Solar Energy System Design Guidelines

As approved by the Jerome Town Council

June 2015

Purpose of These Guidelines

The purpose of this guideline is to provide direction to Jerome's citizens, Boards and Commission members in the use of solar energy technology. This guideline is intended to:

> *Encourage solar energy system installation designs which are compatible with Jerome's neighborhoods and which preserves the Town's historic and visual resources.*

Introduction

A number of trends point toward continued growth of new photovoltaic (PV) installations. People are looking for opportunities to reduce their utility bills, and to minimize their carbon footprint. Historic preservationists maintain that preserving, reusing, and maintaining historic structures is a key to sustainable design strategy, while also recognizing the importance of accommodating renewable energy technologies. Providing guidance regarding solutions and best practices is an important step toward resolving or eliminating barriers to solar energy system installations.

Jerome faces special challenges due to its mountainside location, and the key challenge in Jerome, is locating solar systems in such a way that the system is efficient and productive, while still protecting our historic town site. The ideal solar installation is located in sunny, south-facing location, with optimum tilt angle, which will supply maximum electricity to the site. Not all sites will be suitable for solar technologies.

The project team should encourage outcomes which will meet solar criteria, while maintaining the integrity of our historic resources. Every effort must be made to minimize the negative visual impact of solar panels; always working to protect and maintain our historic Town.

Types of Systems:

Photovoltaic (PV)

A photovoltaic system is a system which uses one or more solar panels to convert sunlight into electricity. It consists of multiple components, including the photovoltaic modules, mechanical and electrical connections and mountings and means of regulating and/or modifying the electrical output.

Solar Shingles

Also called photovoltaic shingles, are solar cells designed to look like conventional asphalt shingle. There are several varieties of solar shingles, including shingle-sized solid panels that take the place of a number of conventional shingles in a strip, semi-rigid designs containing several silicon solar cells which are sized more like conventional shingles, and newer systems using various thin film solar cell technologies which match conventional shingles both in size and flexibility.

Freestanding

Freestanding PV panels or freestanding arrays allow the benefits of renewable solar power without disrupting the roofline or altering a structure. They are placed away from the residence and connected through underground wiring. When a roof may be blocked by trees or not receiving direct sunlight, the mobility of a freestanding panel allows the ability to move it into optimal sunlight areas which may change seasonally.

Design Considerations:

All solar panel installations must be considered on a case by case basis recognizing that the best option will depend on the characteristics of the property. All solar panel installations should conform to the ***Secretary of the Interior's Standards for Rehabilitation***. Applicable Standards are:

> **"Standard Two:** The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property should be avoided."
>
> **"Standard Nine:** New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with massing, size, scale, and architectural features to protect the historic integrity of the property and its environment."
>
> **Note:** see http://www.nps.gov/tps/standards/rehabilitation/guidelines/solar-technology.htm for complete federal guidelines.

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 historic 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

System Size

Avoid unnecessarily large, publicly visible projects, by taking steps to improve the building's current 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.

Least Visible High-Performance Location

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

1. Locate the panel system on the west or east side of the site if it is less publicly visible than the south 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 panels are not always feasible because they may collect water; a 5 percent angle may be sufficient instead. Panels installed at a 5 percent angle can perform approximately 85-90% as well as if they were installed at an optimal 30 degree angle, regardless of whether they are on the south, east or west side of a site.
2. Locate systems on the rear façade of a building, on accessory structures or in other less visible locations if shade patterns would not significantly compromise system performance.
3. 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*.
4. Consider whether shadow-tolerant panels would make a less visible location feasible.

Panel Arrangement and Design

Roof-mounted systems can be highly visible in a hillside town like Jerome. Panel systems mounted on sloped roofs should be incorporated or integrated into the structure design. This is a critical topic when considering a solar energy project and how it will fit within the community.

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.
2. Installations on single-plane roofs are preferable because arrays can create a disjointed appearance on multi-plane roofs (e.g., roofs with dormers).
3. Consistently cover the roof face with the array if possible, leaving the prescribed safety pathways at eaves, ridge, hips and valleys. If full coverage is not possible, either:
    a. Aim for a regularly shaped rectangle of panels; or
    b. Use custom panel shapes to match the shape of the roof. Allow roof elements to remain which have enough size to appear intentional and hold their visual "weight" in the overall design composition.
4. Avoid interrupting arrays with rooftop projections such as vents or skylights. Solid rectangular array configurations are visually cohesive, versus a scattered array which is not as visually pleasing.
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.
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.

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.

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 in a discreet location in the rear yard or in an accessory building rather than placing it within view of the public.

Frame Color

If frames are not blocked from view, colored frames may be used to match or complement the roof or building colors. Use finished trim materials to reduce contrast and glare.

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.

Mounting

Photovoltaic panels are generally less visible when they are installed as close to the roof or ground as possible, with no more than 8 inches and no less than 1.5 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 percent) rather than parallel to the roof slope, in order to maximize system performance. Panels should never project above the roof ridge line.

The following sloped-roof mounting methods are NOT preferred mounting methods

- Flush or direct mounting, where the panel is installed directly on top of the roof.
- 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.
- Any method that removes defining elements of a historic structure.

The Town of Jerome Design Review Board shall use the US Department of the Interior ***'Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings'*** as a basis for review of solar energy projects.

Recommended:

1. Consider on-site solar technology, *only* after implementing all appropriate treatments to improve energy efficiency of the building, which often have greater life-cycle cost benefit than on-site renewable energy.
2. Determine whether the use of solar technology will be successful, and if it will benefit a historic building without compromising its character, the character of the site or surrounding historic district.
3. If possible, consider installing a solar device on a non-historic building or addition located on the site, where it will have the least impact on the historic building and its site.

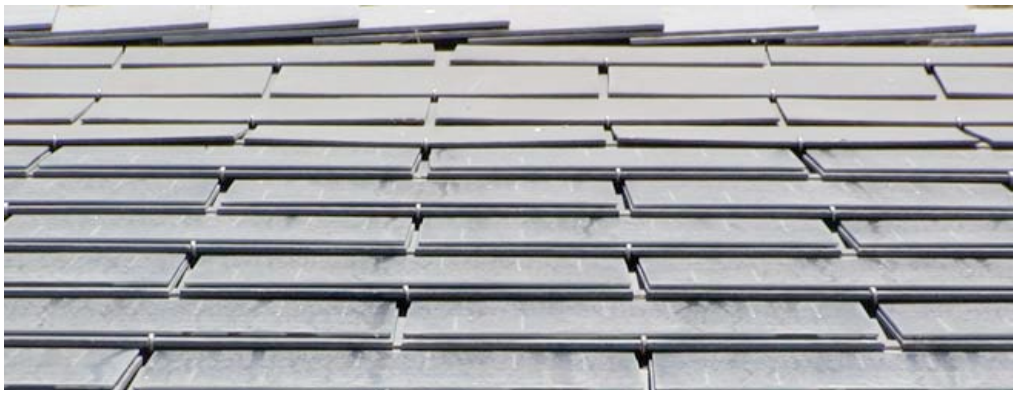
4. Install a solar device on a historic building, only after all other locations on the site have been investigated and determined infeasible.
5. Install low-profile solar devices on the historic building so they are the least visible from any public right of way; such as a low profile flat roof, or where they may be hidden by a parapet.
6. Determine whether solar devices can be installed on a historic building in a manner which does not damage the historic roofing material, negatively impact the building's historic character, and that any such work is reversible.
7. Make every effort to install solar roof panels horizontally,
8. Maintain the historic, character-defining roof slope when installing solar panels.
9. Place solar roof panels where they are the least visible as an effort to maintain the historic character of the building.

Safety Considerations for Residential Solar Energy Installations

When planning a roof mounted solar energy system, additional measures for fire safety should be considered. Roof access and clearance requirements are critical in order to: provide emergency access to and egress from the roof, provide areas for smoke ventilation opportunities and provide pathways to specific areas of the roof.

Panels placed on residential roofs should be located in such a way that a three-foot wide clear access pathway is created from eave to the ridge on every roof slope where panels are located. The access pathway should be located at a structurally strong location on the building (such as a bearing wall). For residential roofs with hips and valleys, panels should be located no closer than one and one-half feet to a hip or a valley, if panels are to be placed on both sides of a hip or valley. If the panels are to be located only on one side of a hip or valley which is of equal length, then the panels may be placed directly adjacent to the hip or valley.

Solar Roof Examples



Solar shingles attached to the front exterior of the shingle. Photo courtesy City of Santa Barbara

Solar shingles. Photo courtesy of Atlantis Energy Systems

Well planned array. Photo courtesy REM Technologies

Two examples of roof arrays designs which detract from the integration with the roof.

Photo's courtesy REC Solar