



Philadelphia Solar
Delivering Clean Energy Solutions

GUIDE TO CLEANING PV PANELS



Introduction:

Solar panels work by allowing light into the solar cells. The more light that hits a panel, the more power it will generate. Due to the upwards angle of solar panels, they are more prone to dirt such as bird droppings and Air pollution, accumulated dust, grease or any other particles in the air that gets caught on the solar panels.

Accumulated dirt will reduce the amount of light transmitted to the cells and hence it will significantly affect the power output. In addition, dirty parts of the panel get hotter faster than other parts, which creates hotspots. These hotspots can increase the rate at which solar panels deteriorate.

General Instructions:

1. 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.
2. Do not use aggressive tools or abrasive material that may cause scratch of the glass. Such as blades, knives, steel wool and other abrasive materials.
3. Various types of soft foams, non-woven fabrics, brooms, soft sponges and soft brushes are permitted
4. Glass cleaner, alcohol, ethanol or methanol are only allowed to use in case of the water cannot clean properly.
5. Never use steam or corrosive chemicals to speed up the cleaning process.
6. Water with low mineral content should be used otherwise dried minerals will be deposited on glass. If low mineral water is not available in the area where modules installed, it is suggested to add the sodium chloride $\leq 2\%$ in water to avoid depositing the dried minerals on glass.
7. The pressure of cleaning water should be less than 690 Kpa.
8. The difference between water temperature and modules temperature should be controlled at a certain range from $-5\text{ }^{\circ}\text{C}$ to $10\text{ }^{\circ}\text{C}$. Also, the pH value of water must be around 6-8 since glass of the module is coated by anti-reflected material.
9. Do not clean the module when the cable or the glass are broken, which may raise the risk of electric shock.

10. The back side of bifacial modules can also generate power; hence, it is necessary to clean the back side.
11. The cleaning of the transparent backsheet of bifacial modules should be done using soft cotton base material to remove the dust or dirt. Or you can use compressed air (pressure less than 2.4 KPa) to blow away the dust/dirt. Do not use any chemicals or water in case of electrical shock.
12. Through any means, the cleaning should not make a damage of the backsheet of bifacial module. If happens, please replace with a new module.
13. Philadelphia Solar modules are designed to withstand high snow loads (5400 pa). However, if removing snow is desired to enhance production, use a brush to gently remove snow. Do not try to remove frozen snow or ice from modules since that may cause micro-cracks in cells.
14. Do not stand, step, walk and/or jump on modules under any circumstances. Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability and void Philadelphia's warranty.

Cleaning Time, Cycle and Region

Philadelphia Solar recommends cleaning during early morning or night when solar radiation is low, and the module is cooler especially in region of hotter region.



It is recommended that the customer evaluates the cleaning frequency according to the actual situation of the region where modules installed in.

For a large-scale photovoltaic power plant with a large number of modules, the time suitable for the cleaning is short each day; it is necessary to plan the cleaning cycle and divide regions based on specific circumstances of the electric field. The subregion division in the cleaning work should be done according to the electrical structure of the photovoltaic station and should ensure that each of the cleaning work can cover all components connected to several combiner boxes or inverters.

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.

Step 2: Scraping: Sticky dirt such as bird droppings, leaves, etc., should be scraped off with non-woven fabric or brush. High-hardness tools are forbidden to use.

Step 3: Washing For the color dirt such as bird dropping, plant juice, etc. on the glass surface or dirt that hardly dust off, then water-cleaning should be used. Water pressure should be less than 5.4 kPa