Commercial Solar Plan Review/Permit

Submittal Guidelines

GREEN BUILDING PROGRAM

City of Scottsdale
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Contents

COMMERCIAL SOLAR ENERGY SYSTEMS

SECTION 1 - INTRODUCTION & BACKGROUND

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 PV panels into alternating current (AC) electricity that can offset the building electrical load.
   b. Photovoltaic cells are incorporated into modules and panels.
      i. Single (mono) crystal and poly-crystalline silicon cells
         - 12-22% efficiency
         - New cell technology are getting to 40% using multiple layers of semiconductor material and a concentrating lens

ii. Thin-film (amorphous) PV cells
- 8-10% efficiency
- Less expensive but requires larger installation area to compensate for lower efficiency.

a. TRACKING SOLAR ENERGY SYSTEMS

Maximum collection of solar radiation occurs when the collector is perpendicular to the direct beam radiation. Tracking collectors follow the path of the sun through the day and excel in dry climates where there is little diffused sunlight.

a. 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. Determination of Type of Review

1. Meet with planner to determine if a Development Review Board (DRB) approval is required.

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.
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 invertors 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. If proposal did not require Development Review Board approval the application can be reviewed over the counter.

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. 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 should be uniform and considered as part of the overall roof configuration. Match the shape and proportions of the array with the shape and proportions of the roof.
2. 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. Roof-mounted equipment shall be screened by a solid wall or louver system at least as tall as the tallest object being screened. The louver system shall completely obstruct the view of the object that is being screened.
   c. Placement and height of panels should be uniform and considered as part of the overall roof configuration.
3. Panel/module height shall not exceed allowable building height per zoning limits.
4. Panel/Module Tilt (Scottsdale's latitude - 33.5 degrees)
   a. Photovoltaic (PV): Tilt angle recommended is maximum 18.5° (latitude minus 15°); 4 in 12 equivalent roof pitch.
   b. Solar domestic hot water: Title angle recommended is maximum 33.5° (latitude); 8 in 12 equivalent roof pitch.
   c. Panel solar exposure:
      i. Southern exposure: Most efficient year round for PV and solar thermal systems.
      ii. Western and eastern 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.

Roof top building integrated system.

Solar PV rooftop installation 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.