



PHOTO VOLTAIC SOLAR PANELS BY

Technology Comparison

There are two primary PV panel technologies being heavily deployed right now. There is thin-film (or amorphous silicon) and there is hard-panel (or crystalline silicon).

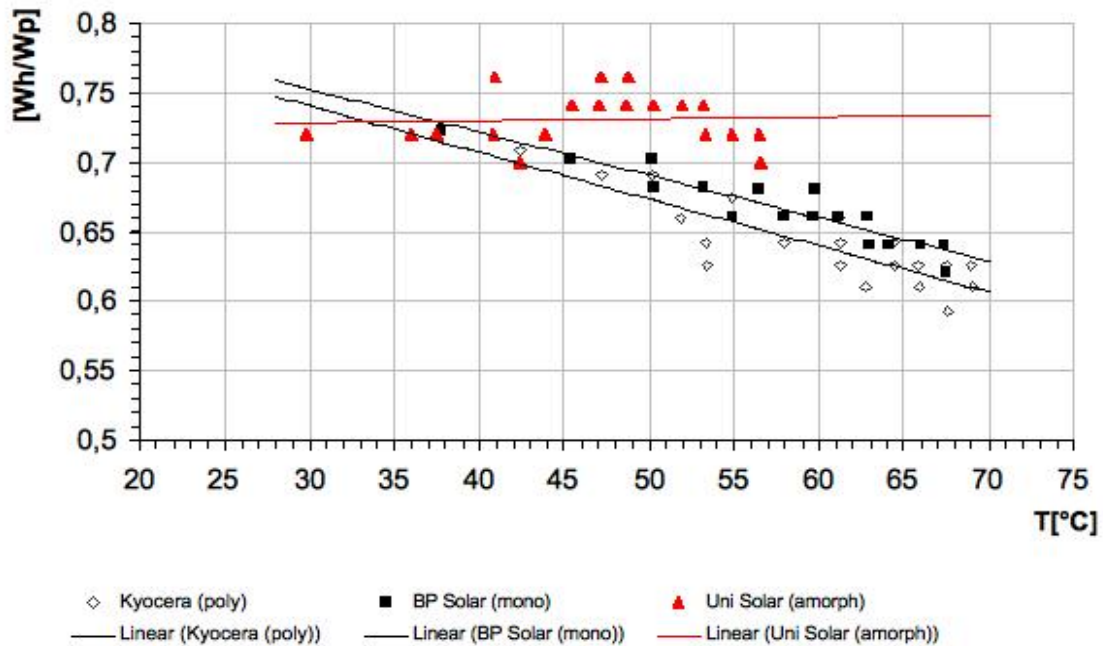
Crystalline panels are either mono or poly crystalline. They vary in size and wattage, ranging from 100 to 300 watts per panel. The average sized panel used is 230 watts. They do have more watts per square foot, but they are also heavier and require a racking system be mounted on the roof surface. The racking is either attached to structural supports through the roof or by using ballasts.

Thin-film panels perform extremely well in high wind conditions. They are also much more hail resistant versus than the glass of the hard panels while maintaining their durable and flexible characteristics. Thin-film is also extremely lightweight at only 0.7 pounds per square foot, versus 5-6 pounds per square foot for hard panels and 12-14 pounds per square foot for hard panel ballasted solutions.

Two of the most significant differences between thin-film and hard panel is this film's greater output at lower light levels and in high heat plus better performance in shaded or soiled conditions. It has been scientifically proven that amorphous silicon outperforms crystalline panels in high heat conditions. The power output of hard panels decreases as the temperature rises, while the power output of thin-film remains constant. Thin-Film also produces more power in low light conditions. The reason thin-film is less affected by shading and soiling is due to the bi-pass diodes design. Each thin-film panel has 22 cells and there is a bi-pass diode between every cell. Therefore, if there is some shading on one of the cells, only the power output of that single cell is affected. Hard panels typically have 72 smaller cells and have only 2 bi-pass diodes between the three sets of 24 cells. If there is some shading, the bi-pass diode will trip and reduce the power output of the entire hard panel by one-third.

Below is a plot graph showing the impact on power output from increases in temperature, for two different types of hard panels and the thin-film. The two black lines represent the two hard panels and it shows that the power output decreases as the temperature increases. However, the power output of the thin-film remains constant as the temperature increases. On roofs where temperatures can become quite hot, this can be significant.

Yield in function of module temperature, Urbino, Central Italy (2003-2004)





Uni-Solar – Thin Film

The primary thin-film product that we currently carry is Uni-Solar. However, we are continually evaluating new technologies to integrate into Soprema's roofing solutions. If you are interested in other thin-film technologies, please contact us.



Solar Laminate PVL-Series Model: PVL-136

- High Temperature and Low Light Performance
- 5-Year Limited Product Warranty
- Limited Power Output Warranty:
92% at 10 years, 84% at 20 years, 80% at 25 years (of minimum power)
- Quick-Connect Terminals and Adhesive Backing
- Bypass Diodes for Shadow Tolerance

Performance Characteristics

Rated Power (P_{max}):	136 Wp
Production P_{max} Tolerance:	$\pm 5 \%$

Qualifications and Safety



UL 1703 Listed by Underwriters Laboratories for electrical and fire safety (Class A Max. Slope 2/12, Class B Max. Slope 3/12, Class C Unlimited Slope fire ratings) for use in systems up to 600 VDC.



IEC 61646 and IEC 61730 certified by TÜV Rheinland for use in systems up to 1000 VDC.

Laminate Standard Configuration

Photovoltaic laminate with potted terminal housing assembly with output cables and quick-connect terminals on top.

Application Criteria*

- Installation temperature between 10 °C - 40 °C (50 °F - 100 °F)
- Maximum roof temperature 85 °C (185 °F)
- Minimum slope: 3° (1/2:12)
- Maximum slope 60° (21:12)
- Approved substrates include certain membrane and metal roofing products. See United Solar for details.



Roofing Concerns

A large portion of solar systems are being installed on commercial and residential roof tops around the world. It is critical that the solar system be installed in a manner that is compatible with the roofing surface, while avoiding any penetrations in the roof membrane and minimizing the weight being added to the support structure. Solar systems have life expectancies of 20 plus years. It is critical to have a durable, quality roof membrane that matches this life expectancy. There are multiple options when installing roof top solar systems. The mechanically anchored approach attaches mounting supports directly through the roof membrane into the buildings support structure. These penetrations must be properly flashed and can become problematic over time. A ballasted approach utilizes weights or blocks to anchor the solar panels to the roof. Ballast pans are engineered into the racking system to hold standard sized blocks. A directly adhered approach utilizes thin-film solar panels and specially developed adhesives to bond the solar panels directly to the roofing membrane. This approach requires no penetrations and is an extremely light weight solution.

BIPV/self-adhered solutions utilize thin-film solar technology that fully bonds the solar panels to the roofing membrane. It is very roof friendly and will resist high winds, is extremely durable and requires no penetrations to the roofing system. It can go over flat or metal roofs and is extremely light weight.

For our granulated (SBS modified bituman) and SopraStar (reflective) cap sheets we use a single-part bituminous cold process adhesive. It prevents any delaminating of the solar panel from the cap sheet.



For our liquid membrane roofing (PMMA), we use our 2 part Alsan RS 230





Frequently Asked Questions

Q. Who installs the panels and how are the panels adhered to the roof?

- A. The panels are installed by Solardis or an approved Soprema contractor in accordance to our standards. The panels are adhered to our membrane with the proper adhesive.

Q. How much weight do the panels add to the roof?

- A. Uni-Solar panels are very light weight, less than a pound per square foot. A typical hard panel system can weigh up to 6 pounds per square foot, 12-14 pounds per square foot for ballasted solutions.

Q. Are there any penetrations to the roof with the SopraSolar system?

- A. No, all of the panels, the wire management system and other equipment are adhered to the roof with a strong adhesive. It's imperative that the roof is as watertight as possible. Any residual water under the panels could result in performance issues.

Q. Who performs all the wiring and electrical hook ups for the PV system?

- A. Solardis or a certified electrician selected by Soprema will wire all panels, install the electrical equipment and tie the system to the grid per the electrical code.

Q. What percent of the roof can be covered in photovoltaics?

- A. On average we can cover between 70-75 percent of the roof with panels. The system is engineered specifically for your roof. We provide shade analysis and take any roof top units such as HVAC into consideration when designing a system.

Q. Can the panels be installed over an existing roof?

- A. The answer to that question depends on the roofing system in place and will be determined on a project by project basis. The PV cells are warranted for 25 years and it's imperative that the roof under the panels last longer than the PV panels.

Q. Can the panels be walked on?

- A. The Uni-Solar panels are very tough and can be walked on, however it is not recommended. The roof becomes a live power plant and access to your roof should be strictly controlled. We design the system with walkways throughout the roof and near high traffic areas to minimize traffic on the panels.

Q. Will the panels work with dust and dirt on them and do they need to be cleaned?

- A. Yes, the panels will still perform with a thin layer of dust or dirt on them. In most of the country, rain water is sufficient enough to clean the panels; however, in desert areas it is recommended that the panels be cleaned twice a year with a non-solvent based soap and water.

Q. Will the panels work with snow on them?

- A. Yes, unlike hard panel systems Uni-Solar panels will still produce some power with less than 2 inches of snow on them.

Q. How do the panels withstand ponding water?

- A. Uni-Solar panels can withstand ponding water for up to 48 hours; however, we design the PV system to minimize the potential for ponding water on the panels.

Q. Should the system be inspected?

- A. Yes, our recommendation is that the system be inspected twice a year. This is part of the maintenance program that is available to the owner. The facility manager should look for debris that is obstructing the panels such as branches after a large storm. Also, the drains on the roof should be inspected for clogs on a regular basis.

Q. What is the warranty on the solar panels?

- A. The panels are warranted for 25 years at 80% efficiency. SOPREMA can offer a unique single source warranty on the roofing membrane and the solar panels.