1866
Hartford Steam Boiler

Munich RE

Risk Solutions

Commercial Solar Photovoltaic Systems

Hartford Steam Boiler
One State Street
P.O. Box 5024
Hartford, CT 06102-5024
Tel: (800) 472-1866
www.hsb.com

Overview - Commerical Solar Photovoltaic Systems

Underwriting & Loss Control Considerations for Solar Photovoltaic Systems

Hartford Steam Boiler

Munich RE

Risk Solutions

Overview of Commercial Solar Photovoltaic Systems

Hartford Steam Boiler
One State Street
P.O. Box 5024
Hartford, CT 06102-5024
Tel: (860) 722-5061
www.hsb.com

This guide provides a baseline background of solar photovoltaic (PV) technology, as well as major system components and configuration. This overview pertains primarily to commercial solar PV installations used to supplement a building's electrical loads.

Introduction to Solar Technology

There are two types of solar technologies found on commercial buildings:

1. Solar thermal — heating of water for direct use or hot water space heating.

2. Photovoltaic (PV) — electrochemical reaction that uses sunlight to produce electricity.

A solar PV system utilizes several key components; they are, solar panels, racks and a mounting system, inverters, and the electrical balance of plant (BOP), which includes cabling, combiner boxes, disconnects, and rapid shutdown devices. Larger installations may also have a transformer(s) to convert the inverter's voltage to the utility distribution voltage. Some installations may also use single or dual axis tracking to follow the sun and increase energy production of the array. Tracking systems are primarily utilized on ground mounted installations. Commercial applications may be roof or ground based systems and typically have a capacity of 40 kW to 1 MW, with an average size being 200 to 270 kW.

Solar panels, or modules, are the heart of any PV system. Fundamentally, individual cells are packaged into modules and they convert the solar energy into direct current (DC) electricity. Amongst several PV panel technologies, crystalline silicon is the most common. The combined power rating of all the panels is referred to as the kW-DC or kW_{Peak} value of the system.

There are two common racking types for roof mounted systems.

1. Ballasted Rack systems — These systems are weighed down by heavy material, usually concrete blocks, to keep them in a fixed position. Ballasted systems are typically placed on flat or very low pitch roofs and require no roof penetrations.

2. Penetrating Rack Systems — These systems are attached through the roof membrane to the structural members of the building. Penetrating rack systems are lighter than ballasted ones.

Inverters are the brains of any solar PV system. They regulate and convert the DC output of many modules into alternating current (AC) at a voltage that is useful for the end-user.

There are two types of inverters used in commercial systems: string inverters and microinverters. String inverters receive the power output from hundreds to thousands of solar panels; they range from 5 to 100 kW. Microinverters are placed on the back of modules and receive the power output from one to three modules; they are sized to the modules' power rating and are used on commercial projects up to ~1 MW. The combined power rating of all the inverters is referred to as the kW-AC value of the system. It is common for the kW-AC rating to be lower than the kW-DC rating, by a ratio of up to 1.6 DC:AC.

Solar PV systems are either grid connected or stand alone. Grid connected systems are designed to operate in parallel with grid supplied electricity, allowing the customer to operate even when the solar system is not producing power. However, a grid tied solar system cannot operate without the grid, unless additional equipment is installed to specifically allow stand alone operation. Grid connected systems can also feed all or part of their produced power directly to the grid; these systems may also have a net metering arrangement. A simple way to think of net metering is with a meter than can spin forwards (consuming energy from the grid) and backwards (sending energy to the grid). For example, if a building uses 7.5 kWh and the PV system generates 10 kWh in a day, the building would have a positive credit of 2.5 kWh for that day. The vast majority of systems on commercial buildings are grid connected. Stand alone systems are designed to operate independently of the electric utility grid and will usually incorporate a battery bank.

This is a summary of coverages. For all coverages, terms, conditions and exclusions, refer to the actual insurance policy.

ES966 (New 8/19)

Hartford Steam Boiler

Munich RE

Risk Solutions

Underwriting & Loss Control Considerations for Solar Photovoltaic Systems

Hartford Steam Boiler
One State Street
P.O. Box 5024
Hartford, CT 06102-5024
Tel: (860) 722-5061
www.hsb.com

This guide includes underwriting considerations for equipment breakdown/business interruption and property risks from solar photovoltaic systems. This overview pertains primarily to commercial photovoltaic solar installations used to supplement an insured’s electrical loads.

Equipment Breakdown/Business Interruption Considerations and Risk Mitigation

1. Installation Quality — If an installation crew is unexperienced, rushed, and or sloppy, severe problems can arise with the system. For example, if cabling is stretched – worse, stretched over/around edges - this can wear out the cable’s protective layer and later cause electrical arcing.

It is beneficial if the local authority having jurisdiction reviews, inspects, and approves the solar system installation prior to start up. It is recommended that the owner also have a third-party inspect and test the system prior to take-over.

2. Equipment and Material Selection — Solar panels are often covered by 10 to 12 year product warranties and have a lifespan of 25 years.

Inverters are typically covered by 5 to 10 year product warranties and have lifespans of 15 to 20 years. Inverter equipment breakdown can be mitigated by having spares and key parts readily accessible.

The solar panels and inverters should have a basic safety certification from a nationally recognized testing laboratory (NRTL); namely, IEC 61215 and UL 1703 for panels and UL 1741 for inverters.

Electrical balance of plant (BOP) breakdowns can potentially lead to property damage. Specific equipment to pay attention to include module wiring, DC cabling, and combiner boxes. Electrical BOP breakdowns can be mitigated with proper equipment and material selection according to their location; for example, wire management solutions should be adequately rated for the outdoors, UV exposure, and system's lifetime.

3. Operations — There should be an operations and maintenance (O&M) provider who will regularly monitor the system's performance and visit the site at a regular interval (for walkthroughs and preventative maintenance). If no O&M provider with solar specialty knowledge is available, consider formally training in-house staff.

Property Considerations and Risk Mitigation

1. Fire — Fire is big property concern for roof mounted solar installations. The international building code requires a solar system's fire class to be equal to or higher than that of the roof. This is in order to prevent the solar system from diminishing the fire rating of the roof; in decreasing order, fire class ratings are: A, B, C, Nonclassified.

Rooftop fires with solar arrays also pose risks to firefighters. However, most, if not all, local jurisdictions have additional fire related building and electrical codes. The building codes include requirements for setbacks from roof edges, which allow fire fighters to access the roof and work around the solar system if need be. For example, a local authority may require a 6′ clear space around the perimeter of the roof, interior pathways of 8′, and setbacks of 4′ from rooftop equipment/openings in order to accommodate firefighters and their equipment. Attempt to determine if the insured's local fire department is aware of the solar system at their premises.

Furthermore, since 2014, the U.S. national electrical code has required the use of rapid shutdown devices. When activated, these devices de-energize the solar system (but never the modules, which are always energized in light) to within safe limits for firefighters to work around the solar array on the roof.

However, building and electrical codes only address the risks of working on the roof ***after a fire*** has started. A solar system's electrically charged parts pose inherent risks of arcing and ***starting a fire***. These risks stem mainly from improper material/equipment selection, poor/inadequate installation, and a lack of preventative maintenance. Therefore, these aspects are key to preventing fire incidents. It is suggested, the space/material/equipment located directly beneath the solar installation are also evaluated to be sure there is adequate protection (i.e. sprinkler systems) and insurance coverage.

2. Roof Loading — Individual solar panels weigh around 50 to 60 pounds and the racking may be further weighted with ballasts or penetrated into the roof's members. Therefore, adding a rooftop array affects the loading and the integrity of a buildings' structure. It is important that a structural engineer was involved in surveying the building and approving the loads and design.

It is also crucial that historical snowfall and local wind patterns are considered. When snow accumulates on the solar array, not only does it affect the performance of a solar system, it also adds to the overall roof load. Some solar panels are designed to carry snow loads up to 5400 Pa (Pascal) or about 5.5' of snow. Scuppers (roof drains) on buildings can offset drainage and ponding hazards from accumulated snow. Regarding wind, solar panels effectively increase a roof's surface area and create increased roof loading when exposed to heavy winds.

3. Hail and Severe Weather (Wind) — Although equipped with shatter proof glass, hail could crack the front of a solar panel and expose live electrical wiring. This damage can result in panel failure and introduce electrical hazards. The solar panels should be at least certified to the ASTM 1038 and or IEC 61215 standards, which test for impacts from hail up to 1" in diameter. If hail is expected to be above 1" in diameter, the solar panel manufacturer should confirm/certify the modules are appropriate for use at that location based on expected hail sizes.

In addition, strong winds can cause solar systems to move or detach completely, which can also lead to injuries or other property damage. The racking must be designed, installed, and monitored with consideration for local wind speeds and storm events.

4. Lightning — Solar systems are susceptible not only to direct lightning strikes, but also the surge events which accompany nearby lightning strikes. The system design should take the lightning occurrence into consideration; systems located in high risk areas for lightning, should have a lightning protection system (with air terminals, conductors, and grounding) on the roof. Furthermore, all systems should be equipped with surge protection devices.

5. Vegetation — Ground mounted systems are susceptible to issues from overgrown vegetation next to equipment, especially if it is blocking ventilation ducts.

6. Flooding — Ground mounted installations may be built in former agricultural fields and may flood frequently or have drainage problems. In such fields, equipment should be elevated off grade level and the flow of water away from one part of the field should not flow into equipment in another part.

7. Theft and Security — Proper fencing and monitoring is key for ground mounted systems. Electrical cabling at PV locations is extensive and can be attractive to thieves and vandals.

Underwriting Considerations

1. Liability — Some businesses lease their roof space to contractors that install PV systems for other customer's use. These arrangements create a few questions regarding liability in case of a loss. Who is responsible for the system's maintenance? Who insures the panels? If a fire breaks out in the array and causes damage to the roof/building, who is liable? If the system was installed under a power purchase agreement (PPA), the contract may also include a Hold Harmless provision in the lease or PPA that could defeat the ability to subrogate a claim.

2. Valuations — Underwriters need to be aware of the increased values and hazards at the time coverage is written or renewed, therefore allowing the opportunity to adjust values and/or rates. If covering a rooftop system, do the building values include the additional cost of the system installation? If the system is not attached (penetrated vs ballasted racking) is the solar system considered personal or private property? If the system is a ground-based system, does the Statement of Values show the exposure and values for the "property in the open"?

3. Extra Expense — In the event of equipment breakdown, there may also be extra expense for the insured to purchase power from the utility at increased cost and/or performance penalties incurred as part of the PPA.

4. Environmental — Solar panels contain toxic chemicals and materials such as arsenic, cadmium telluride, hexafluoroethane, lead, polyvinyl fluoride, gallium arsenide, and copper-indium-diselenide. These chemicals have the potential to be released when panels are damaged by fire, wind or hail and may require special disposal methods. In addition, runoff from panels during firefighting activity may pollute lakes, streams, and or ground water.

This is a summary of coverages. For all coverages, terms, conditions and exclusions, refer to the actual insurance policy.

ES968 (New 8/19)