



## Recycling Land for Solar Energy Development

A growing number of cities and counties are committed to becoming more environmentally, economically, and socially sustainable. However, many of these communities face pressing economic challenges that frustrate efforts to make progress toward sustainability goals. Those that have suffered decades of population and job losses, as well as those especially hard hit by the Great Recession, are struggling with high numbers of vacant properties, be they former industrial sites, abandoned houses, or shuttered strip retail. While many of these properties will eventually find new life through reoccupancy or conventional redevelopment, alternative reuse options may be the best current—if not the only—solution for a glut of brownfields, greyfields, and redfields (see Glossary). One of the most promising of these alternative reuse options is solar energy development, and planners can play a crucial role in helping their communities evaluate and embrace solar energy for vacant land management.

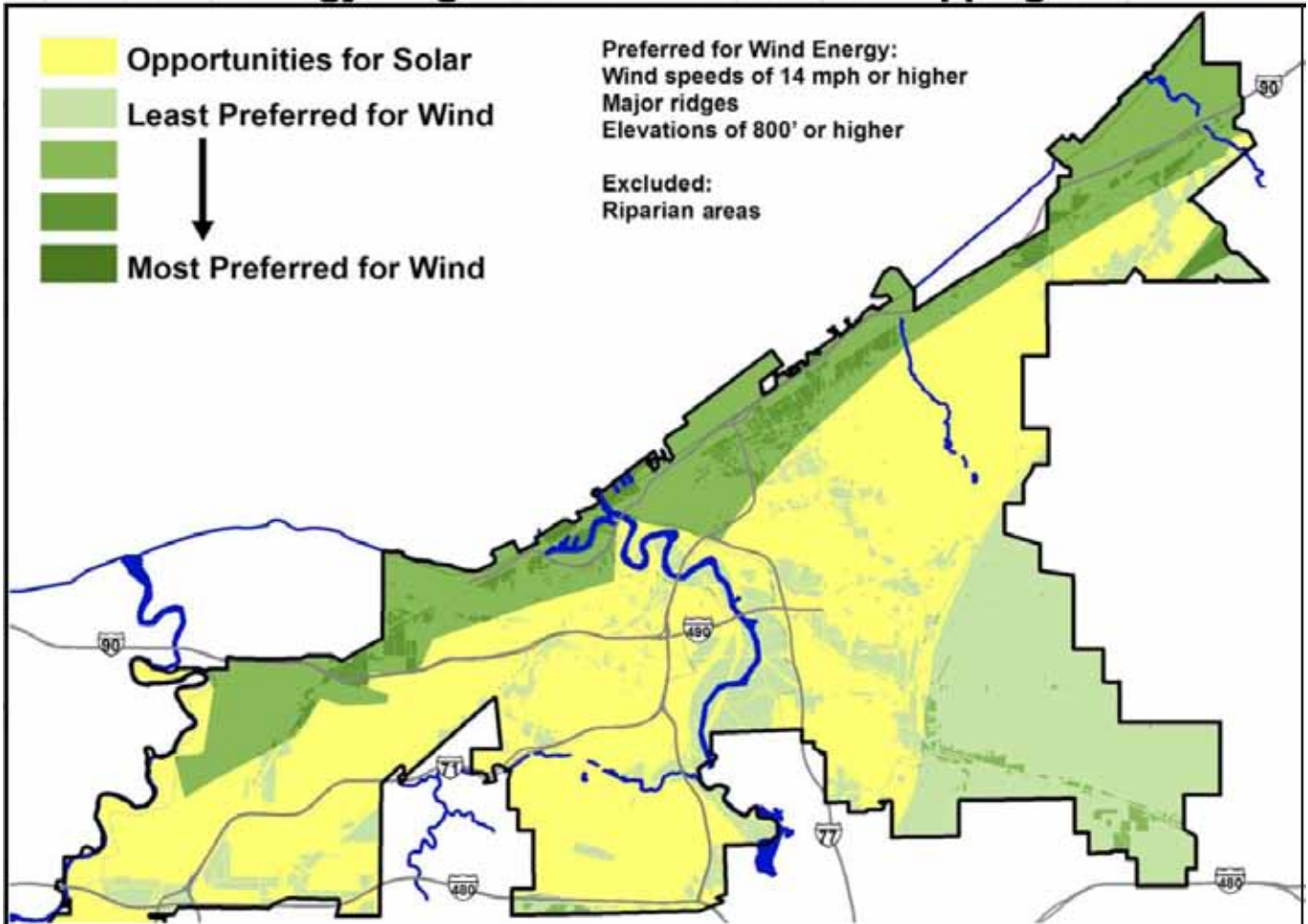
In recent years numerous planners, public officials, and policy advocates have pointed to renewable energy projects as possible strategies for managing previously developed, but currently vacant, land. Building off this theme, the U.S. Department of Energy coined the term *brightfield* to describe brownfield reuse for either solar energy production or solar technology manufacturing (U.S. DOE 2005). In many communities solar energy projects are perceived as better neighbors, and

are therefore less controversial, than other renewables such as wind, geothermal, and biomass, which may be less adaptable to site constraints, may be less compatible with other on-site uses, or may have greater potential impacts on adjacent properties. The relative popularity of solar projects in comparison to other renewables can also be attributed to the prevalence of the solar resource and, in some regions, incentives for solar technology.

Recycling land for solar energy projects is consistent with sustainable development principles. Whether the energy is used on site or sold to the grid, solar redevelopment reduces the demand for fossil fuels and, by extension, the production of greenhouse gas emissions. Construction and installation work creates demand for local green-collar jobs, and in neighborhoods with high percentages of vacant properties, solar installations can reduce blight and improve appearances. When a solar redevelopment project involves cleanup of a contaminated site, it has the dual benefit of decreasing public health risks and repairing damage to the natural environment. Furthermore, large-scale reuse projects provide an alternative to developing greenfield sites, and solar redevelopment at all scales is well positioned to take advantage of existing infrastructure and public services.

While it is true that ground- or building-mounted solar panels can be a good fit for vacant properties of all sizes in a wide range of contexts, serious barriers to recycling land for solar energy production do exist. These barriers may include incom-

## Alternative Energy Target Areas & Criteria for Mapping



*This map, prepared by Re-Imagining a More Sustainable Cleveland's Alternative Energy working group, shows that most of the city is climactically and topographically suitable for solar projects. (Image courtesy of City of Cleveland.)*

plete or inaccurate information about available sites, inadequate solar access, outdated or confusing development regulations, extensive on-site contamination, and insufficient project financing. The purpose of this briefing paper is to provide planners, public officials, and engaged citizens with an overview of considerations and strategies for cities and counties hoping to promote or pursue solar energy projects on vacant properties with little current demand for reoccupancy or conventional redevelopment.

### Community Roles in the Solar Redevelopment Process

The basic process for any solar development project involves six steps: (1) identifying potential sites, (2) assessing site constraints,

(3) designing and securing development approval, (4) construction, (5) operations, and (6) decommissioning (U.S. EPA 2012). When a project is sited on previously developed land, the presence or potential presence of contamination can affect each step in this process.

With these ideas in mind, there are a number of different roles that cities and counties may play in promoting solar redevelopment. These roles include acting as a developer or development partner, providing technical assistance or financial incentives, establishing effective regulations and review processes, and purchasing power produced by solar projects.

Each step in the development process presents opportunities for communities interested in promoting solar installations on vacant properties. Furthermore, for planners and public of-

ficials, there is also a critical step zero—helping the community develop a vision related to solar redevelopment. The sections below highlight specific considerations and strategies for each stage of the development process.

## Developing a Community Vision

Perhaps the most important opportunity that planners and public officials have for promoting solar redevelopment comes through the process of developing clear visions related to renewable energy on previously developed land. By articulating goals and objectives related to recycling land for solar energy projects, cities and counties can signal to residents and developers alike that solar redevelopment is a desirable interim or long-term use for vacant properties. This process may be part of a long-range communitywide planning initiative, such as a new or updated comprehensive plan (as described in the third briefing paper in this series, “Integrating Solar Energy into Local Plans,”) or it may be in the context of a strategic planning initiative focused on formulating strategies for vacant land management.

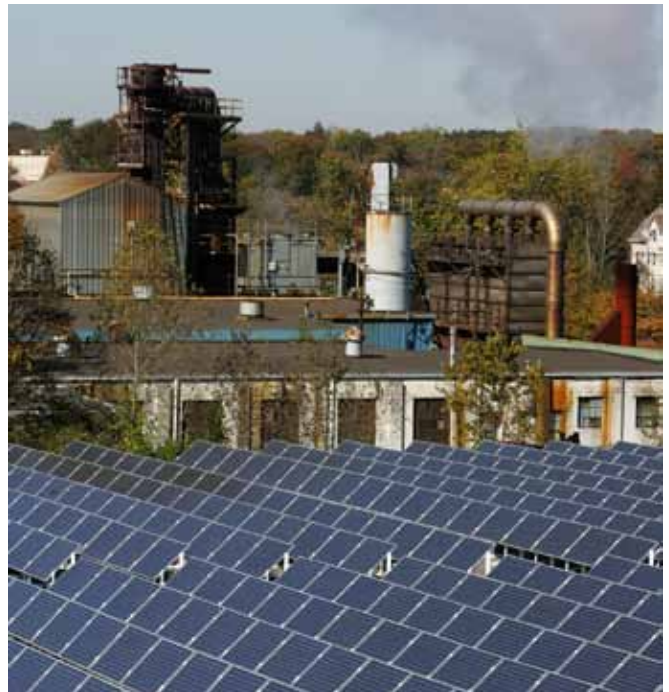
One example of a strategic planning initiative is *Re-Imagining a More Sustainable Cleveland*, led by Neighborhood Progress, Inc., a community development intermediary, in collaboration with the Cleveland City Planning Commission and Kent State University’s Cleveland Land Lab, with funding from the Surdna Foundation. The goal of the planning process was to explore reuse strategies for vacant parcels located outside of the priority development areas identified in the city’s comprehensive plan. The final report includes a discussion of the benefits of reusing vacant land for solar installations along with policy recommendations to incentivize the generation and use of renewable energy.

After a community has clearly articulated a vision for solar redevelopment, it is important to check existing development regulations and design guidelines for consistency with the adopted goals and objectives. For more information on this step, see the fourth briefing paper in this series, “Integrating Solar Energy into Local Development Regulations.” Planners and public officials may need to amend development regulations in order to permit solar installations as a primary use of land in zoning districts targeted for solar redevelopment. This may be accomplished either by adding solar energy systems to existing use lists or by adopting a new district or overlay to facilitate redevelopment. Clear use permissions, development standards, and design guidelines help property owners and

financiers understand what types of projects will be approved in specific locations.

Some communities go beyond simply sanctioning solar installations in their development regulations by offering development incentives for projects that include green design features. For example, Bloomington, Indiana, permits increased density and waives filing fees for projects that incorporate sustainable development practices, such as on-site renewable energy production (Unified Development Ordinance Section 20.05.049).

Apart from development regulations and incentives, communities may adopt green power–purchasing requirements in order to boost the local market for solar energy production. Conventionally, a green power–purchasing requirement establishes a minimum percentage of energy that municipal users must obtain from renewable sources. For example, the City of Lansing, Michigan, has committed to purchasing 20 percent of all of its power from renewable sources by the year 2020 (Lansing 2007). Cities and counties could also use green power–purchasing requirements in a more targeted fashion by giving preferential consideration to power generated as a result of solar redevelopment projects.



*Brockton Brightfields is a 460 kW grid-integrated solar installation on the site of a former manufactured gas facility. (Image courtesy of Brockton Brightfields, City of Brockton, Massachusetts; SCHOTT Solar.)*

## Identifying Potential Sites

The one universal precondition for solar redevelopment is access to sunlight, and there are a number of conditions affecting this access on any given site. In the most general sense, latitude and regional climate dictate the gross quantity and quality of sunlight available to a certain parcel; meanwhile, on-site or nearby topographic features, trees, and buildings can all limit the amount of sunlight available at a specific location. This is discussed in more detail in the fifth briefing paper in this series, “Balancing Solar Energy Use with Potential Competing Interests.” At the macro-scale, EPA provides national and state maps that show how the quality of solar resource varies across large areas, and at the micro-scale, the National Renewable Energy Laboratory’s (NREL) online PV Watts calculator ([www.nrel.gov/rredc/pvwatts/](http://www.nrel.gov/rredc/pvwatts/)) estimates monthly and annual energy production and value based on user-selected location and system characteristics. Beyond these tools, a number of states and local communities have created their own solar mapping tools to help identify suitable locations for solar installations; see the second briefing paper in this series, “Solar Mapping,” to learn more about these tools.

While EPA brownfields lists are a good start for communities trying to identify opportunity sites, most communities have numerous vacant parcels that don’t appear on federal lists. Having a complete inventory of vacant properties helps communities match potential developers to available sites. Because relatively few cities and counties have complete and up-to-date information about vacant properties, it is important for planners and public officials to evaluate existing data sources such as federal, state, and local brownfield lists, parcel-based information systems maintained by the local tax assessor or code enforcement official, and neighborhood-specific inventories maintained by community-based organizations. Ultimately, though, it may still be necessary to conduct a field survey to fill in the gaps or improve the quality of existing data.

One of the most effective tools for any vacant land management strategy is a searchable database that integrates parcel-based information from various sources with geographic information systems (GIS) technology. Perhaps the most sophisticated example of this type of database is the Northeast Ohio Community and Neighborhood Data for Organizing (NEO CANDO) system (<http://neocando.case.edu/cando/index.jsp>), maintained by Case Western Reserve University in Cleveland. However, even simple databases can be used to steer potential

developers toward opportune sites. In addition to identifying the solar potential of vacant properties, communities can also use parcel-based information systems to document and track ownership, liens, foreclosure actions, and code violations that may complicate redevelopment.

Another way that planners and public officials can assist with site identification is by helping potential developers understand the comprehensive plan designations and zoning standards that apply to specific vacant properties. This includes explaining to interested developers what types of projects would be allowed by right or with a discretionary approval on any given property. Along with the other types of parcel-based information discussed above, planning and zoning information can help developers make an initial determination about whether or not to move forward with a site-specific analysis of constraints.

## Assessing Site Constraints

Apart from having adequate access to sunlight, there are a number of site-specific factors that influence the feasibility of solar redevelopment on a given parcel. Structures, trees, surface water, or steep slopes can all affect the amount of usable area for a solar installation, and grid-connected systems typically depend on proximity to existing transmission and distribution lines.

When considering solar projects on brownfields, one of the biggest potential barriers to solar redevelopment is the fear of liability related to the presence, or potential presence, of contamination. Given this fear of liability, there are two basic approaches that cities and counties can take to facilitate redevelopment: (1) proactively assess the potential or presence of contamination on vacant sites or (2) help potential developers understand and navigate site investigation and cleanup processes.

Federal and state brownfields programs typically require compliance with a formal site-investigation process referred to as All Appropriate Inquiry (AAI) to be eligible for funding and liability defenses. The process begins with a Phase I Environmental Site Assessment. This assessment involves a review of existing records for the site, interviews with current and former owners and occupants, and a visual inspection using photographs and maps. In many cases there will be no significant contamination and, therefore, no costly cleanup required for reuse. In cases where a Phase I assessment indicates the presence or likely presence of contamination, site investigators must initiate a Phase II Environmental Site Assessment to gauge the specific nature and extent of the

problem. This assessment involves soil and water sampling and analysis.

When cities and counties proactively assess sites in their ownership, planners and public officials can then communicate findings to potential developers up front. Additionally, local governments may provide funding or technical assistance to private owners to assess their own properties. That way, if contamination is present, stakeholders can explore cleanup options before investing in project design.

NREL developed a decision tree for Richmond, California, to help the city assess the potential for solar energy projects on all known brownfield sites. The decision tree addressed site characteristics, constraints related to ownership and contamination, and financial considerations (NALGEP 2012). NREL and EPA subsequently created a general solar decision tree, available through EPA's Re-Powering America's Lands website ([www.epa.gov/oswercpa/](http://www.epa.gov/oswercpa/)), to help all communities and interested parties assess the solar redevelopment potential of any site.

Depending on the type and extent of contamination, there may be a range of possible cleanup alternatives. In many states the end use of the site determines the extent of remediation required (U.S. EPA 2011). These "risk-based" standards typically require more extensive cleanup for schools and residences than for end uses that pose little risk to humans. By extension, if a solar redevelopment project does not involve residential, recreational, or commercial uses, the remediation bar will likely be lower than for projects that do include those other uses. It may even be possible to use a solar installation on the site to power cleanup activities.

Because cleanup standards and alternatives can be opaque to potential developers with no background in environmental science, planners and public officials can play valuable roles by simply connecting these developers to additional information about relevant state programs and local cleanup experts. A community may choose to take a more active role by assigning the local brownfields program manager or a staff planner to act as a case manager for certain sites, or by developing a guide to help potential developers evaluate potential site constraints. For example, the New York City Brownfield Partnership ([www.nycbrownfieldpartnership.org](http://www.nycbrownfieldpartnership.org)) connects potential developers to engineers, environmental consultants, land-use planners, financial analysts, and environmental attorneys in the brownfield industry. Through this program, partnering professionals and organizations provide free consulting to parties seeking informa-



*This solar installation on a Superfund site in Livermore, California, used concentrated sunlight to destroy volatile organic compounds in the groundwater. (Image Courtesy Warren Gretz/NREL.)*

tion about liability and remediation for contaminated properties.

When considering solar projects on redfields, title issues can complicate redevelopment. Potential developers may be dissuaded by delays and uncertainty associated with securing permission from bank owners and lien holders for site access or property transfer. Some cities and counties have facilitated redevelopment of financially distressed properties by creating land-bank entities to centralize acquisition and disposition efforts.

While the authority and efficacy of land banks varies from state to state, the Neighborhood Stabilization Program, authorized by the Housing and Economic Recovery Act of 2008, and the subsequent American Recovery and Reinvestment Act of 2009 opened new doors for land banks to acquire foreclosed properties. The Genesee County Land Bank Authority in Flint, Michigan ([www.thelandbank.org](http://www.thelandbank.org)), and the Cuyahoga Land Bank in Cleveland, Ohio ([www.cuyahogalandbank.org](http://www.cuyahogalandbank.org)), are both notable examples of land

banks that have had success clearing titles and ensuring redevelopment in line with community goals.

## Designing and Securing Development Approval

There are a range of solar redevelopment options depending on site characteristics and market potential. The size of the parcel, the relative market strength of its location, the underlying zoning, the parcel's solar access, and the presence of contamination can all shape the type of solar energy project appropriate for a given property. Large parcels in industrial districts with abundant access to sunlight and little conventional redevelopment potential may be ideal for utility-scale solar installations. Alternately, vacant lots dispersed throughout a residential neighborhood may be appropriate for a community solar or virtual net-metering project that provides power directly to nearby homes. And a single vacant residential or commercial property may be a good candidate for a third-party ownership arrangement that provides some supplemental income while awaiting a more permanent reuse.

Many cities and counties subject all large solar installations to a conditional or special-use permitting process. While these discretionary reviews are often necessary to evaluate the likely impacts of the project on the community, discretionary development review costs potential developers both time and money. For this reason, cities and counties that can streamline the development review process will be minimizing a major barrier to solar redevelopment. Communities may elect to further incentivize large-scale solar redevelopment by reducing development review or impact fees or by entering into a development agreement that lowers local property taxes or sets a fixed annual payment in lieu of taxes in order to help developers predict and amortize project costs.

Even when a solar project is permitted by right, high permitting fees and delays associated with securing building and electrical permits can pose barriers to smaller-scale projects. In recognition of these facts, cities such as San Jose and Philadelphia have developed streamlined solar permits that replace separate building and electrical permits. Both of these cities also provide guidance materials through department websites to help potential developers navigate the permitting process.

Many communities have leased or donated land to solar redevelopment projects that sell power to the municipality or to the local utility. For example, the City of New Bedford, Massachusetts, has agreed to let ConEdison Solutions install solar

panels on multiple city-owned sites, including schools, municipal buildings, and brownfields, by 2013. The city will purchase the power generated by these rooftop- and ground-mounted systems, and at buildout the distributed network is expected to produce enough electricity for 1,500 homes (Lang 2011).

Cities and counties interested in leasing land for solar redevelopment typically solicit bids using a request for proposals (RFP) process. Through the RFP the community can outline goals for site reuse, specify a lease period, and stipulate conditions for site access (The Solar Foundation 2012).

Distressed neighborhoods with high numbers of residential vacancies and weak market demand may benefit from solar projects that aggregate power produced over multiple lots. In areas with multiple tax-foreclosed properties, it may be possible for cities and counties to partner with a community-based organization to develop a community solar project that offsets power purchased by nearby residents from the local utility. However, because few states have explicitly enabled these kinds of virtual net-metering arrangements, it is important for planners and public officials to seek advice from a knowledgeable attorney before soliciting proposals.

## Construction

The construction phase is of obvious importance to cities and counties committed to acting as developers or development partners for solar projects on public land. This is where communities can witness their visions come to life, and over the past several years there have been numerous success stories of communities transforming contaminated properties into solar farms.

To illustrate, the City of Rifle, Colorado, entered into a partnership with SunEdison, a global solar-power producer, to redevelop a former uranium-processing facility as a 1.7-MW solar energy installation to power the city's new regional wastewater reclamation facility. As a result of the Uranium Mine Tailings Remediation Control Act (1978), DOE had capped radioactive materials by 1996 and is in the process of treating the groundwater contamination through natural flushing and institutional controls. SunEdison covered all development costs, and the city agreed to purchase the electricity produced on site for the next 20 years. Siting the project on contaminated, city-owned land will save taxpayers an estimated \$2 million in project development costs (U.S. EPA 2009).

Cities and counties not acting as developers or development partners can support the construction phase of solar redevel-

ment by providing financial assistance for cleanup activities or solar equipment. This assistance may be in the form of grants or low-interest loans to cover cleanup costs or rebates for solar installations. For example, the City of Oakland operates a sophisticated local brownfields program that stresses risk-based standards and uses a revolving loan fund to assist with remediation activities on brownfield sites, and across the bay, the City of San Francisco offers sizable rebates for solar energy systems installed on residential, commercial, and institutional properties.

Alternately, planners and public officials can play important roles by sharing information with potential developers about state and federal assistance programs related to brownfield redevelopment or solar installation. Apart from EPA and state brownfield-assistance programs, there are numerous states that offer rebates or loans to subsidize the cost of solar energy systems, either in isolation or in the context of comprehensive energy-efficiency improvements. The Database of State Incentives for Renewables & Efficiency (DSIRE; [www.dsireusa.org](http://www.dsireusa.org)) is an excellent starting point for tracking current assistance programs active in each state.

## Operations

In many communities the interconnection process can present a major hurdle for solar redevelopment projects. Cities and counties can minimize this barrier by educating planning and building staff about local interconnection procedures, and communities with municipal utilities can streamline the process by developing standardized interconnection agreements. Examples of municipal utilities with standard agreements include the Sacramento Municipal Utility District in California, Colorado Springs Utilities in Colorado, and Fort Pierce Utilities Authority in Florida.

Once systems are operational, municipal utilities can extend ongoing support to solar redevelopment projects by purchasing power and renewable energy certificates (RECs) from producers. States (and some municipal utilities) enable RECs by adopting renewable portfolio standards (RPS). In states or municipal-utility service areas with renewable energy requirements, RECs are administrative instruments that represent the positive environmental and social benefits of renewable electricity generation. Where enabled, utilities can purchase RECs to comply with RPS targets.

For example, the City of Westfield, Massachusetts, has entered into a lease agreement with Axio Power, Inc., (now

SunEdison) to develop a solar installation on a closed municipal landfill. The municipal utility, Westfield Gas and Electric Light Department, has agreed to purchase the power produced by the facility and then deliver it to municipal facilities at a discounted rate (Moriarty 2012).

## Decommissioning

The decommissioning phase of the solar redevelopment process is where the life of a solar energy system comes to an end. But instead of just seeing this phase as an endpoint, planners and public officials can also think of decommissioning as a prelude to a new redevelopment opportunity.

All solar energy systems have a functional lifespan. While most new systems are designed to last at least 25 years, most communities expect them to exist indefinitely. The risks posed by obsolete systems are twofold: (1) rooftop equipment in a state of severe disrepair may fall or be blown onto neighboring properties during a severe wind event; (2) decommissioned rooftop and ground-mounted systems may detract from community appearance and contribute to blight if left inoperable and open to the elements. For these reasons, it makes sense for cities and counties to help property owners work through options for removing or replacing decommissioned solar-energy systems.

Planners may partner with local environmental or public works officials to develop educational guides that explain local options for safe disposal of obsolete systems. Because some thin-film systems contain small amounts of toxic materials, inappropriate disposal may contribute to the creation of a new brownfield. In many cases, safe disposal will involve either returning the system to the original manufacturer or contracting with a specialized recycler.

In order to encourage proper decommissioning, communities may add provisions related to unused or inoperable systems to their development regulations. For example, the City of Minneapolis gives owners 12 months to remove abandoned or unused freestanding solar-energy systems (§535.840(c)(4)).

Decommissioning also provides an opportunity for planners and public officials to brief property owners on current incentives for replacement systems. In cases where development regulations or permitting processes have changed since the initial installation, planners can also help owners understand current application and review processes. If neighborhood market conditions have improved significantly since the initial

## Glossary

**Brownfield:** Any vacant or underused real property where redevelopment or reuse is complicated by the presence or perceived presence of contamination.

**Brightfield:** Any brownfield that has been redeveloped with a solar energy generation or manufacturing project.

**Greenfield:** Any farmland or open area where there has been no prior industrial or commercial development.

**Greyfield:** Any previously developed commercial property that is underused due to economic obsolescence.

**Redfield:** Any commercial development in foreclosure or facing severe financial distress.

installation, there may also be opportunities for planners and public officials to help owners explore conventional redevelopment options that still integrate solar technologies. For example, new structures may present opportunities for solar-oriented site design and building-integrated systems.

## The Importance of Community Engagement

As discussed above, planners and public officials play crucial roles in engaging the public in developing community visions for solar redevelopment. However, the importance of community engagement throughout the redevelopment process cannot be overemphasized. In communities where solar installations are not common, there may be concerns about the impacts of solar projects on nearby properties. Planners and public officials have a responsibility to keep abreast of common concerns and misconceptions and be able to provide correct and current information in response. For more information on responding to community concerns about solar and taking a proactive approach to educating residents about solar, see the first briefing paper in this series, “Solar Community Engagement Strategies for Planners.”

When a solar redevelopment project involves a brownfield, there is a greater potential for controversy and opposition. Depending on project specifics, residents and business owners

may worry about the effect of the project on public safety or have concerns about preserving community character. Apart from simply communicating the benefits of the project, planners and public officials have a responsibility to share cleanup plans and progress reports with all stakeholders.

## Conclusion

The idea of recycling land for solar energy projects has gained momentum in recent years. Solar redevelopment reduces the demand for fossil fuels and the production of greenhouse gas emissions, and in communities with a large surplus of previously developed but currently vacant land, solar installations can be an effective strategy for controlling blight. However, given the capital investment required for solar equipment and the risks associated with contamination on brownfield properties, potential developers may shy away from redevelopment opportunities unless cities and counties are able to address potential barriers at each step of the redevelopment process. This means planners and public officials have opportunities to help their communities develop visions for supporting solar development and then to craft regulations, incentives, and programs to implement these visions.

■ *This briefing paper was written by David Morley, AICP, APA's Planning Advisory Service Coordinator.*



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**Cover:** Exelon City Solar, the largest urban solar plant in the United States, is located on a 41-acre brownfield in Chicago's West Pullman neighborhood. (© *Image courtesy of Chicago City Solar / Northwestern University.*)

## Planning for Solar Energy Briefing Papers

This is one in a series of briefing papers providing planners with guidance on promoting solar energy use in their communities to help meet local energy and sustainability goals. APA produced this paper through its participation in the SunShot Solar Outreach Partnership (SolarOPs), a U.S. Department of Energy-funded initiative designed to help accelerate solar energy adoption on the local level by providing timely and actionable information to local governments.

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