City of Whittier

BUILDING & SAFETY DIVISION
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(562) 567-9320 Fax (562) 567-2872

M E M O R A N D U M

Date: **April 4, 2013**

To: **Building Inspectors and Permit Technician**

Cc: **Aldo Schindler**
Director of Community Development

From: **Matt Winter**
Building Services Manager / Building Official

Re: **Solar Photovoltaic (PV) Systems Determination**

Background:
In response to increasing demands upon electrical energy generation systems, the *'green building'* movement, state and national alternative energy generation implementation incentives and the general adverse condition of the local and global economies; the following policy is established for the purpose of streamlining plan review and permit issuance processes for certain solar-energy Photo Voltaic (PV) electrical generation systems. This review further provides an evaluation of the common installation costs of a PV system in comparison with our current value-based fee structure.

The Orange Empire Chapter of the International Code Council – Code Interpretation Committee (OECICC-CIC) determined through a survey received from the California Energy Commission and solar PV system installers that the typical residential PV system generates approximately 3 to 4 kilowatts (Kw), covers approximately 250 square-feet of roof area, and adds approximately 850 pounds (i.e. 3.5 psf) to the total roof load. As noted by the survey, most homes retrofitted with a solar PV system were more than 25 years-old, were originally roofed with wood shake, wood shingle or asphaltic-composition shingle materials and have often been re-roofed with heavier roofing-system building materials or have had additional layers of roofing materials applied to the existing roof. It is noted that in addition to compliance with the California Electrical Code, PV systems often trigger other building code compliance requirements including, but not limited to, the following:

1. The ability of the existing roof framing to support the solar PV equipment.
2. The ability of the existing (and often minimal) lateral bracing systems necessary to resist increased seismic loads generated by the PV system equipment.
3. The flame spread ratings of the solar panels compared with the fire-resistive requirements of the existing roof covering.

Analysis:
Typical residential (R-3) roof systems, constructed in the post-WWII era that maintain a minimum roof-pitch design of three vertical feet of rise in twelve horizontal feet of run (3:12), are commonly designed to carry a roof dead-load capacity of approximately 7 to 10 pounds per square-foot of roof surface area. Generally, a roof constructed with an existing wood shingle or asphaltic-composition shingle lain over spaced or solid sheeting and a standard layer of weather-resistant barrier material ranges in weight from approximately 4 to 5 psf. Additional layers of asphaltic-composition shingle roofing or a typical 3-4 Kw PV system add approximately 3.0 to 3.5 psf to the total weight of the roof. It is noted that roof systems utilizing concrete and/or clay-type tile roofing materials and roofs with two existing layers of light-weight roof materials and a solar PV system would typically meet or exceed an assumed 10 psf design load. Therefore, these latter two systems are not included with the scope of this policy document and require engineering analysis as part of the review and approval process.

In accordance with the provisions of the California Building Code Section 1510, the Building & Safety Division allows an existing single-layer wood shingle or asphaltic-composition shingle roof to be covered with one additional layer of asphaltic-composition shingle roofing materials without requiring engineering analysis to be first performed for the increase in gravitational and/or lateral loads. Understanding the criteria outlined in the above paragraph, the OECICC code committee drafted a list of minimum requirements to streamline the approval process of PV installations for systems that cover 250 sq. ft. (or less) of roof surface area and that generate a maximum of 3-4 kilowatts of electrical energy. The code committee further concurred that the given size of installation will have a minimal impact on the structure's vertical and lateral support systems and recommended that structural analysis should not be required. The committee also stated that the roof flame spread requirement should not be applied to the PV cells since the arrays are installed over a roof which should be in compliance with the flame spread requirements.

At present, the fees charged for the review and inspection of solar PV electrical generation systems are calculated on the basis of the value of the improvement added to the property. Given that solar PV systems remain somewhat in the experimental research and development phase, costs are relatively high. Therefore, the current fees charged for plan review and permits do not appropriately reflect the actual (i.e. lesser) time/motion costs expended by staff for the typical installation of a pre-manufactured PV system. Generally, staff finds that approximately 2 hours of time are expended in the plan review process and approximately 3.5 to 4 hours are consumed with inspection and project documentation. Current fees for a typical $60,000 PV installation would allow for approximately 7 hours of plan review and 11 hours of inspection and documentation time which is significantly greater than the allocation required.

Applicability:
The policy/procedure contained herein has been developed in accordance with the general recommendations presented by the OECICC-CIC whose purpose is to create consistency in requirements between its member agencies. This policy shall be implemented effective immediately and shall apply only to solar PV systems erected upon an existing one- or

two-family residence (R-3 occupancy) or to a garage, carport, or other such (S) occupancy structure that is directly accessory to the R-3 occupancy. The S occupancy structure may be attached to or be detached from the R-3 structure. The R-3 and/or S occupancy structure shall further meet the criteria as set forth below:

- The structure shall be built on, or after, January 1, 1941.
- The structure shall be no more than two-stories and a basement in height.
- The structure shall have a minimum roof pitch of 3:12.
- The structure shall have a maximum of one existing roof layer of Class A, asphaltic-composition shingles and shall maintain compliance with the provisions found in California Building Code Section 1510.
- The PV system/parts shall be pre-manufactured and UL listed.
- The PV system shall provide for a maximum of 4.0 kilowatts of electrical energy generation capacity.
- The PV system shall have a surface area (i.e. total of all arrays combined) not to exceed 250 square-feet.
- The PV system supported by the existing roof framing shall not weigh more than 3.5 lbs. per square-foot and 850 pounds in total weight.
- The arrays shall be designed with the PV system supports attached to the roof at a maximum spacing of 48” on-center.
- The arrays shall be arranged on the roof so as to keep required fire department clearances from ridge/ hip lines, valleys, and the edges of the roof, a distance of not less than 3’.

All other systems, or systems applied to structures other than as outlined above, shall be designed under the responsible charge / control of an appropriately licensed engineer or architect (except when otherwise determined by the Building Official) and the submitted drawings and calculations shall bear the stamp and signature of the respective licensee.

In an effort to encourage the development of PV systems as a viable alternative energy source, the following policy determinations are further hereby made:

- The Building & Safety Division will process a “next business-day” plan review and accept plans without further engineering analysis for solar PV electrical generation systems and for structures meeting the above stated criteria that are submitted in accordance with the attached “Solar Photo-Voltaic System Submittal Requirements.”
- The valuation used for calculating plan review and permit fees for PV systems, in compliance with the above stated criteria, shall be fixed at $8,000.00 until such time as otherwise adjusted by the Building Official or adjusted by City Council Resolution.

END OF MEMO

City of Whittier

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SOLAR PHOTO-VOLTAIC SYSTEM SUBMITTAL REQUIREMENTS

ADMINISTRATIVE

1. Provide three sets of plans; minimum sheet size 11" x 17".
2. Attach all manufacturer specification sheets, installation instructions and U.L. listings to the plans.
3. Plans are to be signed by State of California licensed contractor with any of the following classifications "A", "B", "C-46", "C-10", or licensed civil / electrical engineer or architect.
4. Provide architect's and/or engineer's license stamp and signature or contractor license number and signature (only when applicable) on each sheet.

ROOF PLAN

1. Provide a roof plan projected on a site plan. Show the location and dimensions of all solar voltaic equipment and PV arrays.
2. Provide a partial roof framing plan. Show new and existing supporting rafters, beams and headers include rafter size, span, and spacing. Identify roof sheathing and roofing materials. ALTERNATE: Framing information is not required if system complies with Building Official's **Solar Photovoltaic (PV) System Requirements Determination.**
3. Detail equipment support connections to roof. Provide a detail for flashing and water-proofing at system supports.
4. Provide calculations by a licensed professional engineer or architect to verify supporting members are adequate for existing and proposed loads. ALTERNATE: Calculations are not required if system complies with Building Official's **Solar Photovoltaic (PV) System Requirements Determination.**
5. Provide lateral calculations by a licensed professional engineer or architect demonstrating that affected existing lateral resisting elements are no more than 10% overstressed according to the 2007 CBC. ALTERNATE: Calculations are not required if system complies with Building Official's **Solar Photovoltaic (PV) System Requirements Determination.**

ELECTRICAL PLAN

1. Provide Electrical drawings to show compliance with the applicable provisions of the 2007 California Electrical Code.
2. Show the location and size of the main electrical service, AC/DC disconnects, all solar voltaic equipment, and PV arrays on the roof plan.
3. Single Line Diagram: show array configuration, conduit and conductors sizes with derating calculations.

4. Inverter Information: show model number, specification cut sheets, and maximum D.C. input.
5. PV Module Information: show open circuit voltage (VOC), short–circuit current (ISC) max series fuse.
6. Array Information: show number of modules in series, number of parallel source circuits.
7. Wiring and Over Current Protection: show conductor ampacities, adjusted with all derating factors show rating and location of all Over Current Devices (OCD).
8. System Labels and Warnings: show required signage on the plans per 2007 CEC-Article 690.
9. Grounding Details: show equipment ground conductor, ground electrode conductor from inverter to ground rod or ufer ground.
10. Disconnects: show AC/DC disconnects at inverter. DC disconnect required prior to DC array conductors penetrating the surface of the roof or entering the building.
11. System Calculations: show (VOC) calculated 1.13 (temperature correction factor for City of Whittier) (ISC) calculated x 1.25% (NEC 690) x 1.25% (UL 1703).
12. All PV equipment shall be listed by a recognized test lab.
13. Notification of serving utility required prior to activation of PV system.