



NAPA GREEN

SOLAR ARRAY MONITORING & MAINTENANCE

During our Green Winery energy reviews, we have encountered quite a few solar PV arrays. Frequently we have found failures, and high true up bills that were due to failure of PV array inverters. These were frequently not found until the annual true up bills.

We also were often asked how often PV panels should be cleaned and should it be done in house to reduce costs. Doing some research, and based upon what we have heard and seen, we would like to offer some guidelines and recommendations for commercial PV arrays:

To start:

- What does your data say for PV production vs. the design---what's the trend? A sudden drop (without a process change) points to an inverter, a slow decline points to panel cleanliness or performance. Remember PV panels lose production capacity at the rate of about 0.5% to 1.0% per year.
- How much is the loss in electrical output, and at \$0.20/kilowatt hour—how much is it costing you? You can also use this to judge how often to clean panels.
- Have all your array plans and manuals in one place. What do your manuals say about maintenance and cleaning?
- Is your array roof-top or ground-mount? If roof top, how's your access ladders, do you have safe passages on the roof, and adequate tie-off points for fall protection if needed?
- Is your PV array monitoring system working?
- Establish a service vendor relationship before you have a failure
- And—if you get a chance, read this document—it covers all the aspects, and was used for the following recommendations and guidelines. If you are getting bids for this work, reference it as a guideline for what you expect.: <http://www.solarabcs.org/about/publications/reports/operations-maintenance/pdfs/SolarABCs-35-2013.pdf>



What to maintain? What can you check, and how should you do it?

(Note, the following is based on the above document)

Panel Cleaning:

- Safety first—teams of 2, follow all OSHA requirements for ladder safety, tie off, etc., system electrical lockout—do not walk on Modules
- Cleaning gains 5% to 7.5% improvement, so weigh cleaning costs against that savings
- Check your panel warranties to see if cleaning is required, and how often
- As to when, this is depending on location, panel tilt, ag activities adjacent to the site. Remember peak production is June through October (Kinda close to crush and harvest).
- As to how often, the jury is out, use production data to judge this. Start with annual, then use production data to judge if more is needed (and don't forget cleaning by rainfall). For agricultural areas, judge cleaning based on surrounding ag activities, and maximizing production when needed for harvest
- Do this in-house or contract? Consider your labor costs, skillsets and equipment needs
- Access – make sure you can reach all the panels
- Before you do clean:
 - Do a general walk around, Inspect array mounts, roof penetrations
 - Look for obvious, like loose wiring, open electrical junction boxes
 - Loose mounting
 - Cracked panels
- Water source- while deionized is best, tap water is ok if you squeegee off to prevent mineral spotting



- Avoid doing the cleaning when it is hot to avoid cracking panels due to thermal shock (early morning is best)
- Do not pressure wash the panels
- Use soft bristled brushes only to get the accumulated grit
- Check for any runoff needs /precautions for the wash waters

Inverters:

Each inverter manufacturer will have specific requirements for inspection, testing, services, and documentation to meet its warranty obligations. Typical requirements for inverter inspections include:

- Record and validate all voltages and production values from the human- machine interface (HMI) display.
- Record last logged system error.
- Clean filters.
- Clean the inside of the cabinet.
- Test cabinet cooling fans for proper operation.
- Check Fuses and breakers
- Check torque on wiring terminations.
- Check cabinet door gasket seal.
- Confirm warning labels are in place.
- Look for discoloration on the wiring from excessive heat buildup.
- Check continuity of system ground and equipment grounding.
- Check mechanical connection of the inverter to the wall or ground.
- Check the internal disconnect operation.
- Verify that current software is installed.
- Contact installer and/or manufacturer about any issues found.
- Document findings for all work performed.

List of Potential Service Vendors:

These vendors have indicated they will provide maintenance and monitoring support for systems they have not installed themselves, but you will need to verify this when contacting them.

West Coast Solar Energy

Jason Cross - GM
Mike Bohn- Lead service tech
Direct: 707.919.0809
Cell: 707.599.7926
Jason@westcoastsolarenergy.com
They use "Also Energy" for monitoring

Green Stock Solar

Jae Chyun
Office: 707.260.5548
Cell: 925.998.8929
kjchyun@greentocksolar.com

First Edison

Bruno Bardet
707.688.9110
bruno@firstedison.com

BPI Solar

866.214.9304
info@bpi-power.com

Solar Craft

707.778.0568
Service@solarcraft.com

REC Solar

844.732.7652
info@recsolar.com

Sun System Technology

844.477.8787
SSTsolar.com

PV Array Cleaning Vendors

- Pro Solar Clean-Santa Rosa
- Napa Valley Window Cleaners - Napa
- All Season Solar Cleaning, Co.
<https://www.allseasonguys.com/>

Satcon Parts and Expertise:

SIC Solar

Jay Patel - Application Engineer & Technical Support
Office: 408-456-6779 Ext: 126
Direct: 408-716-4926
Cell: 905-630-7911
Technical Support: 408-716-4926
www.sicusallc.com