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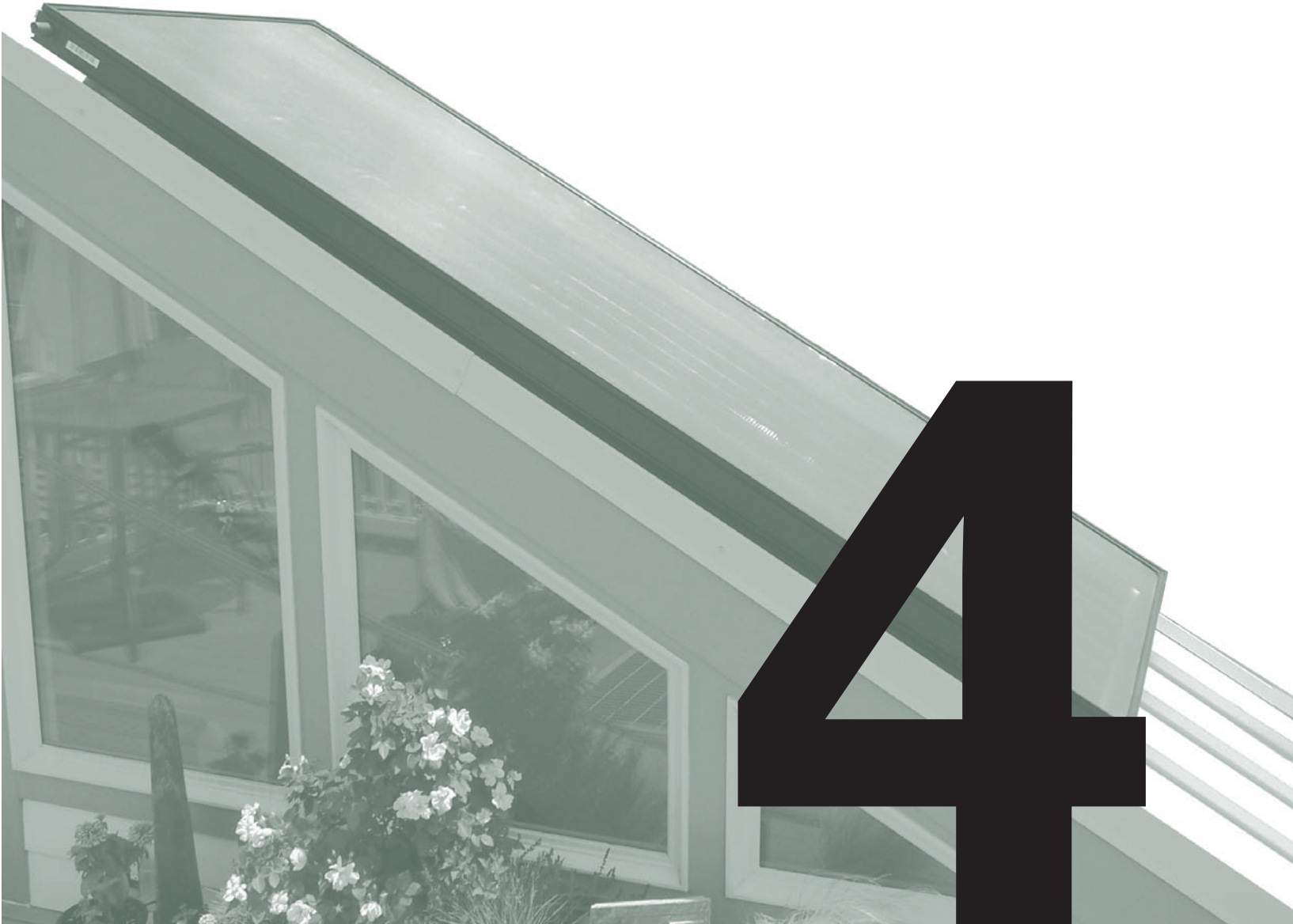

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Balancing the Solar Access Equation

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.

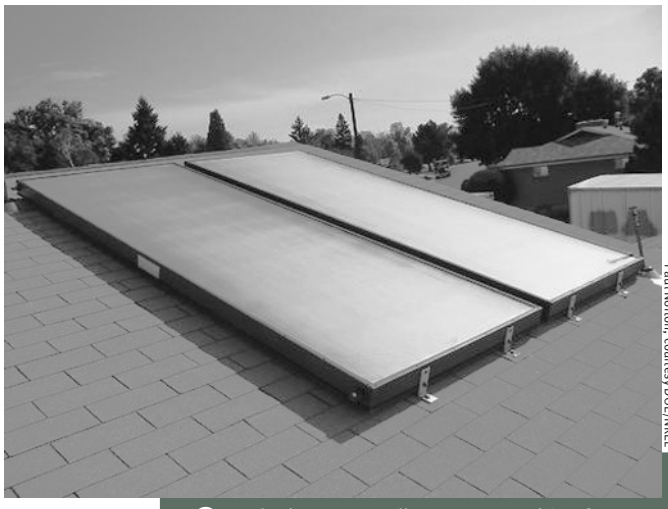
PV systems work best without any obstructions from trees or structures. Because the sun may be higher in the summer or lower in winter, a placement of the PV involves an assessment of these factors. In any specific location, as the surface area of a PV system exposed to sunlight increases, the amount 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

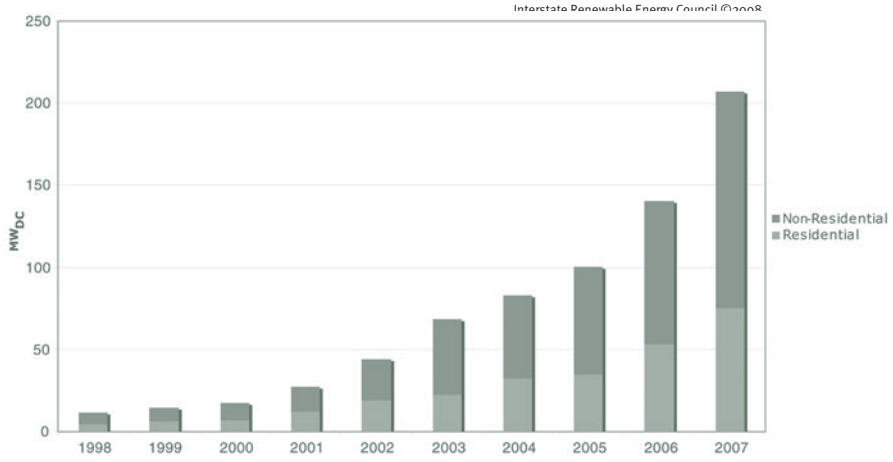
Berkeley, California, has recently established a Sustainable Energy Financing District that leverages private financing through bonds that fund solar photovoltaic systems for residential and commercial properties anywhere in the city. The bonds are repaid by a special tax that is added to the property 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).

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.

Amber Evans

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

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.

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.

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.

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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DOES YOUR COMMUNITY ENCOURAGE RESIDENTIAL SOLAR INSTALLATIONS?

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