Residential Solar Plan Review
Quality Submittal Guidelines

This packet includes submittal requirements for:
- Ground Mounted Solar Systems
- Roof Mounted Solar Systems
- Solar Hot Water Systems

City of Scottsdale
One Stop Shop
7447 E. Indian School Road, Suite 105
480-312-2500

Revised: September 2010
September 2009
General Information for Residential Solar Systems

**Photovoltaic and hot water systems do require a building permit**

Stepping through the approval process:

**PLAN REVIEW → PERMIT → INSPECTIONS**

1. **PLAN REVIEW**
   - Provide 2 complete sets demonstrating all MAG requirements (see attached)
   - Provide 3 site plans (see example and attached minimum requirements). Systems compatible with the “Solar Panel Placement Design Guidelines for Single-Family Homes” will be eligible to receive a counter review; all other proposals, including ground mounted solar units, will be required to submit for a full plan review. *Incomplete site plans will not be accepted.*
   - Provide 3 panel elevations. Show all dimensions. Include distance from roof surface to top of panels, panel tilt angles, parapet heights and roof slope(s). (see attached example)

2. **PERMIT**
   Please note the following requirements for obtaining permits over the counter:
   - Plan review fees, if required, must be paid for the same day the plans are reviewed or submitted for review. This is true whether permits are issued that day or not.
   - Permits can only be signed for by property owners or licensed contractors. All other persons involved with the project (including but not limited to relatives, architects, designers or construction managers) 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 at the City of Scottsdale
   - On permits not listing a licensed contractor, an owner-occupied single family residence property owner can do the work themselves or act as their own general contractor and hire subcontractors to do the work. When choosing to do the work themselves, or to act as their own general contractor, the property owner or designee (see item above) must sign the “Owner-Builder Declaration form” required by the Tax Audit Division of the City of Scottsdale. For detailed information about this form call 480-312-2400 or visit www.scottsdaleaz.gov/taxes.

3. **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.
RESIDENTIAL ROOF MOUNTED SOLAR SYSTEMS
SITE PLAN/ROOF PLAN CHECKLIST & EXAMPLE

Solar Site/Roof Plan Checklist:
Site plan must be legible, show entire lot, and be to scale. Allowed scale is 1”= 20’ minimum -Provide 3 copies of the site plan.

Plans shall include the following:
- Complete legal description:
  (Parcel # (APN), Lot & Subdivision name, QS #, Zoning)
- North Arrow & Bar Scale
- Lot dimensions
- Identify all streets adjacent to lot
- Identify easements (i.e. NAOS or drainage easement-represent on site plan with dashed lines)
- Show all ridge lines, and/or parapets
- Identify all vents, chimneys, or other apparatus, including vertical objects (i.e. trees), that may affect the placement of the panels
- Please make a note on the plan and identify staging area location if heavy equipment (i.e. crane) will be used to install the solar panels.
- Provide the following NOTE to the site plan: No NAOS or Protected Native Plants shall be affected by installation of solar panels (applicable to zoning districts with ESL overlay)

***Solar applications located in a multi-family zoning district (R-5, R-4R, R-4, R-3, R-2) will require a homeowner’s association approval letter with plan submittal.

***Ground mounted solar units have additional submittal requirements. Please see separate “Residential Ground Mounted Solar Systems” Checklist & Example.

For assistance in locating site data information:
http://eservices.scottsdaleaz.gov/dmc/liw.aspx

Revised Sept 2010
RESIDENTIAL GROUND MOUNTED SOLAR SYSTEMS
SITE PLAN CHECKLIST & EXAMPLE

Solar Site/Ground Mounted Plan Checklist:
Site plan must be legible, show entire lot, and be to scale. Allowed scale is 1”=20’ minimum -Provide 3 copies of the site plan.

Plans shall include the following:
- Complete legal description: (Parcel # (APN), Lot # & Subdivision name, QS #, Zoning)
- North Arrow & Bar Scale
- Lot dimensions
- Identify all streets adjacent to lot
- Provide dimensions from existing structures (i.e. site walls, buildings) on lot to solar unit edge.
- Provide details of solar unit’s maximum height from grade and overall size of panel array.
- Identify all lot easements (i.e. NAOS, Drainage Easement, ROW, GLO…)-on site plan with dashed lines.
- Provide a 5’ minimum construction buffer to NAOS.
- Identify existing site walls and callout finished wall height.
- Provide a note on the site plan and identify staging area location if heavy construction equipment (i.e. crane) will be used to install the solar unit.
- Identify all protected Native Plants within 25 ft of the construction area. Add the following note if protected Native Plants will not be disturbed: NO PROTECTED NATIVE PLANTS WILL BE AFFECTED BY THIS CONSTRUCTION.

***Solar applications located in a multi-family zoning district (R-5, R-4R, R-4, R-3, R-2) will require a homeowner’s association approval letter with plan submittal.

For assistance in locating site data information: http://eservices.scottsdaleaz.gov/dmc/liw.aspx
SOLAR ELEVATION EXAMPLE

- South facing panels at 25 degree pitch
- Top of panels will not exceed 8" above adjacent finish roof surface
- Panels will not project above roof line
In an effort to promote uniformity through MAG jurisdictions under the purview of safety, the following submittal requirements are adopted as a MAG standard for securing necessary plumbing/building permits for residential (single-family) Solar Domestic Hot Water (DHW) systems:

1. The location of the solar panel system shall be indicated on the plans, including roof plan, elevation and mounting details for panel installation.
2. Standard plans shall be required and/or on file for systems with water storage on roof (e.g. – integrated collector storage systems or thermosyphon systems).
3. Systems structural engineering analysis shall not be required for flat plate collectors whose weight does not exceed 20 lbs per square foot on roof slopes of 4/12 or less and 16 lbs per square foot on roof slopes greater that 4/12.
4. Standard plans (where permitted by local jurisdiction) shall be on file, including Solar Rating and Certification Corporation (SRCC) System Data (specification sheet).
5. Note on plans that Solar Domestic Water Heating equipment shall be installed in accordance with applicable plumbing codes and in accordance with SRCC and State of Arizona Guidelines.
6. The permit cost for installing a Solar Domestic Water Heating systems shall be treated the same as a water heater replacement.

**NOTE:**

Local planning and zoning regulations involving such requirements as setback, height limitations, color, reflectivity or other design considerations, may apply. See the local governing jurisdiction for further information.
To: Photovoltaic Engineers, Manufacturers, Contractors and Other Interested Parties

Re: Photovoltaic Panels (Solar Panels & Solar Collectors) Administration Construction Policy (ACP) 10-1 Design & Installation (Structural):

Photovoltaic partners,

The City of Scottsdale constantly looks for ways to provide superior customer service. Recently, we learned that the requirements for photovoltaic installations, specifically for structural design, are confusing, resulting in numerous plan reviews to get all the requirements correct.

Therefore, the city has reviewed the currently adopted codes, specifically Section 1609 of the 2006 IBC and Chapter 16 of ASME7-05 and created ACP 10-1 to provide clear guidance to all our customers in the photovoltaic industry – engineers, manufacturers, contractors and owners.

ACP 10-1 clarifies structural requirements for design and what must be included on the permit application, effectively reducing the number of plan reviews and speeding up the issuance of the permit.

We recommend that all parties review and become familiar with ACP 10-1 so that everyone understands the city submittal requirements.

Should you need further assistance, please do not hesitate to contact me directly with your question or concerns.

Sincerely,

Andre Darian, P.E., S.E.
Sr. Structural Engineer
Planning & Development Services
7447 East Indian School Rd, Suite: 125
Scottsdale, AZ 85251
Tel: 480-312-7882
Fax: 480-312-9204
adarian@scottsdaleaz.gov
SUBJECT: Photovoltaic Panels (Solar Panels) design & Installation Memorandum (Structural):

A. Design Wind Loads on Photovoltaic Panels (Solar Panels and Collectors)

The following wind load design methods shall be used when photovoltaic panels bear on or connect to a supporting structure or slab:

- For rooftop mounted panels, ASCE 7-05 Section 6.5.15 shall be used to determine for horizontal wind loads applied to the vertical projection of the roof top equipment. The additional factor for roof top mounted equipment per Section 6.5.15.1 shall also apply.

- For rooftop mounted and ground-mounted panels, ASCE 7-05 Section 6.5.13 shall be used to determine wind uplift on the panel normal to the surface of the panel.

- These sections do not need to be applied simultaneously.

Resistance to uplift loads shall be provided in accordance with the 2006 IBC Section 1605, Load Combinations or ASCE7-05 Chapter 2, “Combination of Loads”.

B. Following is required for Photovoltaic panel submittals made prior to December 31st, 2010.

- This section applies to submittals that are already in the queue. This includes plans that may have received a review but are not permitted yet. However plans permitted after January 1st, 2011 shall comply with Part “C” below.

- This section does not apply to Solar panel submittals that have been permitted.

1. Applicant shall contact the City to discuss submittal details. Please direct all contacts to Andre Darian, P.E., S.E. at: Tel. no. 480-312-7882; Email: adarian@scottsdaleaz.gov

2. Photovoltaic panel design calculations, construction documents and installation manual. Design calculations shall comply with referenced codes listed in Part “A”. Photovoltaic panels plans and calculations shall be sealed and signed by an Arizona registered professional engineer.

Refer to note 4 for exceptions.
3. An Arizona registered professional engineer shall review photovoltaic panel system and its suitability to the supporting structural system, and shall seal and sign calculations and drawings for photovoltaic panels supporting structure. This engineer will be considered as Engineer of Records (EOR) for new construction.

4. EOR shall verify that correct wind design load as specified in Part “A” above, is used in design of photovoltaic panel system. Exception: City may accept photovoltaic panel frames designed for wind per ASCE 7-05 Section 6.5.12.4 however the existing structure and panel connections to existing structure shall be evaluated for wind loads derived from ASCE 7-05 Section 6.5.13.

5. Construction drawings shall specify exact geometry and location of photovoltaic panels on supporting structures. Existing or new framing location, size, and material and attachments shall be identified on drawings.

6. Where photovoltaic panels are to be installed on existing roofs or other structures, EOR shall verify that existing structure can support uplift forces, down forces as well as forces parallel with roof. Structural package shall include construction drawings where location of panels, support anchors, and ballast pans, etc. are clearly identified. Existing framing location, size, and material and attachments shall be identified on drawings.

7. Where panels are to be installed on new structures, EOR shall provide calculations to verify structural members can support photovoltaic panel loads. Structural submittal package shall include construction drawings where location of panels, support anchors, and ballast pans, etc. are clearly identified.

8. Members receiving photovoltaic panel loads shall be individually checked. Photovoltaic panel loads shall be applied as concentrated load, unless material provided to justify uniformly distributed load application.

9. Special Inspection may be required which will be discussed during initial contact. Refer to 2006 IBC Chapter 17 for additional information.

C. Following shall be provided for Photovoltaic panels submittals effective January 1st, 2011.

1. Photovoltaic panel design calculations, construction documents and installation manual. Design calculations shall comply with referenced codes listed in Part “A”. Photovoltaic panels plans and calculations shall be sealed and signed by an Arizona registered professional engineer.

2. An Arizona registered professional engineer shall review solar panel system and its suitability to the supporting structural system, and shall seal and sign calculations and drawings for photovoltaic panels supporting structure. This engineer will be considered as Engineer of Records (EOR) for new construction.
3. EOR shall verify that correct wind design load as specified in Part “A” above, is used in design of photovoltaic panel system.

4. Construction drawings shall specify exact geometry and location of photovoltaic panels on supporting structures. Existing or new framing location, size, and material and attachments shall be identified on drawings.

5. Where photovoltaic panels are to be installed on existing roofs or other structures, EOR shall verify that existing structure can support uplift forces, down forces as well as forces parallel with roof. Structural submittal package shall include construction drawings where location of panels, support anchors, and ballast pans, etc. are clearly identified. Existing framing location, size, and material and attachments shall be identified on drawings.

6. Where panels are to be installed on new structures, EOR shall provide calculations to verify structural members can support photovoltaic panel loads. Structural submittal package shall include construction drawings where location of panels, support anchors, and ballast pans, etc. are clearly identified.

7. Members receiving photovoltaic panel loads shall be individually checked. Photovoltaic panel loads shall be applied as concentrated load, unless documentation provided to justify uniformly distributed load application.

8. Special Inspection may be required. When required plans will be marked to notify applicant after initial review. Refer to 2006 IBC Chapter 17 for additional information.
In an effort to promote uniformity through MAG jurisdictions under the purview of life safety (NEC Article 690), the following submittal requirements are proposed as a MAG standard for securing necessary electrical/building permits for residential (single-family) photovoltaic (PV) systems:

1. Location of PV installation indicated on plans (roof plan and elevation).
2. Mounting details for PV panel installation.
3. Electrical one-line and three-line (showing phases, neutral and ground) diagram.
4. Cut sheet and listing for inverter (DC to AC conversion).
5. Note on plans that PV equipment shall be installed in accordance with NEC 690 and posted with applicable warnings, signage & plaques per NEC 705-10, 690-17 & 690-64(b)(5).

Local planning and zoning regulations, involving such requirements as setback, height limitations, color, reflectivity or other design considerations, may apply. See the local governing jurisdiction for further information.
The following guidelines are to be used in the design and placement of solar panels (photovoltaic and solar thermal systems) on pitched and flat roofs of single-family dwellings for the purpose of compatible design. With a little foresight and planning, a solar system can be effectively integrated into the design of new and existing roofs. Those projects which comply with the design guidelines qualify for over the counter plan review. All other proposals will be required to be submitted for plan review.

A. South Facing Pitched Roofs (within 45° east or west of due south)
   1) Solar panels should be low profile and parallel with the plane of the pitched roof.
   2) Top of the panels should not exceed 8 inches above the adjacent finish roofing surface (e.g. - tile, shingles). Panels should not project above the roof ridge line.
   3) Placement of panels should be uniform. Consider the panels as part of the overall roof configuration. Match the shape and proportions of the array with the shape and proportions of the roof.
   4) Color of panel frames and support structure should be neutral and compatible with roof surface color (exposed frames and components should have a non-reflective surface).
B. North and East/West Facing Pitched Roofs (within 45° of south of due east or west)
   1) Panel tilt angle should not exceed 15 degrees above horizontal plane.
   2) Height of panels should not exceed 24 inches above the roof surface at any point. Panels should not project above the roof ridge line.
   3) Placement and height of panels should be uniform. Consider the panels as part of the overall roof configuration. Match the shape and proportions of the array with the shape and proportions of the roof.
   4) Color of panel frames and support structure should be neutral and compatible with roof surface color (exposed frames and components should have a non-reflective surface).
View from southwest corner
Solar panels on west facing pitched roof exceed the maximum allowable height of 24 inches above roof surface at any point.

View from northwest corner
Solar panels on west facing pitched roof also project above the roof ridge line. Support structure color is not compatible with roof surface color.
C. Flat roofs (½ inch or less per foot slope)

1) Top of panels should not exceed 30 inches above the adjacent finish roofing surface on flat roofs with or without parapets.
2) Placement and height of panels should be uniform. Consider the panels as part of the overall roof configuration.
3) Color of panel frames and support structure should be neutral and compatible with roof surface color (exposed frames and components should have a non-reflective surface).

Solar panels on flat roof with parapets.

Solar panels on flat roof without parapets.
Solar panels on flat roof with parapets.