Roof-Mounted Solar Panel Systems:
Reaping Rewards While Reducing Risk
Converting solar energy to electrical power is hotter than ever. Consider these statistics* regarding U.S. photovoltaic (PV) system installations:

The average price of a completed commercial PV project in Q2 2014 dropped by more than 45 percent from Q2 2012.

The top 25 U.S. corporate solar users have more than doubled their solar capacity since 2012.

The nation’s solar capacity is expected to double over the next two years.

*Source: Solar Energy Industries Association (SEIA®)
Solar power delivers great benefits, but it also carries some risk — the full extent of which has yet to be established in this new and growing industry. As you read this, fire prevention associations, testing labs, insurers, manufacturers, and others are working together to create the standards that will eventually guide the installation, operation, and maintenance of PV systems, also known as solar panel arrays.

Liberty Mutual Insurance is among the most active of these organizations. In the same way that businesses turning to alternative sources of power are leading the way toward their widespread acceptance, Liberty Mutual is leading the way toward identifying the risks associated with these emerging technologies and determining the most effective means of mitigating them. We’re combining our depth of experience in solar power with our own research to establish guidelines and best practices to help forward-thinking businesses protect their people, their property, and their reputations.

This report addresses the insurance risk of roof-mounted PV systems and suggests strategies for controlling that risk. Whether your organization is considering installing a solar panel array, is leasing space to a contractor installing an array for another customer, or already has an array, it’s important to understand the risk exposures these systems represent and learn what you can do, including working with your property insurance carrier, to mitigate that risk.
The Top Five Risk Exposures of Roof-Mounted PV Systems

Installing a PV system on the (mostly) empty roof of your commercial building seems logical. You’re turning wasted space into an electricity-generating asset, one that should pay off for years to come. However, there are also serious, though not insurmountable, risks that arise from the installation of a solar panel array:

**The “Blind Spot”**

One of the greatest concerns in solar panel installations is the “blind spot,” in which a ground fault to the grounded current-carrying conductor occurs undetected. This causes a second ground fault in the panel array, which the ground fault detector/interrupter (GFDI) cannot de-energize. These situations can cause serious electrical shock and fire.

**Roof Loading**

Every roof is designed and built to accommodate a pre-determined “dead load”, such as an air conditioning unit. Adding an array of solar panels to a roof that wasn’t built to accommodate it can cause serious damage to the roof and even lead to potential structural degradation or collapse over time.

**Severe Weather**

The weight of snow on a roof can add to the danger presented by the weight of the solar panel system. Additionally, hail and ice can cause significant damage to solar panels by cracking their protective coating, exposing live electrical components, and ultimately causing the panels to fail.

**Wind**

The addition of a solar panel array on a roof increases the roof’s surface area, which in turn increases the building’s exposure to wind damage. In windy conditions, the space below the panels can also cause pressurization that can damage the roof.

**Fire Hazards**

Solar panel systems cannot only cause fires, but also make them extremely difficult to extinguish. In a roof fire, heat can get trapped in the space between the panels and the roof and quickly spread, shielded by the panels. Not only will the roof suffer significant damage, but its fire classification rating may also be compromised.
Further Challenges

In addition to risk exposures, your business must consider a number of challenges associated with installing a solar panel system on your roof:

**Hindering Firefighting**

Regardless of where a fire breaks out in your building, a solar panel array can interfere with the efforts of firefighters who often need access to the roof. Walking across a roof with a PV array increases the risk of electrocution, slips and falls, and other serious incidents. If the fire is on the roof, the concealed space between the panels and the roof makes it especially difficult to extinguish.

Perhaps the most dangerous firefighting risk of all stems from the fact that, unlike a conventional electrical system, there is no way to turn off a single PV panel or array. Solar panels are always “live,” and contact with them can cause shock or electrocution. In some cases, the entire roof can become electrified, meaning that firefighters would not be able to access the roof at all.

**Question of Liability**

Some businesses lease their roof space to contractors that install PV systems for other customers’ use. These arrangements create a number of questions regarding liability in case of a loss: Who is responsible for the system’s maintenance? Who insures the panels — your carrier or another insurer? Moreover, if a fire breaks out in the array and the cause can’t be determined (which is often the case), who is liable?

**Installation**

In such a young industry, the crew that installs your PV system may not be as well trained and experienced as you would prefer. A faulty installation can cause problems with a system from the start, including arc and ground faults that can cause fires.

**Panel replacement**

It’s difficult to predict which solar power players — contractors, manufacturers, etc. — will still be around in a few years. If your system needs replacement panels unique to a vendor that’s no longer in business, you may need to replace the entire array.
Mitigate Your Risk

As is the case with almost any aspect of your operations, there are serious risk exposures and challenges associated with roof-mounted solar panel systems.

But you don’t have to let those discourage you from your plans for going green. You can take the following steps before, during, and after installation to reduce your risk and, in most cases, gain all the benefits while minimizing the drawbacks of a roof-mounted solar energy system.

Prior to Installation
- Work with your agent, broker, and insurer to learn about the potential risks of a photovoltaic system and how to minimize and/or prevent the potential for having loss.
- Consider installing a PV system in a location other than your roof, such as your parking lot or a nearby parcel of land.
- Work with your local fire department personnel to get their advice and to familiarize them with your operations and the solar panel system you eventually install.
- Create and maintain clear exits and pathways on the roof for maintenance and firefighting personnel. Make sure the panels will be installed in a way that allows access to the various sections of the roof.
- Have a professional engineer evaluate the structural integrity of your roof to ensure it can tolerate the additional weight of the panels and snow. Also, most commercial roofs have been designed to last 20 years. If, for example, your roof is 15 years old, don’t install a PV system you’re going to have to remove in five years — a very expensive operation — so you can replace the roof.
- Be sure to hire a fully qualified and widely experienced contractor to install your system.
- Don’t rely solely on a contractor’s or manufacturer’s assurances regarding the panels to be installed. Make sure they’ve been tested and approved by an independent certification laboratory, such as Underwriters Laboratories Inc. If your area is prone to hailstorms, see that the panels have also been tested and approved for hail impact.

During Installation
- Make sure your contractor takes the following steps:
  - Uses expansion joints on all long runs of conduit
  - Provides disconnects for both the DC and AC sides of the panel array. The disconnects should be clearly identified and readily accessible.
  - Uses correct installation techniques, paying close attention to wire management
  - Installs additional ground-fault and PV array isolation sensing device
  - Provides sufficient ventilation so air can circulate around the panels
  - Securely installs and attaches the panels to minimize wind uplift
  - Uses ground fault protection devices to de-energize the PV system when there’s a ground fault

Post-Installation
- Have qualified contractors conduct preventive maintenance on your system ideally twice a year, but at least once a year.

Leasing Your Rooftop
- If you’re leasing rooftop space to a contractor for the installation of a solar panel array to supply power to a third party, work with your legal counsel and insurer to identify clearly who owns and is responsible for the array.

Existing Systems
- Review the “Prior Installation” and “After Installation” recommendations to see which ones apply to your system, such as maintaining clear roof exits and pathways and having contractors perform preventive maintenance.
- Upgrade your system to ensure detection of ground faults.
If your organization is considering installing a roof-mounted PV system, or if you already have one, familiarize yourself with the risks and challenges associated with solar panel arrays and weigh the potential benefits and costs. And always involve your property insurer in your deliberations — it’ll help you make the brightest decision of all.

Getting the Most From Your Insurer

Whenever your organization plans to make changes to your structures or other property, whether replacing a sprinkler system or adding a new building, it’s a good idea to inform your property insurance carrier.

Your carrier has the experience that can help ensure the changes comply with the latest risk management standards and best practices. This is especially true for the installation of photovoltaic arrays.

If you plan to install a PV system, get together with your carrier early on. Your carrier’s specialists can help guide you through the project, examining the plans and specifications, and reviewing the completed installation. Your carrier can also help you use your contracts to transfer risk to the appropriate parties.

A Partner to Rely On

Liberty Mutual Insurance is at the forefront of PV system safety and risk management. We actively participate in many of the organizations currently writing risk management standards for PV system installation, operation, and maintenance and we’re helping our customers achieve a level of protection that’s more detailed and up-to-date than many local building codes. As municipalities revise those codes, we expect our customers’ systems to be fully compliant. We also distribute a 19-point checklist to assist customers installing solar panels at their facilities.
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