

Solar: A Building Electrification Trend That's Here to Stay



PART II



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Solar is one of the fastest growing sectors in energy production today. Beyond being environmentally sustainable, solar is an approachable technology that can provide clients with significant and long-term energy cost savings.

In the first segment of this two-part series (*Licensed Architect, Summer 2023 pp 10-14*), we covered the benefits of solar, the factors that have contributed to making it a cost-effective energy source, and some of the different mechanical and structural provisions that must be considered when designing a system. In this edition, we will look more closely at common applications for solar, including roof-mounted and ground-mounted arrays and solar carports, key equipment and maintenance considerations, and the long-term economic and environmental impacts of these projects.

Roof-Mounted Solar Options

Many high-quality mounting systems are available to safely and attractively secure solar panels to a variety of different types of roof structures. These systems, which are made of aluminum or stainless steel, are incredibly durable and designed to withstand decades of weather and climate exposure.

For flat or very low-pitched roof applications, the mounting apparatus is commonly attached to the roof using ballast

weight, which minimizes or eliminates penetration of the roof membrane. Specialized clamps are then used to attach solar panels to the mounting structure. Beyond the typical south-facing system, panels can be mounted in an east-west orientation to optimize available roof space, lower the ballast quantity required to hold down the system, and capture solar energy over a longer portion of the day. Finally, while the typical flat roof system is ballasted, anchoring is still possible. Anchoring may even be required or desired, depending on seismic loading of the array or insufficiency in the structural capacity of the existing building.

A range of modular PV mounting options also exist for buildings with pitched roofs. For these applications, racking systems can utilize either an affixed rail or hook system. The racking system is affixed to the roof either by a direct attachment to the roof support or a clamp to the roof material. Clamps are again used to attach the solar panels to the mounting apparatus and a clean, low-profile design can easily be achieved.

Systems on pitched and flat roofs will have different load impact to the supporting building due to the different schemes used to attach the solar racking to the building. In the case of non-penetrating, ballasted racking, the additional dead load from the solar array is typically



South and EastWest-facing rooftop systems

around 5 psf. In the case of dispersed arrays with atypical geometry, the added dead load could be as high as 10 psf; this makes it important that adequate space is made available for the solar array that is free of rooftop units, vent pipes, and other obstacles.

For systems that are mechanically fastened to a pitched roof, the added dead load is much less compared to a ballasted system. A client can expect that a mechanically fastened solar array will add only 2 to 4 psf of dead load to the roof.

For any type of roof-mounted application, an experienced solar installation company can provide intelligent design schemes and also calculate the expected utility offset and savings potential for any system. When an initial design concept is chosen by the client, a solar developer will then work closely with other professionals, including the building's architect and the solar racking manufacturer, throughout the system's engineering process. Final system plans and equipment selections will incorporate local building codes, regional weather considerations such as wind and snow loading and seismic analyses, as well as

the building's structural capacity. The resulting system will be engineered for long-term performance and will also be supported by a long-term warranty.

Ground-Mounted Options for Solar Installations

When there is available land near a building, a ground-mounted solar installation can also be considered. Ground systems can be desirable for customers who want to visually highlight their solar investment. They are also an excellent option when a system's size would be constrained by available roof space, or if the roof's condition or structural capacity cannot support solar.

Ideally, a ground-mounted solar installation is installed close to the building's electrical equipment, allowing the solar system to be interconnected efficiently with the building's existing electrical infrastructure.

Like rooftop systems, a number of durable and attractive racking support options exist. These are commonly



Clients looking for an ultra-sleek design for their roof may be interested in monochromatic or black-framed panels



Ground mounted East West ballasted system



Rooftop systems are incredibly durable withstanding decades of weather exposure

attached to the ground using driven piles, ground screws, or ballast. The selection of which type of foundation to use will depend on soil conditions and the topography of the area. The soil conditions will also dictate the size and specifications of the foundation supports.

Some customers use the area around a ground-mounted installation to highlight other sustainability projects, such as native or wildflower beds or beehives.

Solar Carport and Vehicle Canopy Options

Beyond generating usable solar energy for a business, solar carports can be an attractive way to offer vehicle protection from the weather. On a sunny day, for example, finding a parking spot in the shade is a bonus, and customers with large parking lots can use these areas to offer this benefit while visually highlighting their sustainability investment and reducing their utility dependence.



An efficient ground-mounted solar system will be installed close to a building's electrical equipment



A large carport system in construction atop a parking garage

Solar carports tend to be more expensive to install than standard roof or ground-mounted systems because they often have unique design considerations that can affect project feasibility and financials. Critically, the lofted design of a carport can increase the weather loads experienced by the system, which increases the quantity of materials needed for the carport substructure compared to a regular ground mount array.

Unlike rooftop and ground-mounted solar PV systems, solar carports and vehicle shade structures are frequently accessible by the public, so some additional cost can be expected to accommodate necessary safety protocols for solar carport projects. With demand growing for electric vehicle technology, it can also be a good time to plan for the immediate or future installation of EV charging stations, which can be supported by the solar installation.

Solar carport installation projects fare best financially when vacant land is being developed for a new building and parking area, and allowances for carports can be included in the architectural process and civil design plan. This is another time when involving an experienced solar PV developer early can help a client get the results they want while ultimately saving money and frustration down the road.

Solar Inverters

Beyond the mounting apparatus and the panels themselves, the inverter is the other key piece of equipment in a solar PV system.



Solar carports can support EV charging stations



A solar inverter is a key piece of equipment in a solar PV system

Depending on the size of a solar system, one or more electric power inverters convert the DC power produced by the solar panels into AC current, which is matched to the frequency of the grid and therefore provides usable electricity for the building. Specialized cables transfer the electricity generated by the panels down to the inverter and then into the building's electrical system. This wiring is durable and designed to be utilized for the entire life of the system. Likewise, inverters are solid state equipment, designed to last decades and operate with very little supervision or maintenance required.

Whenever needed or desired, a solar PV system can easily be turned off. DC current can be stopped with a disconnect switch at the inverter. The entire PV system can be disabled with the utility disconnect located at the meter.

Solar Maintenance Considerations

Once installed, solar systems generally require minimal routine maintenance, though having an operations and maintenance contract with an established solar company relieves this responsibility and gives customers peace of

mind the system is performing as expected over its useful life. Typical routine maintenance activities that are simple to do for any person include visual inspections of cables, ensuring all nuts and bolts are tight, and inspecting ballast for any shifts. Any intensive maintenance activities, such as inverter troubleshooting or panel replacement, should always be handled by trained professionals.


Some solar providers offer web-based performance monitoring. This tool has myriad benefits for customers. First, it gives their solar technicians an alert if a potential system issue is present. Secondly, it gives the technician a way to remotely access, troubleshoot, and sometimes repair the problem, which is more efficient and cost-effective to the customer than a physical site visit. Monitoring platforms also capture solar production data from the inverter to provide customers with interesting, useful, and visual dashboards to showcase their solar investment and validate their ROI.

The Long-term Economic and Environmental Benefits of Solar

In our work with commercial customers at SunPeak, even moderately sized systems located in the Midwest will reduce a customer's environmental impact by millions of pounds of carbon dioxide and save the building owner hundreds of thousands of dollars in energy costs. When you combine these savings with accessible federal tax credits and other financial incentives for solar, the decision to invest becomes an obvious choice for many customers.

Key Takeaways

Regardless of which type of system a customer may prefer, solar provides decades of safe, sustainable, hassle-free, and cost-effective electricity. By involving an experienced solar provider early in the building design process, architects can consider all of the factors necessary to help their clients implement solar successfully. This not only benefits the environment but also adds value to the property and reduces long-term operating costs for the customer.

For more information on the benefits of solar installations, read part one of this series (*Licensed Architect, Summer 2023 pp10-14*). Images: Courtesy of SunPeak 



Some solar providers offer web-based performance monitoring

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