PR TECHNOLOGIES

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SolarPower

Most commercially available photovoltaic modules are comprised of individual cells made from silicon, connected in series and laminated behind glass or plastic. Single-crystal silicon cells are the most efficient. Polycrystalline (or multi-crystalline) cells are slightly less efficient than single crystal cells. Thin-film is 30% less efficient that single crystal.

Efficiency is also effected by cell coverage in a PV module. Square cells can be packed very closely, allowing most of the module surface to generate power. Modules made with round cells will have a lower cost, but the space between these cells in a module is effectively wasted space, and causes the module to have less power output for any given area.

Some cells are semi-round and will have an efficiency between round and square cells. A module made with square polycrystalline cells will be slightly more efficient than one made with round single crystal cells.

Module efficiency determines the surface area that is required for any given power output. The increased cost of higher efficiency PV modules becomes beneficial if there are space constraints. Less efficient modules will require more mounting structures, increasing the balance-of-systems cost. This is most important when the modules are mounted on tracking mounts.

Thin-film modules are made by depositing silicon on stainless steel foil and encapsulating the foil in plastic. They are less fragile than crystalline modules. Glass thin film modules use much less silicon, and have a lower cost, but are about ½ as efficient as other modules.

Some thin-film panels are flexible and can even be rolled up, making solar electricity very mobile. Testing has shown that there is a shorter panel life expected for thin-film panels, some as low as 12 years, but to compensate some manufacturers are extending 20 year warranties. Uni-solar, Solarex and Siemens manufacture thin-film panels.

Panels come in various output voltages. The standard is 12VDC nominal, but other single output voltages (6, 24, 51VDC) and dual output voltage panels (6 and 12VDC, 12 and 24VDC) are also available. When working with higher voltage, such as water pumping or utility-intertie systems, higher voltage panels are convenient. Or if you need to charge a 6 volt battery, the lower voltage panels are required.

We sell PV modules in sizes that range from ½ watt to 300 watts. Most large power systems are built from arrays of modules in the 75 to 120 watt range. This wattage is high enough to be a significant part of the system and that the physical size is not too large to lift and position. 40 to 55 watt modules are a good choice for small systems such as small water pumping systems, or in any system where less than 75 watts is required.

The 120 and 300 watt modules reduce labor by reducing interconnections. 300 watt modules must be shipped by truck in wooden crates so they are most economical when used in systems requiring over 3000 watts of PV modules. They are often used in very large and utility intertie systems and can reduce wiring by as much as 80%, lowering overall system cost and increasing system reliability.

It is important to use UL listed panels for NEC compliance in inspected systems. However, UL listed panels generally do not differ from unlisted panels. UL listing is expensive and may add to the panel price. Class 1, Division 2 FM approval for explosion resistance is required near gas and oil pipelines. A class A fire rating may be required in some commercial rooftop applications.

The mechanical specifications of PV modules are also important. Junction boxes differ by their size, type of connectors and whether they will accommodate conduit. Presently, most commercially available panels have well-designed junction boxes. Some module manufacturers offer interconnection cables that, although expensive, can simplify and expedite installation.

Some small modules (usually 30 watts or less) come with wire leads and have no junction boxes. Most PV modules are framed with aluminum and have bolt holes that allow them to be attached to mounting structures. There are some unique frame options available that simplify mounting without racks for RV, roof and flush mounting. (Some modules are also available unframed for special applications.) Most manufacturers use tempered, high light transmission glass that allows more of the sunlight to the cells and breaks without shards.

The encapsulant (the material sandwiched between the face glass and PV cells) has been

greatly improved since PV production began, and discoloration and breakdown is no longer an issue in modern modules. PV cells are blue or black and differ in the way they look. Architects for building integrated applications often prefer blue poly-crystalline cells.

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