



# Photovoltaic Systems on roofs

## What is the hazard?

Solar power is becoming a popular alternative source of electricity. However, installing solar panels on combustible roofs not only increases the fire hazard, but it could also increase other hazards that the user/owner needs to consider.

Photovoltaic (PV) systems contain multiple components, including the module circuitry, cables, inverters and combinerboxes etc., which introduce several different risks for a fire to start.

In addition, fire fighters may have to fight a fire in the presence of significant voltage, which also poses a threat to their personal safety and can delay effective fire intervention.

## How to reduce the risk

Before installation is considered, a thorough risk assessment should be carried out. In general, solar panels and inverters must comply with the relevant National and International Standards. Solar panels containing expanded plastics should also be avoided and the cables should be of the low combustibility type.



Risk Assessment should include reviewing the structural integrity of the building is not affected by the additional weight of the PV systems and related components as well as due to additional wind loads. The roof condition should also be checked by an expert prior to the installation due to a lifetime of the PV system of at least 25 years.

Solar panels should not be installed on combustible building roofs or on roofs which have combustible insulation.

If P&C Insurance should be informed about the planned PV system in the starting phase of the project.

## Installation

- A 4-eye review of the electrical design of the PV system should be done by an external expert prior to the installation. The electrical design should be checked at least against legal codes. An acceptance test should be done by same expert when the installation of the PV system is completed.
- Ensure that there is adequate roof drainage and check how the installation of the solar panels will affect the drainage system for the roof. Prepare a plan for the safe removal of snow.
- Module mounting systems should be firmly secured to the roof to prevent storm damage. The frames must be designed in such a way that they prevent dirt and water deposits.
- Ensure that the correct cabling is used. Low voltage cabling for low voltage applications. High voltage cabling for high voltage applications. All of the cables and connectors must be designed for outdoor usage.
- The panels and/or panel arrays and cables should be properly identified making it possible to switch-off panels for maintenance and/or in the event of an emergency.
- Lightning protection system should be provided and adapted being in line with legal codes afterward the new installation of a PV system.
- A sufficient distance should be maintained between solar panels, cable racks and roof surfaces for adequate ventilation.
- Positive and negative cables should be routed in the same trays to reduce the effect of induction from atmospheric electric activity leading to possible surges.
- All cables associated with the PV systems entering building structures should have surge protection.



Cables from the solar panels should not be routed through high hazard rooms such as a boiler room, a transformer room, switching rooms, flammable liquid storage rooms, etc.

- Solar panel arrays should be kept at a minimum distance of 1 metre from roof edges and roof vents, to reduce the risk of a fire spreading.
- Solar panel arrays should be kept at a minimum distance of 5 metres from a fire wall, to reduce the risk of a fire spreading.
- Cable trays should not be installed over a fire wall if fire proofing to the cable tray at the fire separation has not been provided.
- The inverter and associated equipment should preferably be installed outside on the rooftop. If this is not possible the inverter should be located in a separated, well-ventilated, dry, non-combustible enclosure equipped with automatic fire detection and, if feasible, equipped with an automatic fire suppression system.

Cables should not lay directly on the roof and should be installed on non-combustible cable trays.

Inverters on the DC and AC sides should be equipped with surge protection.

- The remote control panel with circuit breakers for the panel arrays should be installed at a safe distance from the panels to allow safe access.
- In addition to the remote control panel having an emergency shut-off button, one should also be installed next to the access to the roof
- All alarms, including technical fault, should be centralized in a permanently manned location (or connected to an off-site central station to cover unoccupied periods). A response plan in respect of the alarm and technical fault should be developed.
- A thermographic inspection should be carried out on all of the electrical components, including cable connections, immediately after the solar array is ready to be used. Any identified faults should be repaired immediately.

## Maintenance

Annual maintenance should be performed in accordance with the manufacturer's specifications, and should include the testing of circuit breakers, inverters, fault to ground detectors and the overall electrical balance of the installation.

- Mechanical connections to solar panel supports should also be inspected annually.
- The solar panel array insulation resistance should be tested every three years.
- Thermographic surveys should be conducted every two years, as a minimum, for detecting possible hot spots.



- Visual inspections are needed after every severe weather incident, e.g. storm, hail, snowfall, etc. It is particularly important to give high priority to the removal of snow. Visual inspections should also be done after roof work or any work related to the PV system has been carried out.
- Surge arrestors should be visually checked on a regular basis and typically after incidents of lightning strikes.

## Fire-fighting

Discuss all details with your local fire brigade and make sure they have a thorough understanding of how to fight a fire in this type of equipment.

- As a general rule, to help fire-fighting, the size of a solar panel array should not be more than 30 x 30 m. When more solar panels are required the distance between arrays should be at least 5 metres. A emergency response plan should be developed in dialogue the local fire brigade.
- If there is water for fire-fighting available on the roof, employees must be made aware of the dangers of trying to fight a fire in the arrays due to the electrical equipment being energised.
- An adequate number of extinguishers should be located at the roof level. The fire extinguishers should have sufficient capacity and be classified for fighting electrical fires (EN 1866 or NFPA 10)
- It should be possible to gain access to the roof from at least two different directions.

*This Hazard Info Sheet is and is intended to be a presentation of the subject matter addressed. Although the authors have undertaken all measures to ensure the correctness of the material, it does not purport to list all risks or to indicate that other risks do not exist. If P&C Insurance does not give any guarantee thereof and no liability is assumed by reason of this Hazard Info Sheet as it is only advisory in nature and the final decisions must be made by the stakeholder. It shall not be applied to any specific circumstance, nor is it intended to be relied on as providing professional advice to any specific issue or situation.*

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