



## Solar Carports – Flexibility in design

by Michael Gumm

**IN THE UNITED STATES**, over 20% of the urban land area is dedicated to parking lots. Land in urban areas is becoming an increasingly expensive and a scarce resource. Private and municipal owners of parking lots are searching for better opportunities to make their parking facilities multi-functional and more productive.

The installation of solar (photovoltaic or PV) carports on both private and public-owned parking lots provides a new and cost-effective opportunity for generating clean, renewable energy without consuming additional land resources. Solar PV carports can provide far more power generation area compared to the more limited rooftop surface commonly used for many solar installations.

Parking lots in general have more solar potential and less shading issues than rooftop solar and can be easier to install than rooftop solar installations and be less disruptive to the facility. Two additional advantages to mounting solar on carports versus roof-mounted solar arrays include no roof penetrations, which increase exposure to potential water leaks, and the ability to avoid additional roof inspection or engineering and repair costs regarding the age, service life, and integrity of the building's roof.

Rooftop solar installation can have a huge impact on roof warranties and might shift future liabilities from roof problems from the roof manufacturer to the building owner. Eventually, a rooftop array may have to be removed for a roof replacement and then re-installed, increasing the overall PV costs. These risks and costs are eliminated with solar carports.

Solar PV parking canopies offer the parking lot owner and the environment considerable value:

- Highly desirable shade for parked cars
- Rain and snow protection
- Protection from hail damage
- Reduced UV exposure
- Reduced parking lot temperatures and heat island effect
- Low-cost renewable power generation
- Low power distribution and energy transmission cost for the utilities
- Improved municipal energy independences

### **Lightweight, flexible solar vs. glass**

Traditionally, most solar carports use conventional, heavy-glass crystalline solar modules installed on rails over large, heavy-gauge structural steel building components requiring large support columns with deep concrete piers or large ballast blocks. Even carports designed and built using architectural metal panels require additional heavy gauge structural steel, railing, and roof clamps, all adding weight and cost to the solar carport.

Newer flexible lightweight CIGS based solar thin-film modules offer the same high efficiency power output as standard crystalline modules, while weighting less than 0.7 lb/sf vs the 3-5 lbs/sf for crystalline modules. The lighter weight of flexible thin-film solar modules means less structural steel is required in the carport design, which means less cost and faster construction time. Solar carports constructed with lighter flexible thin-film PV modules can use light-gauge roll-formed steel, which allows the support columns to be placed further apart, creating a more open design.

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Constructing solar carports using resin-based coatings painted on architectural standing-seam panels, and square rib corrugated metal panels with painted light gauge steel, provide a low maintenance, longer-service-life structure that blends in with the facility building design.

The flexible lightweight thin-film modules can be laminated onto architectural metal panels at the factory and then shipped to the project site ready for placement on the support structure, allowing the contractor to use pre-engineered modular unit construction. This reduces onsite construction time, and subsequently reduces construction costs.

Good wind and seismic performance engineering is important to carport design. With traditional glass modules, there is concern about the stresses of wind and seismic movement. In addition, purlins can sag when support columns are placed far apart, impacting glass module and rail attachment. Architectural metal panels provide stiffer support surfaces, can span wider distances, and are engineered for good wind and seismic performance while using lighter structural support.

### Installing solar modules onto existing carports

Many facility owners have existing carports without solar. Owners often want to retrofit these existing carports, only to realize that the original design and construction will not support the additional weight of conventional crystalline modules. Until now, the only option was to tear down the existing carport structure, and to design and rebuild the carport to support conventional solar.

Flexible, lightweight thin-film solar modules can be installed over existing carports constructed with architectural metal panels

and some square rib corrugated metal panels without affecting the current weight limitation design. On carports with non-compatible metal panel profiles, these metal panels can be removed and replaced with new architectural metal panels without having to modify the existing support structure at a cost lower than full replacement. Flexible thin-film modules can be installed onsite, requiring fewer installers and equipment, speeding up both new construction and retrofit installations, all at a lower cost.

When considering solar carports, new lightweight flexible thin-film solar modules can be considered the best choice to speed up construction at a lower cost, with more design flexibility than using conventional crystalline modules.

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