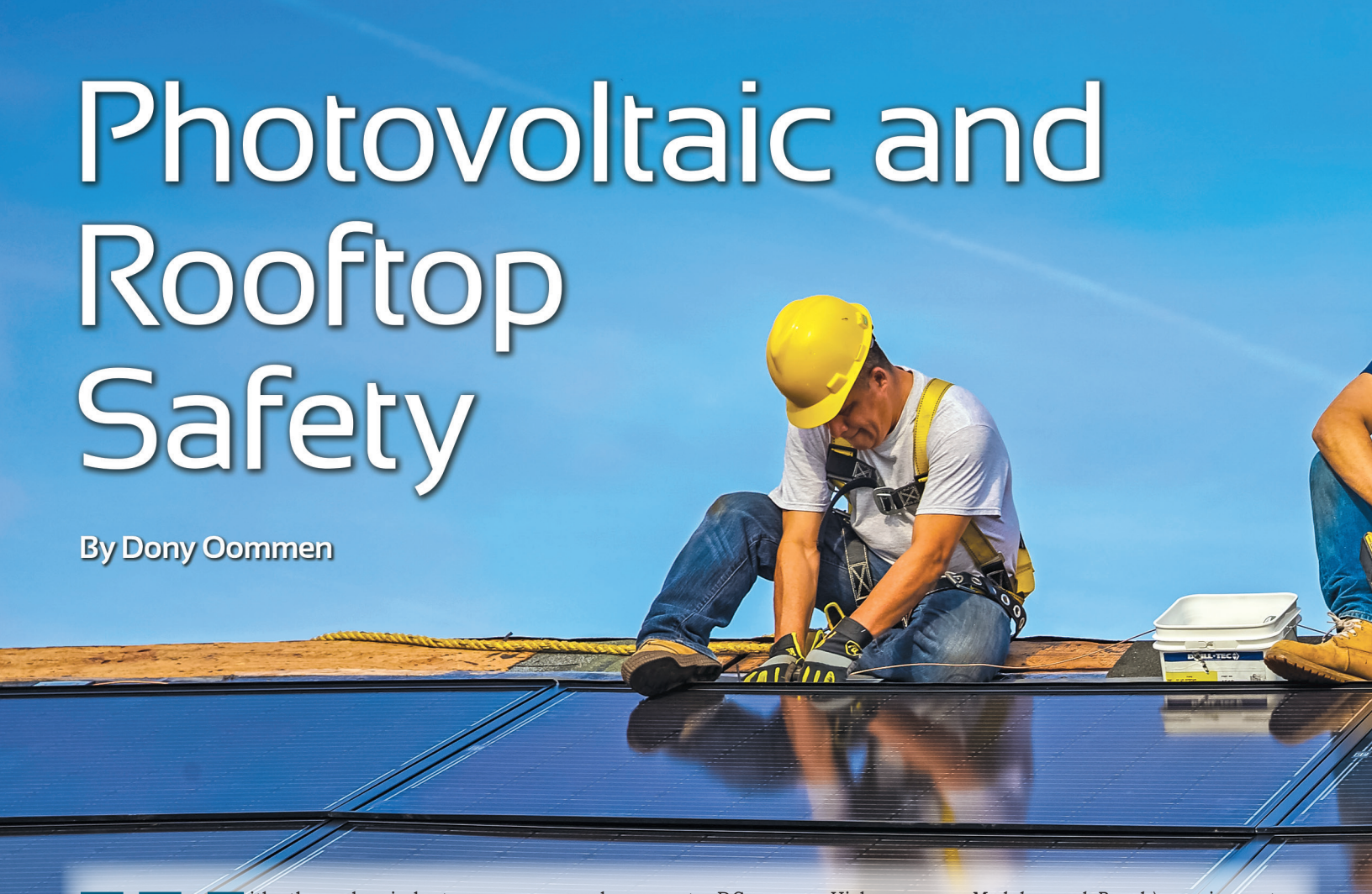
Photovoltaic and Rooftop Safety

By Dony Oommen



With the solar industry rapidly expanding, novices are entering the industry, solar projects are becoming cost-competitive, and installation schedules are hurried. The concept of safety is sometimes overlooked. Health and safety hazards do exist—especially during installation. Safety is never optional, and it is the law. When safety standards are enforced, it benefits the workers, the organization, and the solar/roofing industry as a whole. Let us look at some of the ways to implement safety in a solar environment.

SAFETY AT THE DESIGN STAGE

A safe design starts at the drawing board. A good solar design is always supported by a detailed onsite audit, reviewing existing construction/electrical documents, and electrical equipment specifications. A solar designer should be knowledgeable concerning the latest electrical, building, and local codes. The codes address a wide range of safety topics. A few main safety topics from the codes are mentioned below:

- **Safeguarding from the hazards of working with electricity –** Solar panels generate DC power. High-voltage DC is considerably more dangerous than AC. Solar panels do not have an on/off switch. They are considered electrically hot when light falls on them. Besides the solar panels themselves, there are multiple conduit runs, grounding and bonding systems, junction boxes, disconnects, DC/AC inverters, breakers, and meters that form part of the entire photovoltaic (PV) system. The National Electrical Code (NEC) briefly addresses the safety requirements for every part of the PV system.
- **Designing with code-compliant equipment –** Solar panels and related electrical equipment chosen for the project should be code-compliant. Solar panels must meet UL 1703 (*Standard for Flat-Plate Photovoltaic Modules and Panels*) requirements. Solar mounting systems must meet UL 2703 (*Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use With Flat-Plate Photovoltaic Modules and Panels*) requirements. Solar inverters must meet UL 1741 (*Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources*) requirements. These codes dictate the minimum safety requirements for the equipment.
- **Designing for firefighter safety –** The International Fire Code (IFC) and the International Residential Code (IRC) have photovoltaic (PV) array design requirements that address access pathways and allow firefighters to ventilate the roof during a thermal event. The solar designer should consider solar array setbacks from the roof edges, as well as maximum array sizes when designing PV systems.
- **Signs, labels, and marking on solar equipment –** The NEC has several requirements for solar labeling, warning signs, and marking on different solar equipment. This information is relevant to electricians and firefighters.

Figure 1 – Installers using personal protective equipment while installing GAF's DecoTech™ Solar System on a home in New Jersey.

Based on the complexity of the project, the permit drawings should be stamped by a structural and/or electrical engineer after review. The permit design should comply with all applicable codes and also get approval from the local authority having jurisdiction (and may require the local fire marshal's approval) before construction begins.

SAFETY AT THE INSTALLER LEVEL

A trained crew is a safer crew. Safety training and certifications are provided by a number of groups, such as the Occupational Safety and Health Administration (OSHA), National Roofing Contractors Association (NRCA), and the North American Board of Certified Energy Practitioners (NABCEP). Company safety policies and processes must be documented and updated regularly. Follow these steps to be a safe installer:

- **Use of personal protective equipment (PPE) –** Falls are one of the leading causes of fatalities in the construction industry. Installers must use personal fall arrest systems while working on roofs. Hard hats are required when there is a possibility that a person may be struck on the head by a falling object or if there is a possibility of them hitting their head against a protruding object. Wear gloves to handle hot or sharp objects. Wear goggles when cutting metal. *Figure 1* shows installers using PPE while installing a solar system.
- **Handling mechanical/pneumatic/electric tools –** In the solar and roofing trade, the installer must be trained in the use of a variety of tools and safety meters. Examples are drills, hacksaw, pliers, crimpers, torque wrenches, and AC/DC multimeters. Make sure that all the equipment is in proper working condition.
- **Understanding solar product assembly and installation –** Generally, assembly of the solar product is required on the ground or on the roof. The assembly could involve multiple parts put together by hand or with tools. Study and understand the system before starting work. The installer must be familiar with the installation instructions of the solar panels, mounting systems, and electrical equipment. The installation instructions also contain information on grounding methods, wiring, troubleshooting, maintenance, and other safety precautions.
- **Be alert –** Always be alert and know your surroundings. Never work alone when installing solar systems. Review safety procedures before starting work. Be in good health to meet the physical demands of the work. Remember the most important thing is to get back home safely at the end of the workday.

SAFETY AT THE JOB SITE

The job site may present multiple hazards. These hazards may be harsh environments (high heat, strong winds, snow, rain, or noise), unprotected skylights or roof edges, overhead power lines, trip hazards, energized circuits, working on ladders and scaffolds, operating heavy machinery, etc. It is important to identify, eliminate, or mitigate the hazards before beginning work. Address these hazards by following clearly defined and detailed safety procedures. A few steps to follow are described below:

- **Job briefings –** Start the day with a job briefing that addresses the hazards onsite, safety and emergency

procedures, PPE requirements, and location of the first aid kit and safety equipment.

- **Working on ladders and scaffolds –** Follow OSHA regulation for using ladders and scaffolds.
- **Working on elevated surfaces –** Follow OSHA regulations for work on roofs.
- **Barriers –** Install guardrails next to skylights. Install warning line systems along the roof edge if there are no parapets. Cordon off areas where materials are staged or where heavy machinery, such as lifts and cranes, are used.
- **Safe circuits –** Always work on de-energized circuits. Use electrical insulating gloves.
- **Environmental exposure –** Wear long-sleeved shirts and hats during prolonged sun exposure. Wear appropriate boots on slippery surfaces. Wear ear protection when exposed to elevated sound levels.

PV systems and safety should go hand in hand. Developing a culture of safety at all levels, from design concept through installation, will ensure not only the safety of the installers but a solar system that should perform for its intended purpose.

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Polyethylene-Core Panels Accused in Fatal London Fire

Photo by Natalie Oxford

Officials continue to point fingers in the June 14 fire in Grenfell Tower apartments in London, England, which killed approximately 80 people. But the loudest voices are blaming the use of polyethylene exterior cladding for allowing the rapid spread of the blaze. Such cladding is banned in the U.S. on buildings higher than 40 feet.

Polyethylene panels, made of aluminum sheets surrounding a plastic core, were installed in the 2016 cladding refurbishment of the building housing low-income residents. Thousands of buildings across the United Kingdom may have been fitted with similar materials. High-rise buildings in France, the UAE, and Australia with such cladding have reportedly been hit by fires that spread rapidly.

Watch *RCI Interface* for an upcoming article on fire resistance of exterior cladding.

VEGETATIVE STANDARDS APPROVED AND SEEKING REAPPROVAL

The association representing sheet membrane and component suppliers to the commercial roofing industry (SPRI) is revising ANSI/SPRI VR-1, *Procedure for Investigating Resistance to Root Penetration on Vegetative Roofs.* The standard, first published in 2010, is being canvassed for reapproval. The test standard examines the ability of a root protection barrier to prevent root penetration through the waterproofing layer on low-slope, single-ply membrane and coated roofs.

On another note, ANSI/SPRI VF-1, *External Fire Design Standard for Vegetative Roofs,* has been approved and is available at https://www.spri.org/pdf/ANSI_SPRI-VF-1_External-Fire-Design-Standard-for-Vegetative-Roofs_2017.pdf.