Hybrid vigor

Planting solar panels on green roofs produces mutual advantages

Green Roof at the Dr. Wesley Grant Rec. Center, Asheville. Living Roofs, Inc. photo

▫ By Emilio Ancaya ▫

There are two facts of nature that we can always count on – the sun shines and plants grow in a living partnership.

This synergistic truth now goes even a step further when solar energy is gathered via solar photovoltaic panels embedded amid the plants comprising a green roof. It is, in a unique way, a modified form of photosynthesis.

Solar panels are no longer unusual sights in either urban or rural landscapes, ranging from literally acres of panels in a solar farm to a single unit on the roof of a home. However, green roofs still are not widely known or understood by many people, though the awareness is growing. In general terms, a green or living roof is a vegetated covering for a roof, with soil and plants taking the place of metal, gravel ballast, asphalt, shingles or tiles. It's not a new technology since sod and other living materials have topped human dwellings for centuries.

But the growing demand for environmentally sound, sustainable solutions is increasingly leading to utilization of green roofs by architects, engineers, landscape architects and roofing contractors. This demand has increased the use of green roofs on commercial, institutional and residential projects through both new construction and retrofits.

In its simplest form, a living roof usually consists of an initial layer of waterproof membrane on which additional layers are built up. The final and visible element is a soil base covered by carefully selected species, textures and colors of plants that provide more than simple aesthetics. A properly designed and installed green roof delivers a wide and diverse range of benefits, including reductions in energy costs, improved stormwater management, enhanced air quality and better longevity of roof materials.

And now it's been determined these same benefits significantly enhance the performance and efficiency of solar panels planted on a green roof. According to several recent studies, strategic placement of photovoltaic (PV) panels in a "solar garden" has proven both to improve energy gathering and the wellbeing of the plants on the green roof. In essence, this integration establishes a microclimate that is mutually beneficial, and enriches and expands the advantages offered by both.

Research conducted at the Bronx Design and Construction Academy in New York City indicated an efficiency boost of about three percent, while ongoing research in Berlin shows that solar panels on a green roof average a six percent higher output than those on a standard roof. Other research has produced increases in performance of up to 16 percent. Key elements having an impact on the boost are the size of the roof, how panels are positioned, climate and the types of vegetation utilized.

The critical underlying issue is that solar panels get hot. A major impact on PV output is the extreme heat on rooftops that both affects energy capture and presents maintenance issues. It's the cooling aspects provided by an accompanying green roof that produce significant performance gains in PV panel performance. The plants serve as insulation and "air conditioning" for the heat-sensitive PV elements, such as microinverters, since a green roof typically is up to 30 degrees cooler than a conventional roof. The cooling effect increases energy-gathering efficiency, while reducing or eliminating the need for complex mechanical systems to remove heat. The green roof also decreases the amount of airborne pollutants and dust that can be harmful to PV panels and their systems, reducing mainte-

Green roof with solar panels, Pittsburgh, PA. Xero Flor America photo

nance requirements and costs while having a positive impact on system longevity.

It's also worth noting that placing PV panels on a roof effectively eliminates issues that hamper at-grade locations. Typically, such sites must be permitted, and grading is usually needed for proper stormwater control and to reduce erosion. Frequent maintenance is necessary, and perimeter fencing often is required. However, installing solar arrays on a commercial flat roof eliminates the need for fencing and drainage is effectively handled by the underlying green roof. Virtually any size or scale of solar green roof dramatically decreases a building's impact on the environment and saves valuable green space at ground-level.

One unexpected finding of the recent studies was that the green roof's plants also profit from the presence of PV panels. The shade created by the panels lessens the sun's direct impact on the plants, even those selected especially for their ability to withstand full sun for long periods of time. The presence of shaded areas also allows the use of more shade-tolerant species that broaden diversity and improve a green roof's overall importance as an eco-friendly solution that helps increase the energy performance of a building since it reduces unwanted heat gains in the summer and heat losses in winter. The materials that form the infrastructure for a roof garden act as insulation for the building, often producing energy savings of up to 30 percent.

Capitalizing on these mutual benefits is gaining ground as innovative design and manufacturing approaches focus on strategic positioning of PV panels and plant cover to boost performance and maintain the health of the green roof. It is important to note that a successful and productive "solar garden" requires the involvement and interaction of experienced, knowledgeable professionals with the combined expertise to install a sustainable green roof, and properly array and operate the PV panels.

But the proven fact is that every percentage point of improvement in the performance of solar photovoltaic panels has a positive impact on the acceptance, accessibility and utilization of this valuable form of alternative energy capture and production. Increasing the partnership between solar energy and green roofs appears destined to generate positive results that will produce environmental, economic and aesthetic value.

Emilio Ancaya, GRP, is co-founder of Living Roofs, Inc., a green roof design/build and maintenance company based in Asheville. www.livingroofsinc.com.