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PRACTICE SOLAR USES

A photograph of a hill covered in solar panels, with a large black number 11 overlaid in the bottom right corner. The image is tinted with a light purple/blue color.

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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.



➡ 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 CO₂ 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.

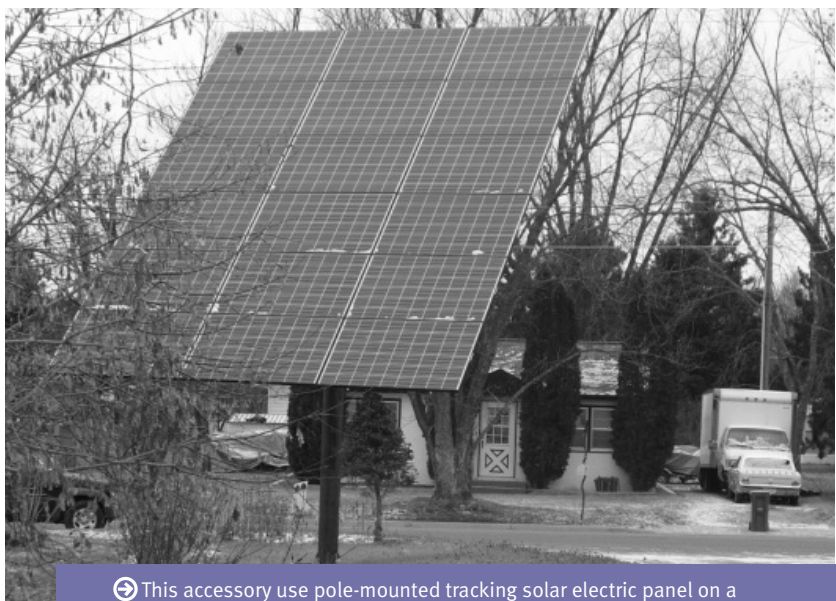
To shed some light on these issues for the cities’ regulatory offices, the Minneapolis–St. Paul Solar Cities program undertook a survey of the 24 other cities in the Solar America Cities program that were at various stages in the development of solar energy. Some were seeing hundreds of installations 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](http://www.solaramericacities.energy.gov)).

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 rec-

ognize 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.

installations 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

➡ 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



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.

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

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.

(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.

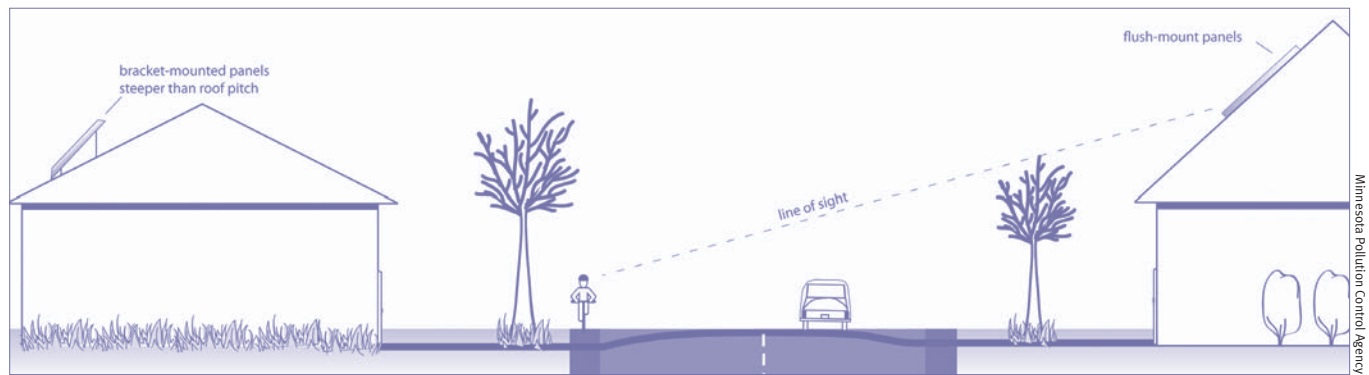
PREEMPTIVE STATE LEGISLATION

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



③ 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.

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

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. De-

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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HOW DOES YOUR COMMUNITY REGULATE SOLAR ENERGY SYSTEMS?

