

Rooftop Photovoltaics: The Decision-Making Process



In today's "green market" environment, anything that is perceived as renewable, sustainable, cool, recyclable, and/or energy efficient is in demand. These sought-after design elements meet not only the construction community's interests, but they also serve society's interests in protecting our environment and conserving our energy resources. Photovoltaics (PV) are a part of this popular movement. Converting the sun's energy into thermal and/or electrical power is appealing to all of us who pay energy bills. Because of this, many associated with the roofing industry are inquiring about PV technology. Consequently, a number of roofing material manufacturers, consultants, and roofing contractors are promoting this technology.

Given the ever-increasing cost of energy, adding photovoltaic panels to a roof seems like an easy decision. Upon further consideration, this interesting idea is complicated by many facts and figures. Here are a few of those factors that complicate the decision:

The Cost Of Photovoltaics

How much does a system cost and how much will it save? In 2008, photovoltaic systems cost between 10 to 12 cents per kilowatt. Larger systems cost 22-40 cents per kilowatt. Once net cost (installed cost less any potential rebates or available

tax credits) is determined and the estimated annual output calculated, the estimated savings per year can be determined. With this information, the payback in years can be determined. Based on the cost of these systems, the current price of energy, and the current efficiency of these systems, the simple payback can be 20 years or more! This starts to complicate what one would have hoped to be the easy part of the decision.

The Efficiency Of Photovoltaics

This factor needs to be researched on a variety of levels. The efficiency of the specific panel types (crystalline or amorphous), solar efficiency rating in the project's geographic location, mounting location (roof or ground), and maintenance efficiency need to be considered. For instance, since photovoltaic systems become less efficient as temperatures rise, placing the system on the roof may greatly reduce the overall effectiveness of the array compared with a ground-mounted array.

Mounting and integrating.

There are two choices when considering rooftop PV systems: rack mounted and flush mounted thin film PV or building integrated PV (BIPV) options. The chart below summarizes the factors to consider with each type.

CONSIDERATION	RACK MOUNTED PV	THIN FILM PV (BIPV)
Cell type	Multi-crystalline cells	Amorphous cells
Efficiency as a solar component	More efficient	Less efficient
Ease of integration	Less difficult	Integrated into the roof membrane
Heat effect on efficiency of PV cell	Some effect	Significant effect
Partial shading effect on cell efficiency	Most affected	Least affected
Roof system options	Open	Restricted
Cell cost per unit area	More expensive	Less expensive
Roof area required to achieve kilowatt	Less	Approximately 2-3 times surface area compared with multi-crystalline
Ease of repair/replacement	Less difficult	More difficult
Effect/aging of roof system	No effect	Increased potential
Hail resistance (tested)	Pass	Pass
Ease of maintenance	Non issue – simply replace cell	Possible issue – roof membrane repair required
Traffic resistance	Issue only if horizontally mounted	A concern
Wind performance	Rated by rack system supplier	Based on the wind rating of the roof system
Winter weather performance	Little effect	Problem with snow and ice accumulation

Obviously these considerations make the choice to pursue photovoltaics more difficult. However, if cost is not the primary driver, and the realization that PV efficiencies are presently limited (but will likely improve over time) can be overcome, and the decision to proceed is affirmed, following are some recommendations.

For situations where owners and consultants are interested in PV applications for roofs, Siplast currently defers to professionals who specialize in this technology for appropriate recommendations and guidelines. An owner or his representative should consider the following:

- **Fully evaluate the condition of the existing roof prior to purchasing a PV system.**

- The membrane may be aged to the degree that a replacement is imminent following the PV array installation. Consideration should be made as to whether replacement of the roof system is more practicable and economical before the deciding on the PV investment.

- **Identify solar integrators in your market area.**

- These are the professionals who are best qualified to install your photovoltaic systems and interface with your power company to get your system “on line”. Also, warranties provided by the panel suppliers are extended through integrators. Integrators are also best suited to help with overall system design, size requirements and can be helpful in determining tax credit opportunities and potential rebates.

- **Research PV system suppliers and options.**

- Research the various suppliers. There are numerous major suppliers to consider. Most suppliers post their efficiency data, meet certification guidelines, and offer term guarantees. Choose the system supplier that best meets your requirements. You may wish to consult the various integrators you are considering to assist in this process.

- If a rack mounted system is chosen, once the panel selection is determined and the size and quantity is determined, consult the various rack suppliers and determine which system will best fit your needs. Some of the considerations are how the

rack system is installed and interfaces with your roof system. Weight and wind uplift criteria are critical considerations that need to be addressed. Once again, your integrator may provide assistance with this selection.

- If a BIPV, or thin film, system is chosen certain roof system restrictions should be considered. Thin film systems are adhered directly to the membrane, and thus are more susceptible to damage from mechanical abuse or heavy foot traffic. Ponded water must be avoided. The roof membrane must be compatible with the BIPV, as most thin film PV systems generate a considerable amount of heat during a warm day.

Helpful Web Resources

- solarbuzz.com
- akeena.net
- findsolar.com
- sunpowercorp.com
- pvwatts.com
- 3drock.us/company/
- dsireusa.org
- evergreensolar.com
- agt.com
- unirac.com
- solarintegrated.com nrel.gov/solar/
- uni-solar.com

Evolving Technology

While PV technology has been available for the last 30 years, there will be continuing developments that could make current solar energy systems obsolete in 5-10 years' time.

Severin Borenstein, Director of University of California Berkley Energy Institute, stated on February 28, 2008: “We are throwing away money installing the current solar PV technology, which is a loser. We need a major scientific breakthrough and we won't get it by putting panels up on houses.”

Whether or not this statement is accurate will be determined over time. What is clear, is that there are many technical, financial, and developmental decisions that must be made in the process of determining the viability of photovoltaic technology on any given application.

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