SOLAR ENERGY SYSTEM DESIGN GUIDELINES & SOLAR RECOGNITION AWARD PROGRAM

December 2006, Prepared By
COMMUNITY DEVELOPMENT DEPARTMENT
CITY OF SANTA BARBARA

EXHIBIT A

Purpose of These Guidelines

These guidelines provide guidance to property owners, architects, contractors and others who may be interested in using solar energy in their buildings. The guidelines include general principles as well as specific techniques for designing solar energy systems that can take advantage of solar energy. The purpose of these guidelines is to achieve the following goals:

- Encourage solar energy system installation designs which are compatible with their neighborhood and which preserve the City's historic and visual resources.
- Implement the Solar Recognition Program to publicly recognize high-performance, aesthetically designed solar installations which voluntarily comply with these guidelines.
- Promote early design consideration for integration of solar energy systems into new structures, additions and reroof projects.

How to Use These Guidelines

Are the guidelines mandatory or voluntary?

These guidelines are generally voluntary. They are not intended to prohibit, restrict or condition the use of any solar energy system for aesthetic reasons nor do they mandate solar energy use. The City encourages thoughtful consideration of these guidelines to achieve the goals listed above. Solar energy system designers or users who follow these guidelines can qualify for special recognition from the City Council. (See page 5, for more information regarding the "Solar Design Recognition Program.")

For projects that are required to receive Architectural Board of Review (ABR) or Historic Landmarks Commission (HLC) review, these guidelines will be used by the ABR and HLC to assist in determining the architectural appropriateness and neighborhood compatibility of the project.

Are the guidelines only for residential buildings?

The guidelines and the Solar Design Recognition Program are for all uses, including both residential and commercial.

Are the guidelines applicable citywide?

These guidelines and the Solar Design Recognition Program are applicable city-wide, in all zones, and in all neighborhoods.

Do the guidelines focus only on photovoltaic systems?

No, the guidelines address photovoltaic systems and solar thermal systems (e.g., solar hot water systems).

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Other City of Santa Barbara Solar Energy Handouts

The following additional solar energy documents are available at the City of Santa Barbara's Planning and Zoning Counter at 630 Garden Street:

- Get Started With Solar!
- Passive Solar Building Design Guidelines & Award Program
- Solar Energy System References and Resources
- Which Solar System Projects Require Design Review?

INTRODUCTION

The City of Santa Barbara enjoys an average of 300 sunny days per year. This sunny weather makes Santa Barbara well-suited for environmentally friendly solar energy use. Energy conservation and solar energy use are integral to sustainable building. The City encourages aesthetically designed solar energy use to protect and enhance the natural environment. Solar energy benefits include natural environment preservation and energy independence and security. Government rebates and tax incentives increase solar energy system affordability. Both photovoltaic systems, which produce electricity, and solar thermal systems, which heat air or water, are discussed in these guidelines.

Million Solar Roofs

Million Solar Roofs is a federal initiative with a goal of solar energy systems to be installed on one million roofs in the U.S. by the year 2010. The City of Santa Barbara participates in the Million Solar Roofs Partnership in Santa Barbara County. The Partnership brings together business, government, the energy industry, and community organizations to further solar initiatives.

One barrier to solar energy use identified by the Santa Barbara County Million Solar Roofs Partnership is that the panelized design of solar electric systems is often not considered compatible with existing community aesthetic standards and architectural requirements. This document encourages solar energy systems by providing specific guidance on how to create solar energy systems with positive aesthetic qualities. Also, the Solar Design Recognition Program within these guidelines provides a way to publicly recognize high-performing, aesthetically designed solar projects.

> "One City goal is to achieve and maintain a healthful natural environment"

– The Conservation Element of the City's General Plan.

> "In keeping with our community's values and the need to reduce the burden that our daily activities have on the natural environment, the City must take a more proactive approach and work to develop a sustainable community."
>
> **Sustainable community/city:** A community or city that meets its present needs without sacrificing the ability of future generations to meet their own needs. More specifically, a sustainable community is one that improves and enhances its natural, social and economic resources in ways that allow current and future members of the community to lead healthy, productive and satisfying lives.

– The City of Santa Barbara's Sustainable City Program's First Annual Report.

Solar Design Recognition Program

The City's Solar Design Recognition Program publicly acknowledges projects that achieve high performing solar system designs compatible with neighborhoods by following these guidelines.

The City Council annually recognizes projects in two categories:

1) Solar Energy System Recognition Awards, for photovoltaic or solar thermal systems that follow these guidelines, and
2) Passive Solar Building Recognition Awards for projects that follow the City's Passive Solar Building Design Guidelines, available as a separate handout.

See page 35 to determine whether a solar energy system project qualifies for the recognition program.

Award winners receive an appreciation certificate and a traditionally styled exterior wall plaque in the shape of a sun symbol similar to the image on the cover of this document. The certificate and plaque are presented to award winners publicly each June at a City Council hearing.

EXISTING SOLAR ACCESS LEGISLATION AND REGULATIONS

STATE LEGISLATION

These guidelines are consistent with the State of California's policy to "promote and encourage the use of solar energy systems and to limit obstacles to their use" as stated in legislation enacted in 2004 (Government Code 65850.5). These guidelines are also consistent with the State's Solar Rights Act (Civil Code Section 714), Solar Easement Law (Civil Code Section 801 & 801.5, and Revenue and Taxation Code Section 73.

The State's Solar Shade Control Act limits the amount of shade that a tree or shrub can cast onto a neighbor's solar energy system after that system is installed (Public Resources Code 25980-25986). For more information, see the City's "Solar Energy System References and Resources" handout.

CITY SOLAR ACCESS ORDINANCE

The City's Solar Access Ordinance regulates the height of new residential development on the north side of properties. The ordinance ensures adequate access to sunlight is available on the south side of properties so that passive solar heating opportunities are available and solar energy systems can be installed.

Permits for Solar Energy Systems

Permits and Zoning Approval

Building permits are required for all solar energy system installations. Many solar system projects can qualify for an "over the counter" permit, while some may require a limited in-house review. The "Photovoltaic System Submittal Procedures" handout, available at the Planning and Building and Safety Counters, describes the necessary submittal materials and installation requirements for photovoltaic systems. Solar energy systems must also comply with all Zoning Ordinance requirements. An "over-the-counter" approval from Zoning is possible for projects that:

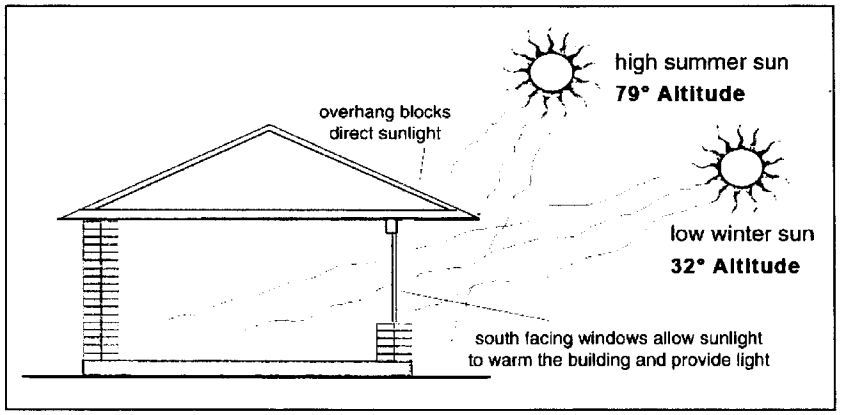
- Comply with all Zoning Ordinance requirements, and;
- Are less than 1,000 square feet or 10 kW AC, and;
- Are not located in a special Design District, Historic District, or the Demolition Review Study Area and are not on a City Landmark or Structure of Merit.

Projects that do not comply with the above criteria may need to go through normal Zoning plan check routing.

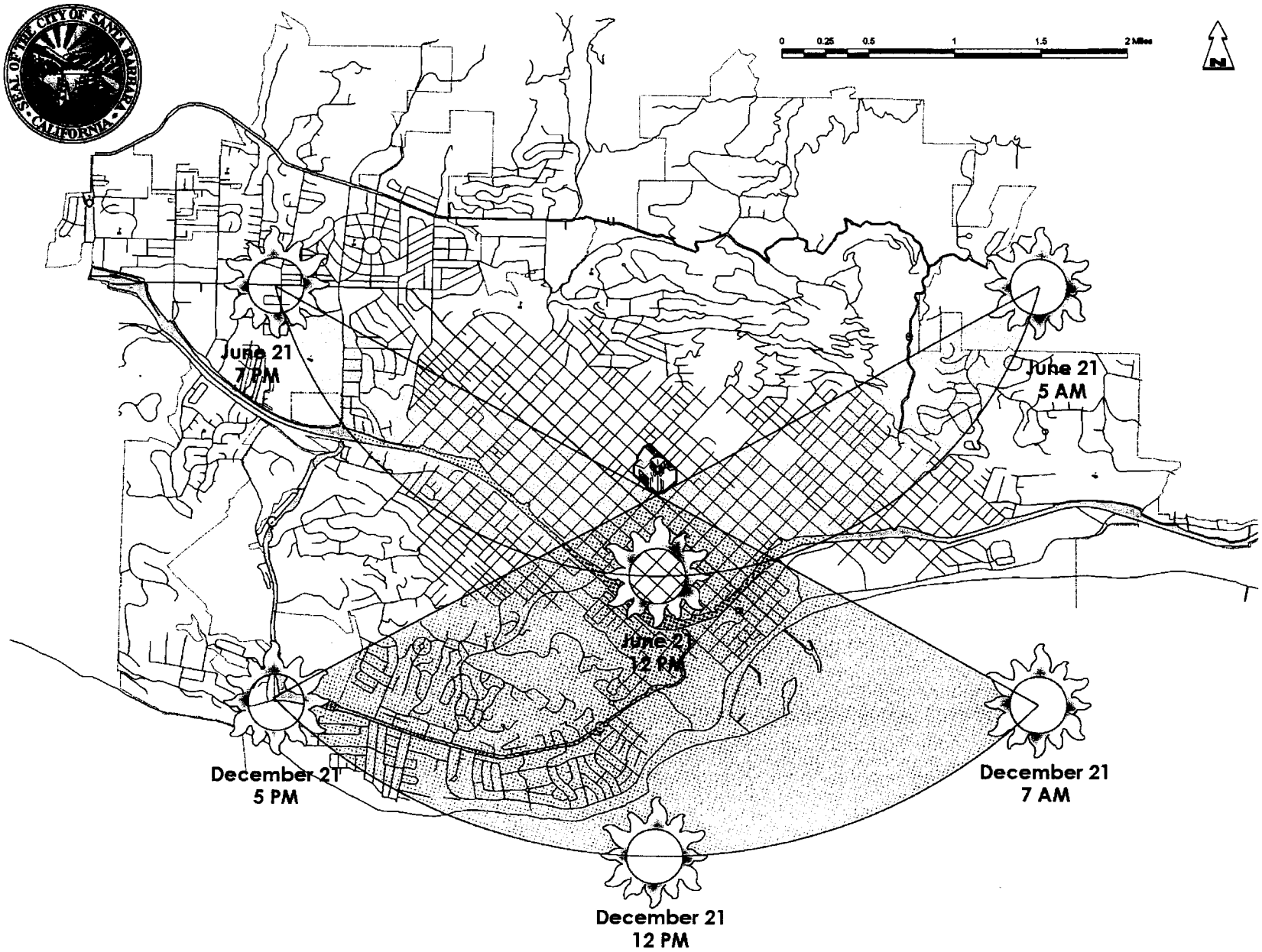
Any Zoning Ordinance violations on the property must be abated prior to building permit issuance. The State's solar rights laws do not exempt solar energy systems from the City's Zoning Ordinance enforcement procedures.

Santa Barbara's Solar Orientation

The latitude where a solar system is installed, as well as local weather conditions create unique solar patterns. Santa Barbara is at a 34° degree latitude and often has morning overcast conditions. Since daily sun patterns are from east to west, sometimes a slightly south west orientation can be advantageous so that the panel exposure is maximized for afternoon sun. The angle of the sun as well as daily east and west sun paths are different in winter and summer. (Refer to Illustrations 1 and 2.)



(Illustration 1) This drawing shows a home that uses passive solar heating principles. In the summer, the overhang blocks the warm sun. In the winter, south-facing windows allow sunlight for warmth. Source: "Santa Barbara County Green Building Guidelines," by the Sustainability Project.



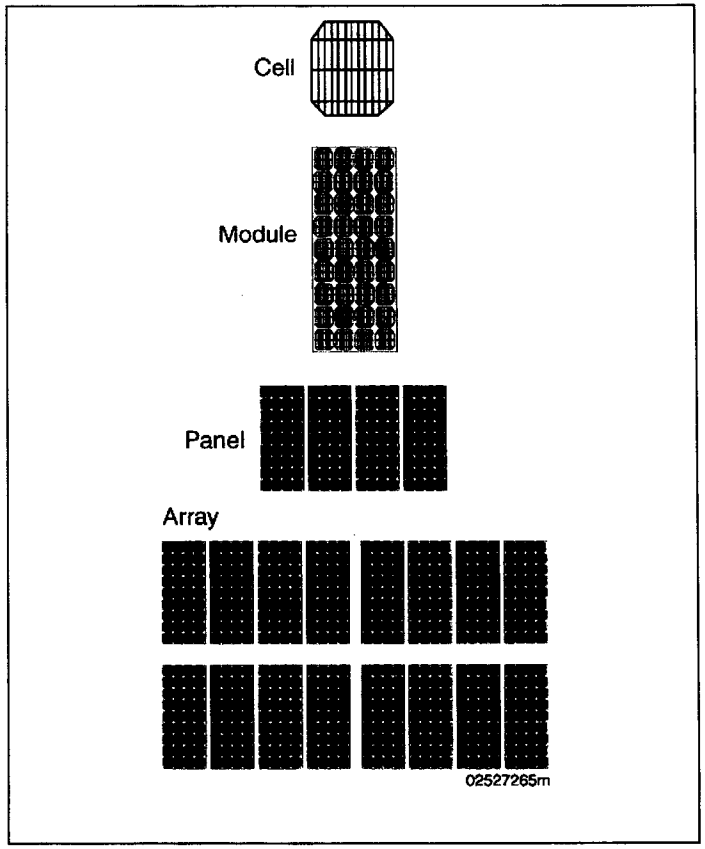
(Illustration 2) This diagram shows the sun's path from sunrise to sunset at summer and winter solstice from the perspective of the Santa Barbara County Courthouse.

Solar Energy System Technologies

This section of the guidelines describes common solar energy technologies used to serve residential and commercial structure energy needs. Photovoltaic (electric) and solar thermal (water heating) technologies are briefly described. Solar technology which does not appear as a panel, or "building integrated" technologies are also introduced in this section. For more detailed information about solar technologies available, consult the separate "Solar Energy Systems Resources" handout at the Planning and Zoning Counter.

Photovoltaic Systems

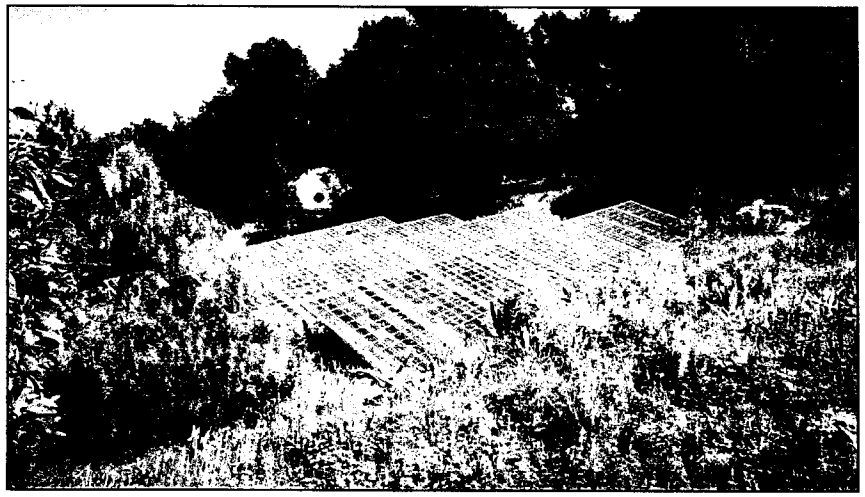
Photovoltaic systems convert the sun's light into electrical energy. The energy is produced by photovoltaic (PV) cells, which are typically made of silicon. The electricity generated by a system travels through an inverter and then into a home or other building to provide for its energy needs. Some systems also have a battery to provide backup electricity. (Refer to Illustration 3.)



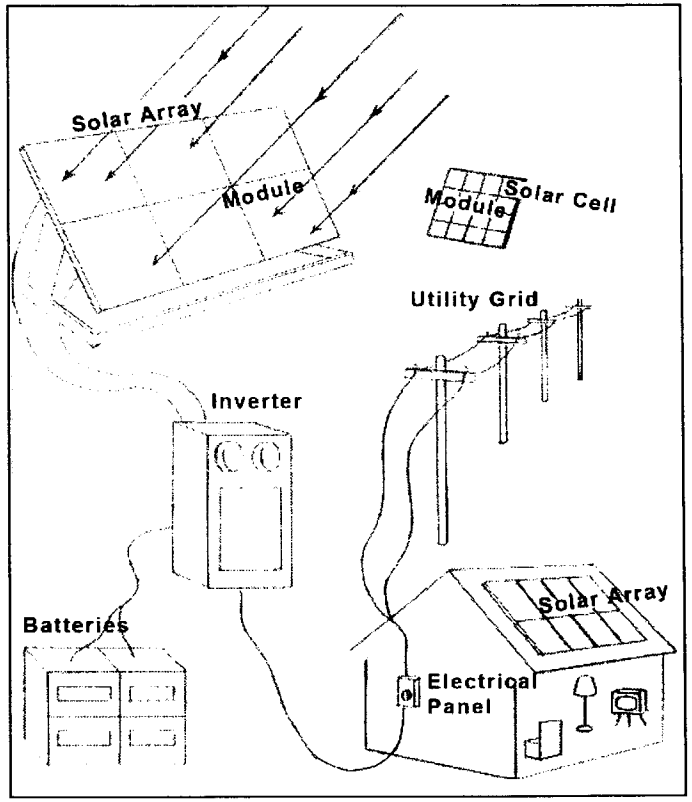
(Illustration 3) Source: "Building-Integrated Photovoltaic Designs for Commercial and Institutional Structures," by Patrina Eiffert and Gregory J. Kiss

Most systems in Santa Barbara are grid-connected; they receive electricity from both the PV array and Southern California Edison's electrical grid. When grid-connected systems generate more electricity than the building uses (such as on a sunny afternoon), the surplus electricity enters the grid. When the system produces less than the building uses (such as in the evening or when it is cloudy), SCE's grid provides electricity to the building.

PV modules have no moving parts, typically require little maintenance other than occasional rinsing and can last over 25 years. PV system costs depend on the system's type and size. (Refer to Illustrations 4 and 5.)



(Illustration 4) This photovoltaic array produces electricity that is used to power a nearby home.



(Illustration 5) "Solar Energy Resource Guide," 6th Edition, by NorCal Solar.

There are two common photovoltaic materials: crystalline silicon and amorphous silicon (e.g. thin films).

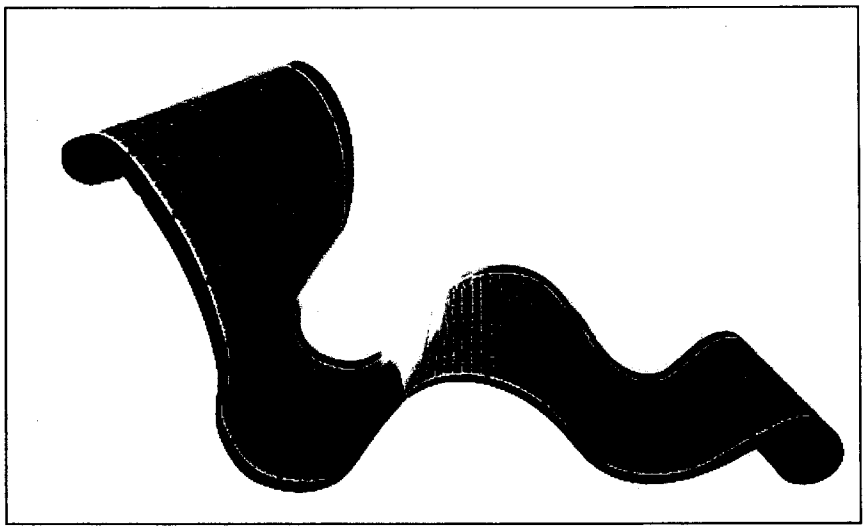
Crystalline Silicon

Most solar modules consist of rigid crystalline silicon wafers enclosed in aluminum frames and covered with glass on the top. The modules are typically rectangular, but crystalline silicon modules are also now available in custom shapes such as triangles in order to match the shape of a roof. Crystalline silicon modules come in two types: monocrystalline and polycrystalline. Monocrystalline modules produce more energy per square foot than do polycrystalline modules. The two types have somewhat different appearances due to their different crystalline structures. Crystalline silicon module performance declines when the modules are shaded or exposed to high temperatures. (Refer to Illustrations 6 and 7.)

(Illustrations 6 and 7) Monocrystalline PV panels (left) have a different appearance than polycrystalline panels (below).

AMORPHOUS SILICON (THIN FILMS)

Amorphous silicon modules (e.g. thin films) are made by depositing a very thin layer of PV silicon onto surfaces such as metal, glass or plastic. Thin films are amorphous (flexible) and do not need to be encased in frames or glass. They can be mounted discreetly on roof shingles or standing-seam metal roofs or incorporated into windows. Thin films perform better in hot and shaded conditions than do crystalline silicon modules. However, compared to crystalline silicon modules, thin films are less available commercially and require more surface area to produce the same amount of electricity. They may also not last as long as crystalline silicon modules. (Refer to Illustration 8.)



(Illustration 8) Thin-film photovoltaic materials are flexible and durable and can be applied to many different surfaces. Source: PowerFilm

BUILDING-INTEGRATED PHOTOVOLTAICS

Photovoltaic panels are most commonly mounted on top of roofs or on the ground. However, building-integrated photovoltaic (BIPV) systems integrate PV material directly into the building's materials such as the roof or glazing. BIPV systems can be particularly visually attractive because they are integrated with the building design. BIPV technologies include PV shingles or tiles, PV laminates, and PV glazing.

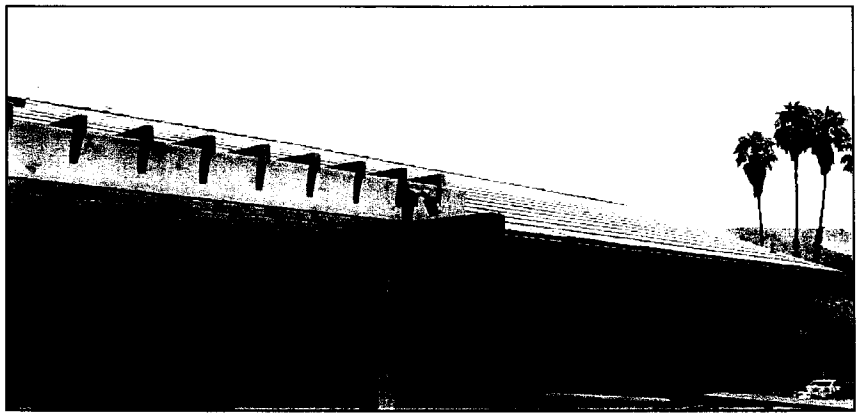
Photovoltaic Shingles or Tiles

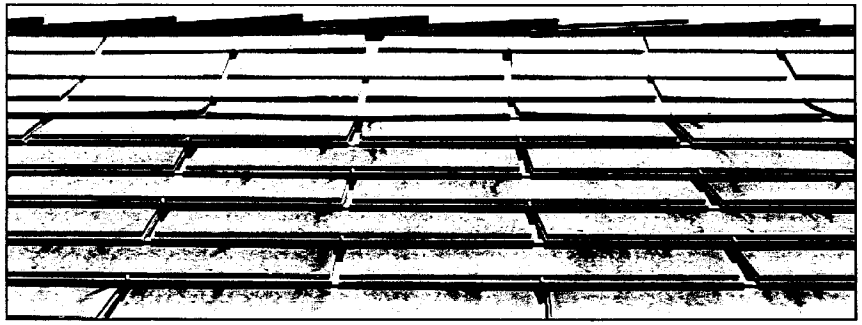
BIPV roof shingles (aka "solar shingles" or "solar tiles") function as regular shingles but have a PV material on the surface. Some manufacturers create shingles with a thin-film PV layer. Other manufacturers attach crystalline silicon PV cells to concrete tiles. Note that "tile" in this case does not refer to clay Mission-style tile or its look-a-likes.

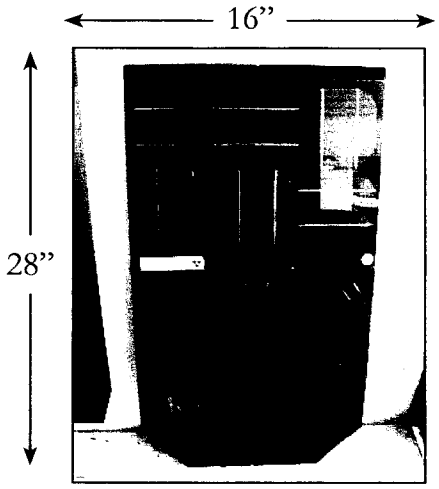
Advantages of photovoltaic shingles include:

- No need for bulky panels and supports.
- Function just as normal roofs do, with regular weather-proofing and water-shedding abilities.
- Look very similar to standard roofs. Solar shingles can look somewhat blue or glossy relative to regular shingles when first installed, although they tend to look more normal within a few days as dust accumulates. Excessive dust should be cleaned off with water during the dry season in order to maintain performance. Right after rinsing, the original reflective appearance can return for a few days.
- Can require less maintenance than traditional solar panels.
- Over time, the electricity generated by solar shingles can help offset the cost of a re-roof.

(Refer to Illustrations 9, 10 and 11.)



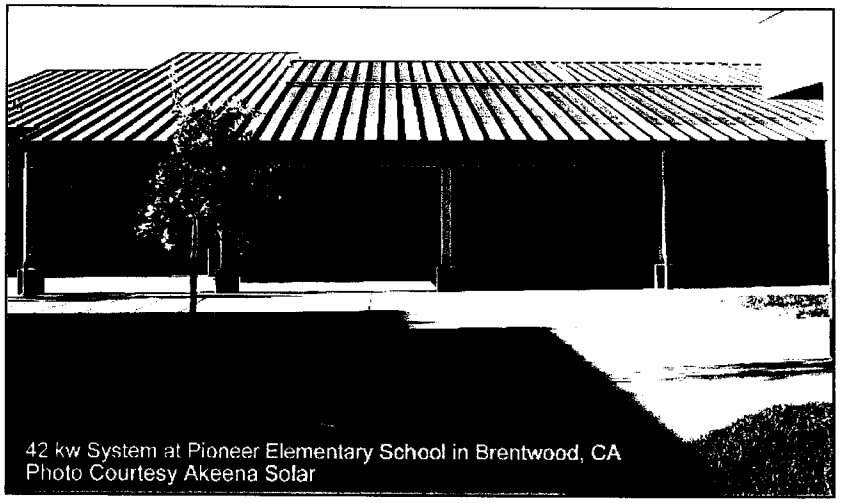




(Illustrations 9, 10 and 11) The solar shingles on the Arroyo Burro Watershed Resource Center function like a normal roof shingle. Photovaltaic cells are attached to the front exterior of the shingle.

PHOTOVOLTAIC LAMINATES

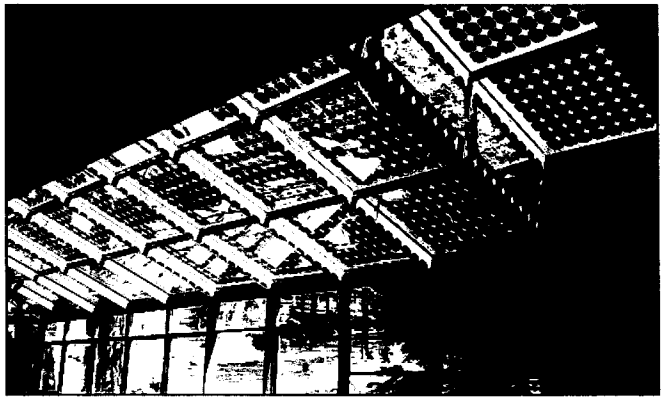
PV laminates are thin films laid in strips on sloped metal roofs. They cannot be installed on flat roofs; the angle must be at least 5°. Because the laminates can only be used on metal roofs, they tend to be most common on industrial and institutional buildings. (Refer to Illustration 12.)



(Illustration 12) This elementary school's standing seam roof is covered with solar laminates that produce electricity. Source: Akeena Solar.

PHOTOVOLTAIC GLAZING

PV materials can also be integrated into glazing by, for example, sandwiching PV cells between two layers of glass. This permits light to enter the building, but the glass is not fully transparent. More transparent forms of PV glass are under development. PV glazing is typically used for glass facades on large commercial or industrial buildings. It can also be used for residential sunrooms but an overly large amount of glass may be needed to produce the same amount of electricity as other system types. (Refer to Illustration 13.)

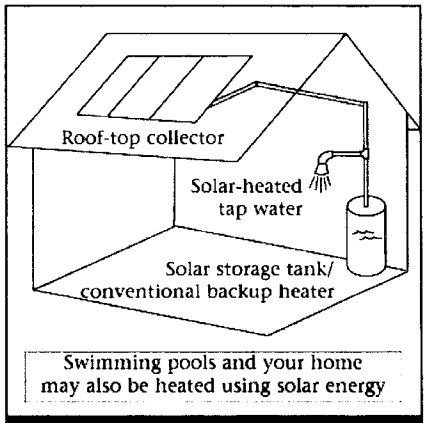


(Illustration 13) Photovoltaic cells are embedded in the glass roof of this solarium. The roof lets in natural light while producing electricity. Source: Atlantis Energy Systems

Solar Thermal Systems

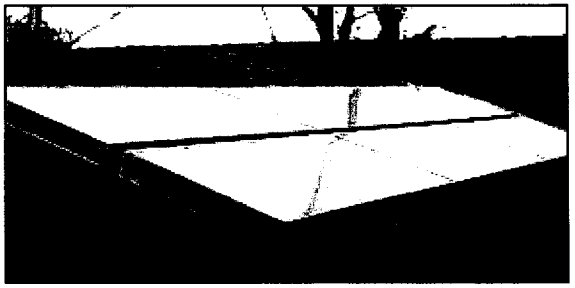
Solar thermal systems (e.g. solar hot water systems) use the sun's energy to produce heat that is transferred to a building's air or water. Unlike photovoltaic systems, solar thermal systems do not produce electricity, but they can reduce energy bills and greenhouse gas emissions by reducing reliance on utilities' electricity or natural gas for heating. Solar thermal systems include: solar hot water systems, which heat water; solar space heating systems, which heat air; and solar space cooling systems, which cool air. Some systems perform more than one of these functions. These guidelines focus mainly on solar hot water systems, which are the most common.

Solar hot water systems generally consist of one or more solar collectors, one or more tanks in which the heated water is stored, and pipes that circulate fluid. A typical collector is a weatherproof box, measuring 2 to 4 feet wide and 5 to 12 feet long. The collector surface is glazed to let in the sun's heat. A metal absorber inside the collector gathers heat and transfers it to attached pipes. There are two common types of collector systems: flat-plate collector systems and integral collector-storage (ICS) systems. A flat-plate collector is only about 4 inches tall, because it does not store water. An ICS collector is thicker, about 10 inches tall, because it contains pipes that double as storage tanks. (Refer to Illustrations 14, 15 and 16.)

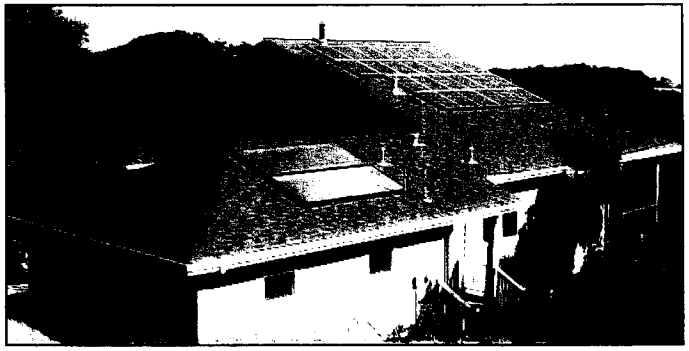


Simplified representation of a solar water-heating system

(Illustration 14) Source: "A Consumer's Guide: Heat Your Water with the Sun," by the U.S. Department of Energy's Energy Efficiency and Renewable Energy division



(Illustration 15) A solar hot water collector. The collector is "thicker" than a solar electric panel and it lacks crystalline modules.

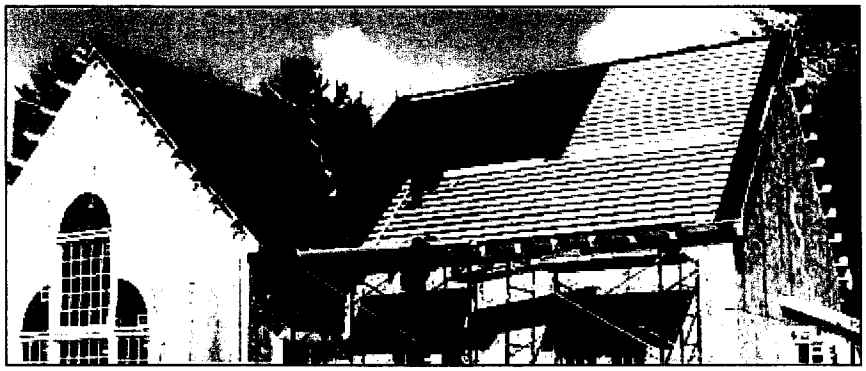


(Illustration 16) The roof on this home has both solar hot water collectors (left) and photovoltaic panels (right). Source: Sun First Energy Systems.

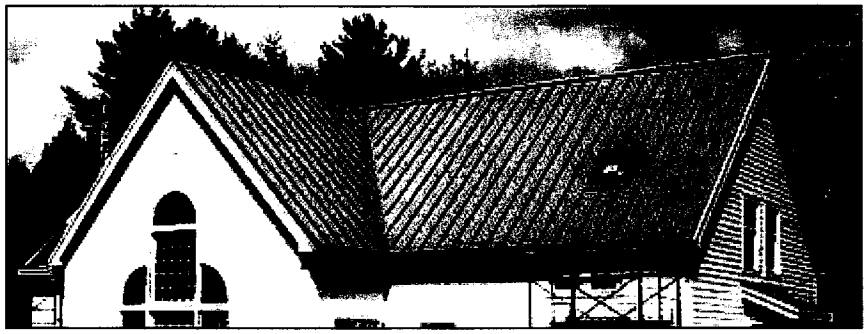
BUILDING-INTEGRATED SOLAR THERMAL SYSTEMS

In a typical building-integrated solar thermal system, the collectors form part of the roof. Instead of absorbing heat in a glazed collector box mounted on the roof surface, building-integrated systems absorb heat directly from the roof. This works because certain roof materials (such as metal and cement tiles) conduct heat relatively well. Building-integrated solar thermal systems are not appropriate for other roof materials because they do not transfer enough heat. Many building-integrated solar thermal systems have no visual impact because they are located underneath the roof surface. Some of these systems contain a thin layer of heat-absorbing pipes underneath the roof surface. In other systems, a pocket of air underneath the roof surface is heated and then transferred through ducts to the building's mechanical water heating or space heating equipment.

Building-integrated solar thermal systems can have higher upfront costs (roughly 10-20% more) than installing glazed flat-plate collectors if the costs of installing a new roof are included. Installing a new roof is the main expense in most building-integrated solar thermal systems, so incorporating a system into a desired or needed re-roof project can pose few additional costs. The systems also have longer life expectancies than traditional collector systems (up to 50 years as opposed to 15-20 years), allowing for greater long-term savings. Building-integrated systems produce less heat per square foot than do other solar thermal systems because the building-integrated systems are not glazed. However, building-integrated systems are much larger, occupying entire roof planes, and thus produce the same total heat output and utility bill savings as collector boxes. Building-integrated solar thermal systems can be combined with photovoltaic shingles or other photovoltaic technologies. (Refer to Illustrations 17 and 18.)



(Illustrations 17 and 18) Building-integrated solar hot water systems can be installed inside the roof (above), making them invisible when the roof is completed (below).



New Construction and Reroofing

When a new home, addition or reroof is contemplated, it is a good time to think about how to accommodate solar energy systems into the project. Consider installing a solar system as part of the project, as the cost of the solar system can be reduced by combining its installation with other work. Also, federal tax credits and state grants are highest in 2006 and the state rebate is scheduled to slightly decrease each year through 2017.

If budget constraints are great, at least design the project so that there is a high performance, attractive location for a solar energy system to be installed in the future. Coordinating the design of the system and the design of the building will help ensure that a high-performance, attractive system can be easily installed later. Planning ahead for a solar system location can also ensure a system can fit in well on a structure, rather than needing to be placed elsewhere on the site where ground permeability might be lost.

Review the City and Community Environmental Council's "Get Started With Solar" Brochure, available as a separate handout. Consider where a system could be located, what size it would need to be and how it might be laid out. Following are some specific techniques for addressing solar energy systems when designing new construction.

All buildings:

At a minimum:

- ☑ Design one section of roof with at least 300 square feet of space for solar installations, where all mechanical equipment and skylights are absent, preferably south-facing at an angle close to 30°, not visible from public areas and free of shading. Many architectural styles accommodate a 30° roof slope, are appropriate to Santa Barbara and are compatible with photovoltaic panels and solar hot water systems.

- ☑ Consider an architectural style that includes a "flat" roof with a parapet architectural feature. Mission Revival, Italianate, and some neo-classical architectural styles commonly can include a parapet roof system. Parapet roof systems can very effectively and attractively screen solar energy systems, as illustrated on page 31.

- ☑ Choose plant and tree types and locations so that plants will not grow to shade areas on the property or on neighboring properties where solar energy systems are installed.

- ☑ Design and locate structures so they will not shade areas on the property or on neighboring properties where solar energy systems are installed.

AT A MINIMUM: (CONT.)

☑ Design with passive solar building design principles in mind. (See Passive Solar Building Design Guidelines, available as a separate handout)

REROOF:

- When new roofing is installed it presents a convenient opportunity to use building-integrated roof shingles, or to install mounted solar panels.

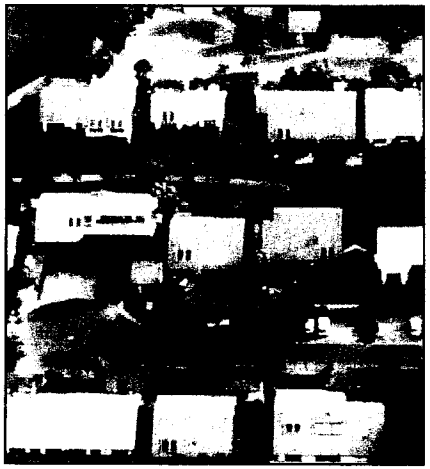
SUBDIVISIONS:

- Maximize the number of lots which have rear (or large) yard solar access on the south and design structures and landscaping to accommodate solar energy systems on each building. Carefully consider mature tree heights and locations in accordance with shadow patterns.
- Where feasible, buildings shall be sited to avoid shading existing solar energy systems on adjoining lots. Also where feasible, buildings should be sited to avoid shading by existing, proposed, or potential buildings on adjoining lots.

(Refer to Illustrations 19 and 20.)

CONDOMINIUMS:

- Condominium projects should include solar energy system designs in plans because it can be difficult for individual condominium owners to modify structures once an Association has been formed for a condominium complex.



(Illustrations 19 and 20.) The siting, layout and landscaping of the homes in these northern California subdivisions allows each to access solar energy. Top photo: "Premier Gardens" subdivision in Rancho Cordova. Source: Sacramento Municipal Utility District. Left photo: "Village Homes" subdivision in Davis. Source: Michael Corbett.

SOLAR ENERGY SYSTEM DESIGN GUIDELINES AND AWARDS

Following these guidelines can achieve a high performing solar installation design that preserves neighborhood and community character. These Guidelines also provide guidance for "challenging" solar sites, where panels are visible to the public, so that the panels become a neighborhood enhancement through superior design techniques.

Projects that meet the Solar Design Recognition Program checklist items can qualify for a Solar Energy System Recognition Award. Three types of projects can be recognized with a Solar Energy System Recognition Award:

1) **"Standard"** Solar Recognition Projects, where site conditions allow for a high performing solar system to be located outside of the public view;
2) **"Design Challenge"** Recognition Projects, where site visibility conditions require careful design to achieve aesthetic goals; and
3) **"Special Challenge"** Recognition Projects, where "Mission-style" tile roofs, historic structures or commercial buildings create special design challenges.

Please note, Passive Solar Recognition Awards are also available, see the City's Passive Solar Design Guidelines for more information on that program.

STANDARD SOLAR ENERGY SYSTEM PROJECTS:

NOT PUBLICLY VISIBLE

Standard Solar projects have minimal design challenges in comparison to other site locations and layouts. Standard Solar Recognition awards are given where high-performance solar panels are relatively easy to locate substantially outside of the public view. The award recognizes the installer for prudently taking advantage of site conditions amenable to solar. Other guidelines in the "Design Challenge" and "Special Challenge" sections of this document do not necessarily need to be followed where solar panels are not visible from the street. Standard Solar Energy System Projects include:

STANDARD CATEGORY 1:

Ideal Site Solar Installations

STANDARD CATEGORY 2:

Flat-Roof-Mounted Solar Energy Systems

STANDARD PROJECT CATEGORY 1: IDEAL SITE SOLAR INSTALLATIONS

The ideal location for a solar energy system in Santa Barbara is:

- On a flat lot in an Infill area (not in the Hillside Design District)
- Facing the south side of a lot, behind a main structure which shields the solar system from view from the street
- In a location where no vegetation or structures would cast shadows onto the system in a way that would decrease system performance by more than 15%
- No public park, beach or trail with views of the site to the south of the lot
- Not in a historic district or on a historic structure

☑ The solar system is proposed on an ideal high performance solar system site, out of the public view.

Where it is possible to install a solar panel in such an ideal location, any type of solar system design or mounting is acceptable and may achieve a Solar Recognition Award because the project is not publicly visible. The City encourages all property owners with ideal solar sites to consider installing high performing Solar Energy Systems shielded from public view. Of course, more visible locations are also appropriate for solar energy systems, but more consideration of aesthetic concerns and system performance is recommended for non-ideal sites.

STANDARD PROJECT CATEGORY 2: FLAT-ROOF PANEL SYSTEMS

Systems mounted on flat roofs can usually easily be installed so they are not visible from public areas. South- and southwest-facing systems aiming for optimal system performance would be angled well above the roof, making them visible from below if there is no screening parapet. Consider angling panels at a flatter angle if this will reduce their visibility. Panels mounted at a 5° angle versus an ideal 30° angle do not lose more than 15% of performance. Acceptable flat roof panel systems meet both of the following criteria.

☑ The flat-roof panel system successfully uses one of the following solutions:

- An architecturally compatible parapet hides the angled system from public view (Refer to Illustrations 45, 46 and 47 on page 32), or
- The system is placed far enough toward the rear of large buildings so the system will not be visible from public areas, or
- If the system is visible, it is mounted at an angle of no more than 5° from the roof surface.

☑ If the system will be visible from buildings above, the panels are organized into simple, rectangular groups.

Design Challenge Solar Energy System Projects: *Publicly Visible*

Design Challenge Solar Energy System Projects are projects where high-performance solar panels cannot be located substantially outside of the public view. Special effort to carefully choose an appropriate solar technology type, aesthetically place and carefully mount the panel is required for an appropriate publicly visible solar panel installation. The Design Challenge Solar Energy System award recognizes the special effort which applicants for these Solar Energy Systems have made to create an aesthetically integrated solar system installation. The "easiest" solution, where the least amount of special design may be needed, in this category is to use "building-integrated" technologies. These technologies can easily blend in with buildings unless a building is historic or has a tile roof. Roof-mounted panel systems visible from the street must carefully follow the mounting and general visibility reduction and integration techniques in "Category 2" to be eligible for a Solar Recognition Award. Acceptable Design Challenge Solar projects are in the following categories:

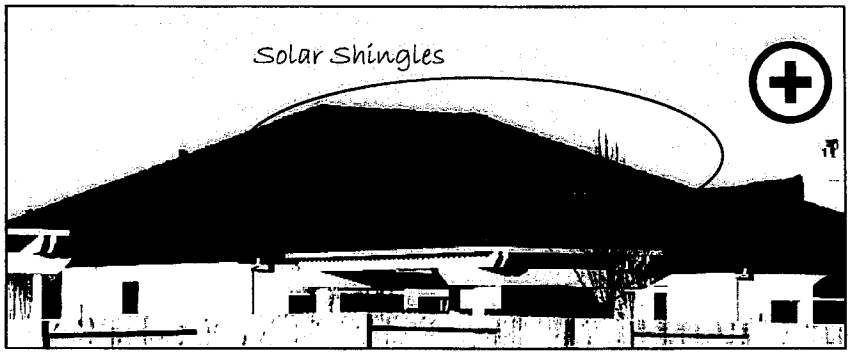
Design Challenge Category 1:

Building-Integrated Technologies Solar Energy Systems

(For more details see page 20.)

Design Challenge Category 2:

Carefully Designed and Mounted Panel Solar Energy Systems (For more details see page 22.)



(Illustration 21.) Category 1: An example of building integrated solar energy system technology. Source: Atlantis Energy Systems.

(Illustration 22.) Category 2: An example of a "carefully designed and mounted panel solar energy system". Source: R&M Technologies

Following are two summary tables that can assist with general solar energy system technology, location and design choices.

The following chart is a summary of options available where lot orientation and constraints require a publicly visible solar panel system.

OPTIONS FOR SITES PUBLICLY VISIBLE FROM THE SOUTH		
DESIGN OPTION	**ADVANTAGES**	**DISADVANTAGES**
Building-integrated technology such as solar roof shingles on publicly visible south side	• High system performance • Easily accepted visual appearance if non-historic, non-tile roof site • Eligible for Solar Design Recognition Program	• Increased installation cost (approx. 10-15%)
Panel system on west or east side, installed at 5° angle	• May lessen public visibility • Eligible for Solar Design Recognition Program	• Small decrease in system performance (approx. 10-15%)
Panel system on publicly visible south side	• Optimal system performance may be possible • May be eligible for Solar Design Recognition Program if design is well-integrated	• Higher public visibility creates a greater design challenge

The following chart is a general guide to choosing among available technology options for some development types and locations.

Which Solar Energy System Type is appropriate for Which Location?

System Type	*Location*			
	Single-family residential lots < 15,000 sq. ft. (usually Infill lots)	Single-family residential lots > 15,000 sq. ft. (usually Hillside lots)	Multi-family residential, commercial, industrial, mixed-use lots	Historic districts and structures
Building Integrated Technology Solar Energy Systems				
Photovoltaic shingles and glazing	Appropriate	Appropriate	Appropriate	May be Appropriate
Photovoltaic roof laminates	Not appropriate	May be appropriate with special design	May be appropriate with special design	Not Appropriate
Carefully Designed Mounted Panel Solar Energy Systems				
Roof-mounted panel systems	Appropriate if well-designed or not publicly visible	Appropriate if well-designed or not publicly visible	Appropriate if well-designed or not publicly visible	Appropriate if not publicly visible
Ground-mounted panel systems	Usually not appropriate due to shadow constraints. Not appropriate if publicly visible.	Appropriate if well-designed or not publicly visible	Appropriate if well-designed or not publicly visible	Not Appropriate

DESIGN CHALLENGE CATEGORY 1: BUILDING-INTEGRATED TECHNOLOGIES

Building-integrated photovoltaic technologies (such as solar shingles, roof laminates and glazing) and building-integrated solar thermal technologies generally blend in extremely well with existing environments Technology in this area is rapidly evolving. As new innovative technologies evolve, these guidelines may need to be updated and new technologies can be evaluated on a case by case basis.

Building integrated technologies may be appropriate on designated historic resources and historic districts if installation of the system does not alter the character defining features of the building or pose a negative impact on its historic setting. It is always preferred that building integrated technologies be installed on portions of the building that are not visible from the public right-of-way. Proposed installation of building integrated technologies on historic structures or within historic districts would be evaluated on a case by case basis.

These Solar Energy Systems are more expensive than regular solar panel systems and the City recognizes the special investments homeowners may make for these aesthetically beneficial systems as valuable to the community. Building-integrated technologies are acceptable, and eligible for a Solar Recognition Award, if the project is not on a historic resource site and the following criteria are met. See page 35 for a summary of Building Integrated Technology concepts.

PHOTOVOLTAIC SHINGLES OR TILES

Solar shingles or "tiles" are integrated into the roof and are the most preferred mounting method for sloped roofs.

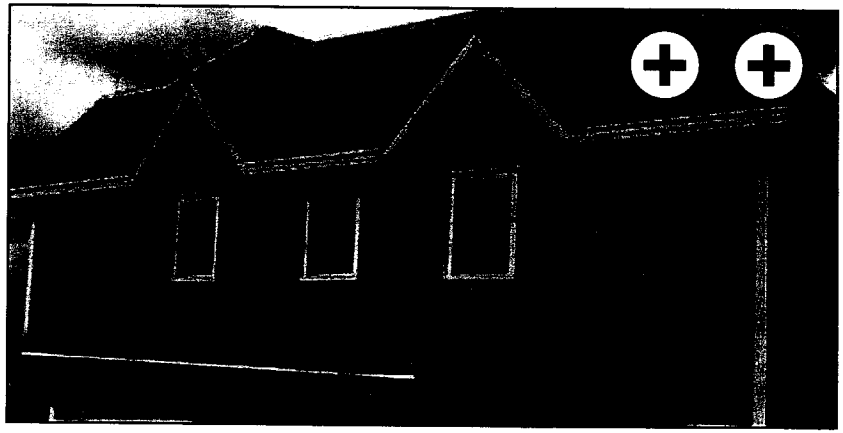
☑ The entire roof face is covered with solar shingles in order to avoid a visual contrast between solar shingles and regular shingles. Or, if not possible, the shingles are installed in an aesthetically appropriate regular shape of shingles. (Refer to Illustrations 23, 24 and 25.)

PHOTOVOLTAIC LAMINATES

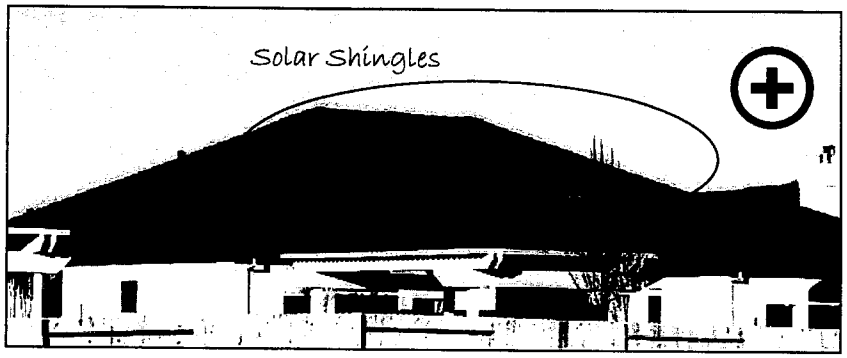
Photovoltaic laminates have a different aesthetic appearance because the photovoltaic material is laminated onto long metal roofing panels.

☑ An aesthetically appropriate laminate design is proposed for a commercial, industrial, mixed-use or multi-family residential project

☑ If the project is proposed for a single-family residential project, the design is innovative in nature to achieve an appropriate aesthetic appearance.



(Illustration 23) Photovoltaic shingles are best integrated when they cover the entire roof so as not to contrast with the other shingles. Source: Atlantis Energy Systems.



(Illustration 24) The shingles on the top section appear slightly different than the rest of the roof, but overall, integrate well. Source: Atlantis Energy Systems.

(Illustration 25) These solar roofing tiles have been applied in a way that creates irregular shapes on the roof and the tiles do not completely cover the entire roof plane.

Photovoltaic Glazing

Photovoltaic glazing is rare for small-scale projects but may become more common eventually. Photovoltaic glazing may be useful wherever a large, semi-transparent or opaque glass surface is desired.

- ☑ An aesthetically appropriate PV glazing design is proposed for a large commercial or industrial project's atriums, awnings, walls or roofs.
- ☑ If the PV glazing is proposed for a residential structure, the design is innovative in nature to achieve an appropriate aesthetic appearance.

Building-Integrated Solar Thermal Technologies

Consider using building-integrated solar thermal technologies so that solar thermal systems are not visible from public areas. Solar thermal building-integrated systems require a cement or metal roof.

- ☑ A cement or metal roof is proposed on a commercial non-historic structure.
- ☑ A cement-tile roof is proposed with the system on a single-family structure, where the cement-tile roof would be considered compatible with the neighborhood.
- ☑ A cement-tile roof is proposed in a historic district or on a historic structure if a cement-tile roof is appropriate for the historic district or structure.

DESIGN CHALLENGE CATEGORY 2: CAREFULLY DESIGNED AND MOUNTED PANEL SYSTEMS

Publicly visible solar energy systems which do not use building-integrated technologies require special attention to placement and design to ensure a pleasing appearance. For a mounted solar system design to be considered well integrated with a building, it should meet criteria in all of the following categories:

- Appropriate Size
- Least Visible High-Performance Location
- Panel Arrangement and Design
- System Infrastructure Screening
- Frame Color
- Glare
- Mounting

Ground mounted systems are also subject to additional criteria. Publicly visible panel systems that meet all of the criteria categories are eligible for a design award as part of the Solar Design Recognition Program, whereas publicly visible systems that are not well-integrated are not eligible. See page 36 for a summary of carefully designed and mounted panel system concepts.

SYSTEM SIZE

Avoid the need for overly large publicly visible projects by taking steps to improve the building's energy efficiency. It is far less expensive to reduce heating, cooling and lighting demand than it is to satisfy that demand with a high-tech solar energy system.

☑ The proposed system is no larger than necessary to meet the building's electricity needs and to compensate for the initial energy used in home construction. Also, reasonable steps have been taken on the site to reduce electricity use (e.g. outdoor lighting fixtures are for safety lighting only and, if a single-family residence, the structure is smaller than 4,000 square feet).

LEAST VISIBLE HIGH-PERFORMANCE LOCATION

Choose the least visible location where performance decreases by no more than 15% by following these guidelines:

- Locate the panel system on the west or east side of the site if it is less publicly visible than the south side of the side and there are appropriate shading factors. Locating panels on the east or west side of a site results in only a modest, acceptable decrease in system output as long as the panels are close to horizontal (flat). Flat panels are not always feasible because they may collect water; a 5° angle may be sufficient instead. Panels installed at a 5° angle can perform approximately 85-90% as well as they would if installed at an optimal 30° angle, regardless of whether they are on the south, east or west side of a site.

Least Visible High-Performance Location (continued)

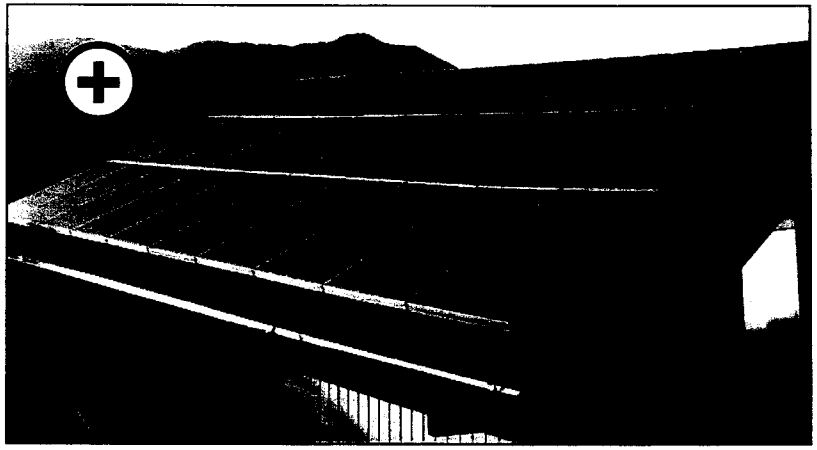
- Locate systems on the rear façade of a building, on accessory structures or in another less visible location if shade patterns would not significantly compromise system performance.
- Only mount panels on the roof. Do not consider projecting panels from walls or other parts of structures, unless it is a commercial structure creating a well designed "awning" with the solar panels.
- Consider whether shadow-tolerant panels would make a less visible location feasible.

☑ The system is located in the least visible location where at least 85% of optimal system performance can be achieved.

Panel Arrangement and Design

Roof-mounted systems are very common in Santa Barbara and can be highly visible. Panel systems mounted on sloped roofs should be incorporated or integrated into the structure design. This topic is important. Seven concepts and illustrations of this topic follow on the next four pages.

1. Consider the panels as part of the overall design composition. Match the shape and proportions of the array with the shape and proportions of the roof. (Refer to Illustrations 26 and 27.)

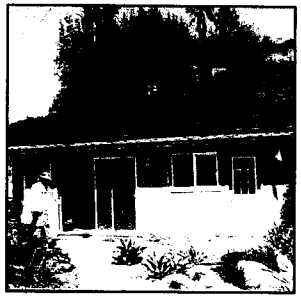


(Illustration 26) This system matches the shape and proportions of the roof. Source: Sun First! Energy Systems

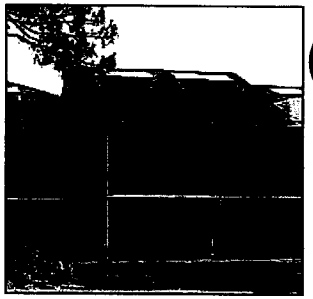
(Illustration 27) These panels are not well-proportioned to the roof. They visually overwhelm the structure. Source: "Design Guidelines for Historic Districts in the City of Pasadena, California"

PANEL ARRANGEMENT AND DESIGN (CONTINUED)

2. Installations on single-plane roofs are preferable because arrays can create a disjointed appearance on multi-plane roofs. (Refer to Illustrations 28, 29 and 30.)



(Illustration 28) This installation is on a single roof plane and is very well integrated with the building. Source: REC Solar.



(Illustration 29) This solar thermal (hot water) installation is on a townhome's single roof plane and integrates well by mimicking the rectangular patterns on the building's facade.

(Illustration 30) The panels on this roof do not integrate as well with the dormer and its multiple roof planes as they would with a single roof plane.

3. Consistently cover the entire roof face with the array if possible. If not possible, either:

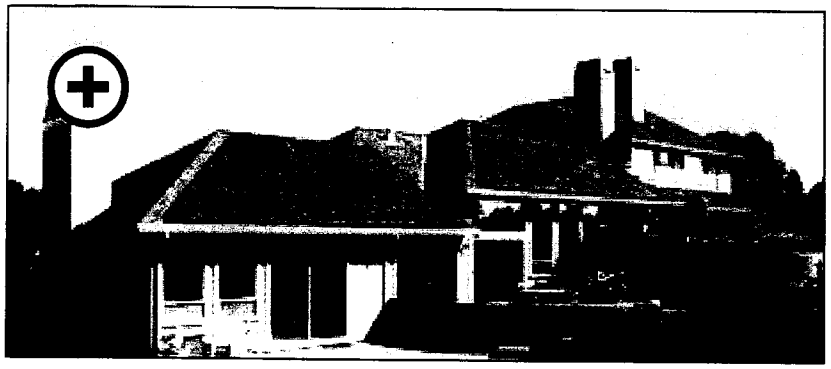
   a. aim for a regularly shaped rectangle of panels; or (Refer to Illustrations 31 and 32.)

(Illustration 31) This installation is relatively attractive because of the regular rectangular shape that matches the roof shape. Source: REC Solar.

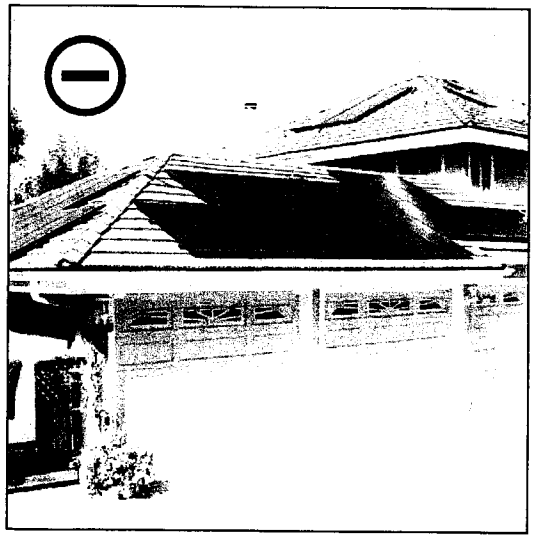
(Illustration 32) The irregular shape of this array makes it less attractive.

   b. use custom panel shapes to match the shape of the roof. Some manufacturers will create custom panel shapes such as triangles. (Refer to Illustrations 33 and 34.) If the roof is not entirely covered with panels, avoid leaving small or thin portions of the roof surrounding the array. Allow roof elements to remain which have enough size to appear intentional and hold their visual "weight" in the overall design composition.

Panel Arrangement and Design (continued)

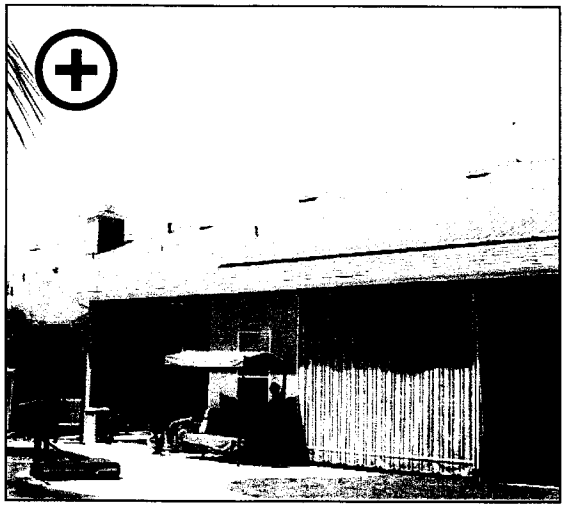


(Illustration 33) Triangular solar panels match the triangular roof planes on this home. Source: SPG Solar

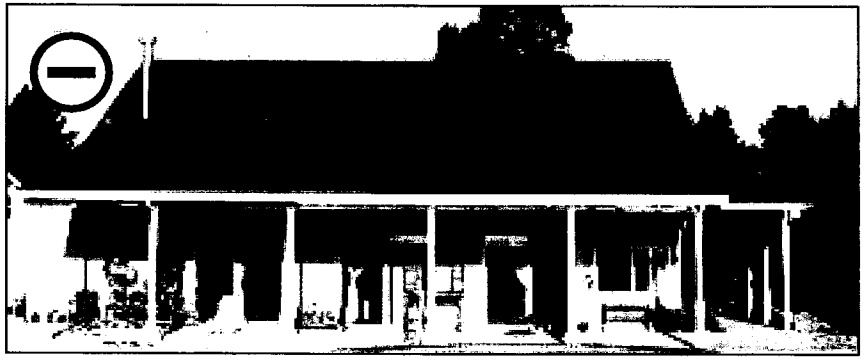


(Illustration 34) This home's array looks less integrated because there are no triangular pieces to match the triangular roof shape.

4. Avoid interrupting arrays with rooftop projections such as vents or skylights. (Refer to Illustrations 35 and 36.)



(Illustration 35) This array is visually cohesive because it is not broken up by projections such as vents or skylights. Source: REC Solar.



(Illustration 36) The multiple skylights on this roof interrupt the array in several places, preventing it from being visually cohesive.

PANEL ARRANGEMENT AND DESIGN (CONTINUED)

5. Avoid breaking up systems into multiple panel areas. Try to limit the array to one rectangular panel section on each side of the structure. (Refer to Illustrations 37 and 38.)

6. In some cases, placing an array along the lowest edge of the roof may make it less visible from a distance.

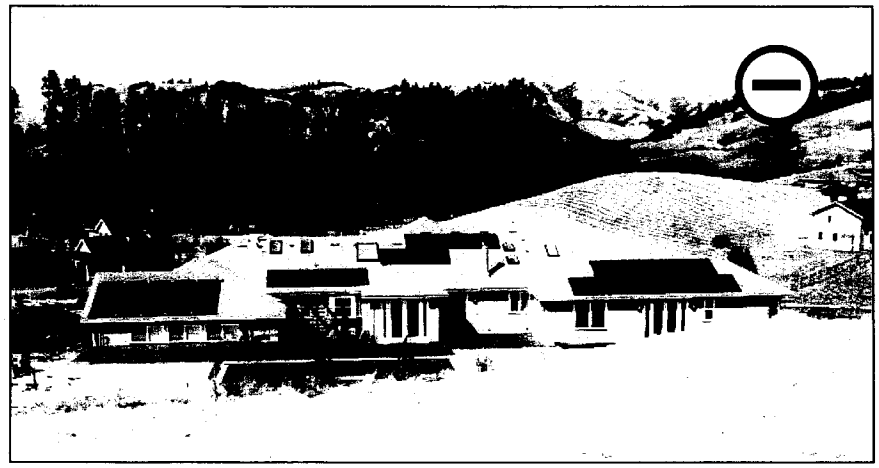
7. Coordinate roof and building color and pattern as much as feasible with the color and pattern of the collection array. Darker roofing colors can better compliment mounted solar energy systems.

☑ If the system is mounted on a sloped roof, the system is integrated and incorporated into the structure design by following the previous seven guidelines.

SYSTEM INFRASTRUCTURE SCREENING

Use appropriate facades, walls, fences or landscaping to screen the system's supporting framework from view. Walls and other screening materials should be fully integrated with the overall site and building design. Wall colors should complement those of the site and building. Screening is especially important if a panel is over 8 inches above the roof or ground.

(Illustration 37) This system is less visually distracting because there is only one group of panels. Source: NorCal Solar.



(Illustration 38) This system is more visually distracting because it is broken up into several irregularly shaped groups of panels.

System Infrastructure Screening (continued)

Some tree trimming to avoid panel shadowing is appropriate, but trimming should not be more extensive than necessary.

Avoid exposing equipment, conduits or pipes to public view. Place conduits in inconspicuous locations such as underneath the roof if possible. Locate equipment (e.g., hot water tanks) in a discreet location in the rear yard or in an accessory building rather than placing it on the roof if possible.

☑ The proposed system follows the guidelines above regarding screening frames, supports, equipment and conduits.

Frame Color

☑ If frames are not blocked from view, colored frames are used to match or complement the roof or building colors. Installers can obtain frames in a wide variety of colors. Use finished trim materials.

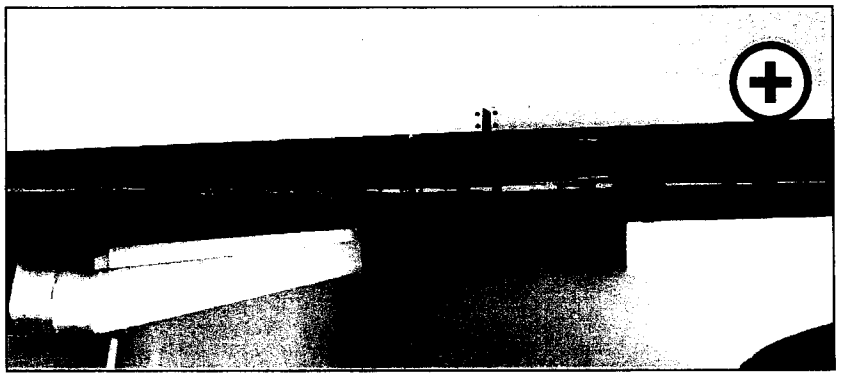
Glare

- Use panels with non-reflective coatings.
- Exposed frames and components should have a non-reflective surface.
- Reflection angles from collector surfaces should be oriented away from neighboring windows and, to the extent possible, away from public areas.

☑ The proposed system follows the above glare guidelines.

Mounting

For more traditional panel systems such as photovoltaic panels or solar thermal collectors, the systems are generally less visible when they are installed as close to the roof or ground as possible. (Refer to Illustrations 39 and 40.)



(Illustration 39) The panels on this roof have no more than 8 inches of space between them and the roof, reducing their visibility.

(Illustration 40) These panels are sharply angled off the roof and are thus highly visible from the street.

MOUNTING (CONTINUED)

Panels should be as close to the roof plane as possible, with no more than 8 inches between the roof and the panels. A possible exception may be panels that are located on the east or west side of a site in order to reduce visibility. These panels may need to be close to horizontal (5°) rather than parallel to the roof slope in order to maximize system performance. (Refer to Illustrations 39 and 40.) Panels should not project above the roof ridge line.

In some cases, flush or direct mounting may be possible where the panel is installed directly on top of the roof. This is less visible than other panel mounting methods, but it should only be used if sound weatherproofing can be provided and if the panels would not overheat.

Please note, the following sloped-roof mounting methods are NOT preferred mounting methods, and would not be eligible for the Solar Design Recognition Program:

- Standoff mounting greater than 8 inches. This adds to the mass, bulk and scale of the building and focuses attention on the solar panel.
- Frame or rack mounting. This is highly visible and greatly adds to the mass, bulk and scale of the building. It is the least preferred roof-mounting method.

☑ If the system is mounted on a sloped roof, a mounting method eligible for the Solar Design Recognition Program, as described below, is used.

MOST PREFERRED SLOPED-ROOF MOUNTING METHOD	Building-integrated technologies (solar shingles, roof-integrated solar thermal)
↕	Direct or flush mounting (if feasible)
	Standoff mounting 8 inches or less
	Standoff mounting greater than 8 inches
LEAST PREFERRED SLOPED-ROOF MOUNTING METHOD	Frame (aka rack) mounting

Ground-Mounted Systems

Ground-mounted systems are bolted into the ground and supported by frames. If possible, ground-mounted systems should be installed so that they are not readily visible from public areas. Ground-mounted systems can be well-suited to large hillside lots; however, many hillside locations can be easily seen from areas below. Ground-mounted systems' designs should be sensitive to this issue. If the ground-mounted system is visible from public locations, try to mount the panels as close as possible to the ground while allowing adequate drainage and preventing vegetation from shading the panels. Provide attractive vegetation to further "frame" and "soften" the appearance of ground-mounted panels. Remember to locate systems outside of required setbacks and open yard areas. All of the following guidelines should be followed for publicly visible ground-mounted systems.

1. Least visible high-performance location. Locating systems in rear yards is likely to make systems less visible from the street, but some rear-yard systems may be highly visible throughout the neighborhood or other parts of the city. Locate systems toward the bottom of a hill rather than at the top to reduce visibility if feasible.

☑ The system is located in the overall least visible location where 85% of optimal system performance can be achieved.

2. Appropriate Array Arrangement.

☑ Large ground-mounted arrays are appropriately broken into separate rows or squares.

3. Minimized visual impact from support frames.

3a. Install systems as close to the ground as feasible to match the slope of the hillside. This avoids the need for tall frames and supports. Many slopes in Santa Barbara's hillside areas are a minimum of 10° (or approximately 20% slope). At this angle, systems can achieve approximately 95% of the optimal system output.

☑ The system is installed within 1 foot of the natural ground topography.

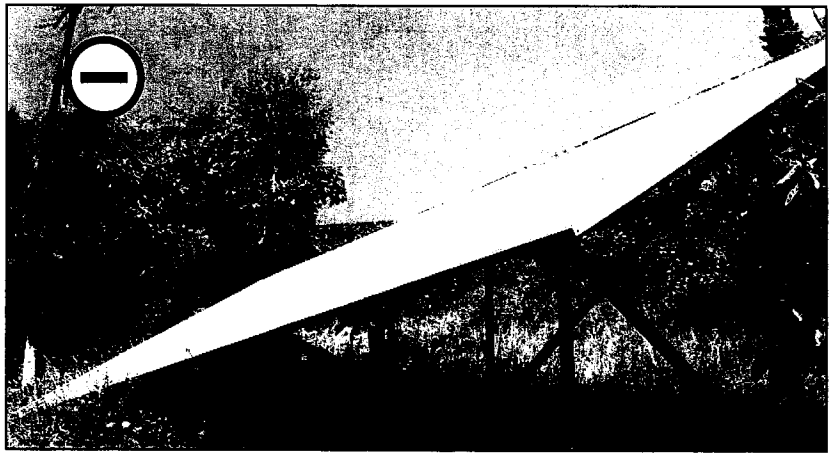
OR

3b. Custom-fitted triangular walls can help to hide the frames and supports of systems that are mounted off the ground. Such walls should use earth-tone colors and preferably native, natural materials and should be integrated with surrounding vegetation. Drought-tolerant, preferably native ground-cover landscaping can help to frame ground-mounted systems. Taller screening and landscaping on the north side of panels is encouraged.

☑ Frames are hidden with natural material walls or drought-tolerant, preferably native landscaping with a mature height which will not shade the panel.

(Refer to Illustrations 41 and 42 on following page.)

(Illustration 41) This site uses native landscaping to frame the array, helping to integrate it into the site. The panels are also located close to the ground to further reduce their visibility.



(Illustration 42) This array protrudes several feet above the ground with little landscaping to mask the exposed framing system, and making it visible from public areas below.

Special Challenge Solar Energy System Projects: *Mission Tile, Historic Districts and Structures, and Commercial Systems*

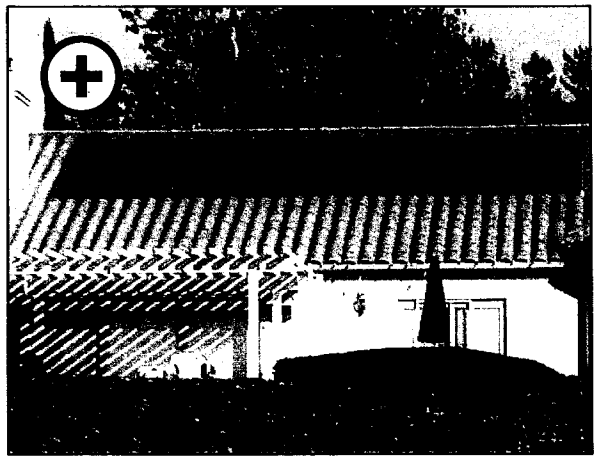
Special Challenge Category 1: "Mission-Style" Tile Roofs on Non-Ideal Site Conditions

"Mission-style" tile roofs are integral to Santa Barbara's special character, especially in special design districts like the El Pueblo Viejo District. Avoid placing arrays on publicly visible terra cotta or Mission-style" tile roofs because the dark coloring and smooth finish on solar panels contrast greatly with terracotta colored, detailed tile patterns Also, in Santa Barbara, the contemporary look of solar panels would contrast with the "historic" feel traditional Mission style C-tiles provide. (Refer to Illustrations 43 and 44.)

For this challenging situation, consider alternative, less visible system locations instead such as:

- Ground-mounted systems
- Systems on non-tile roof accessory structures (ex; a shed)
- An architecturally compatible parapet screening method to hide the panels on a terra cotta roof without placing the panels on tiles

☑ If buildings with Mission-style tile roofs are on site, an innovative solution is used to achieve higher performance without installing the system directly on a publicly visible roof. Guidelines for "Design Challenge" projects are also followed.



(Illustration 43) An array on a terra cota tile roof outside of the public view, such as this array oriented towards a backyard, is appropriate.

(Illustration 44) Dark, flat solar arrays look out of place on publicly visible terra cotta tile because of the contrasting colors.

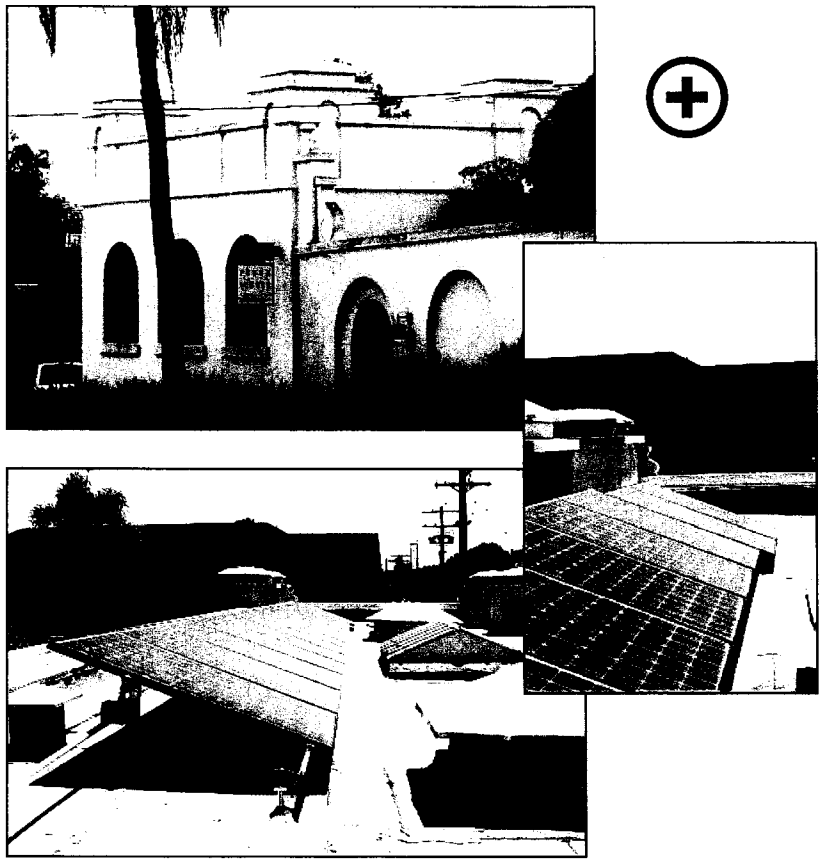
SPECIAL CHALLENGE CATEGORY 2: HISTORIC DISTRICTS AND STRUCTURES

Solar energy systems in Historic Districts, on designated Landmarks or on Structures of Merit should not be visible from the public right of way. Some historic buildings in Santa Barbara with Mission Revival or Mediterranean Revival architectural styles have parapets, which can be used to hide solar energy systems. (Refer to Illustrations 45, 46 and 47.)

Solar system installations should not damage or alter the exterior of historic structures. For panels that are not flat, consider using custom-fitted walls that match the structure to screen system frames and supports.

Building integrated solutions such as photovoltaic shingles, laminates and glazing may be appropriate on historic structures where they are not publicly visible. Depending on system design, historic significance of the host building, and visibility, building integrated technology may sometimes be acceptable on visible portions of historic structures, but this would be evaluated on a case by case basis.

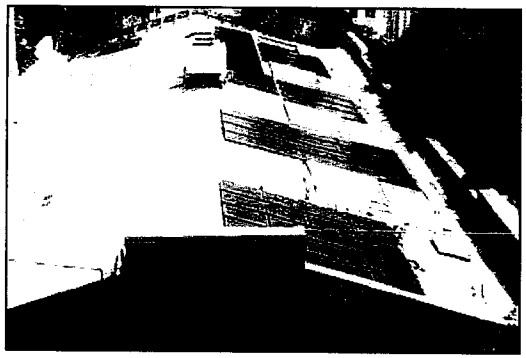
☑ The system is not visible from public areas, and only solar technologies which integrate well with historic structures are proposed. Guidelines for "Design Challenge" projects are also followed, as appropriate.



(Illustrations 45, 46 and 47) This historic building at 34 W. Mission Street was once part of the "Flying A Studio," where many movies were filmed. Its solar panels are completely invisible from the adjacent streets, allowing the building to retain its historic character. The panels are on a flat roof, but they are hidden by the building's parapet. The panels are organized in a straight line, avoiding vents and skylights. The two panels closest to the parapet are slightly out of alignment with the rest of the panels in order to prevent them from being visible from the street.

Special Challenge Category 3: Commercial Systems

Commercial systems tend to be much larger than residential systems and as a result, can be more difficult to shield from public view. Commercial systems need to follow the same guidelines as other systems, as listed above, but special consideration is needed where a large publicly visible system is proposed. Choose an appropriate type of system for the building.



(Illustration 48) This commercial solar panel system on the San Francisco "Rosebud Agency building" is mounted flush with the roof behind a parapet system.

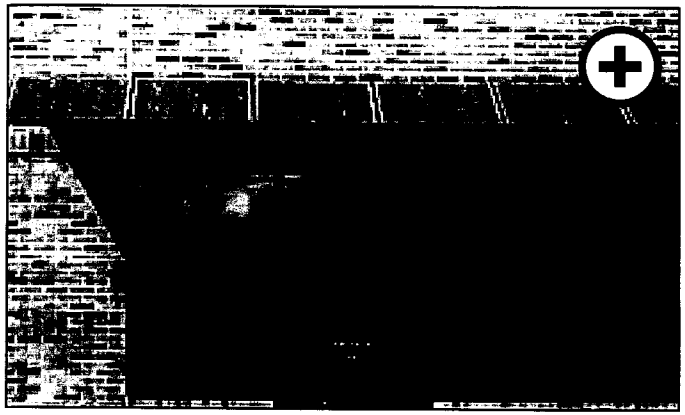
Commercial systems eligible for the Solar Design Recognition Program:

- Systems that are completely hidden from public view by a parapet or other means
- PV laminates on sloped metal roofs or PV glazing
- PV panels that serve as well designed, regularly sized awnings
- Solar energy systems located on well-designed architecturally compatible trellises located in parking lots
- Other publicly visible systems that meet the "Design Challenge" guidelines above

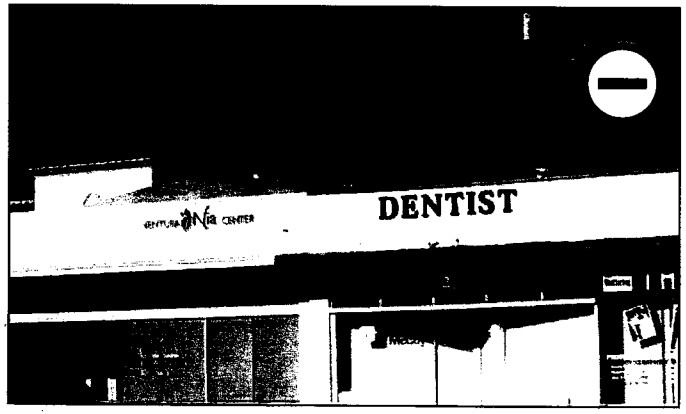
☑ A solar energy system eligible for the Solar Design Recognition program is proposed. Guidelines for "Design Challenge" program are followed.

Most Preferred Commercial System Type	Systems that are completely hidden from public view by a parapet
↑	PV laminates on sloped metal roofs or PV glazing
	PV panels that serve as regularly sized awnings
↓	Publicly visible roof-mounted systems that meet guidelines
Least Preferred Commercial System Type	Publicly visible roof-mounted systems that do not meet guidelines

COMMERCIAL SYSTEMS (CONTINUED)

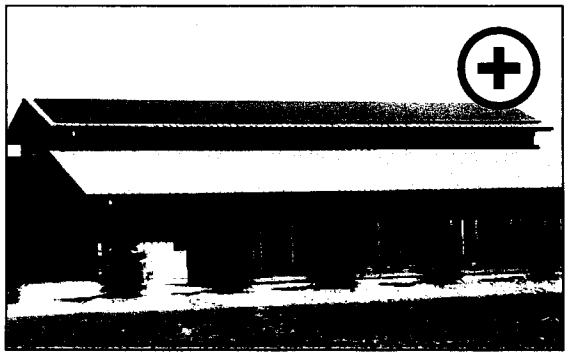


(Illustration 49 Photovoltaic panels form the awning over the window on this building. This is a less visually distracting way to integrate a large system onto a commercial building. Source: Eco Footage.com



(Illustration 50) This commercial system would be much less visually impactful if it were installed within 5 degrees of the flat roof or behind a parapet system.

(Illustration 51) A natural wood colored support framing system and generous use of plant materials could make parking spaces covered with solar panels both functional and aesthetically pleasing in Santa Barbara commercial parking lots. Source: REC Solar



(Illustration 52) This roof system on a storage building is well integrated with the building design. Source: REC Solar

Solar Design Recognition Program Checklist: Solar Energy System Recognition Awards

Use this checklist to determine whether a solar energy system project is eligible for the City of Santa Barbara's Solar Design Recognition Program. A project may be eligible for a Solar Energy System Recognition Award if it meets the criteria in one of the following project eligibility areas:

1) Standard Projects;

2) Design Challenge Projects; or

3) Special Challenge Projects.

A project does not need to meet the criteria in more than one of the project eligibility areas in order to receive an award. Staff will make recommendations to City Council regarding solar energy systems which qualify to receive an award through the Solar Design Recognition Program.

Standard Project Eligibility: *Not Publicly Visible*

Projects are eligible for a Solar Energy System Recognition Award if they meet all of the criteria in either Category 1 or Category 2.

Standard Category 1: Ideal Sites for Solar Installations

☐ The solar system is proposed on an ideal high performance solar system site, out of the public view.

Standard Category 2: Flat-Roof Panel Systems

☐ The flat-roof panel system successfully uses one of the following solutions:

- An architecturally compatible parapet hides the angled system from public view, or
- The system is placed far enough toward the rear of large buildings so the system will not be visible from public areas, or
- If the system is visible, it is mounted at an angle of no more than 5° from the roof surface

☐ If the system will be visible from buildings above, the panels are organized into simple, rectangular groups.

DESIGN CHALLENGE PROJECT ELIGIBILITY: *PUBLICLY VISIBLE*

Projects are eligible for a Solar Energy System Recognition award if they meet all of the criteria in either Category 1 or Category 2.

DESIGN CHALLENGE CATEGORY 1: BUILDING-INTEGRATED TECHNOLOGIES

The following types of Building Integrated Technologies are recommended as attractive solar energy system solutions.

PHOTOVOLTAIC SHINGLES OR TILES

- ☐ The entire roof face is covered with solar shingles in order to avoid a visual contrast between solar shingles and regular shingles. Or, if not possible, the shingles are installed in an aesthetically appropriate regular shapes of shingles.

PHOTOVOLTAIC LAMINATES

- ☐ An aesthetically appropriate laminate design is proposed for a commercial, industrial, mixed-use or multi-family residential project
- ☐ If the project is proposed for a single-family residential project, the design is innovative in nature to achieve an appropriate aesthetic appearance.

PHOTOVOLTAIC GLAZING

- ☐ An aesthetically appropriate PV glazing design is proposed for a large commercial or industrial project's atriums, awnings, walls or roofs.
- ☐ If the PV glazing is proposed for a residential structure, the design is innovative in nature to achieve an appropriate aesthetic appearance.

BUILDING-INTEGRATED SOLAR THERMAL TECHNOLOGIES

- ☐ A cement or metal roof is proposed on a commercial non-historic structure.
- ☐ A cement-tile roof is proposed with the system on a single-family structure, where the cement-tile roof would be considered compatible with the neighborhood.
- ☐ A cement-tile roof is proposed in a historic district or on a historic structure if a cement-tile roof is appropriate for the historic district or structure.

Design Challenge Category 2: Carefully Designed and Mounted Panel Systems

For this category, structure mounted systems must have each box checked for all the design criteria below for award eligibility. Ground mounted systems must meet all three criteria of the ground mounted category.

System Size

☐ The proposed system is no larger than necessary to meet the building's electricity needs and to compensate for the initial energy used in the home's construction. Also, reasonable steps have been taken on the site to reduce electricity use (e.g. outdoor lighting fixtures are for safety lighting only and, if a single-family residence, the structure is smaller than 4,000 square feet).

Least Visible High-Performance Location

☐ The system is located in the least visible location where at least 85% of optimal system performance can be achieved.

Panel Arrangement and Design

☐ If the system is mounted on a sloped roof, the system is integrated and incorporated into the structure design by following the seven guidelines on pages 22–25 regarding: 1) overall design integration, 2) installation on a single plane roof if feasible, 3) covering as much of a roof face as possible, 4) avoiding array pattern interruptions from rooftop equipment, 5) avoiding creating multiple panel groups, 6) consideration of placement on the lowest edge of a roof if it does not cover the entire roof plane, and 7) coordination of panel materials and framing with roof and/or building colors as feasible.

System Infrastructure Screening

☐ The proposed system follows guidelines regarding screening frames, supports, equipment and conduits.

Frame Color

☐ If frames are not blocked from view, colored frames are used to match or complement the roof or building colors.

Glare

☐ The proposed system follows the glare guidelines.

Mounting

☐ If the system is mounted on a sloped roof, an eligible mounting method described on pages 26 - 29 is used. Usually, acceptable mounting methods include the top of the panel being located less than 8" from the structure at all points.

Ground-Mounted Systems

☐ The system is located in the overall least visible location where 85% of optimal system performance can be achieved.

☐ Large ground-mounted arrays are appropriately broken into separate rows or squares.

☐ The system is installed within 1 foot of the natural ground topography; OR frames are hidden with natural material walls or drought-tolerant, preferably native landscaping with a mature height which will not shade the panel.

SPECIAL CHALLENGE PROJECT ELIGIBILITY

Projects are eligible for a Solar Energy System Recognition Award if they meet the criteria in Category 1, 2 or 3.

CATEGORY 1: "MISSION-STYLE" TILE ROOFS ON NON-IDEAL SITE CONDITIONS

☐ If buildings with Mission-style tile roofs are on site, an innovative solution is used to achieve high system performance without installing the system directly on a publicly visible tile roof. Guidelines for "Design Challenge" projects are also followed.

CATEGORY 2: HISTORIC DISTRICTS AND STRUCTURES

☐ The system is not visible from public areas, and only solar technologies which integrate well with historic structures are proposed. Guidelines for "Design Challenge" projects are also followed, as appropriate.

CATEGORY 3: COMMERCIAL SYSTEMS

☐ A solar energy system type eligible for the Solar Design Recognition Program is proposed. Guidelines for "Design Challenge" projects are followed.

Definitions

Angle: The shape or space formed by two line segments meeting at one point. In these guidelines, angle is measured in degrees of a circle from a horizontal plane. For example, a panel angled 0° would be horizontal, a panel angled 90° would be vertical, and a panel angled halfway between vertical and horizontal would be at a 45° angle.

Array: A number of solar panels connected together in a single structure. Typically, one array powers one building.

Building-integrated photovoltaics (BIPV): A type of photovoltaics in which the collectors are integrated into the building construction materials such as the roof or glazing.

Cell, photovoltaic: The most basic unit of a photovoltaic module, where the materials necessary to produce electricity are located. A solar module can have roughly 36 photovoltaic cells.

Collector: The portion of a solar energy system where the sun's energy is captured into the system. Photovoltaic cells are the collectors in a photovoltaic system. A solar thermal system collector typically refers to an entire box that absorbs the sun's heat. Many solar thermal system collectors let in heat through a glazed surface and then absorb it inside using special coatings. These collector boxes can measure several feet in width and length, similar to a photovoltaic module.

Conduit: A metal tube housing electrical wires.

Glazing: A covering of transparent or translucent material (typically glass or plastic) used for admitting light.

Grid, electrical: An electrical utility distribution network.

Grid-connected: Connected to the electrical grid. Refers to solar electric systems that can transfer the power they produce to the grid.

Inverter: A piece of electrical equipment that converts DC (direct current) power produced by a photovoltaic array to AC (alternating current) power used in residences and businesses.

Module: An encapsulated panel containing a number of electrically connected photovoltaic cells.

Net energy metering: The practice of crediting a homeowner's electricity bill for surplus power produced by a solar energy system and exported to the electricity grid.

Panel: Often used interchangeably with "module," but can also refer to a row of one or more modules.

Parapet: A low wall along the edge of a roof, commonly used in Spanish, Italianate, Mission Revival and Neo-Classical architectural styles and on commercial buildings.

Performance, system: The energy output of a solar energy system.

Photovoltaic: Capable of producing electricity from light.

Public area: Any publicly owned property, including public sidewalks, streets, trails, parks, beaches and plazas.

Roof pitch: The angle or slope of the roof. Often expressed in the units of vertical rise to 12 units of horizontal run.

Roof plane: A single, uniform roof surface with equal pitch throughout.

Solar access: Ability of a building or collector to receive light and heat from the sun.

Solar energy: Energy from the sun, including heat and electricity generated using the sun's radiant energy. This is distinguished from energy derived from fuels or from the action of wind or water.

Solar energy system: A system, such as a photovoltaic or solar thermal system, that uses the sun's energy to produce electricity or heat.

Solar hot water system: A system that uses the sun's energy to heat water.

Solar thermal system: A system that uses the sun's energy to produce heat. Solar hot water systems, solar space heating systems and solar space cooling systems are all examples of solar thermal systems.

Style, architectural: A way to classify architecture based on the appearance and character of a building's design and construction.

Yard, front: The open space, unoccupied and unobstructed from the ground upward, extending across the full width of the lot between the front lot line and the nearest wall of any building.

Yard, open: An open space, on a lot or parcel of land, unoccupied and unobstructed from the ground upward, which does not contain any of the following: (a) cut or fill sloped greater than one foot (1') rise or fall in five feet (5') of horizontal distance; (b) portion of a front yard; (c) paving or other surfacing designed for use by motor vehicles or trailers.

Yard, rear: The open space, unoccupied and unobstructed from the ground upward, extending between the rear lot line and the nearest wall of any building.