

# Solar System Safety and Maintenance

**For Installers**

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November 8, 2011





# Disclaimer

**This presentation is provided as an overview to provide a basic understanding of PV inspection and maintenance considerations**

**This overview is not to be used to perform inspection or maintenance services by anyone**

**The presentation is an overview and therefore does not necessarily include every aspect of inspection and maintenance of PV systems**

**All inspection and maintenance should be performed by a professional licensed contractor**



# Need for Maintenance

**Most PV systems require little maintenance, but periodic checks ensure safety and optimal performance.**

- Annual or every other year inspections recommended, or if energy output changes significantly during clear weather
- Inspections at time of system ownership change
- Degree & frequency of maintenance required depends on
  - System configuration
  - Installation type
  - Location



# Who Performs Maintenance

**Should only be performed by a qualified installer or service technician familiar with PV systems, components, and proper safety procedures.**

**Maintenance procedures are covered in NABCEP PV Installer Job Task Analysis available at:**

**<http://www.nabcep.org/certification/pv-installer-certification>**



# PV Maintenance Procedures

1. **Perform Visual Inspection**
2. **Verify System Operation**
3. **Perform Corrective Actions**
4. **Verify Effectiveness of Corrective Actions**



# Perform Visual Inspection

**Array Maintenance**

**Shade Control**

**Electrical Equipment Maintenance**



# Perform Visual Inspection

## General visual inspection activities

- Verify equipment grounding
- Identify hazards
- Inspect weatherproofing systems
- Inspect for wiring damage
- Identify damage due to corrosion
- Identify mismatched equipment
- Document findings



# Array Maintenance

**For activities involving working around or touching modules the array should be disabled by covering modules or opening the array disconnect.**

## **General Activities**

- Module inspection
- Shade control / soiling
- Debris removal
- Array mount inspections



# Array Maintenance



## Critical Inspection Items

- Module mounting
- Module integrity
- Cell discoloration
- Damage to module glazing
- Array shading
- Array soiling
- Unsupported wiring
- Mismatched equipment
- Water ponding
- Ice damage



# Shade Control

**Ongoing growth of trees and other vegetation may impact the solar availability of the array.**

## **General Activities**

- Perform regular shading analysis of array(s)
- Inform customer about impact of shading and recommend regular tree trimming where necessary

# Shade Control



## Maintenance Tips

- Maintain historical shading analyses
- Identify increases in shading over time
- Tree growth or man made obstructions?
- Discuss any shading changes and potential mitigations with customer



# Electrical Equipment Maintenance

## General Activities

- Visual inspection of inverters, transformers, and other electrical equipment.
- Inspect all wiring, conductors, terminators, conduit, and junction boxes
- Disconnects, fuses, and circuit breakers checked for proper operation
- Exposed conductors checked for insulation damage, clean and secure terminals, adequate strain relief, and properly connected and supported conduits

# Electrical Equipment Maintenance



## Other Inspection Items

- Check inverter status
- Check connections damage due to overheating
- Equipment temperature measurements with IR non-contact thermometer
- Check conduit fittings
- Evidence of animals?



# Verify System Operation

## General Activities

- Verify source circuits are connected
- Measure/document system electrical parameters, calculate expected and compare
- Test system electrical equipment operations
- Compare historical kWh performance against expected noting inter-annual weather variability
- Interview customer and document concerns
- Recommend corrective actions



# Perform Corrective Actions

- Replace faulty components
  - Defective modules
  - Frayed wires
  - Blown fuses
- Locate and repair ground faults
- Locate and repair line to line faults
- Mitigate negative local conditions
- Clean arrays, heat sinks, and other equipment
- Seal compromised weatherproofing systems
- Clean and replace system labeling



# Verify Corrective Actions

- Retest system operations, electrical parameters, and environmental conditions
- Compare pre to post-maintenance values
- Retest weatherproofing system
- Reorient customer to system





# Maintenance Plans

- Important to ensure necessary tasks are performed
- Includes all the necessary maintenance tasks and their respective schedules
- Vary by system configuration, installation type, and location
- May evolve as needed for a particular system
- Implementation of maintenance plan should be recorded in a maintenance log



# Maintenance Plans

Task	As Required	Monthly	Semi-annually
Inspect modules for damage			✓
Address shading issues	✓		
Remove debris	✓		
Inspect mounting system			✓
Check inverter		✓	
Inspect/clean electrical equip.			✓
Monitor system volts & amps		✓	



## Further Learning

**NABCEP certified training programs teach necessary skills for performing PV maintenance. For more information:**

<http://www.nabcep.org/resources/training>

**For more information about PG&E and solar:**

<http://pge.com/solar/>

**For more PG&E solar classes:**

<http://pge.com/solarclasses/>

**To download this presentation:**

<http://pge.com/solareducation/>

**For the PG&E Solar Customer Service Center:**

**1-877-743-4112**

# Thank You

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