Rooftop photovoltaic systems

ISSUES UP ON THE ROOF
HELPING COMPANIES UNDERSTAND THE MULTI-FACETED RISKS BEHIND SOLAR ENERGY OPPORTUNITIES

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The benefits of rooftop photovoltaic systems come with risks.

Rising energy prices, climate change-related concerns and government incentives for renewable energy have created significant opportunities for companies in the solar energy industry. Compared to other sources of energy, heat and electricity generation, including fossil fuels, nuclear, wind and geothermal, solar is one of the fastest growing renewable energy sources in the world. This will likely be a multi-billion dollar global industry over the next several years, translating into significant capacity and generation growth. In 2013, the Solar Energy Industry Association characterized solar as "an economic engine," with 143,000 solar workers in the U.S., employed at 6,100 businesses in every state.

The growth in solar has resulted in a significant rise in commercial rooftop installations. While these installations can help building owners reduce electrical operating costs and develop a hedge against rising utility rates, a number of other issues should be considered before a PV system is installed. These issues include increased roof loads and potential structural issues, increased fire risk, such as the potential reduction in the fire safety classification of the roof, potential water leak issues, liability issues related to the solar panel installers and other contractors that need to service or install rooftop equipment, including existing or unrelated equipment, such as an HVAC unit, and the fall and electrical exposure to emergency responders.

While these risks can have a direct impact on the building hosting the PV system or people working on or around the system, they also can have an impact on those companies involved in the installation and maintenance of solar equipment.

The Database of State Incentives for Renewables and Efficiency, maintained by the North Carolina Clean Energy Technology Center, at N.C. State University, can provide information on both state and federal incentives and tax credits.

Planning the solar project

Building owners can help reduce the potential risks associated with roof-mounted PV systems by understanding the risks and exercising diligence in planning the work. Planning includes pre-design and pre-installation evaluations; proper selection of vendors (licensing, experience and safety); evaluating third-party contracts with those who perform the work; and understanding building codes and requirements for the design and installation phases of the PV system.

Structural assessment

Before the work starts, a licensed structural engineer should evaluate the building to determine if the structure can safely support the new load, whether it is a ballasted system, attached or hybrid system (combination attached and ballasted). This evaluation will require the engineer to interpret various building codes and standards as existing building codes may not provide adequate guidance for wind forces and structural capacity presented by these rooftop systems.

Roof covering life assessment

A roofing consultant/manufacturer should assist in determining the remaining service life of the existing roof. The solar energy system could be on the roof for 20 years, so the roof system needs to be able to maintain its integrity until then.

Roof warranty

It is important to verify that the roofing warranty/guarantee will not be voided/or impacted by the installation of the system, otherwise you may end up voiding the warranty inadvertently. Arrange to have the roofing consultant/manufacturer included in the design and planning phases to help avoid any problems. In addition, it is advisable to have the roofing consultant/manufacturer witness the installation to help ensure that potential damage is addressed immediately. Roof coverings may become damaged as a result of increased foot traffic and construction activities, so it is important to address these exposures during the planning, design, installation and maintenance phases.

Equipment access

Contact service contractors that maintain rooftop equipment, such as heating and air conditioning units, and ensure that safe, adequate access is contemplated and maintained in the design. Adequate working clearance must be made available around the units in order to perform routine maintenance, including access to roof drains.

Electrical compatibility

Work with an electrical contractor to help ensure that the existing electrical system will accommodate the PV installation. An electrical engineer should evaluate and confirm that the existing system can support the new electrical load, or confirm that there is space to accommodate new circuits, switches and breakers, if needed.

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Fire department considerations

The presence of the PV system represents a unique challenge to fire fighters due to the fact that the PV system remains energized as long as there is daylight. This can represent a shock or electrocution hazard to fire fighters. A second challenge for fire fighters relates to roof top access. The presence of the array may hamper or inhibit the fire department from fighting a fire in a building that has a PV system installed on its roof. It is important to let the local fire department know that the PV system is being installed and to seek input from local code officials or fire department representatives to assist in the pre-planning.

Weather-related risk assessment

A risk assessment should be undertaken to evaluate the historic and expected hail risk at the installation site, as hail could cause severe damage to the modules and other system components. In the event of lightning, the system should also be equipped with surge protection devices on combiner boxes, inverters and communication data lines.

If the system will be installed on a pitched roof that could become snow-covered, the design needs to contemplate snow sliding off the modules as it is warmed by the sun or the heat generated by the solar modules. If sidewalks or parking areas are located directly below the solar array, additional care should be taken to help prevent the snow from sliding off the modules. This can be done in a couple of different ways, including:

- Designing the array in smaller sections to provide breaks, thereby limiting the amount of snow that could slide off at one time; or
- Setting the array back from the roof so the snow slides onto the roof first and not directly to the ground below.
- Once the system is installed, the snow on the modules will need to be monitored. Where there is a risk of snow sliding off the roof, the walkways and parking areas below should be barricaded until the modules no longer are snow-covered.

National and local codes and industry standards

Contact the local building department and ask about any specific code and zoning requirements that need to be part of the design and installation. Design and installation of PV systems should be in accordance with current editions of all recognized building codes applicable to PV system installations and, at a minimum, meet local code requirements. Not every jurisdiction adopts current standards immediately following publication.

Find out which edition of the NFPA 70, National Electrical Code, has been adopted and enforced by your jurisdiction. The National Electrical Code is updated every three years to address new exposures, but code adoption can be a long process and your jurisdictions may employ an earlier version.

Local building codes may require roofing systems meet or exceed a specific fire rating. The installed solar array system, the module, the racking, mounting, and the array configuration on the roof, are all part of determining the fire classification for the array. This rating needs to meet or exceed the local building code requirements for fire safety of the roof.

Selecting and managing third parties

It is important to weigh all the risks of installing solar, whether it is from contractors who need roof access, potential water leaks or a potential electrical fire. You need to be assured that the construction and operation of this system will not negatively impact your business.

When selecting a solar provider or engineering and procurement contractor (EPC), a number of considerations should go into your selection process to help provide you with confidence in the qualifications and ability of the provider/contractor to deliver quality work with a commitment to safety.

Before any work begins:

- Get references and conduct a background check.
- Ensure that all necessary licenses and certifications are current.
- Get all terms in writing. Use contracts.

Considerations include, but are not limited to the following:

Licensing

Contact the local building department and inquire about the department's experience with solar installations and any licensing requirements. As a relatively new industry, only a few states have licensing requirements for trades, such as electricians or roofers, involved in photovoltaic installations. Consider selecting professional installers who are certified by the North American Board of Certified Energy Practitioners (NABCEP). The NABCEP is a trade organization that was established to develop and implement quality credentialing and certification programs for solar installation contractors. NABCEP certification can help you to identify contractors with the technical and safety knowledge and skills specific to solar installations.

Contracts and risk transfer

Your company could be held responsible and financially liable for mistakes made by solar installation contractors and their service providers/subcontractors. A written agreement that addresses the risks involved in the installation and maintenance of a solar array and confirms that the contractor and their subcontractors will take responsibility for claims and damages resulting from their work can be an effective way to minimize your exposure. This type of agreement, sometimes referred to as a "Contractual Risk Transfer" agreement, may have the following components:

Indemnification agreement – In general, it is an agreement that the contractor will take responsibility for damages resulting from their work, or the work of their subcontractors, even if a claim is made directly against the property owner. There are a variety of legal issues to consider in the context of indemnification agreements and it is best to discuss these types of agreements with your legal counsel.

The Power Purchase Agreement may contain a similar type of indemnification agreement, but one that protects the solar panel owner, and others, from risk. It is best to have legal counsel review all contracts involved in the solar installation and maintenance, to help you effectively managing your risk.

Insurance specifications – Insurance specifications may be listed within this written contract, providing details regarding types of coverage required and minimum insurance limits. This can give you more confidence that that the contractor will have the financial ability to pay for damages. It is best to discuss insurance specifications with legal counsel, or someone that can advise you about what may be appropriate to protect you and your business.

Certificate of Insurance – Obtaining a Certificate of Insurance from the contractors involved in the solar installation before work begins can also help you manage contractor's insurance requirements.

Fall protection and safe roof access

Roof work presents a significant fall hazard. Contractors and maintenance staff should have effective fall protection programs, policies and procedures in place. This might include the use of temporary guardrails along the roof perimeter. A straight ladder through a rooftop hatchway may not be an ideal access point to the roof. If this is the case, consider installing an exterior stair tower. The exterior stair tower can help provide better and safer access for both installation contractors and the maintenance contractor (and in addition, it can help keep installation contractors or other non-employees from accessing areas of your business restricted to the public, such as production areas, stock rooms, and offices). An exterior stair tower can be secured with a fence and access gate, limiting access to contractors.

Attending to property considerations

Fire risks and controls

Typically, a building's fire detection and suppression system does not extend to the rooftop. As a result, a fire on the roof could go undetected. Components and detectors can be installed and monitored that can signal an event, such as an electric arc. In turn, the event can be investigated to determine if a fire is imminent or has started. Some of these components can shut down the electrical output which may prevent further damage to the roof and solar array.

Electrical risks and controls

As long as the solar modules are exposed to light, electricity is being produced. This electricity is enough to present an electrical hazard to unqualified and untrained workers who might be on the roof performing routine building maintenance or to firefighters who are responding to a fire. As a result, it is important to consider installing a mechanism for the rapid shut down of the system in order to create a safe zone at the module level.

Roof protection during installation

The EPC or solar provider should also be able to demonstrate to you how the roof will be protected from damage during the installation process, including damage from the additional foot traffic or from sharp tools/objects.

Inspecting and ongoing maintenance

Initial inspection

A poorly installed system could present additional hazards to your building, employees and customers. As a result, you should consider hiring a third-party engineer to witness the commissioning or to inspect and test the system to help ensure that the system is installed as designed and that any changes are properly documented and reviewed by the engineer of record.

Ongoing inspections and maintenance

Once the system is installed, inspection and the ongoing operation and maintenance of your PV system requires more than washing dirt off the solar modules. These systems may be exposed to constantly changing environmental conditions, such as ultraviolet light from the sun, extreme temperatures, high winds, heavy rain, blowing snow and hail. As such, PV systems require a detailed maintenance program to help ensure system longevity and safe operation.

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Ongoing inspection and maintenance considerations include, but are not limited to:

A visual inspection such as:

- Ensuring that there aren't any loose hanging wires in the array or wires that may be stretched across a sharp or abrasive edge. The wires can become damaged if not secured in place.
- Ensuring that wire terminations inside the combiner boxes and inverters are still tight by inspecting the torque marks. A loose wire termination could create enough heat to become a potential source of ignition.

Testing such as:

- Performing continuity testing and insulation resistance testing to ensure that the wiring conductors are still intact and are maintaining their insulation properties. The continuity testing can help locate broken ground wires, which are essential for both the safety of the system and people that may come in contact with the array.
- Performing thermographic scans of inverters, combiner boxes and disconnects to help ensure that no abnormal heat is being created in these devices. The buildup of heat in these devices could cause premature failure of that component, as well as potentially create enough heat to become a source of ignition.
- Whether ongoing PV system operations and maintenance are performed by in-house staff or a third party, operations and maintenance reports should be reviewed for any deficiencies. A third-party consultant could be hired to review these reports if you don't have the expertise in house. This can help ensure that the system is being maintained properly.

Additional information on the fundamentals of PV System Maintenance can be obtained from the Solar America Board of Codes and Standards (SolarABCs), solarabcs.org. SolarABCs is funded by the U.S. Department of Energy to improve building codes product standards, reliability and safety.

The promise of a bright future

Forecasts indicate that the solar energy industry will see significant growth as user demand for renewable energy and the "greening" of the environment increases. However, this growth is not without some risk. An understanding of those risks and diligence to address them at each phase of a PV installation can go a long way to help ensure that the system provides safe and efficient power for a long time.

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Before you begin your solar installation project, evaluate factors that could potentially impact the outcome of your installation, from pre-planning through to ongoing maintenance, including, but not limited to:

Roof

- Remaining life of roof in years
- Warranty/guarantee
- Roof access and safety condition (ladder, stairs)
- Structural integrity – can it support the system?
- Is the system ballasted or attached?

Electrical

- Updates needed to the electrical system?

Presence of rooftop mechanicals

- HVAC
- Elevator
- Refrigeration

Building department

- Licensing requirements

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For more information, log in to the Risk Control Customer Portal at travelers.com/riskcontrol. (Need help? Read our Registration Quick Guide.) You also can contact your Risk Control consultant or email Ask-Risk-Control@travelers.com.