eBook

The Sun Rises on a New Opportunity

KEVIN P. SMITH & BRIAN WONG, STUTMAN LAW

STUTMAN

The use of solar energy as a clean and green alternative to fossil fuels has increased dramatically in the last 10 to 15 years. Solar energy is here to stay and its role as an alternative energy source will continue to grow for the foreseeable future.

The bad news is that solar energy technology was developed and brought to market quickly because of the demand for clean and green energy, and because of significant tax credits offered by the federal and state governments. Some industry players have even referred to the early "boom" years in solar energy as being like the "Wild West." Things were happening quickly and not everything was well thought out. Many solar energy systems only 7 to 10 years old pose unique fire risks. While solar electric systems being installed today are safer, even the newest systems still present risks and cause fire losses.

Fortunately, there is good news. A significant percentage of solar electric fire losses provide good subrogation potential, if you know a bit about rooftop solar electric systems, how the systems cause fires and what to look for when it happens.

SOLAR ELECTRIC BASICS

Here is what you need to know about rooftop solar electric systems in a nutshell. Rooftop solar electric systems are generally composed of 6 major components:

1. Photovoltaic panels which produce electricity
2. Racks that hold the panels
3. Connectors
4. Combiner boxes
5. Wiring
6. Inverters

Photovoltaic panels, often referred to simply as solar panels, are the rectangular flat panels that produce electricity when exposed to light. A small, residential system might be made up of 30 solar panels, and a large commercial system could include up to 7,000 solar panels.

Solar panels

Solar panels are usually mounted in racks when installed on a roof, and they are connected to each other in a series. Each solar panel has two wires and each wire has a connector at the end of the wire. One wire and connector connects to the next solar panel in line immediately to the left, and the other wire and connector connects to the next panel installed immediately to the right. This forms a string of panels. Although a particular rooftop system may include many panels, the strings of solar panels connected together usually consist of no more than 12 to 15 panels.

Solar panels mounted in racks

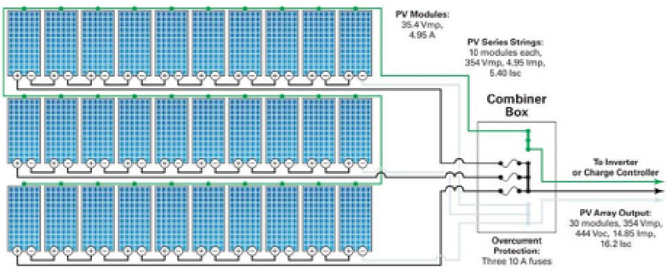
Multiple strings of panels are wired to another component known as a combiner box. Smaller wires leading from 7 to 10 separate strings of panels will enter the combiner box and be connected to components inside. Two larger wires are led from the combiner box, carrying the power of the 7 to 10 strings of panels on to the inverter. (More about the inverter later). The combiner box usually contains some circuit protection.

Panel wires and connectors

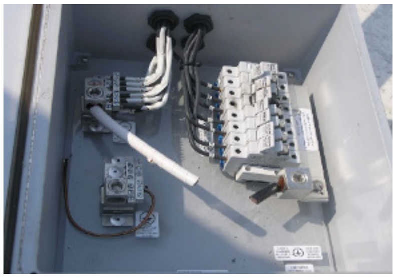
Connected

Imagine a large commercial system having 7,000 panels. With 13 panels per string, there are a total of 539 strings. With no more than 10 strings per combiner box, there are at least 54 combiner boxes.

The numbers get bigger. A commercial system having 7,000 panels has a total of 14,000 factory-installed connectors used to make 7,000 connections during installation in the field. Each string has two field-installed connectors for a total of 1,078. Each combiner box contains 16 to 22 field-made connections, for a total of 960 to 1320 field connections at combiner boxes. Naturally, wiring all these panels to each other, to combiner boxes and to inverters requires a lot of wire.



Strings of panels wired to a combiner box



Inside a combiner box

The point to be taken is that there are a lot of connectors, connections and wire associated with rooftop solar systems. All of these connections and wire are located outdoors, exposed to the sun, wind and rain. What could possibly go wrong?

The electricity produced by solar panels is usually direct current, or DC current, like the electrical current that comes from a car battery. By contrast, most buildings use alternating current, or AC current. Consequently, to make the electrical current generated by solar panels useful, the DC current must be converted to AC current. This job is performed by a component known as the inverter. On large, commercial solar electric systems, the inverter is mounted on the ground and looks like a large electrical cabinet. Residential inverters are much smaller and are sometimes not mounted on the ground.

Ground-mounted inverters

Much of the circuit protection for a solar electric system is contained in the inverter. The inverter also monitors the output and performance of the solar electric system and can usually report output and performance data to the user and the utility purchasing electricity produced by the system.

SOLAR ELECTRIC FIRES

Fires caused by solar electric systems generally fall into one of three categories:

1 Improper installation

2 Product defect (including failure to warn)

3 Lack of maintenance

The number one cause of solar fires is **improper installation**. There are a very large number of connections and a lot of wire involved in each system. Electrical connections are potential trouble spots and a significant percentage of electrical fires originate at connections.

The electrical connectors used in the systems are designed for outdoor use. However, the most typical failure involves water getting into a connection, causing corrosion, resistance heating, further deterioration of the connection and eventually a fire. Water can get into a connection in a number of ways. The connectors used are designed to snap together and mate firmly, preventing water intrusion. A simple error by an installer can result in two connectors not being firmly mated together. Connecting strings to combiner boxes involves field installation of connectors, which can also be done poorly.

Once all the connectors are connected and all the wire has been run, the wire and the connectors should not simply be left lying on the roof, where they could be stepped on during maintenance, or immersed in a puddle when it rains. Instead, the excess wires should be coiled and secured under the panels, off of the roof surface, to minimize the possibility of water getting into a connector. This is good wire management, and it does not always happen.

In the case of bad wire management, expansion and contraction associated with temperature change, and movement caused by wind, can result in wire chafing against the frames of the racks or the edges of the panels. This can cause damage to the insulation and a ground fault if an exposed conductor touches a metal surface.

Product defects can also be a problem because there are some bad connectors out there. The connectors generally have plastic housing with metal internal components. Due to poor design and material choice, the plastic housing of certain connectors can deteriorate over time as the result of exposure to sun and water. Cracks develop, water gets in and trouble starts.

Particularly with regard to the slightly older systems, there are also failure to warn issues. The most commonly used building code in the country, the International Building Code ("IBC"), classifies roofing systems for fire performance, with Class A roofs having the greatest fire resistance, and Class C roofs having the minimal degree of fire resistance acceptable under the Code. Solar panels are assigned similar fire performance classifications. However, until recently, the industry only sold solar panels having the minimum Class C fire performance rating.

The question arose, if solar panels having a Class C fire performance rating are mounted on a roofing system that has a Class A fire performance rating, will the roof still perform like a Class A roof in the event of a fire? This became a concern in California because in certain parts of the state, Class A roofing systems are required to minimize the spread of wildfires caused by burning embers floating on the wind and landing on roofs. Testing was performed and the solar industry got some bad news. If a Class C solar panel is installed on a Class A roof, that roof will no longer have the fire resistance characteristics of a Class A roof. Still worse, if one places a Class C panel on a Class C roof, that roof will no longer have the fire resistance characteristics of a Class C roof, which is the absolute IBC minimum. In other words, there are a lot of solar electric systems on a lot of roofs that have reduced the fire resistance of those roofs to a performance level below the Code minimum. This means that if a fire happens, it is likely to spread faster and do more damage than otherwise would have been the case. The industry has addressed this and achieved significant progress. However, consumers who suffer a rooftop solar electric fire and then find out about this issue might conclude that they never would have bought system had they known of the risk before purchase.

Consumers who suffer a rooftop solar electric fire and then find out about this issue might conclude that they never would have bought system had they known of the risk before purchase.

The other problem with slightly older systems is poor circuit protection. With the exception of the fuses in the combiner boxes, all the circuit protection is electrically downstream from the solar panels, wiring and most of the connectors. Further, the fuses in the combiner boxes tend to function poorly. Therefore, if an electrical fault in the system does develop, there is a good chance that the circuit protection on an older system will not operate to open the circuit and prevent a fire. Again, a building owner who suffers a solar electric fire and then finds out that the circuit protection does not work very well might conclude that he or she never would have bought the system in the first place had the risks been communicated. This can form the basis of a failure to warn claim.

Next, there are certain roofing systems that are just too combustible for use with rooftop solar electric systems. Most fires involving rooftop solar electric systems cause damage to the system itself, as well as damage to the roof of the building. However, in most instances, the damage does not go beyond that. That changes if the roof is too combustible.

In commercial roofing, flat roofs are frequently insulated with plastic foam insulation. The most commonly used plastic foam insulation is polyisocyanurate, known as ISO. ISO will burn, but not particularly well. However, there is another type of plastic foam insulation favored by the cold storage industry know as polystyrene. Cold storage frequently produces condensation at the roof level, which can be absorbed by other types of insulation, causing the roof to gain weight. Polystyrene does not easily soak up moisture, making it attractive for cold storage purposes. The problem is that if polystyrene does ignite, it burns significantly better than ISO. It also melts, liquifies, and results in burning liquid plastic dripping through the ceiling into the building, rapidly spreading the fire. Again, the owner of a building with polystyrene insulation may feel that had the fire risks associated with a solar system been communicated, he or she would never have installed a rooftop solar electric system.

Polystyrene does not easily soak up moisture, making it attractive for cold storage purposes.

Finally, solar electric system **maintenance** is necessary over time. Some sellers of these systems hate to point this out because maintenance increases the cost of owning and operating the system. Performing periodic inspections can mean finding deteriorating connections and chafing wire before a fire happens. Failing to perform this maintenance can lead to fires. Moreover, failure to inform the purchaser that maintenance is necessary may support a negligence or failure to warn claim against the seller.

INCREASING SUBROGATION POTENTIAL

Armed with this knowledge and the right expert, the chances of making a subrogation recovery increase. Particular attention must be paid to that part of the rooftop solar electric system that was not destroyed by the fire. That is where you are going to find evidence of poorly made connections, bad wire management and/or defective connectors.

Usually, if poor installation caused the fire, the installer will have enough coverage to answer for the loss because these fires are typically limited to the roof. In the case of a large loss that is likely to exceed the installer's coverage, subrogation professionals need to start thinking about failure to warn theories against the manufacturers of the panels, combiner boxes and inverters. It is likely that no one ever told a potential rooftop solar electric purchaser that the presence of the system's panels would reduce the fire performance of the roof below IBC minimums, or that the system's circuit protection did not function well. An insured who just suffered a major loss is likely to testify that he or she never would have installed the system had these hazards been disclosed in a straightforward manner.

It is likely that no one ever told a potential rooftop solar electric purchaser that the presence of the system's panels would reduce the fire performance of the roof.

In addition, there are ways to greatly reduce the possibility that a rooftop solar electric fire will spread to the roof structure of the building. Noncombustible cover boards, similar to drywall, can be placed underneath the solar electric system, separating a system failure from the combustible roof. A prospective purchaser who understands the actual hazards is likely to conclude that a cover board is necessary. Rarely do sellers of these systems disclose those hazards, which may also come into play with respect to a failure to warn claim.

RESIDENTIAL SOLAR FIRES

Although the systems are smaller, residential solar power systems still face many of the same problems as the large commercial systems, with a few variations on the theme including different options for recovery in the event of a fire. There are often multiple entities involved in the system for a single property, which can present an opportunity for recovery or a morass of defendants pointing fingers on liability.

We have recently seen a rise in fires related to defective connectors. In particular, one brand of connecter has been the root cause of enough fires that the CPSC is currently investigating for a potential recall. These particular connectors are often included as part of the individual panel inverters or connected in the course of field repairs. In either event, evidence from failed and pre-failure connectors demonstrates the same basic issue of material degradation leading to resistance heating and eventually fire.

In the early stages of a fire investigation where a failure in a residential solar system is suspected, it is important to examine and retain as much of the system as possible. Even where the connection which caused the fire has been wholly consumed, identifying the manufacturer of the component may become highly relevant pending CPSC action, and because identification of proto-failures can assist in building a case against the product manufacturer(s). Additionally, the failure mode of these connectors will often give rise to alerts in the monitoring software triggering pre-fire service calls to replace connectors. For example, in one instance, two pre-fire service alerts resulted in a technician working on the system to replace failed connections that had not, in the first two incidents, caused a fire. The third failure, however, resulted in a catastrophic event and severe damage to the residential property.

Identifying the manufacturer of the component may become highly relevant.

In conclusion, solar electric systems are intricate and pose unique fire hazards. These losses may lend themselves to pursuit of multiple subrogation targets and liability theories. Beginning an aggressive investigation, with a qualified expert, as soon as possible after a loss occurs is critical to maximizing recovery potential.

Contact Us

KEVIN P. SMITH & BRIAN WONG,
STUTMAN LAW

(888) 579-1144

INFO@STUTMANLAW.COM