



Commercial Solar Plan Review/Permit Submittal and Design Guidelines



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COMMERCIAL SOLAR ENERGY SYSTEMS

SECTION 1 - INTRODUCTION

A. General

This packet provides an overview of the application process and general information regarding commercial solar energy systems. It is designed to provide guidance to property owners, design professionals, and contractors who may be interested in installing solar energy systems on commercial buildings. The guidelines are intended to:

1. Promote early design considerations for integration of solar energy systems into new and existing commercial buildings.
2. Ensure the design and placement of on-site solar energy systems preserve or enhance the overall architectural integrity of a building and/or property on which it is located.
3. Minimize visual clutter on readily visible pitched and flat roof areas.
4. Help facilitate Scottsdale's distributed generation future.

B. Solar Energy System Descriptions

A solar energy system converts solar energy to usable thermal, chemical or electrical energy to supplement or replace utility supplied electricity or fuel. Solar energy helps to reduce our reliance on non-renewable energy such as fossil fuels. Scottsdale has 85% annual sunshine (over 300 days in a year) where ample sunlight is available to generate electricity to support energy needs.

1. Solar Domestic Water Heating

Solar water heating is water heated by the use of solar energy. A solar water heating system reduces energy consumption by preheating water so that the water heater or boiler does less work. The system consists of two primary components:

- a. Solar collectors that are commonly installed on the roof; and
- b. A storage tank is typically located in the building with an auxiliary (back-up) water heater. Potable water is preheated by the solar collectors via a heat exchanger. The water can be heated for a wide variety of uses, including industrial uses which can help reduce consumption of fossil fuel generated energy.

2. Photovoltaics (PV - Solar Electric)

A solar electric system produces electricity that is distributed to the building via an electrical panel, offsetting electric energy that would otherwise be purchased from the utility. This system consists of the following components:

- a. One or more inverters convert the direct current (DC) electricity produced by the photovoltaic (PV) panels into alternating current (AC) electricity that can offset the building electrical load.
- b. PV cells are incorporated into modules and panels. The concept of efficient solar power is to absorb as much light as possible while reflecting as little light as possible. As such, solar panels use high-transmission, low-iron glass to absorb more light, while producing less glare and reflectance than standard window glass. Solar PV panels typically weigh no more than 5 pounds per square foot.
- c. Roof Mounting Systems

- i. Structurally mounted panels are attached to the roof structure to protect against wind uplift and lateral movement. This type of system requires roof penetrations and should be a roof warranty consideration.
- ii. Ballast systems use a predetermined amount of weights to secure panels on the roof for protection against wind uplift and lateral movement. This type of system does not require roof penetrations.
- d. Building Integrated PV (BIPV)
BIPV can replace roofing (tiles or metal roofing), siding, curtain wall, glazing, overhangs and shade canopies (walkways and carports). Most thin-film PV modules are flexible so that they can be used on curved surfaces. Some BIPV applications are no more expensive than premium architectural cladding materials such as granite or marble.

SECTION 2 – PLAN REVIEW, PERMITS & INSPECTIONS

A. Obtain case approval

1. Submit a Pre Application Request to obtain Development Review (DRB) approval. Most requests can be processed as a Minor case

B. Plan Review Submittal requirements for photovoltaic (PV) and solar domestic water heating

1. Provide 2 site plans and roof plans showing location of proposed installation including the locations for all proposed wall and ground mounted equipment and associated screening
2. Provide 2 panel elevations with dimensions. Include distance from roof surface to top of panels, panel tilt angles, parapet heights and roof slope(s).
3. Cut sheets and mounting details for panels.
4. Panel array with dead loads, at mounting points, exceeding 50 lbs. will require structural substantiation.
5. Electrical one-line and three-line diagrams (showing phases, neutral and ground).
6. Cut sheets and listing for inverters and modules.
7. Note on plans that PV system shall be installed in accordance with the National Electric Code (NEC).
 - a. Section 690 and posted with applicable warnings, signage and plaques.
 - b. Sections 705.10, 690.17 and 705.12.
8. Note on plans that solar domestic water heating system shall be installed in accordance with applicable plumbing codes and ICC-SRCC ratings.
9. All permit applications for commercial solar systems must be submitted to the One-Stop-Shop either in person or digitally.

C. Permits

1. Plan review fees must be paid for the same day the plans are reviewed or submitted for review. This is true whether permits are issued the same day or not.
2. Permits can only be signed for by property owners or licensed contractors. All other persons involved with the project must have a statement signed by the property owner naming who has permission to sign and receive documents on the owner's behalf to obtain plan reviews and building permits.

D. Inspections

An inspection card will be issued detailing the required inspections. Typically, one final inspection is conducted; however actual inspections may vary depending on your project.

SECTION 3 – DESIGN GUIDELINES

A. Roof Mounted Systems

1. Low Pitch and Flat Roofs (with a slope of less than 2:12)
 - a. Provide a 6-foot-wide clear perimeter around the edges of roof. Provide a min. 4-foot clearance around roof access hatch with at least one 4-foot min. clear pathway to parapet or roof edge. See International Fire Code (IFC) for exceptions and other clearance/access requirements.
 - b. **For buildings 2 stories or less**, the panels shall be enclosed by a screen wall at least as tall as the panels unless an alternative approach is otherwise approved by the Development Review Board (DRB).
 - c. **For buildings more than 2 stories**, the top of panels shall not exceed 30 inches above the roof surface at any point unless otherwise approved by DRB. The ends of each row of tilted solar panels that are more the 18 inches above the roof surface shall be covered so the underside of panels is not visible. The color shall be compatible with the solar panels.
 - d. Placement and height of all panels shall be uniform and located to avoid shadows cast by parapets, roof equipment and screen walls.
2. Pitched Roofs (with a slope of 2:12 or steeper)
 - a. Panels shall be located not less than 3 feet from the ridge. See International Fire Code (IFC) for exceptions and other clearance/access requirements.
 - b. Placement and height of panels shall be uniform, parallel with roof slope and project no more than 8" from the roof. Match the shape and proportions of the array with the shape and proportions of the roof as approved by DRB.
3. Panel/module height shall not exceed allowable building height per zoning limits.
4. Panel/Module Tilt (Scottsdale latitude - 33.5 degrees)
 - a. Photovoltaic (PV): The maximum recommended tilt angle is 18.5° (Scottsdale latitude minus 15°); 4 in 12 equivalent roof pitch.
 - b. Solar domestic hot water: The maximum recommended title angle is 33.5° (Scottsdale latitude); 8 in 12 equivalent roof pitch.
 - c. Solar panel exposure:
 - i. Southern exposure: Most efficient year-round for PV and solar thermal systems.
 - ii. Western exposure: Efficiency is best during the summer months but depends on tilt angle for PV systems (south western to western exposure could be optimized during peak energy load).
 - iii. Northern exposure: Least efficient for both PV and solar thermal systems.



Uniform solar panels aligned with roof slope.



Low-slope solar PV panels below roof parapet.

B. Ground Mounted Systems

- 1. Top of panels shall not exceed 6 feet unless considered an accessory structure per zoning limits.
- 2. No more than 20% of a lot shall be covered with a solar energy system.



Pedestrian solar PV shade canopy.



Ground mounted solar PV system.

C. Commercial Carport Structures

- 1. Height, setbacks and placement shall comply with zoning ordinance and Development Review Board (DRB) stipulations.



Solar PV carport structure.



Solar PV parking shade canopy at top level of garage.