

## The advantages of flexible thin-film solar modules

May 31, 2016 [Kelly Pickerel](#) : [2 Comments](#)

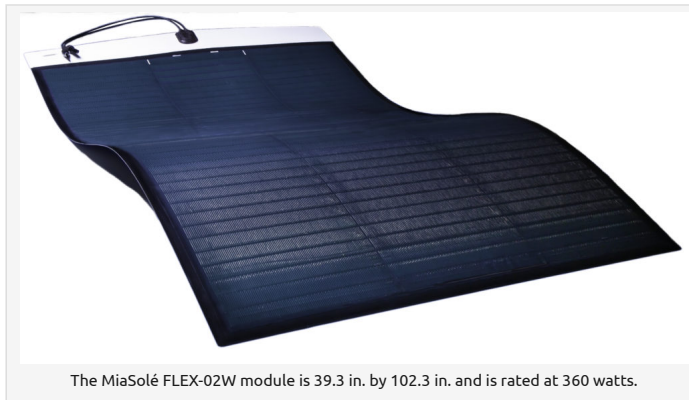


By [Michael Gumm](#), Application Technologist, [MiaSolé](#)

The flexible and lightweight solar modules of today have efficiencies that rival that of traditional rigid silicon panels, while their flexible format and non-penetrating peel-and-stick installation make them ideal for a wide variety of applications unsuitable for heavy silicon panels.

Flexible thin-film solar has been around for a number of years. The first generation flexible thin-film photovoltaic (PV) modules were developed around amorphous silicon (a-Si), a non-crystalline form of silicon. The early generation a-Si thin-film modules, while lightweight and flexible, provided a low power output—only about 5 to 6% power efficiency—meaning only 5 to 6% of the sun's energy was converted into electricity. The result was very low power density, requiring a large area to produce a power output equal to that of crystalline silicon modules. Even with the low power output, a-Si modules were popular because the peel-and-stick adhesive application did not require racking assembly, ballast or roof penetrations. To solar installers, this meant an easier installation with a faster learning curve. Labor costs were also lower because project staging, loading and installation could be completed faster with fewer workers than with conventional rack-mounted glass modules.

The next generation flexible thin-film PV modules to enter the marketplace were built using copper-indium-gallium-selenide (CIGS) thin-film PV technology. These new flexible CIGS modules offered the same benefits as a-Si—lightweight, flexible, peel-and-stick application—at a much higher power efficiency (MiaSolé's FLEX line of flexible CIGS thin-film modules reaches efficiencies exceeding 16%).



The MiaSolé FLEX-02W module is 39.3 in. by 102.3 in. and is rated at 360 watts.

Flexible solar modules are ideal for membrane roofs, including TPO and EPDM low-slope roof systems. Because these thin-film modules can weigh as little as 7-oz per sq. ft, they can be installed over low-load-capacity roofs that prove challenging for conventional crystalline panels and rack systems because the roofs can't support the added weight. Today's flexible modules use a factory-applied butyl-based self-adhesive with a 30-year proven performance history. Installed with this simple peel-and-stick adhesive, flexible modules become an integrated part of the roof system and have the same wind uplift and seismic performance characteristics of the roof system itself. From an installer perspective, without racks to assemble, ballast to carry and place, or leak-causing roof penetrations, peel-and-stick thin-film modules are the simplest, fastest and lowest labor cost rooftop solar solution.

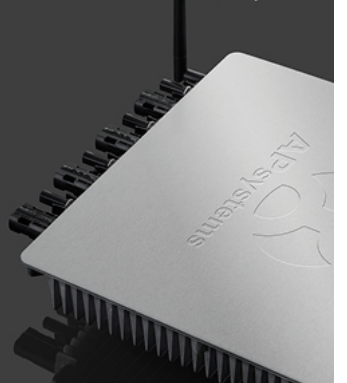
Some flexible modules are also designed for architectural standing seam metal roofs, where the module can be adhered directly to the metal roof surface in between the raised seams. The result is an aesthetically pleasing solar roof that doesn't have obtrusive racks mounted to the outside of the metal seams that detract from a clean, streamlined look.

The benefits of thin-film modules extend well beyond roofing. Lightweight and flexible modules with no-penetration installation enable solar power generation in a wide variety of non-roofing applications. A good example is landfills. Flexible modules with a large format make PV landfill installations over geo-membranes both practical and cost-effective compared to traditional Subtitle D closures and ballasted crystalline rack systems. Large-scale geo-membrane panels can be factory-assembled with flexible solar modules laminated directly onto the geo-membrane surface. Then the combined solar membrane package can be rolled up and transported to the landfill site. This greatly speeds up installation time while reducing labor costs, especially on state and county projects that require Davis-Bacon wages to be paid on site. Often the cost savings of using the geo-membrane compared to a full Subtitle D closure alone can offset a significant percentage of the solar cost.



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Transportation is another market in which flexible and lightweight thin-film modules provide significant advantages. Federal and state regulations limit how long buses and large-haul tractor-trailer rigs can idle in place. Applying flexible thin-film solar modules to a bus or trailer roof, coupled with on-board power generation integrated with additional battery storage and an off-grid inverter, means tractor-trailer rigs can power the driver cabin during mandated sleep/rest overs without idling the engine. Solar power can also be used to offset refrigeration power for cold storage trailers.



The MiaSolé FLEX-02N line of modules is rated between 115 and 130 watts.

Flexible thin-film modules can also be applied to bus rooftops, so that when the vehicles are idling, solar power can heat and cool the bus while powering accessories such as Wi-Fi, power plug-ins and refrigeration units, all without burning fuel. In the personal RV sector, rooftop solar can reduce engine and generator run-time. For both commercial and recreational use, flexible and lightweight thin-film solar modules make a serious reduction in vehicle fuel cost while reducing air pollution and achieving a fast payback.

Flexible thin-film solar modules can also be used in many other applications, such as floating solar reservoir covers and large canal waterway solar covers. These covers help reduce water losses due to evaporation, and once solar modules are installed they can also provide renewable energy to process and move water. Floating covers built with flexible polymer membranes and lightweight support structures provide a low-cost option compared to using heavy glass solar modules with large structural supports and flotation components. Tension fabric using cables or lightweight space-framing structures can span across water and irrigation canals. On large steel water towers, flexible solar modules can bond directly to the steel tank providing solar power to pump water for storage while a battery backup can provide emergency power in the event utility power is lost.

The technical achievements of CIGS result in high efficiencies when added to non-penetrating, peel-and-stick installations, and their flexible format make them ideal for a wide variety of applications unsuitable for heavy silicon panels. Flexible thin-film solar modules increase the number of surfaces that can be used to provide solar energy generation, providing more opportunities for renewable, clean energy, helping move the bar forward to a carbon-neutral future.



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