further, buildings now produce about 40 percent of U.S carbon emissions, another reason to take advantage of solar power.

We know that more solar energy falls on our roofs than is required to meet the U.S. demand for electricity. However, our land-use policies and regulations discourage the use of this valuable resource. We need to do everything we can to encourage decision makers, the building industry, and building owners to think of buildings as energy producers. For our future well-being it is essential that we consider energy production and use as an integral part of building design for new construction and renovations alike. We need to encourage builders, developers, designers, engineers, and owners to use the environment to heat, cool, ventilate, daylight, and power our buildings. As planners we need to help educate and promote changes in how we design and renovate buildings and to use land-use controls to enable that to happen.

It can no longer be an either-or choice between environmentally sensitive building design or dense development to achieve viable transit systems. It can and must be both. We cannot favor one approach to reducing energy use over another in making recommendations to decision makers. That is because the dominate fuel sources for buildings and for transportation differ. At present, most energy for transportation comes from oil or biofuels. In contrast, coal is the primary energy source for buildings—with some natural gas, hydroelectric, nuclear, and wind supplementing the grid. Of these energy sources, only hydroelectric, nuclear, and wind energy do not contribute carbon emissions. Concentrated solar thermal plants may begin providing electricity In the near future.

According to Energy Information Administration 2005 survey data, an office building uses about 40 percent of its energy for heating, cooling, and ventilation; 30 percent for lighting; and 16 percent for office equipment and other "plug" loads. A commercial building built to American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1 (a standard commonly referenced in building codes) may use about 20 percent of its energy for heating and cooling, up to 70 percent and sometimes more for lighting, and the remaining for hot water, pumps, and equipment. A typical home may use one-half its energy demand for space conditioning (heating, cooling, and ventilation), 20 percent each for refrigeration and hot water, and the remainder for appliances and electronics.

It is crucial that we use all the opportunities we can muster to design buildings to meet their energy needs. We must begin to think of buildings as being net energy producers—that is, buildings that can put energy into the electric grid instead of just taking it out.

How do we achieve such buildings? We begin by minimizing the energy load of the building itself. This is done by using efficiency measures to conserve energy and passive solar design strategies and other solar technologies to produce energy.

The objective of passive solar—or whole-building—design is to capture the natural environment using elements that are already employed in buildings and to do so at little or no increase in construction or renovation costs. The resulting buildings are more economical to maintain, aesthetically pleasing, comfortable, and healthy. They are light and airy, easier to sell and rent, and pleasant places to live, study, and work. Studies have shown that employee absenteeism is reduced and performance improves when office buildings incorporate elements of solar design. Buildings that take advantage of solar building design are less dependent on fuel cost variations and can maintain comfort during power outages. They may employ any architectural style desired and be of any building type and use required—single or multifamily housing, institutional, commercial, or industrial.

Passive solar buildings use a south-facing orientation (north-facing in the southern hemisphere) and building components (like windows, walls, and floors) to capture the benefits of the sun for heating and daylighting, and they use natural air flows and temperature gradients (the difference between daytime and nighttime temperatures) for ventilation and cooling. They use landscaping and overhangs for shading. In some climates they may use evaporative cooling or cooling towers, and soon, all climates may be able to adopt evaporative cooling technologies because of new research on desiccant technologies (materials capable of removing moisture from the air).

Once the building's energy need is minimized, owners may consider active solar thermal for domestic hot water (DHW) and auxiliary heating and photovoltaics (PV) for electricity. Excess electricity can be fed into the utility's grid for others to use.

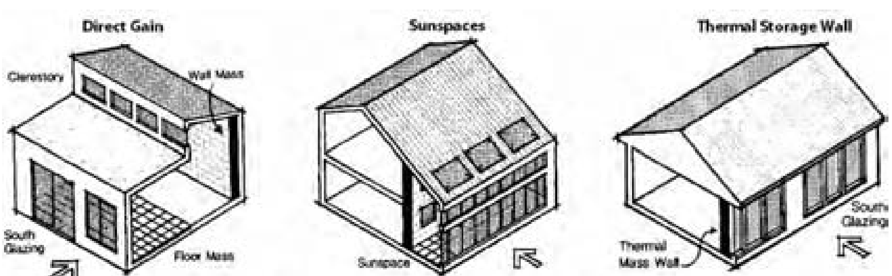
ASK THE AUTHOR JOIN US ONLINE!

Go online from May 10 to 21 to participate in our "Ask the Author" forum, an interactive feature of Zoning Practice. *Mary-Margaret Jenior will be available to answer questions about this article. Go to the APA website at www.planning.org and follow the links to the Ask the Author section. From there, just submit your questions about the article using the e-mail link. The author will reply, and* Zoning Practice *will post the answers cumulatively on the website for the benefit of all subscribers. This feature will be available for selected issues of* Zoning Practice *at announced times. After each online discussion is closed, the answers will be saved in an online archive available through the APA* Zoning Practice *web pages.*

About the Author

Mary-Margaret Jenior, AICP, is retired from the Department of Energy, where she was responsible for the development and management of the passive solar/whole buildings research program. She represented the U.S. government on the International Energy Agency Solar Heating and Cooling Programme Executive Committee. Earlier in her career she was a practicing planner for the City of Cincinnati, the USN Trident Program, and the U.S. Air Force.

The important message is that solar building design can not be achieved simply through "add-ons." The approach discussed above is integral to the building and needs to be considered in the predesign stage, whether for new construction or renovation.



Courtesy of DOE/NREL and the Sustainable Buildings Industries Council

Direct gain is the most common passive solar system in residential applications. Sunspaces provide useful passive solar heating and also provide a valuable amenity to homes. A thermal storage wall is an effective passive solar system, especially to provide nighttime heating.

ELEMENTS OF SOLAR BUILDING DESIGN

Before we see how these ideas can be encouraged through land-use regulations, it is necessary to understand how to incorporate solar concepts into buildings. Keep in mind throughout the following discussion that solar design is location-specific. We'll begin with basic solar building design concepts and technologies.

Latitude. Depending on location, the height and angle of the sun in the sky (the azimuth) throughout the year and climate characteristics (for example, heating and cooling degree days and air-flow patterns) will establish the basis for the design of solar buildings and therefore, solar access requirements. (Specific climate data are available for numerous weather stations nationwide. Even within a given geographic area, microclimate variations must be taken into account. Design tools such as ENERGY-10 and Energy Plus contain the weather data files for numerous U.S. locations).

Energy-efficiency measures. These measures include proper levels of insulation and glazing type, control of air infiltration, properly sized mechanical equipment, efficient appliances and office equipment, and electric lighting systems and controls.

Daylighting. This refers to the use of solar radiation captured through the use of clerestory glazing, sawtooth roof monitors, light shelves (horizontal surfaces over the windows' exterior that reflect daylight onto the ceiling and deep into the building), light tubes, and other means of bringing light into the building. Studies have shown that daylight can reduce electric bills 30 to 50 percent. Skylights are commonly used for daylighting. However, unless they are designed as an integral part of the building, they will likely increase the cooling load. Electric lighting controls are integral to the use of daylighting so that light levels are constant when people are present and fixtures are not on when radiation levels are adequate.

Suntempering. For housing and small nonresidential buildings, suntempering may be a desirable approach. Suntempering is accomplished by simply moving more of the windows to the south and relying on interior finishes and furnishings for thermal or heat storage. However, suntempered buildings will not reduce the use of purchased energy to the degree that solar buildings will.

Passive solar or whole building design. Passive solar is the building itself. A passive solar building makes use of the building's nonmechanical elements and proper orientation to provide daylighting; to collect, store, and distribute solar energy; and to take advantage of natural cooling. These buildings have thermal mass to store and emit heat during times when it is needed and to lessen the need for air conditioning. The amount of thermal storage required is dependent on the area of south-facing glass. Care must be taken in selecting glazing so that the solar gains from the southern orientation are maximized. These buildings also employ means to direct natural airflows (solar-drive convective air movement) into the building using such strategies as operable windows, vents at floor level, and wing walls (walls that project from the building) to bring air into the building. Additional ventilation is provided by whole-house fans and operable clerestory or cupola windows. Passive solar buildings may also use night radiation to flush excess heat. This method involves exposing masonry surfaces to the cool night sky and insulating these surfaces from outside air during the day. As daytime temperatures rise, the cooler surface acts as a heat sink for the living space.

An ideal design will orient the major work, study, and living areas to the south and minimize the east- and west-facing glass. Even the type of glazing selected for each orientation may differ so that solar gains for south-facing glass are maximized and those for east- and west-facing glass are minimized.

Passive solar buildings draw upon at least one of three design strategies to provide heat: direct gain, sunspaces, and thermal storage—or Trombe—walls. Trombe walls are glazed, south-facing masonry or concrete walls with a selective surface that aids in collecting and storing the solar radiation. A thermal storage system is often referred to as an indirect system.

> Passive solar buildings draw upon at least one of three design strategies to provide heat: direct gain, sunspaces, and thermal storage.

passive solar buildings since the collectors are likely to be placed at ground level. Hawaii now requires that all new homes install solar hot water systems.

Photovoltaic (PV) systems. PV systems generate electricity. The PV system might be on the building's roof, integrated into its overhangs, or provide the skin for the building's facade or atrium. Distributed power is a term likely to become part of our future vocabulary. Distributed power is PV-generated power that is fed into the utility's grid. In time, if enough buildings generate more power than they need, we will have less need for additional power plants.

Ventilation air. For nonresidential buildings like institutions, industrial facilities, and warehouses, transpired air collectors

Courtesy of DOE/NREL, Credit—Jim Yost

Courtesy of DOE/NREL, Credit—Keith Gawlik

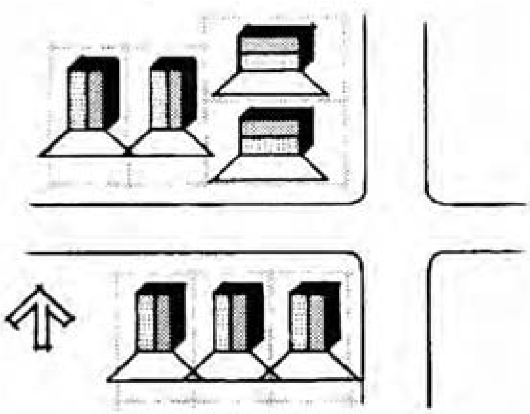
Left: This retail complex in Silverthorne, Colorado, features PV, clerestory windows, daylighting, diffusing skylights, and a solar wall. Right: This Federal Express building in Denver uses an absorber wall to help preheat intake air.

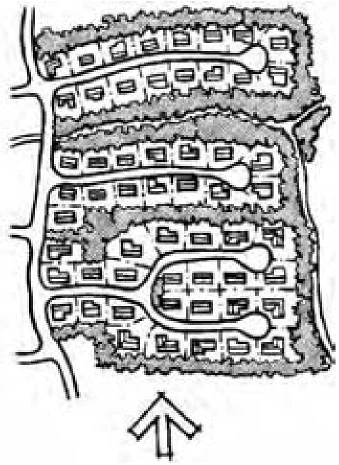
Passive solar buildings depend on proper glazing-to-storage ratios and properly sized overhangs to avoid overheating in spring and fall. Because these buildings use normal building components to meet much of their heating and cooling needs, they require little maintenance. In some climates, a passive solar home or small nonresidential building (e.g., a school or office building) may not require a central heating and cooling system—a major cost saving benefit—and those that do require auxiliary heating and cooling will use smaller systems than conventional buildings.

Buildings of 10,000 square feet or smaller make up the majority of the nonresidential sector. Contrary to popular perceptions, smaller commercial, institutional, and industrial buildings are similar to residential buildings in that they do require heating as well as daylighting, cooling, and ventilation. For larger buildings, daylighting is especially important since lighting is sometimes the biggest user of energy. Many buildings, regardless of size, can benefit from using solar to heat and to preheat ventilation air.

Active solar systems. This refers to the use of collectors, usually located on the roof to collect solar radiation to heat water for domestic uses and possibly, to provide auxiliary heating in the winter months. The systems that provide both hot water and heat are often referred to as combisystems. Some collectors for hot water systems are freestanding, especially when roof orientation is not ideal. For these systems greater solar access is necessary than required for placed on the south side of buildings have proven to be an effective technique to preheat ventilation air. Transpired collectors are a dark-colored, perforated facade with a fan, or the building's existing ventilation system draws air into the building. The air space between the absorber and the building wall form a plenum. The solar energy absorbed by the dark absorber and transferred to the air flowing though it can preheat intake air by as much as 40°F. The absorbers can be added to or designed as part of the building's facade. Because of fire code requirements, they may not be appropriate for some multistory buildings.

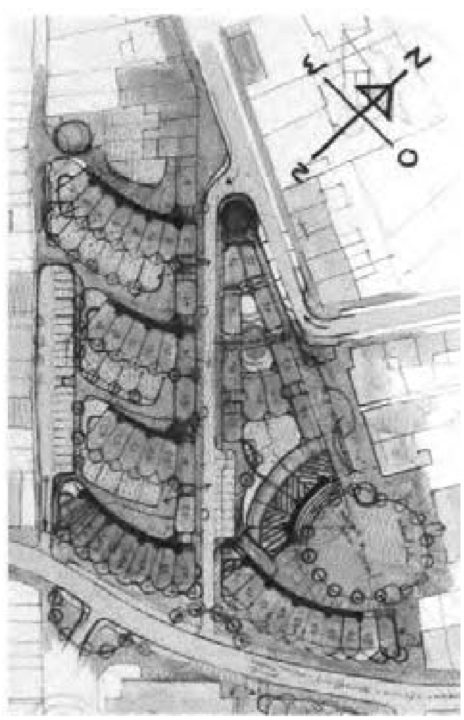
Evaporative cooling. This refers to the use of a water medium to cool air for climate control in dry climates. Not all climates require compressors to cool air and control humidity inside buildings. Materials that remove moisture from the air are known as desiccants. Desiccant technologies are evolving and can be integrated into evaporative systems for use in all climates.





Courtesy of DOE/NREL and the Sustainable Buildings Industries Council

Above: For homes in solar subdivisions, solar access may be provided to the rear, side, or front yard. Short east-west streets tied into north-south collectors is a good street pattern for solar access. Below: This subdivision plan from Deventer in the Netherlands shows how even dense development can be sited protect solar access.



Courtesy of NOVEM, Credit—Netherlands Architecture Institute Rotterdam (Architect Theo Bosch)

Local development controls should encourage subdivision layouts that provide for maximum east-west orientation for residential and smaller nonresidential uses.

Geothermal heat pumps. The ground maintains a relatively constant temperature of 50 to 60°F (10 to 16°C). Thus, the ground temperature is warmer than the air temperature in winter and cooler in the warm months. Geothermal (or ground-source) heat pumps take advantage of the earth's constant temperature to heat and cool buildings. Because the system is outside the building, geothermal requires more land area than the other techniques discussed above.

IMPLICATION FOR LAND-USE CONTROLS

Currently, relatively few communities include provisions in their local development controls that ensure that environmental resources can be used to heat, cool, daylight, and electrify buildings. The discussion that follows outlines a number of considerations for subdivision and zoning standards that would help private developers build and remodel buildings that are better able to take advantage of access to solar energy.

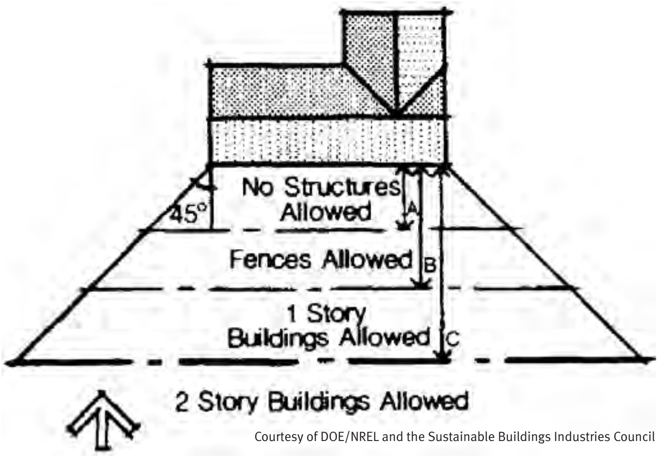
Subdivision design

Local development controls should encourage subdivision layouts that provide for maximum east-west orientation for residential and smaller nonresidential uses. In the northern hemisphere, major living, work, and study areas should face south (north in the southern hemisphere) to the extent possible. It is easiest to protect solar access in subdivisions having streets that run east-west or 25 degrees of east-west. Where streets run north-south, cul-de-sacs or loop streets help provide for solar access. For dense development, creative site design is essential.

Development standards

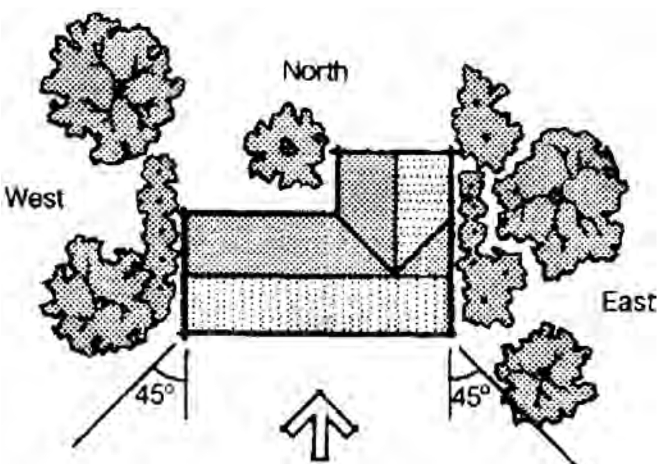
Yard and height requirements of zoning ordinances can be used to ensure solar access. In an ideal situation, south-facing glazing should receive four hours of sun on December 21. That generally means that there should be no obstruction within an arc of 60 degrees on either side of true south. Relatively good solar access will still occur if the glazing is unshaded within an arc of 45 degrees. What the horizontal clear distance needs to be is location-specific and depends on the height of the subject building of interest and the adjacent structures. Boulder, Colorado, for example, includes shadow lengths by height of building for 10:00 a.m., noon, and 2:00 p.m. on December 21 in its development code. Properly sized overhangs will shade the glazing in the summer when the sun is higher in the sky.

Since not all lots are large enough to accommodate optimum solar access, it is important to assess shading patterns in establishing compromises on yard requirements. One possible compromise is a flexible approach to building orientation and yard requirements when streets run north-south. With appropriate side yard



Courtesy of DOE/NREL and the Sustainable Buildings Industries Council

Above: Buildings, trees, or other obstructions should not be located so as to shade the south wall of solar buildings. Below: Trees and other landscaping features may be effectively used to shade east and west windows from summer solar gains.



Courtesy of DOE/NREL and the Sustainable Buildings Industries Council

allowances, buildings that are oriented perpendicular to the front lot line on north-south streets can still take advantage of solar access. In many cases, there is no reason that the main building axis needs to face the street and that yard requirements cannot be varied to allow for solar access.

Obstacles can reduce not only the amount of solar available for winter indoor climate control, they can also limit daylighting and radiation falling on active solar collectors and photovoltaic surfaces. For example, the limbs of a deciduous tree can reduce solar heat gains in passive solar buildings, and trees on the south side can all but destroy passive solar performance unless they are close to the building, with the lower limbs removed so that winter sun can penetrate under the trees canopies.

When used properly, landscaping can provide for shading and ventilation. The ideal for shading is the use of deciduous trees to shade the east, southeast, southwest and west sides of the building and trellises with deciduous vines to shade the east windows during the summer months. Evergreens and shrubs can be used to block prevailing, cold wind in the winter and shade heat-absorbing paved areas during warm seasons. Also, trees, fences, and shrubbery can be used to channel summer breezes into the building.

Daylighting design tools such as ENERGY 10, available from the Sustainable Buildings Industries Council, provide a simplified means for accounting for select obstacles and can be used to assist in setting yard and landscaping requirements for planned developments. More adequate algorithms for tools such as EnergyPlus are emerging. Planning agencies may wish to draw upon the skills of energy analysts to help them establish yard and landscaping requirements where unique site conditions exist.

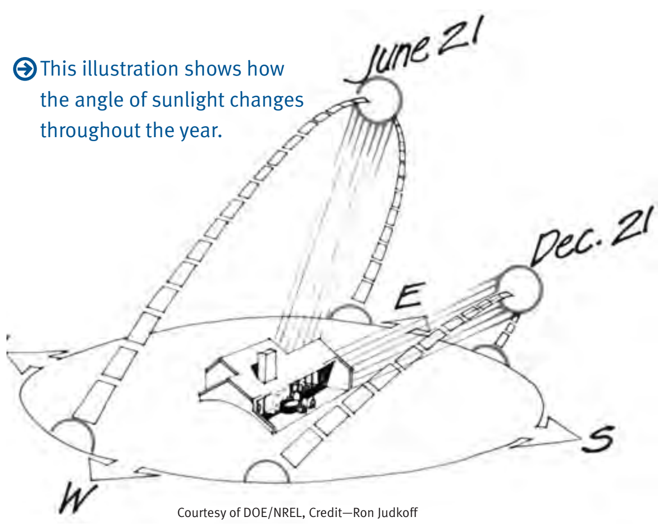
Paved surfaces such as driveways, walks, and patios can reflect heat and glare into buildings through glazings. Development standards should encourage impervious surfaces to be located and designed to minimize these effects.

Because solar building design requires operable windows for ventilation, the location of off-street parking is important. Large parking facilities can be a detriment to indoor air quality if vehicle exhaust is allowed to enter the building through windows or vents. Development standards should keep parking areas away from operable windows and vents and ensure that these areas are located so that prevailing breezes do not carry exhaust into buildings.

Communities may wish to consider the use of overlay zones or planned unit development restrictions to ensure that solar access is adequate. In some instances, it might be possible to apply the principles of form-based codes, although that option needs careful study to determine if it would be feasible.

Aesthetics need not be an issue in solar building design. There is sometimes a preconceived belief that buildings designed or renovated to use solar are "odd" in appearance. This is a misperception. Collectors needed for active solar systems can be roof-integrated and the photovoltaic systems can function as the skin of the building, as roof shingles or standing seam roofing, as glazing for atria and covered walkways, or be integrated into building overhangs or awnings. As for passive solar buildings, they can be of any architectural style. There are no special panels or other special details that announce that a building is passive solar. All its components or elements are designed as an integral whole beginning at the predesign stage.

This illustration shows how the angle of sunlight changes throughout the year.



Courtesy of DOE/NREL, Credit—Ron Judkoff

As more jurisdictions reference HERS Home Energy Rating Systems) or LEED (Leadership in Energy and Environmental Design) in their building codes, they will need to ascertain the extent to which their modified building codes are in agreement with their land-use controls.

CONCLUSIONS

The land-use control considerations outlined above not only are essential to provide for future energy needs and as means to limit global-warming emissions, they need to be looked at as a way to improve the local (i.e., micro) balance of payments. When less money goes to remote power companies, more of that money can remain in the local economy. And the adoption and enforcement of solar access controls provide the proper environment for the creation of new job skills and employment options for residents. According to a study by the University of California, Berkeley, as many as 1.9 million jobs can be created by 2020. The American Solar Energy Society's study projects 4.5 million jobs by 2030 across all regions and sectors of the economy, with the largest growth occurring in construction, farming, and professional services. After all, like energy management, economic development is also an integral part of local planning.

Unfortunately, few cities or counties have recognized the need for solar access requirements. For those that have, the steps taken tend to be very limited. Most cities and counties have limited the focus to subdivision regulations, and have not recognized the need to also adjust zoning standards. Even existing development can use whole-building solar design concepts when renovating. Thus, development standards need to provide for solar design options in developed areas. Because solar design is location-specific, no community's standards should be exactly the same as another's, though all need to address the factors outlined above. Further, even in a given geographical region, there will need to be differences in the specifics of a standard. For example, Denver's requirements and those of Evergreen, Colorado, which is at a higher elevation, will have different provisions.

Some communities have encouraged the use of easements to protect solar access. While these legal mechanisms will work, it is more efficient and beneficial to have requirements that apply to all properties. For a community to reduce its demand for energy, greater benefit will occur when all development and renovation decisions recognize and provide for solar access. This statement is also true in southern climates. Contrary to standard belief, even communities in places like Florida and Arizona can benefit by developing land-use controls that require solar access for the building, as well as for the solar hot water and PV panels. In the sunny Southern states the peak energy demand is during wintertime cold spells, not during summer heat waves as in the North.

Finally, as more jurisdictions reference HERS (Home Energy Rating Systems) or LEED (Leadership in Energy and Environmental Design) in their building codes, they will need to ascertain the extent to which their modified building codes are in agreement with their land-use controls.

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Oberlin College's Adam Joseph Lewis Center for Environmental Studies has 4,682 square feet of photovoltaic panels, closed-loop geothermal wells that provide heating and cooling, daylighting, and an engineered wastewater treatment system modeled on natural wetland ecosystems. Photo by Robb Williamson: www.williamsonimages.com. Design concept by Lisa Barton.

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Solar Access: Recommendations for the City and County of Denver

Prepared for the City and County of Denver, Colorado

Prepared by Hannah Muller,
U.S. Department of Energy Solar Energy Technologies Program

March 2009

THE IMPORTANCE OF SOLAR ACCESS

The City and County of Denver has committed to investing in clean energy sources to spur economic development and meet environmental and climate change goals. With over 300 days of sun per year, Denver is rich in solar resources. This report discusses how Denver can maximize opportunities for harnessing the sun's energy through a set of solar access ordinances and enforcement guidelines to aid property owners in their efforts to install solar energy systems, as well as protect the investment of individual property owners.

The sustainability review of the proposed changes to Denver's Zoning Code completed by Doug Farr & Associates in November 2008 determined that solar access is one of the top two issues that Denver should address within its 2009 Zoning Update. Without a set of well-coordinated solar access laws, Denver will face conflicts between stated City priorities, such as higher density development, tree preservation, and renewable energy adoption. By logically incorporating solar energy considerations into zoning codes and ordinances, Denver can clarify the responsibilities of various parties, achieve balance between City priorities, and avoid costly and time-consuming lawsuits.

NATIONAL CONTEXT

As with most land-use related matters, solar access laws have traditionally been enacted at the state and local level. Many states passed solar access laws in the 1970s; currently, 34 states (including Colorado) and about a dozen municipalities have some form of solar access law. Colorado's solar access laws prohibit residential covenants that restrict solar access (with exceptions), and allow property owners to agree voluntarily to solar easements with their neighbors[1].

As solar energy systems become more affordable and available to mainstream property owners, solar access is re-emerging as a regulatory area in need of clarification and coordinated, thoughtful enforcement. At least 15 of the 25 major U.S. cities participating in the U.S. Department of Energy's Solar America Cities program are in the process of reviewing their solar access laws. The Solar America Board of Codes and Standards published a report in October 2008 reviewing the status of solar access laws nationwide, and recommended a model state statute and best practices for local governments, many of which are referenced in this paper.

UNDERSTANDING SOLAR ACCESS

In order to harness the sun's energy, a property owner must have access to sunlight, and the right to install a solar energy system that converts sunlight into useable energy[i]. Accordingly, consideration of solar access should be separated into two categories: *solar easements*, which deal with access to sunlight, and *solar rights,* which deal with the right to install a solar energy system.

Solar Easements

Solar easements are legal agreements that protect access to sunlight on a given property. Solar easements are necessary because U.S. courts have held that there is no common law right to sunlight. This means that if the sunlight falling on a property is disturbed by another party, the property owner has no cause of action for nuisance, damages, or injunctive relief[2]. Currently, in Denver, a property owner could invest $30,000 in a solar energy system, only to have that system rendered nearly useless when a neighbor builds a second story addition or lets nearby trees grow to shade the solar system.

In order for a property owner to protect solar access on their property, they must obtain a solar easement. Colorado state law allows property owners to agree voluntarily to solar easements with their neighbors. In most of the U.S., including Denver, a property owner must actively pursue a solar easement. This typically consists of retaining a lawyer to draft the easement document, obtaining the signatures of adjacent property owners approving the easement, and ensuring that the easement is properly recorded in public records. Easement terms vary, but typically the neighbors commit to not building any structure or installing any landscaping that would block the sunlight falling on the property with the easement. Under this process, one unsupportive neighbor can prevent a property owner from obtaining an effective solar easement.

Solar easements can be creatively negotiated to have flexible conditions and terms. For example, easements can be written to cover only certain areas of a property, or to allow a certain percentage of shading from neighboring structures or landscaping. Easements may also contain provisions requiring financial compensation if excess shading occurs. This flexibility allows easements to effectively protect solar energy system owners without overly limiting the activities of neighboring property owners. Once created, the easement is attached to the property deed and generally stays with the property at sale.

Voluntary solar easements as a mechanism to protect solar access have several shortcomings. They require the property owner to be aware of the importance and availability of an easement, and have the time and money to work with a lawyer, neighbors, and the local government to develop and record the easement. Even an educated and persistent property owner can be thwarted by an unsupportive neighbor. And should a conflict arise where a neighbor is accused of violating a solar easement, enforcement options are generally limited to a costly and time-consuming personal lawsuit.

Local governments can take steps to improve the solar easement process, such as tying easements to solar system permits, and creating enforcement mechanisms such as fees levied on any property owner in violation of a recorded easement. More detailed recommendations are provided below.

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[i] This paper discusses solar access as it relates to active solar energy systems such as photovoltaics, solar water heaters, and solar thermal space heating and cooling. Passive solar energy systems such as south facing windows are also an effective way to use the sun's energy to light and heat a building; however, legislating access for passive solar is a complicated proposition. As discussed below, solar easements offer some protection for property owners interested in passive solar.

Solar Rights
Access to sunlight does no good if a property owner is prohibited from installing a solar energy system on their property by a restrictive covenant of a homeowners association or a local ordinance. Solar rights statutes and ordinances protect the rights of property owners to install solar energy systems.

Most homeowners associations (HOAs) have a set of covenants and restrictions that are intended to maintain certain characteristics of the community. These restrictions often focus on aesthetics. Through its bylaws, an HOA can directly or indirectly prohibit the installation of solar energy systems. Examples of indirect prohibition include height restrictions or restrictions on modifications to street-facing roofs.

A restrictive covenant that effectively prohibits the use of solar will not be upheld where state or local law expressly provides otherwise through a solar rights statute or ordinance[2]. Current Colorado law does limit the ability of HOAs to restrict solar energy systems; HOAs may only enforce restrictions that do not significantly increase the cost of installing or operating the system. The City of Denver does not currently have any ordinances that provide property owners with additional solar rights beyond what is specified in state law.

While residential property owners are given some solar rights under Colorado law, it is easy to imagine how these rights could be improperly exercised or contested in practice. The City of Denver therefore has a role to play in helping its residents understand their solar rights. This can be accomplished through a combination of outreach, clarifying ordinances, and enforcement; specific recommendations are provided below.

In addition to HOAs, local governments can also effectively prohibit the installation of solar systems through zoning codes and ordinances such as height restrictions and historic structure protections. Denver's codes and ordinances should be reviewed with an eye toward potential modifications that would retain the original intent of the ordinance without having the side effect of prohibiting solar system installation. Specific examples of how to incorporate solar exemptions or flexibility into existing code are provided below.

City staff should note that solar systems require adequate rooftop square footage in order to serve a reasonable portion of a building's energy load. For this reason, solar systems should be permitted on primary dwelling units, in addition to accessory dwelling units.

BEST PRACTICES FOR PROMOTING AND PROTECTING SOLAR ACCESS

Offer Solar Access Permits *(City of Boulder, CO; City of Ashland, OR)*
One way to protect a property owner's investment in a solar system is to tie the solar permitting process to a process of creating a solar easement. Solar systems typically require a permit from a local government authority, and by incorporating a solar easement into the permitting process, paperwork is minimized and solar systems are more likely to be protected. The cities of Boulder, CO and Ashland, OR have implemented solar access permit schemes that involve granting easements. A solar system registry that uses GIS mapping can assist in tracking solar installations.

The ordinance providing for the special permit process can address the following:

- What constitutes an impermissible interference with the right to direct sunlight granted by a solar access permit and how to regulate growing vegetation that may interfere with such right.
- Standards for the issuance of solar access permits, balancing the need of solar energy systems for direct sunlight with the right of neighboring property owners to the reasonable use of their property within other zoning restrictions.

- A process for issuance of solar access permits including, but not limited to, notification of affected neighboring property owners, opportunity for a hearing, appeal process and recordation of such permits on burdened and benefited property deeds.
- Enforcement mechanisms, such as fees levied on parties who violate the terms of an easement[2].

Create Solar System Registry *(County of Santa Cruz, CA)*
A solar system registry and map, in addition to being a useful tool for tracking solar energy adoption within a city, can help inform and expedite enforcement of solar access laws. Online mapping software can show the location of every solar energy system within a city, alerting contractors and city planners to the need to consider the impacts of development of a neighboring parcel.

Revise Local Ordinances Posing Unintended Obstacles *(City of Los Angeles, CA; City of Sacramento, CA)*
Careful review of zoning codes and ordinances can reveal areas where a well-intended ordinance has inadvertently restricted 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.

For example, the City of Los Angeles exempts solar systems from standard building height limitations, but requires that for each foot of additional height, the solar system must be set back from the roof edge by an additional foot. The City of Sacramento is encouraging urban forestry, but requires that city planners responsible for tree planting in residential areas consider solar access and minimize rooftop shading. The City of Gainesville, Florida protects certain species of trees but allows the removal or relocation of regulated trees if they are preventing the installation of a solar system.

In some cases, codes and ordinances related to aesthetics and historic structures can effectively prohibit installation of solar systems. Regulations based solely on aesthetic considerations will not stand in court unless they bear a reasonable relation to public welfare. In order to avoid court proceedings, Denver can review its aesthetic-related ordinances to ensure that they consider the benefit provided by solar systems and aim for a compromise that preserves aesthetics while allowing for clean energy production.

Set Standards for New Construction *(City of Sacramento, CA; City of Sebastopol, CA; Marin County, CA)*
Solar access can often be more easily addressed for new construction than existing construction. Local governments have developed an array of zoning ordinances for new construction that protect solar access and solar rights, including:

- Require east-west street and building orientation (typically within 30 degrees of the east-west axis)
- Require landscaping that complements solar energy systems
- Require dedication of solar easements for all newly constructed buildings

In addition to protecting access to sunlight for solar energy systems, these regulations also facilitate greater use of passive solar space heating and lighting, one of the most efficient ways to heat and light a building.

Require Clear Homeowners Association Rules *(State of Hawaii)*
A state or local government can require homeowners associations (HOAs) to establish rules for solar system installations within their community. By spelling out the exact aesthetic requirements and necessary approvals and distributing this information to its members, the HOA can avoid costly lawsuits. Because an HOA may not necessarily be equipped to develop such rules on its own, the state or local government should provide guidance to HOAs that explains state and local solar access laws, and suggests some parameters the HOAs may wish to follow.

ADDITIONAL RECOMMENDATIONS FOR DENVER

Consider Solar Access for Commercial Properties

The vast majority of solar access laws on the books relate to residential properties. However, commercial properties are often optimal sites for solar energy installations; they tend to have large flat roof areas and high energy loads. Furthermore, a commercial size solar energy system is a significant investment that is currently not protected by any state or local ordinances. If a car dealership installs a $500,000 solar system, and a year later another developer constructs a 10 story condo complex that shades the dealership's solar panels, the dealership has no recourse.

Many of the solar easement and solar rights provisions granted to residential properties can and should be made available to commercial properties.

Conduct Outreach and Provide an Information Center

Solar access is a complicated issue with which few people are familiar. As an increasing number of residents and businesses turn to solar as a clean, reliable energy source, more questions will arise about solar access and the responsibilities and liabilities of various parties. The best way to avoid lengthy and costly lawsuits involving property owners, the local government, and HOAs is to develop a website and conduct outreach to educate property owners, HOAs, contractors, and city officials about solar access laws. The City of Denver should identify a solar access point of contact within city government, to whom all inquiries can be directed.

THE BOTTOM LINE

Solar access will become a prominent issue over the next five to ten years as solar system costs drop and become competitive with conventional electricity rates. Thousands of Denver residents and businesses will turn to solar energy to power their homes and commercial buildings. Denver needs to recognize the great opportunities and complications of distributed generation such as rooftop solar, and do its part to facilitate a smooth transition to cleaner, more secure energy production. The City of Denver has an opportunity to comprehensively address solar access and ensure that its residents and businesses can take advantage of the city's sunny weather and power their homes and buildings with clean, reliable solar energy

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Solar Energy and Land-Use Regulation

By Brian Ross and Suzanne Sutro Rhees, AICP

As solar energy gains a foothold as a source of energy for our homes and businesses, communities face multiple questions as they incorporate solar energy installations into their development regulations.

While seemingly straightforward, putting solar panels on a roof raises a host of questions as to how a solar energy system fits into a typical set of land-use categories. Is a rooftop solar installation merely a piece of equipment, like an air conditioner or water heater, that goes with the home or business? Is the solar installation a separate use from the primary building, to be regulated under the provisions of accessory uses? What about a ground or pole-mounted system? Because solar electric energy systems produce power like a generator or a power plant, should these systems be regulated like other power generators? Can different types of solar systems be different types of land uses—one a piece of equipment, another a power plant?

SOLAR AMERICA CITIES

The U.S. Department of Energy (DOE) is partnering with 26 cities across the nation to investigate and test solar energy market transformation initiatives. DOE created the Solar America Cities program to identify and remove barriers to the use of solar energy in urban areas. Solar energy is expected to reach "grid parity" within the next five to 10 years (when solar energy costs become equivalent to the cost of electricity on the electric grid). Because the cost of grid-based electricity varies by utility, customer type, and time of day and season, grid parity refers to a wide range of prices. The Solar America Cities program uses the participating cities as laboratories to test how local governments can remove barriers to solar investment and installation, recognizing regional differences in solar resources, building types, regulatory structures, and financing tools.

Brian Ross

This photo shows a typical two-panel solar thermal system, flush-mounted on the roof and visible from the street, with no setback from the roof edge on three sides.

The cities of Minneapolis and St. Paul were designated as Solar Cities in 2008. The two cities had only a dozen solar installations in 2008, but are looking ahead to a transformation of local markets that could produce hundreds of system installations annually. How could their regulatory and permitting systems handle hundreds of solar systems each year? It became clear that neither city's land-use code provided sufficient guidance as to how to incorporate solar energy systems in the development process.

SOLAR ENERGY REGULATIONS IN MINNEAPOLIS AND ST. PAUL

When the cities of Minneapolis and St. Paul were awarded a joint Solar America Cities grant in 2008, neither had addressed solar energy installations in their development regulations in any substantive way. Both were national leaders in jointly adopting a CO_2 reduction plan well over a decade ago, and both have adopted policies as part of their comprehensive plans that support the use of renewable energy, including solar energy. But neither city's regulations had kept pace with their plans and policies.

The cities were required by the regional planning authority, the Metropolitan Council, to address solar access in comprehensive plans, but the policy requirement had no complement for development regulation. Minneapolis had created a solar access ordinance in the 1970s, but rescinded it as unworkable. However, the city's code does identify solar energy installations as an allowed accessory use in all districts. The St. Paul zoning code does not separately list solar installations as a permitted accessory use, but solar systems are treated similarly to rooftop mechanical equipment such as air conditioners and ventilation equipment. In 2009 St. Paul's citywide building design standard was amended to change the screening requirement for mechanical equipment in order to avoid undue restrictions on solar equipment. Meanwhile, the city's development code is largely silent on solar energy, although the few installations are treated as permitted accessory uses. The code also allows solar access as a criterion for a hardship in a variance case.

Solar installations were still unusual in the two cities as they began participation in the Solar America Cities program, with fewer than 50 installations over the last three years.

ASK THE AUTHOR JOIN US ONLINE!

Go online during the month of November to participate in our "Ask the Author" forum, an interactive feature of Zoning Practice. *Brian Ross and Suzanne Sutro Rhees, AICP, will be available to answer questions about this article. Go to the APA website at www.planning.org and follow the links to the Ask the Author section. From there, just submit your questions about the article using the e-mail link. The authors will reply, and* Zoning Practice *will post the answers cumulatively on the website for the benefit of all subscribers. This feature will be available for selected issues of* Zoning Practice *at announced times. After each online discussion is closed, the answers will be saved in an online archive available through the APA* Zoning Practice *web pages.*

About the Authors

Brian Ross is a principal at CR Planning, Inc., and has served as the Minneapolis-St. Paul Solar City Coordinator for the last two years. He has worked in land-use and energy policy for over two decades, assisting local governments, state agencies, and consumer and environmental advocates. Ross was the primary author of Minnesota's model ordinances for sustainable development (*From Policy to Reality*) and was a major contributor to Minnesota's guidebook on sustainable comprehensive planning, *Under Construction*.

Suzanne Sutro Rhees, AICP, is a principal planner with the Minnesota Department of Natural Resources as well as a freelance writer and zoning consultant. She worked with Brian Ross on the survey of Solar America cities and was a contributor to Minnesota's model ordinances for sustainable development.

The Solar Cities program, however, sets a goal of getting ahead of potential barriers to solar installations. Even with a slow ramp-up of installations, both cities have discovered that their development review process does not provide clear direction or standards to address solar installations. With several new solar incentive programs coming online in 2010 (both the utility and the state are offering substantial rebates for solar investments), the stage is set for a potentially large increase in the number of installations.

In both cities, the zoning codes' silence (or limited guidance) on how solar installations should or would be handled in regard to height and coverage limits, regulations on primary and accessory land uses, and visual and safety impacts on- and off-site had already raised issues of interpreting differing policy and regulatory goals. While a few solar installations can be handled on a case-by-case basis, hundreds of solar installations would require more specific guidance for regulatory staff, solar installers, and city residents and businesses.

New solar systems could come in a variety of sizes and configurations, from small residential systems to acres of rooftop on institutional and industrial buildings, from building-mounted systems to pole and ground-mount systems. The systems could be installed in commercial, industrial, and residential zoning districts. Solar systems would likely be proposed for downtown buildings, within residential and commercial areas, in historic districts and areas covered by special design standards, and in the Mississippi River overlay district that runs through both cities.

To shed some light on these issues for the cities' regulatory offices, the Minneapolis–St. Paul Solar Cities program undertook a survey of the 24 other cities in the Solar America Cities program that were at various stages in the development of solar energy. Some were seeing hundreds of installations and measuring total solar capacity in megawatts (MW) of production; others were similar to Minneapolis and St. Paul in seeing the first kilowatts (kW) of solar capacity installed.

SURVEY METHOD

We contacted Solar City coordinators and city staff people listed as contacts though the Solar America City website (www.solaramericacities.energy.gov), e-mailed questions, and conducted e-mail and telephone follow-up. We conducted online searches of zoning ordinances and development regulations, looking for any mention of solar energy. In addition, we gathered information from DOE and the national energy labs (Sandia National Lab, National Renewable Energy Lab) and conducted ad hoc reviews of solar land-use conflicts in communities that were not participating in the Solar America Cities program.

The amount information available on city websites regarding solar and energy assistance programs varies widely. Some provide resources such as fact sheets and

Brian Ross

This accessory use pole-mounted tracking solar electric panel on a commercial lot is at the edge of a residential neighborhood.

ANECDOTES AND EXAMPLES

A solar energy professional in Utah decided to walk the talk and install a photovoltaic system on his property. Trees on his and surrounding lots limited reasonable solar access to the front yard. The home owner checked with his local permitting officials and determined that accessory structures were not allowed in front yards, but small structures associated with gardens, such as a pergola or similar decorative structures, were allowed in front yards provided the footprint was less than 120 square feet and the structure no more than one story in height.

The home owner designed a pergola structure with high efficiency panels flush-mounted on the sloped rafter to meet aesthetic standards. He submitted the application, which was rejected as a violation of the land development zoning code. Because the pergola was connected to the house via an underground electric circuit, the structure was now considered to be accessory to the primary use, and therefore not allowed in the front yard, even though its appearance was identical to an allowed pergola.

Tucson's Solar America Cities program worked with the city's zoning department to ensure that solar accessory structures were allowed in the zoning code. When, however, they developed a proposal to use closed landfill sites within the city as "solar farms," they discovered that the zoning code required a rezoning to industrial, because the solar system was a primary use and under the code was defined as a generating system (grouped with combustion electric generating plants). Developers were unwilling to move ahead with this scenario, fearing that neighbors to the site would adamantly oppose the rezoning, effectively preventing the use of these sites for solar energy production. Ultimately Tucson defined a new primary land use (renewable energy generation), modified its previous definition of "generating system" to exclude most renewable fuels, modified its zoning ordinance to identify where renewable energy generation was a permitted primary use, and established procedures for notice and hearings to allow for development of such systems in most zones.

St. John's College in Stearns County, Minnesota, entered into an agreement with Best Power International to build and operate a 400 kW solar farm on cropland adjacent to college. The college approached the county for zoning approval. The county zoning code was silent on solar energy as a land use. County officials, while enthusiastic about the innovation in their county, could not approve the project without a rezoning process that defined solar as an allowed land use in the zoning district and set performance and submittal requirements. A new ordinance was adopted that defines solar farms as a conditional use in several districts and sets design and performance standards. The plant is up and running.

The City of Roseville, Minnesota, zoning code was silent regarding how solar installations are treated as either accessory or primary uses. A home owner hired an installer to put a solar electric system on the backyard side of his roof. A few blocks away, an unpermitted solar installation on a rack that was higher than the roof peak has generated a number of complaints from neighbors. The city denied the building permit for the new system because solar systems were not permitted under the current zoning code, and a new code would not be completed until next year's building season. The solar installer was able to work with the city to develop and adopt an interim policy so that the installation could proceed.

permitting guides, while others—generally the smaller cities—simply provide the name of a contact person. In some cases, solar project assistance is provided largely by the local utility or a nonprofit organization. For example, Austin, Texas, is partnering with Austin Energy, the local utility, while Milwaukee is working with the Midwest Renewable Energy Association.

Of the 24 cities in the program, about half responded in some manner, and 10 cities provided detailed responses. Many are focusing on market transformation efforts, such as training assistance to solar installers, support of solar manufacturing businesses, direct design assistance to home owners, and various financing mechanisms, rather than examining permitting or administrative barriers. As described below, some cities have made substantial progress toward removing regulatory barriers and creating incentives within the permitting process.

SURVEY FINDINGS

As of the time of the survey (2009) we found that only about a quarter of the cities had updated their ordinances to explicitly recognize solar equipment as a specific type of accessory structure or to recognize free-standing installations as a use. Even fewer cities provided any regulatory exceptions or incentives for solar installations.

We reviewed each city's ordinances and asked the renewable energy program manager or zoning administrator how they regulated the following types of systems:

- Building-mounted systems, either photovoltaic or thermal (hot water) panels
- Building-integrated systems, usually thin film photovoltaic applications such as solar shingles
- Pole- or ground-mount solar systems
- Large-scale pole- or ground-mount systems (solar farms) where solar is the primary land use rather than an accessory use or a component of the primary use

The first three types of uses are usually accessory to the principal use on the property, whether that use is a house, a commercial building, or a parking lot. The management of accessory uses and structures can be general ("no incursion into required yards") or specific to the use or structure. We asked the cities whether they treated solar systems as an accessory use, as mechanical equipment, as a separate permitted use, or as some other land-use classification.

Placement of equipment: setbacks, height limits, and lot coverage

Most of the cities surveyed treat solar equipment as a nonspecified accessory use or as a type of mechanical equipment. While this approach may not pose problems, some ordinances require screening of mechanical equipment, which could impede solar access. Requiring pole- or ground-mount systems to meet building setbacks could restrict their placement from locations that might offer the best solar access. Lot coverage ratios could similarly prevent or limit pole- or ground-mount installations if such installations were treated as simply another accessory structure, or could result in installations out of scale with the other structures if simply exempted from coverage ratios.

Berkeley's zoning code allows solar energy equipment to project into required yard setbacks with an administrative use permit, if the zoning office finds that the modification is necessary for the effective use of the equipment and that the principal building meets city standards for energy conservation. In Portland, Oregon, solar in-

Meet Minneapolis

➔ This large (600 kW) commercial solar system covers almost five acres of rooftop as an accessory use at the Minneapolis Convention Center.

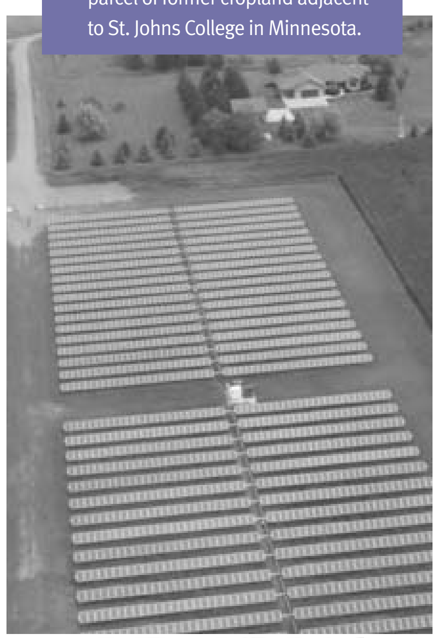
stallations that are six feet or less in height may be placed in setbacks. Installations taller than six feet may be allowed within setbacks through a land-use review adjustment process. In San Diego solar installations are permitted within rear and side yard setbacks. In Tucson, Arizona, architectural features that are part of a solar energy system may project up to four feet into required front yard setbacks. Features include overhangs, moveable insulating walls and roofs, detached solar collectors, reflectors, and piping.

Building height limits can also restrict the placement of solar equipment. Photovoltaic shingles or roof tiles are clearly a part of the roof itself, but photovoltaic or thermal panels will protrude above the roof plane, and potentially above the zoning district's height limit. A number of cities allow solar equipment to exceed height limits to some degree. In Portland the height of solar panels is not calculated for flush-mounted installations (no more than 18 inches from the roof surface to the top of the panel) on a pitched roof, unless the panels will extend above the highest ridge of the roof. In Sacramento, California, solar energy systems may exceed building height requirements by up to 20 percent, as well as projecting four feet into yard setbacks.

Cities with zoning ordinances that restrict impervious coverage or building coverage on a lot typically do not exempt freestanding solar installations from coverage limits, although we found a few exceptions. In San Antonio, Texas, the surface area of ground-mounted collector arrays does not count toward impervious coverage limits, but the mounting poles, footings, and other improvements on the site do. In Santa Rosa, California, pole- and ground-mounted systems are not counted toward impervious coverage.

Seattle has one of the more comprehensive approaches to the placement of solar equipment. Solar collectors are defined in the city's code as "any device used to collect direct sunlight for use in the heating or cooling of a structure, domestic hot water, or swimming pool, or the generation of electricity." Collectors are permitted by right as accessory uses, and may be placed within side and rear yards with setbacks that vary by district. Solar collectors within yards are not counted toward lot coverage if all setback and height requirements are met.

➔ This 400 kW solar installation is the primary land use on a five-acre parcel of former cropland adjacent to St. Johns College in Minnesota.



Westwood Professional Services

Seattle's code also provides flexible height limits for roof-mounted solar systems. These vary by district; in low-density residential districts solar collectors may exceed the district height limit by four feet, provided that the total height from existing grade to the top of the collector does not exceed the height limit by more than nine feet. In multifamily and nonresidential districts height allowances are greater; in most nonresidential districts solar collectors may extend up to 15 feet above the maximum height limit, so long as the combined total coverage of the rooftop features do not exceed 25 percent of the roof area when typical features (such as elevator penthouses) are present.

Large systems as primary land uses

While domestic-scale solar installations are becoming more widespread, larger utility-scale installations (excluding rooftop installations that are accessory to the primary use) are still rare within the boundaries of most of the Solar Cities. Few cities recognize or distinguish solar power production from any other type of power generation. One can argue that a solar array is a less intensive use than a typical coal- or gas-fired power plant, and could be appropriate in, say, an agricultural district or a business park. However, if large freestanding solar installations are treated only as industrial uses, their placement will largely be limited to industrial districts.

In most zoning codes, power generation is a use typically allowed only in industrial districts. For example, in Salt Lake City, electric generating facilities are permitted within manufacturing districts within 2,640 feet of an existing 138 kV or larger electric power transmission line. Solar farms would similarly be limited to those areas unless defined as a distinct land use from other power production. Such a case recently occurred in Tucson, where proposed solar farm installations on closed landfills were denied a zoning permit because the sites were not zoned industrial.

One city that does distinguish solar from other power generation is San Antonio, where a photovoltaic "solar farm" use is a permitted use in agricultural and industrial zoning districts. Site plan review is required, along with setbacks and buffering if the solar farm abuts single-family residential uses. In Stearns County, in nonurban Minnesota, similarly defined solar farms are conditional uses in several nonindustrial districts, including agricultural districts, provided other siting standards are met. Stearns County was the location for the first solar farm in Minnesota and needed a zoning code modification in order for the project to proceed.

Solar installations on nonconforming structures

Many municipal ordinances limit the degree to which a nonconforming structure can be improved before needing to be brought into compliance with current zoning requirements. Such a requirement could prevent older, nonconforming buildings from installing solar systems (which is sometimes the point of such requirements, but may be unreasonable in other cases). Does the addition of a solar installation to a nonconforming structure (nonconforming as to lot area, setback, lot coverage, or other features) constitute an improvement or expansion?

Responses from Solar Cities vary. For example, in Denver, building-mounted systems are not considered an improvement to nonconforming structures unless they alter the building structure or are not considered flush-mounted and exceed height limits. Madison, Wisconsin, uses a similar interpretation. However, in Orlando, Florida, and Santa Rosa, California, building-mounted systems are considered an improvement. Minneapolis and St. Paul both consider the installation of a solar system to be an improvement to the building, potentially requiring building nonconformities to be addressed, although the cities are flexible regarding mechanical system installation on nonconforming uses.

Permitting and plan review

Residential-scale solar installations must meet electrical and plumbing codes, and most cities require building permits, as do Minneapolis and St. Paul. Most of the cities surveyed do not require a separate zoning permit for an accessory system, although most do require zoning review within the permitting process. A number of the Solar Cities are working to expedite or streamline the building permitting process for solar installations, particularly for residential or small commercial systems (small systems being defined as having somewhere between 4 and 10 kW of capacity). Minneapolis and St. Paul have recently created a permitting guidance document for residential solar electric systems, removing uncertainty about when structural engineering is required and what information is needed to acquire a permit in a single trip.

Seattle has developed a client assistance memo that guides the applicant through permit and land-use requirements (the setback and height requirements mentioned above), design and installation considerations, interconnection requirements, choosing a contractor, and financial incentives.

Portland offers a program guide for solar water heating and photovoltaic electric generators installed on one- or two-family dwellings that outlines permitting requirements and identifies situations in which additional design review may be required.

San Francisco has established expedited permitting requirements for solar photovoltaic systems; planning department review is waived except when the system creates or is part of a vertical or horizontal building addition. Electrical permits are the only ones required; building permits, building permit fees, and building inspections are waived in most cases. Site plans are only required for systems producing over four kW output.

Tucson has established a credit incentive program that will waive a portion or all of the permit fees on a new building or when retrofitting existing buildings with a qualifying solar energy system, up to a maximum of $1,000 or the actual amount of the permit fee, whichever is less.

Sacramento waives permit fees for solar photovoltaic systems and solar water heaters installed on existing residential buildings.

SOLAR ACCESS

Neither the survey nor this article directly addresses issues of solar access. In reviewing the literature on solar energy land use, solar access had been assessed in multiple publications. Zoning tools to address solar access issues related solar access laws and provisions and solar design and subdivision are covered in the April 2010 issue of *Zoning Practice* ("Solar Access: Using the Environment in Building Design"); a summary of solar access tools addressed by the Solar American Board of Codes and Standards (www.solarabcs.org).

A *University of Illinois Law Review* study assessed a number of solar access tools available to local government: See Rule, Troy A. 2009. "Shadows on the Cathedral: Solar Access Laws in a Different Light." University of Missouri School of Law Legal Studies Research Paper No. 2009-24; *University of Illinois Law Review*, Vol. 2010, p. 851.

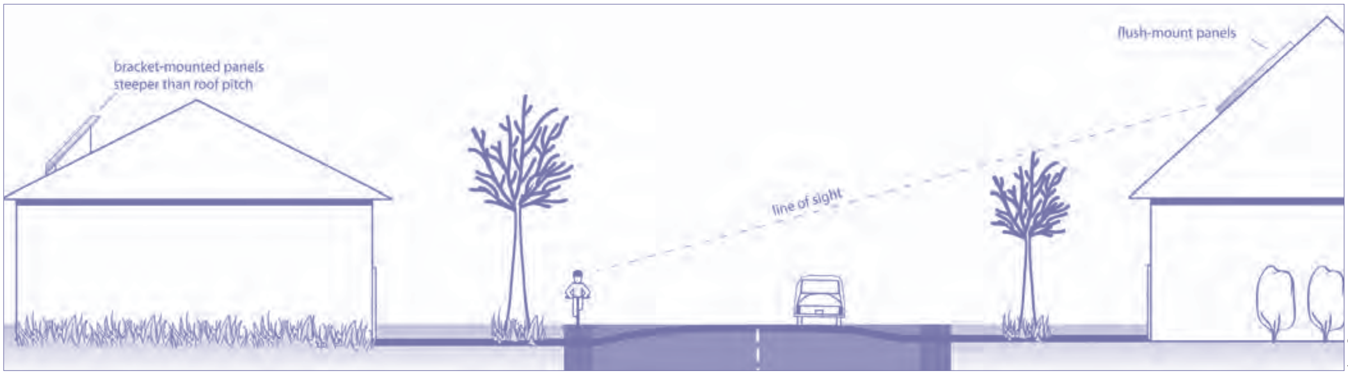
PREEMPTIVE STATE LEGISLATION

Several states have adopted legislation that preempts the ability of local governments to regulate solar and wind energy facilities. The Solar Cities in California have the greatest number of installations and the most developed solar energy markets in the nation, but have addressed many of the potential land-use issues via state legislation rather than local decision making. For instance, the California Solar Rights Act (Calif. Civil Code 714) limits local government restrictions on solar installations to "reasonable restrictions . . . that do not significantly increase the cost of the system or significantly decrease its efficiency of specified performance, or that allow for an alternative system of comparable cost, efficiency, and energy conservation benefits." The act also requires local governments to use a ministerial or administrative application review, such as Berkeley's administrative use permit referenced above, instead of a discretionary process.

Wisconsin is closer to Minnesota in regard to the size and maturity of the solar energy market. Wisconsin has also established several laws that constrain local government authority to regulate solar and wind energy installations unless the restriction:

- serves to preserve or protect public health or safety,
- does not significantly increase the cost of the system or decrease its efficiency, and
- allows for an alternative system of comparable cost and efficiency.

State laws like Wisconsin's can create unintended consequences because of their broad scope. For instance, the Wisconsin law makes it difficult if not impossible for local



Minnesota Pollution Control Agency

The new model solar energy ordinance published in *From Policy to Reality: Updated Model Ordinances for Sustainable Development* includes a design standard illustration for pitched-roof solar installations.

governments to establish any siting standards for solar or wind installations, particularly in historic or design review districts. In 2009, a new law was passed directing the Wisconsin Public Service Commission to establish statewide siting rules for wind energy in order to address the conflict between promotion of renewable energy and consideration of other reasonable land use and development goals.

Minnesota has no preemptive law regarding local land-use regulation. The Minnesota state building code is a "max/min" code that preempts most local building code modifications, but land-use regulation remains the prerogative of local government. Some discussion of statewide land-use standards has taken place in regard to wind energy installations, but no preemption of local solar land-use regulation has been seriously considered.

Minnesota does, however, have state law enabling local governments to use "solar easements" to protect solar access, and has very recently enabled local governments to use bonding and property tax assessments for leveraging private sector solar investment. The solar easement statute (Minn. Statute Section 500.30) has the greatest relationship to land-use regulation, offering direction on how to address solar access issues, one of the potential land-use conflicts that can arise with broad solar investment. The statute does not, however, solve the solar access issue, but merely offers a potential solution by enabling solar easements to be purchased from adjoining property owners.

CONCLUSIONS

Local government land-use regulation is designed to meet a variety of goals, including protecting safety and well-being, minimizing nuisances (perceived or real), and creating a mix of land uses that creates synergy rather than conflict. Promoting investment in renewable energy is a relatively new goal, and balancing renewable energy goals with the other myriad goals of land-use regulation can be a challenging issue.

> The cities with the most developed solar energy markets have state legislation that defines limits on local regulation, effectively addressing many of the land-use conflict issues at the state level.

The cities with the most developed solar energy markets, primarily in California, also have state legislation that defines limits on local regulation, effectively addressing many of the land-use conflict issues at the state level. In most states, however, solar energy land-use conflicts are left for local governments to address. Development standards that explicitly address solar as an allowed accessory use, such as lot coverage, height, setback, and roof setback, are a good place to begin encouraging investment in solar installations. The next step might be to create incentives, such as reduced setbacks, expedited permitting, or reduced permit fees, for solar installations. The most challenging issues may surface when local government are faced with large-scale solar farms that function as primary land uses. As energy production approaches this industrial scale, the potential for actual or perceived land-use conflicts is likely to increase.

Sunflowers, an Electric Garden, is a public art installation that uses solar panels to collect energy along a bike/ped trail in Austin, Texas. Cover image courtesy of David Newsom Photography; design concept by Lisa Barton.

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Site Design Strategies for Solar Access

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The Rocky Mountain Land Use Institute

Sustainable Community Development Code
Research Monologue Series:
Energy

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About the Research Monologue Series
The Sustainable Community Development Code, an initiative of the Rocky Mountain Land Use Institute, represents the next generation of local government development codes. Environmental, social, and economic sustainability are the central guiding principles of the code. Supporting research for the code is represented by a series of research monologues commissioned, presented and discussed at a symposium held at the University of Denver in September of 2007. RMLUI and the University of Denver's Sturm College of Law extend its gratitude to the authors of the papers who have provided their talents and work pro bono in the service of the mission of RMLUI and the stewardship of the creation.

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Cover photos: Left and center, "Taking the Lead in Building Production-Style Solar Homes", by Peter Hildebrandt, available online at ***http://www.distributedenergy.com/de_0503_taking.html*** (last accessed December 21, 2007); Right, U.S. Department of Energy, Building America Best Practices Series, High-Performance Home Technologies: Solar Thermal and Photovoltaic Systems, available online at http://www.eere.energy.gov/buildings/building_america/pdfs/41085.pdf (last accessed on December 21, 2007.)

I. Background

A great deal of attention has been placed on the role of sustainable building design and construction techniques in recent years. Many communities have adopted standards requiring compliance with programs such as The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™. The LEED system has become the nationally accepted benchmark for the design, construction, and operation of high performance green buildings. The program encourages the use of products and techniques to promote sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.[1]

Much less emphasis, however, has been placed on the role of site planning in a sustainable design program—and more specifically, on site design for solar access. The incorporation of both active and passive solar techniques are highlighted in any discussion of green building design, yet in order for either approach to be viable, they must have unobstructed solar access for a certain period of each day. Without careful consideration during the planning stages of a new neighborhood, future opportunities for the installation of active or passive features can be dramatically reduced or even eliminated altogether.

The planning, design, and development community is becoming more aware of the issue, however. This is evidenced, in part, by a pilot program recently kicked off by the U.S. Green Building Council (USGBC) entitled LEED for Neighborhood Development or LEED ND. LEED ND establishes a rating system that integrates the principles of smart growth, new urbanism, and green building into the first national standard for neighborhood design. The pilot program is currently undergoing evaluation and is anticipated to be officially launched in 2009. In its current form, the LEED ND program incorporates a section on Solar Orientation intended to, "achieve enhanced energy efficiency by creating the optimum conditions for the use of passive and active solar strategies." The section is one of twenty potential credits under the section entitled Green Construction & Technology.[2] While the provisions included represent an important step towards broader

Active Solar

Active solar systems use solar collectors and additional electricity to power pumps or fans to distribute the sun's energy. Heat is absorbed and transferred to another location for immediate heating or for storage for use later. The heat is transferred by circulating water, antifreeze or sometimes air.

Passive Solar

A "passive" solar house provides cooling and heating to keep the home comfortable without the use of mechanical equipment. This style of construction results in homes that respond to the environment.

At its simplest, passive cooling includes overhangs for south-facing windows, few windows on the west, shade trees, thermal mass and cross ventilation. Some of the same strategies that help to heat a home in the winter also cool it in the summer.

Source: Northeast Sustainable Energy Association; photo, The Garst House, Olympia, Washington.

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[1] U.S. Green Building Council, LEED Rating Systems, available online at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222 (last accessed December 21, 2007).

consideration for solar access, for now, their application is limited primarily to greenfield development and to the individual developers who choose to use them.

The level to which the incorporation of solar concepts is *advisory* vs. *mandatory* can weigh heavily on the results. As is the case with most design guidelines, merely "suggesting" that an applicant follow one or more guidelines typically creates uncertainty on both the parts of the applicant and the staff reviewing the proposal and can result in inconsistent outcomes. Incorporating standards that require the incorporation of solar concepts into zoning codes where they may be readily enforced is one approach that has been implemented in communities such as Ashland, Oregon; Fort Collins, Colorado; and San Francisco, California—to name a few. Examples of the types of standards that have been employed and additional communities that are using this approach are included in Section III of this chapter.

For the purposes of discussion, this paper contains references to two types of solar concepts:

"Solar access" refers to a building's ability to receive the benefits of the sun's rays without obstruction from neighboring buildings, structures, plants, and trees; and

"Solar site orientation" refers to situating a building to optimize exposure to the winter sun for passive heating and lighting, while reducing this exposure to the summer sun to minimize overheating.

Source: California Local Government Commission; photo, Tindall Homes, Legends at Mansfield, Princeton, New Jersey.

Zoning regulations can also play a role in inhibiting the implementation of solar concepts, sometimes inadvertently. This is particularly true in areas of a community with relatively rigid requirements, either because the area was built prior to the advent of solar technology—such as in a historic district—or because the area is part of a planned community that controls the appearance of development through a detailed set of covenants, conditions, and restrictions (CC& Rs). Regulations regarding roof pitch, yard depths, landscaping, reflective roof surfaces, and building height are just a few of the potential obstacles that may exist. Mechanisms for avoiding or removing these obstacles are addressed in Section III of this chapter.

Some states have passed statutes to limit the effect of restrictive covenants on solar energy: to date Colorado, Oregon, California, and Minnesota. For example, Colorado Revised Statute 38-30-168 limits the effect of restrictive covenants on solar energy by prohibiting covenants that restrict or prohibit solar energy devices based solely on aesthetics. Although reasonable aesthetic provisions may be applied at the local level or through a homeowner's association, they must not significantly increase the cost of the solar device. California's Solar Rights Act of 1978 allows for similar discretion at the local level. Both the authority granted local governments by these statutes and the extent to which local governments have acted upon them varies.

[2] U.S. Green Building Council, LEED Rating Systems, available online at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148 (last accessed December 21, 2007).

A recent article published by the Solar Energy Society of Canada, Inc., entitled *Ten Features of Successful Solar Policies*, highlights the role of local governments as one of the most important factors in the long term success of solar energy, stating— "Municipal policies are possibly the most important policies as they can lay the foundation for making solar technically possible." [3]

This paper includes an overview of the benefits of incorporating site design strategies for solar access at the local level as well as an overview of potential strategies and regulations that have proven effective in protecting solar access at the local level.

The State of California's 'Go Solar California!' website provides consumers a "one-stop shop" for information on rebates, tax credits, and incentives for solar electricity systems in California.

II. What are the Benefits of Adopting Solar Access Provisions at the Local Level?

Solar Access Provisions can be beneficial at a variety of levels. At a site planning level, organizing new development to achieve proper solar orientation can improve the energy efficiency of buildings on the site at little or no additional cost. When combined with other sustainable building techniques, the benefits of requiring and/or protecting solar access can be dramatic. For example, placing a building's long face on an east-west axis with a large percentage of its windows on the south side can reduce fuel consumption by up to 25%.[4] In its Solar Access Design Manual, the City of San Jose, California states that it found that proper solar orientation of new homes built in the San Jose area produced total energy savings of 11 to 16.5 percent—with up to 40 percent savings from space cooling.[5]

Buildings realize even greater energy savings by integrating other passive solar design elements, such as light colored walls, increased insulation, and night ventilation along with proper solar site orientation. This is expressed in recent report written for the California Energy Commission entitled, "Passive Solar Marketing Strategy, Appendix C: Energy Savings Analysis," which sites that new homes that incorporated a host of passive solar design features reaped significant heating and cooling savings—reducing heating needs in San Diego homes by 52% and cooling needs in Sacramento homes by 73 percent.[6]

In addition to promoting a measurable reduction in energy usage, solar access provisions can also help ensure that the conversion of homes from traditional energy

[3] Federic Pouyot, "Ten Features of Successful Solar Policies," Solar Energy Society of Canada, Inc., Spring 2007 newsletter, available online at http://www.sesci.ca/docs/SOL_Spring_Issue_2007-05-10.pdf (last accessed December 21,2007).
[4] Guide: Putting Renewable Energy to Work in Buildings, available online at http://www.ucsusa.org/clean_energy/energy_efficiency/putting-renewable-energy-to-work-in-buildings.html (last accessed December 21, 2007).
[5] City of San Jose, California. Solar Access Design Manual

sources to solar energy over time can be accomplished relatively easily. Homes that are pre-designed to accommodate solar devices, not only from a site planning standpoint, but from a plumbing, wiring and structural standpoint as well can make future installations much easier and less costly.

III. Land Use Code Strategies: What actions can local governments take to ensure solar access is maintained?

While numerous examples of local governments adopting regulations to protect solar access opportunities are cited in this chapter, there is much yet to be done. At a nationwide level, the percentage of communities who have taken such bold steps is marginal. This section outlines specific strategies and actions to be taken by communities wishing to take their broad energy efficiency policies to the next level. Three types of strategic actions are discussed: removing regulatory obstacles, implementing protective regulations, and creating incentives. Each discussion is accompanied by specific examples from communities who have successfully implemented the strategies at a local level. The examples help illustrate how the strategies can be adapted to a range of situations depending upon the level of policy commitment, available staff resources, and political environment.

#1: REMOVE REGULATORY OBSTACLES

In order to achieve the maximum benefits of solar energy in our communities, obstacles must be removed at a local level. As a first step, a thorough review of existing zoning code provisions, subdivision regulations, and design standards should be conducted to determine which existing standards, if any, could stand in the way of the installation of solar devices at a site specific level.

Obstacles to the installation of solar collectors often arise in historic districts or in planned communities with CC & Rs where aesthetic concerns are elevated. In these instances, the prohibition of reflective roof surfaces, flat roof surfaces, or roof structures are just a few ways in which the standards may unintentionally rule out the installation of traditional solar collectors within an established neighborhood.

As an alternative to removing regulations that conflict with solar access objectives altogether, flexibility can be built into existing provisions. Three ways in which flexibility may be incorporated into regulations are discussed below.

ALLOW FOR EXCEPTIONS

One means of encouraging the use of solar collectors while maintaining the aesthetic character of a community is to craft a detailed set of exceptions to the limiting ordinance that includes solar energy devices. The City of Los Angeles has such a provision in its Historic Preservation Overlay Zone[7]:

Roof structures for the housing of elevators, stairways, tanks, ventilating fans or similar equipment required to operate and maintain the building, skylights, towers, steeples,

[7] City of Los Angeles Municipal Code, Section 12.20.3. Historic Preservation Overlay Zone, available online at http://www.dsireusa.org/documents/Incentives/CA04R.htm (last accessed December 21, 2007.)

flagpoles, chimneys, smokestacks, wireless masts, water tanks, silos, solar energy devices, or similar structures may be erected above the height limit specified in the district in which the property is located if, for each foot such structure exceeds the height limit, an equal setback from the roof perimeter is provided, except that stairways, chimneys and ventilation shafts shall not be required to be set back from the roof perimeter. No portion of any roof structure as provided for above shall exceed the specified height limit by more than five feet.

ALTERNATIVE COMPLIANCE

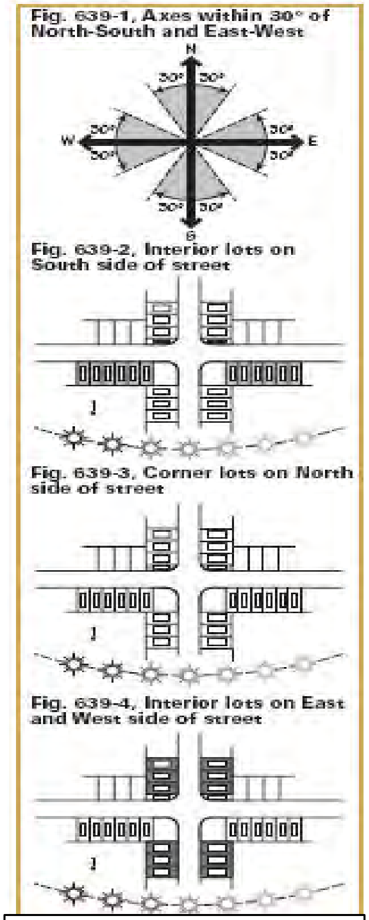
In lieu of outlining specific performance criteria that an applicant must satisfy in order to qualify for an exception or variance, some communities opt to simply include an alternative compliance provision. Typically, an alternative compliance provision allows an alternative approach to be substituted in whole or in part for a plan that meets the regulation in question. An example of this approach is included in Section 3.2.3 of the City of Fort Collins, Colorado code, Solar Access, Orientation, and Shading[8].

MINOR ADJUSTMENTS

Allowing modest adjustments to side, front and/or rear yard setback requirements (or other conflicting regulations) that allow applicants to meet solar access requirements can also be an effective means of providing flexibility. Examples of this type of provision can be found in Section A8.018 of the City of Gresham, Oregon's Solar Access Standards[9] and Section 11.15.6868 of Multnomah County, Oregon's Solar Access Provisions for New Development[10].

#2: IMPLEMENT PROTECTIVE REGULATIONS

One of the most straightforward ways to ensure that solar access objectives can be implemented at the site level is to incorporate protective regulations as part of the zoning code. Many communities have adopted regulations to ensure the protection of solar access. Although the regulations vary to a large degree in their complexity and overall scope, their purpose and intent tends to remain relatively consistent and that is to encourage, rather than discourage the use of both active and passive solar energy systems and to protect the right to solar access.



City of Portland, Oregon Solar Access Regulations.

[8] City of Fort Collins, Colorado Land Use Code, available online at http://fcgov.com/cityclerk/codes.php (last accessed December 21, 2007.)

[9] City of Gresham, Oregon Development Code, available online at http://www.ci.gresham.or.us/departments/planningServices/dp/code.asp#code (last accessed December 21, 2007.)

[10] Multnomah County, Oregon Land Division Ordinance, available online at http://www2.co.multnomah.or.us/Community_Services/LUT- Planning/urban/landdiv/ld_nav.html (last accessed December 21, 2007.)

Following is a brief overview of the types standards included in Solar Access Ordinances implemented by communities across the West. Standards are grouped into three categories: Site Planning/Building Orientation Standards, Building Envelope Standards, and Building Code Requirements.

SITE PLANNING/BUILDING ORIENTATION STANDARDS

Require a minimum percentage of solar-oriented lots—many Solar Access Ordinances require a certain percentage of the lots in a new subdivision to conform to the definition of "solar-oriented" to preserve the potential for solar energy usage. "Solar-oriented" lots typically orient the long face of a building within 30 degrees (15 degrees is optimal) of the east-west axis. Minimum percentages range from 65 percent (Fort Collins, Colorado) to 80 percent (Multnomah County, Oregon).

Require variation in width of lots to maximize solar access—the City of Portland, Oregon incorporates standards in its Solar Access Regulations[11] which call for the narrowest lots on interior lots on the south side of the street and corner lots on the north side of the street on streets that are within 30 degrees of a true east-west axis and for wider interior lots on the east or west side of the street on streets that are within 30 degrees of a true north-south axis.

Require key features of a development plan to have access to sunshine—Fort Collins, Colorado also requires elements of the development plan (e.g., buildings, streets, pedestrian pathways, circulation, open space) to located and designed to protect existing or planned solar energy systems.

BUILDING ENVELOPE STANDARDS

Establish solar setbacks—solar setbacks define the height of the shadow that may be cast upon an adjoining property during a specific time of day and time of year. Solar setbacks take into account the height and massing of a proposed structure or other site element along with the slope of the site in order to calculate the amount of shade that would be cast on the adjoining property. Examples of solar setback standards can be found in communities such as Ashland, Oregon[12] and Berkeley, California[13].

Solar access permits/guarantees—in communities such as Teton County, Wyoming[14] solar access rights are only granted through a permitting process. In

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[11] City of Portland, Oregon, Solar Access Regulations, available online at http://www.portlandonline.com/shared/cfm/image.cfm?id=72542 (last accessed December 21, 2007.)

[12] City of Ashland, Oregon, Municipal Code, available online at http://www.dsireusa.org/documents/Incentives/OR06R.htm (last accessed December 21, 2007.)

[13] City of Berkeley, California, Energy Conservation Requirements, available online at http://www.ci.berkeley.ca.us/sustainable/buildings/RefGuide/2%20energy%20conservation/2.4SolarThermalandRenewableEnergySystems.html (last accessed December 21, 2007.)

[14] Teton County, Wyoming, Solar Access Regulations, available online at http://clerk1.state.wy.us/plan/docs/ComprehensivePlan/Resolutions/Solar.pdf (last accessed December 21, 2007.)

order to be eligible for solar access protection, a solar permit must be granted that is linked with an existing or proposed solar collector that complies with the resolution. The resolution attaches no rights to a solar collector which is shaded by pre-existing structures or vegetation. Once the permit has been granted, the permittee has up to two years to request certification of beneficial use. Without certification, the permit would no longer be in effect.

Tree Dispute Resolution—the City of San Francisco's code contains a Tree Dispute Resolution ordinance[15]. The ordinance establishes a process and criteria by which property owners may evaluate and resolve issues regarding the obstruction of solar access to a property by a tree or trees on a neighboring property.

BUILDING CODE REQUIREMENTS

Note: Although the focus of this chapter is on site planning strategies rather than building specific standards, the concept described is noted due to its relevance within both areas of discussion.

Require buildings to be "Solar Ready"— the U.S. Department of Energy outlines best practices to make homes "Solar Ready" in its recent report, Building America Best Practices for High-Performance Technologies: Solar Thermal & Photovoltaic Systems[16]. To be considered "Solar Ready" homes are oriented for maximum solar exposure, are pre-wired and plumbed for solar collectors and PV modules, and have roof structures strong enough to handle the weight of solar systems. The concept is derived from the theory that making renewable energy elements, such as solar collectors, easy to install and use will encourage their use on a broader scale.

INCENTIVES

In part due to the cut-and-dry nature of most solar access standards, examples of incentives to encourage the incorporation of site design strategies for solar access at the local level appear to be limited. However, in cases where site planning for solar access is encouraged rather than required, it may be possible to allow applicants to "earn" additional density or height by incorporating solar concepts into a project's overall design. This was an approach used by the City of Austin in its design standards for commercial and mixed use corridors.[17] This type of give and take approach is also built into the LEED ND program, as discussed in the introduction.

Perhaps the most compelling incentive for a developer or home owner to pursue the integration of solar access concepts is the range of rebates, tax deductions, and other financial incentives available at the federal, state, and local level for the installation of solar devices.

[15] City of San Francisco, California, Tree Dispute Resolution Ordinance, available online at http://www.municode.com/content/4201/14142/HTML/ch016_1.html (last accessed December 21, 2007.)

[16] U.S. Department of Energy, Building America Best Practices Series, High-Performance Home Technologies: Solar Thermal and Photovoltaic Systems, available online at http://www.eere.energy.gov/buildings/building_america/pdfs/41085.pdf (last accessed on December 21, 2007.)

[17] City of Austin, Texas, Development Code: Subchapter E: Design Standards and Mixed-Use, available online at http://www.ci.austin.tx.us/development/downloads/final.pdf (last accessed on December 21, 2007.)

III. Conclusion

Land Use Code Strategies:

Removing Obstacles

- Review existing zoning provisions, subdivision regulations and design standards to determine any obstacles at the site specific level
- Build flexibility into prohibitive regulations to allow for exceptions, alternative compliance and minor adjustments

Incentives

- Earn additional density or height bonuses for incorporating solar concepts into a project's overall design
- Rebates, tax deductions and other financial incentives available at the federal, state and local level for the installation of solar devices

Regulations

- Incorporate protective regulations for solar access as part of the zoning code
- Require a minimum percentage of solar-oriented lots
- Require variation in width of lots to maximize solar access
- Require key features of a development plan to have access to sunshine
- Establish solar setbacks
- Allow for solar access permits/guarantees
- Require buildings to be "Solar Ready"

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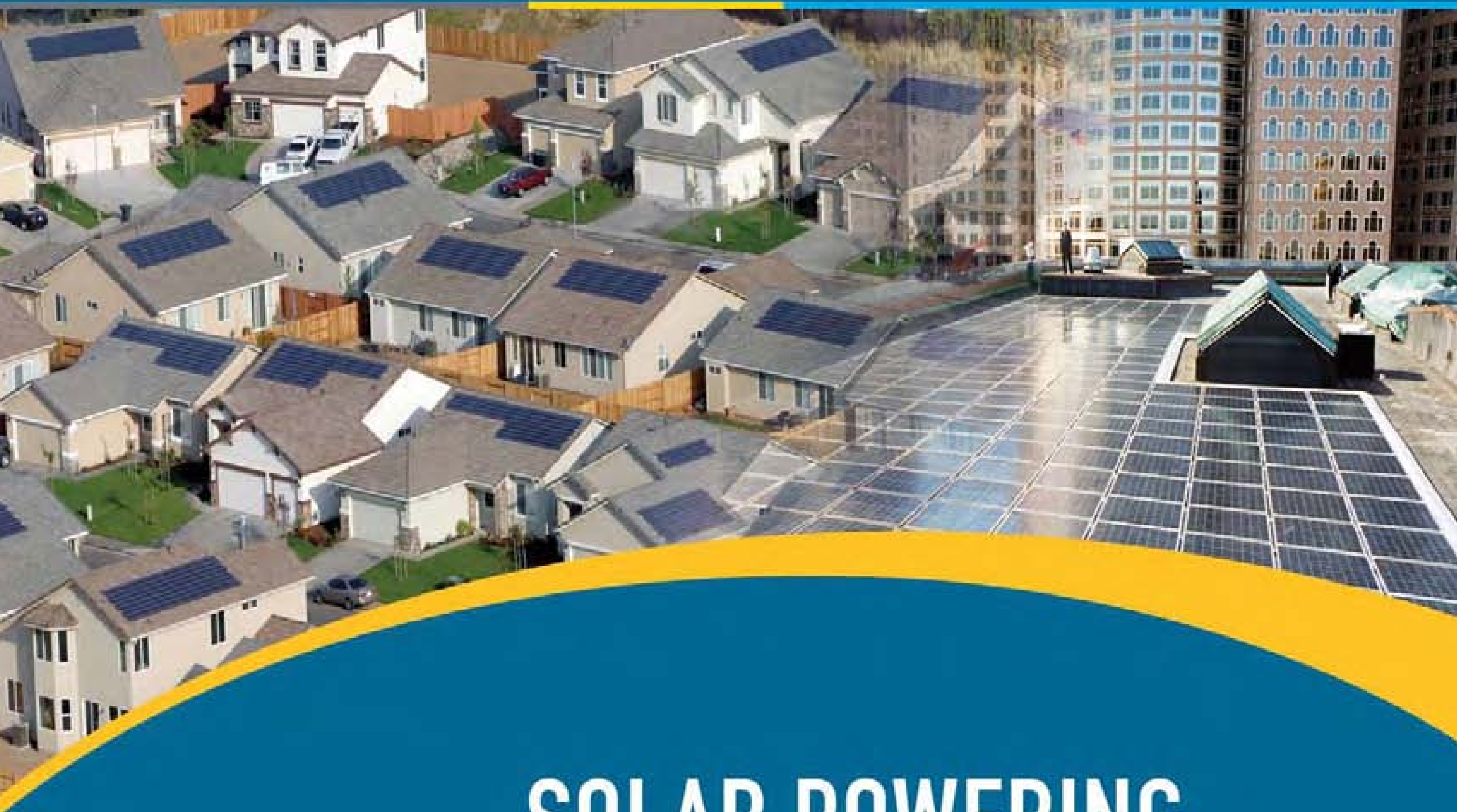

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- California Center for Sustainable Energy (http://energycenter.org)
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- Florida Solar Energy Center (www.fsec.ucf.edu/en)
- Interstate Renewable Energy Council (www.irecusa.org)
- Lawrence Berkeley 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)
- Oak Ridge National Laboratory (www.ornl.gov)
- Sandia National Laboratories (www.sandia.gov)
- Solar Electric Power Association (www.solarelectricpower.org)
- Southwest Technology Development Institute (www.nmsu.edu/~tdi)
- Vote Solar Initiative (www.votesolar.org)

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

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

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

EXECUTIVE SUMMARY

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

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

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

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

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

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

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

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

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

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INTRODUCTION

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

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

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

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

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

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

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

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

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

BENEFITS
Identifies benefits from implementing the policy or program.

IMPLEMENTATION TIPS AND OPTIONS
Lists various tips and options for designing and implementing the policy or program.

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

ADDITIONAL REFERENCES AND RESOURCES
Lists reports, references, and tools that offer more information on the topic.

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

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

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

Getting Started: Assessing A Community's Policy Environment

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

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

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

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

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

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

Additional References and Resources

PUBLICATIONS

Freeing the Grid

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

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

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

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

Network for New Energy Choices, September 2008

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

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

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

Clean Energy Group, April 2008

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

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

Developing State Solar Photovoltaic Markets

Vote Solar Initiative, Center for American Progress, January 2008

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

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

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

Clean Energy Group, December 2007

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

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

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

1.0

ORGANIZING AND STRATEGIZING A LOCAL SOLAR EFFORT

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

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

Data current as of August 2010

1.1

Create a Solar Advisory Committee or Task Force

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

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

Implementation Tips and Options

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

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

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

Examples

Houston, Texas: Creating an Advisory Council and Correspondence Group

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

Milwaukee, Wisconsin: Initiating the Milwaukee Shines Advisory Committee

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

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

Additional References and Resources

WEB SITES

Solar America Cities

www.solaramericacommunities.energy.gov/solaramericacities

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

1.2

Hire or Designate a Local Solar Coordinator

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

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

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

BENEFITS

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

Implementation Tips and Options

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

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

Examples

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

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

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

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

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

1.3

Survey Residents and Businesses To Identify Barriers

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

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

Implementation Tips and Options

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

Examples

Berkeley, California: Surveying Businesses and Residents To Identify Barriers

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

New York City, New York: Conducting an Installer Survey

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

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

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

- Equipment warranties
- Documentation of cost savings

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

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

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

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

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

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

1.4

Conduct an Installation Baseline Survey

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

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

BENEFITS

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

Implementation Tips and Options

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

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

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

Examples

Boston, Massachusetts: Quantifying the City's Installation Baseline

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

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

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

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

Additional References and Resources

WEB SITES

The Open PV Mapping Project

http://openpv.nrel.gov

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

PUBLICATIONS

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

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

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

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

U.S. Solar Market Trends 2009

Interstate Renewable Energy Council, July 2010

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

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

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

Lawrence Berkeley National Laboratory, October 2009

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

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

1.5

Establish Solar Installation Targets

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

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

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

BENEFITS

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

Implementation Tips and Options

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

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

Examples

Boston, Massachusetts: Determining Boston's Solar Installation Targets

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

Portland, Oregon: Setting Citywide Installation Targets

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

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

Additional References and Resources

WEB SITES

National Renewable Energy Laboratory, In My Backyard

www.nrel.gov/eis/imby

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

National Renewable Energy Laboratory, Renewable Resource Data Center

www.nrel.gov/rredc

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

Solar America Cities

www.solaramericacommunities.energy.gov/solaramericacities

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

PUBLICATIONS

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

National Renewable Energy Laboratory, December 2009

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

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

Analysis of Web-Based Solar Photovoltaic Mapping Tools

National Renewable Energy Laboratory, June 2009

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

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

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

1.6

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

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

BENEFITS

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

Implementation Tips and Options

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

Examples

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

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

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

Boston, Massachusetts: Incorporating Solar into Transportation and Emergency Planning

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

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

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

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

Additional References and Resources

WEB SITES

American Planning Association, Planners Energy and Climate Database

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

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

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

3.0

UPDATING AND ENFORCING LOCAL RULES AND REGULATIONS

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

This section will help community leaders identify which rules and regulations are in place in their community, and where they can make improvements to accelerate solar energy development. The chart below shows which of the 25 Solar America Cities have undertaken each of these activities and allows communities to assess their own efforts in these areas.

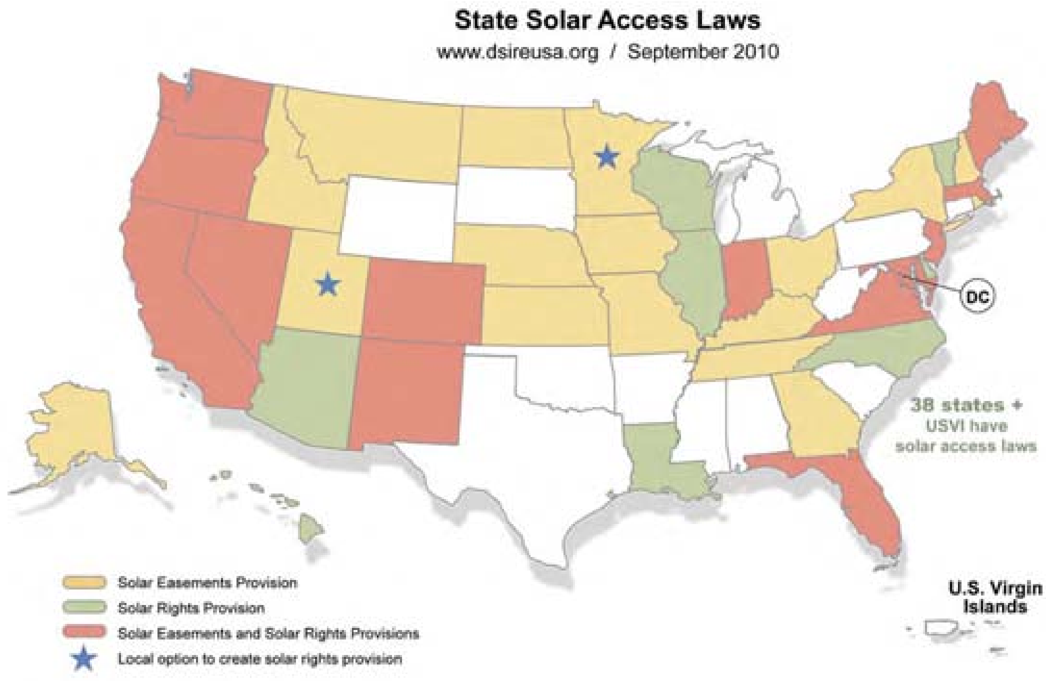
	Your Community	Ann Arbor	Austin	Berkeley	Boston	Denver-Boulder-Aurora	Houston	Knoxville	Madison	Milwaukee	Minneapolis-St. Paul	New Orleans	New York	Orlando	Philadelphia	Pittsburgh	Portland	Sacramento	Salt Lake City	San Antonio	San Diego	San Francisco	San Jose	Santa Rosa-Sonoma County	Seattle	Tucson
3.1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

Data current as of August 2010

3.1

Solar Access and Solar Rights Laws

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



As of September 2010, 38 states and the U.S. Virgin Islands protect solar access or solar rights (see map). Local governments also have the authority to adopt policies that support solar access and **solar rights**. Solar access can be protected through **solar easements**, which are legal agreements that protect access to sunlight on a property. Access to sunlight means that one property can continue receiving sunlight across property lines without obstruction from landscaping or structures on a neighboring property. Easements can be creatively negotiated to have flexible conditions and terms, including potential compensation requirements if a neighbor interferes with access to sunlight. Solar easements are typically transferred with the property title, and don't terminate unless specified by the easement's conditions. Solar easements are usually voluntary, which limits their effectiveness because system owners have no guarantee of an agreement with a neighbor.

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

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

BENEFITS

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

Implementation Tips and Options

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

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

Examples

Ashland, Oregon: Protecting Solar Access Through Setbacks and Permits

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

Madison, Wisconsin: Allowing Solar Energy Systems in Historic Districts

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

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

Additional References and Resources

WEB SITES

Database of State Incentives for Renewables & Efficiency

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

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

Rules, Regulations, and Policies: Solar Access Laws

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

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

PUBLICATIONS

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

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

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

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

Renewable Energy and the Neighbors

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

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

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

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

Prepared by Hannah Muller for GreenPrint Denver, March 2009

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

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

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

Solar America Board for Codes and Standards, October 2008

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

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

3.2

Solar-Ready Building Guidelines

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

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

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

Implementation Tips and Options

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

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

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

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

Examples

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

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

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

Additional References and Resources

PUBLICATIONS

Solar-Ready Buildings Planning Guide

National Renewable Energy Laboratory, December 2009

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

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

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

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

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

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

A Homebuilder's Guide to Going Solar

U.S. Department of Energy, December 2008

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

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

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

3.3

Streamlined Solar Permitting and Inspection Processes

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

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

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

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

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

BENEFITS

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

Implementation Tips and Options

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

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

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

Examples

Portland, Oregon: Processing Permit Applications Electronically

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

San José, California: Streamlining the Permitting and Inspection Process

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

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

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

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

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

Additional References and Resources

WEB SITES

Solar America Board for Codes and Standards

www.solarabcs.org

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

SolarTech: Making Solar Happen

www.solartech.org

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

Vote Solar: Project Permit

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

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

PUBLICATIONS

Commercial Solar Permit Fee Report

Sierra Club, October 2010

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

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

Field Inspection Guidelines for PV Systems

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

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

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

Addressing Institutional Barriers: Opportunities for Streamlining Solar PV Project Timelines

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

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

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

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

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

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

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

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

Solar America Board for Codes and Standards, October 2009

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

Report: www.solarabcs.org/permitting

Solar Electric Permit Fees in Northern California: A Comparative Study

Sierra Club, December 2008

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

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

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

Network for New Energy Choices, September 2008

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

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

Inspector Guidelines for PV Systems

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

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

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

3.4

Code Official Training

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

BENEFITS

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

Implementation Tips and Options

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

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

Examples

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

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

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

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

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

Additional References and Resources

WEB SITES

Solar America Board for Codes and Standards

www.solarabcs.org

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

Southwest Technology Development Institute's Codes and Standards Resource Page

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

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

PUBLICATIONS

Field Inspection Guidelines for PV Systems

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

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

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

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

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

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

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

Inspector Guidelines for PV Systems

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

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

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

3.5

Installer Licensing and Certification

State regulation and licensing of solar contractors continues to evolve as the industry matures. Typically, states require **solar water heating** (SWH) installers to hold a plumber's license and **photovoltaic** (PV) installers to hold an electrical license. As of September 2010, 14 states and Puerto Rico have defined a specialized solar contractor's license (see map). In most cases, these are specialties within the electrical and plumbing classifications and are required for contractors who don't hold a plumber's or electrical license. Solar expert Jim Dunlop, P.E., formerly of the National Joint Apprenticeship and Training Committee (NJATC) and the Florida Solar Energy Center (FSEC), summarizes the need for licensing:

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

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

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

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

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

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

BENEFITS

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

Implementation Tips and Options

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

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

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

Examples

Austin, Texas: Requiring Installers to Demonstrate Qualifications

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

Louisiana: Establishing a Solar Classification and Certificate of Training

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

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

Additional References and Resources

WEB SITES

Electronics Training Administration

www.eta-i.org

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

North American Board of Certified Energy Practitioners

www.nabcep.org

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

PUBLICATIONS

The Qualified Solar Installer

J. Dunlop, Solar Today, September/October 2009

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

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

Credentialing: What's in a Name? A Lot

J. Weissman, Solar Today, September/October 2009

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

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

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

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

Visit www.solaramericacommunities.energy.gov
for the most up-to-date resources on
going solar in your community.

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

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