
Crystalline modules on steel

# Our Photovoltaic Destiny

By Dan Perkins

## More Energy Will Be Generated on Rooftops

**Investment in solar electric power continues to accelerate the development of photovoltaic technologies, and the roofing industry has a primary role to play in integrating these products into roof systems.** Logic suggests and recent trends confirm that solar electric systems will be installed on the roofs of the buildings they power. This trend will become more evident as the next generation of PV products becomes available to consumers and installers. One of the immediate obstacles to this technological thrust is the failure of the roofing industry to take a leading role in the integration of PV products into roof systems designed specifically for accommodating this technology.

### Why Rooftop Energy Will Flourish

Contemplation of basic facts continually lead to the same conclusion: Energy will be generated on rooftops.

Solar energy is everywhere in fairly even distribution. Each and every hour a square meter of sunlit area offers 1 kilowatt of electric power, roughly 10 percent of this is harvestable given current technology. Over one year, the same PV array placed in the overcast northern reaches of Houghton, Mich., will produce two-thirds of the power of a similarly rated array placed in the heart of the Nevada desert. This ultimately means a viable PV system is viable anywhere.

Rooftops have become preferred territory for PV generation for simple reasons. Rooftops are "free real estate," providing an area to install a PV array that has already been consumed by a structure. Rooftops also represent "point-of-use" locations with the buildings beneath them consuming the power generated on them. Point-of-use electricity is roughly three times more valuable at the meter than utilities pay at the point of generation. Roughly two-thirds of the cost of electricity is in distribution and administration. This reality drives PVs away from centralized large-scale generation models toward distributed generation on rooftops.

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The best way for the roofing industry to get involved with development is to get involved with installations. It doesn't take long to identify the difficulties with applications and shortcomings with product offerings when you work with them. Solutions come to mind, and product development starts.

It is important to remember the people on the PV side of product development have little to contribute to those of us trying to apply these technologies to our roofs. Attaching, flashing, wiring and integrating PV products into our roofing products is our work and our destiny.

### Absorbing the Rooftop Energy Business

In workmanship and warranty, roofers are fully responsible for the roofs they install. Weathertightness, performance to ASTM and UL standards, materials and application standards, etc., all fall on the roofing contractor. Because of this, there is nothing that can be installed on a roof in a warrantable manner that is not acceptable to and authorized by the roofing contractor, his distributor and his product manufacturer. This puts the entire PV roofing industry firmly in the hands of the current roofing industry if it is willing to take up the challenge.

PV cells are components just as steel and paint are components of metal roofing products. This simple fact means PV manufacturers will provide components to the roofing industry and not visa-versa. Ultimately, the people who will own, manufacture, distribute and install PV roofing products are most likely people who are already in


Dan Perkins developed this vented accessible ridge cap to work as a wiring channel for an amorphous film array.


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the roofing industry today.

The people within our industry who master this challenge will do so by starting early. Progressive contractors will sell and install currently available PV systems and visionary manufacturers will start developing and testing integrated PV roofing products. Distributors will select, promote and sell PV systems that enhance their product lines.

As the early participants come up to speed on the existing technologies, the necessary improvements will become self-evident to them and they will assume some of the role in the necessary evolution of these products. Some of that development will result in proprietary systems owned and marketed by members of the roofing community.

**Currently Available PV Technologies**

The term "photovoltaic" applies to a material's ability to convert photons or visible light into moving electrons. A photon connects with and excites a molecule of PV material as it passes through it. This action kicks an electron from the valence ring of the molecule, and the electron flies wildly until being directed into a current by positive and negative doping agents, which are applied to the outside layers of the PV material. Traditional PV materials are silicon-based, but a new generation of materials, including copper, indium, gallium, selenium compounds (CIGS) and cadmium telluride (CdTe) are making their way into thin film technologies.

**Crystalline Modules**

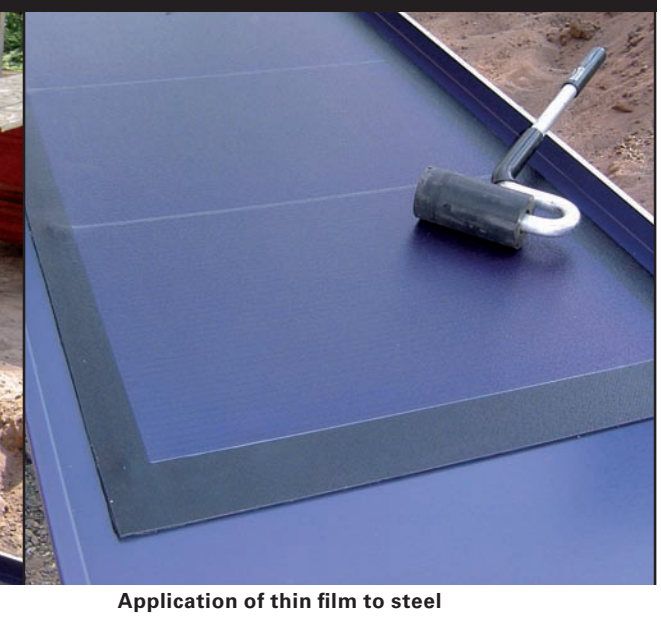
Crystalline modules are made from silicon crystals grown at temperatures of 1,750 F (954 C) and then sliced into thin wafers. Positive and negative doping agents are applied, and thin wires are etched into them to harvest the current. These wafers are typically mounted in glass and packaged in an aluminum frame. Crystalline modules represent 95 percent of the PV market at this date.

In an effort to capture the California tile roof market, a number of manufacturers have created crystalline modules that approximate the sizing of concrete tiles. Most of the crystalline modules manufactured, however, are the traditional rectangles seen mounted on roof racks and trackers.

A major drawback with crystalline technology is the amount of energy and material consumed in manufacturing. Roughly five years of the total energy a crystalline module produces is consumed in manufacturing, and it uses 100 times the amount of industrial-grade silicon than its thin film counterparts for similarly rated components. The benefits of crystalline modules include time-proven performance and higher efficiency ratings.

**Amorphous Film**

Amorphous films are silicon based, but they are not manufactured from grown silicon crystals. The silicon and doping agents are applied to a



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substrate of stainless steel or glass in a deposition chamber where micron thick layers of material can be applied in a consistent manner. Wires are then applied over the surface, and the entire film is encapsulated in insulating and protective materials.

### Other Thin Films

There are a number of new thin films, including CIGS and CdTe products. Some are commercially available now, and some are still in development. The hope is these products will offer substantial competition to current pricing as they come into larger scale production.

### Integrate Your Product Line

One thing is certain: The price of energy will continue to rise, and the demand for these products will rise with it. Green energy values have doubled in the past year because of mandates in 25 states requiring that utilities provide a percentage of their energy portfolio in alternative generation.

The question is not whether PV products will make their way onto roofs and into the daily lives of roofing professionals. The question is how we will embrace and integrate these technologies into our product lines. MCN

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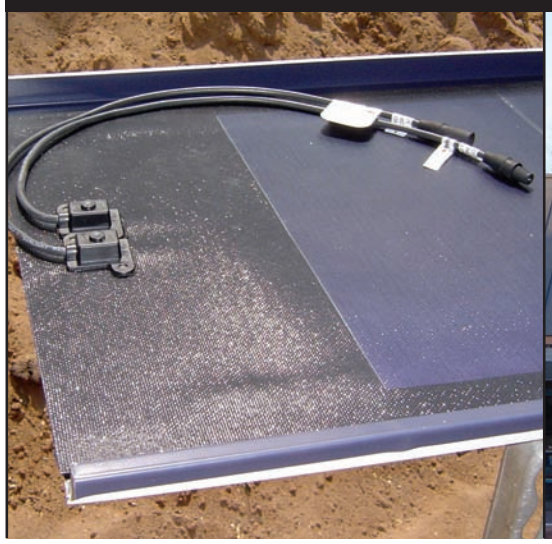

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**Crystalline modules on a small residence**

**This is a 4-kilowatt, off-grid, amorphous thin film application on steel.**