



MANA ENERGY
مانا انرژى 2024

Guide to Maintenance & Cleaning PV Modules

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Introduction

The best solar installation companies offer 25 to 30-year warranties to ensure performance over the lifespan of your panels. However, it's still important to know about proper solar panel maintenance. The main requirement is regular cleaning when dust and other particles accumulate on the surface of your panels, it can block sunlight, and electricity production can decrease.

1-Routine inspection and maintenance of solar panels

1. Check whether the module is damaged, discover it in time and replace it in time.
2. Check whether the module connecting wire and ground wire are in good contact and whether they are falling off.
3. Check whether there is heat at the junction of the combiner box.
4. Check whether the module bracket is loose or broken.
5. Check and clear away the weeds around the modules that block them.
6. Check whether there is any cover on the surface of the module.
7. Check for bird droppings on the panel surface and clean them if necessary.
8. Evaluate the cleanliness of the modules.
9. In windy weather, key inspections of the modules and brackets should be carried out.
10. In heavy snow days, modules should be cleaned in time to avoid snow and ice accumulation on the surface of the module.
11. During heavy rain, check whether all waterproof seals are in good condition and whether there are any leaks.
12. Check whether any animals have entered the power station and damaged the modules.
13. In hail weather, key inspections should be carried out on the surface of the panels.
14. Detect the temperature of the module and compare it with the ambient temperature for analysis.

If you find the following problems, you should immediately ask professionals or after-sales service to adjust or replace the photovoltaic modules;

- (1) Photovoltaic modules have broken glass, burned back plates, obvious color changes, etc.
- (2) The junction box in the photovoltaic module is deformed, cracked, burned, or the terminal block cannot be connected.

2- Cleaning Solar Modules

Many solar manufacturers and installation companies, recommend cleaning your PV modules at least twice per month. Depending on site conditions and the weather, you may need to clean your system more frequently. For example, dust will accumulate faster on solar panels if there is a large construction project near your home.

If energy output consistently drops by 5%–10% compared to baseline performance but every thing is ok, you need cleaning the modules.

Depending on Environmental Conditions inspect modules:

- Dry and Dusty Climates: Assess every 2–4 weeks.
- Humid and Rainy Climates: Assess every 6–8 weeks (rain may naturally clean panels).
- High Pollution Areas: Inspect weekly.

Rain can clean your solar panels for free, washing away built-up material such as dirt and bird droppings. However, you should always conduct a visual inspection after extreme weather, to make sure your solar panels are still in good working condition.

- When cleaning modules, do not step on the modules; do not spray water on the backside of the module or the cables; do not clean the backside of the modules; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do not use steam cleaner.
- Do not try to clean broken glass or modules with broken lines or exposed wires, as it may cause electric shock.
- Do not use bare fingers or hands without gloves to touch or handle the glass surface of modules. Wear clean gloves to prevent fingerprints and other dirt from staying on the glass.
- The aluminum frames of photovoltaic solar panels and photovoltaic racks have many sharp angles. When cleaning, wear appropriate work clothes and work caps to avoid scratches and injuries.

2-1-Selection of cleaning time

The module glass cleaning should be done in the early morning, in the evening, at night or on rainy days. At the same time, when cleaning in the morning or evening, select the period when sunshine is not strong.

You can wash solar panels with a garden hose, but you should never do this on a hot summer day. PV modules reach high temperatures under the sun, and the sudden cooling effect caused by washing can cause cracks on their surface. Keep in mind that your solar panels may still be warm after sunset, especially if the weather has been particularly hot.

Do not clean your solar panels on a sunny day because it can leave smudges since the water can evaporate quickly.

2-2-Cleaning Process

A Normal cleaning work including three steps: sweeping, scraping and washing.

Step 1: Sweeping in this steps dust and foreign materials are removed by using dried duster or even mop. It is important to make sure that dust is not removed to the corners of the modules to avoid any hotspot that may cause damage to the module. This step is supposed to be enough if there are no deposits.

If the Modules were installed in the desert, due to less water and more dust. Recommend to use the gas to blow the sand, remove away most of the sand on the surface of Modules.

Step 2: Scraping: If there is hard foreign matter such as dirt, bird droppings, plant branches, leaves, etc., closely attached to the module, the module should be scraped with non-woven fabric and must not be scratched with high-hardness objects; if the foreign matter is removed, do not scratch regions without hard deposits.

Step 3: Washing If there are colored substances such as bird droppings, plant juices, etc., on the module surface, or dust that cannot be whisked off due to high indoor humidity, the colored substances need to be removed by washing. The colored substances are generally removed with clean water by spraying the clean water onto the region with pollutants and scraping with a brush. Oily substances, if any, may be removed by coating water blended with alcohol onto the colored region and scraping with a brush after the solution penetrates through the pollutants. If necessary, the module may be cleaned with commercial glass cleaner, together with non-woven fabric or a wipe blade for windowpane cleaning.

2-3-Cleaning tools and chemical agents

You should never clean solar panels with roof rakes, hard brushes or other tools that may scratch their surface. Also, avoid chemical cleaning agents since they can also cause damage. Soft brushes and squeegees are suitable for solar panel cleaning, or you can use a leaf blower or garden hose.

All types of commercial glass cleaners, alcohol / ethanol / methanol may also be used. Do not use abrasive powders, abrasive cleaners, scrubber cleaners, polishers, sodium hydroxide, benzene, nitro-thinners, acid or alkali and other chemical substances.

If there are greasy dirt and other substances on the surface of the PV module which are difficult to clean, use a friction-free neutral liquid detergent; Do not use any organic solvent containing acid or alkaline to clean the module.

2-4-Requirements for water quality

- ✓ PH: 5 ~7
- ✓ Chloride and Salinity : 0 - 3,000 mg/L
- ✓ Turbidity : 0-30 NTU
- ✓ Conductivity : 1500~3000 $\mu\text{s}/\text{cm}$
- ✓ Total dissolved solids (TDS) : ≤ 1000 mg/L
- ✓ Water Hardness—calcium and magnesium ions : < 600 mg/L
- ✓ Non-alkaline water must be used; demineralized water shall be used if the condition permits.

The pressure of the cleaning water should be less than 690KPa. It is not recommended to use water with high mineral content as it may deposit on the glass surface when the water is dry. Most municipal water can meet the above two requirements.

Do not use steam or corrosive chemicals to speed up the cleaning.

2-5-Cleaning Solar Panels in Winter

Sometimes snow and ice can accumulate on solar panels but since they're angled, it usually melts and slides off. Should snow or ice persist, spraying panels with lukewarm water can help remove it.

Avoid using hot water to clean snow and ice from solar panels because the temperature discrepancy can cause the panels to crack. You can also brush the panels off with something non-abrasive to prevent scratches.

2-6-Modules inspection after cleaning

Ensure that the module under visual inspection is clean, bright and free of stains;

- ✓ Spot check to verify whether there is soot deposit on the module surface;
- ✓ Check to see that there are no visible scratches on the surface of the module;
- ✓ Check to see that no man-made cracks are on the module surface;
- ✓ Check to see that whether the module support structure is leaning or bent after cleaning;
- ✓ Check to see that whether the wiring terminals of the module are detached;
- ✓ After cleaning PV modules, fill out the PV module cleaning record.

3-Shaded Solar Panels

Solar panels suffer a drastic loss of energy production when covered by shadows since less sunlight can reach their surface. Professional solar technicians will try to place your solar panels in an unshaded area during installation. However, growing vegetation and other rooftop equipment can create new shadows, covering your solar panels.

Many home solar panels are connected together using a string circuit, meaning all PV modules in the circuit are affected when one is unproductive. A concentrated shadow covering just one of your solar panels can decrease the electricity output of the entire array.

Tree branches that grow above your solar panels should be trimmed regularly to prevent shading. Other rooftop equipment such as solar hot water collectors and air conditioners should be installed so they will not cast a shadow on your home solar system.

Dust and other waste materials can accumulate on your solar panels and have the same effect as shadows. These materials can block incoming sunlight, and electricity production drops as a result. As mentioned before, you should clean solar panels regularly to ensure high productivity.

4-Maintenance of solar inverter

- Keep the inverter clean and minimize the intrusion of dust (once every six months)
- Make sure the inverter is free from insects or animals (once a season)
- Check to make sure all electrical connections are clean and secure (once every six months)
- Software data storage (once a month)
- Cooling fan maintenance and replacement (once a year)
- Safety function check, check the inverter LCD and system shutdown function (once every six months)
- Software optimization (once every six months to a year)

5-Maintenance of solar bracket

- Use photovoltaic brackets installed on prefabricated bases. The prefabricated bases should be placed stably and neatly, and the position must not be moved. All bracket connections should be firm and reliable, and all bolts should be complete.
- If the anti-corrosion and anti-rust coating on the surface of the bracket cracks or falls off, it should be repainted in time.
- The bracket must be well grounded, especially before the thunderstorm season every year, the grounding system should be checked to see if the connection is strong and the contact is good.

