When Solar Gets Sexy

A common perception amongst architects regarding solar photovoltaic (PV) is to hoist rectangular solar panels somewhere on a building roof and integrate wires to building's electrical mains. Doesn't sound very sexy, does it? Instead, let's not think of solar PV as a separate system like air conditioning or water heating. This is where Building Integrated Photovoltaic (BIPV) solar comes in, to start thinking of solar PV as a building material that also happens to produce electricity.

Solar Rolls Attached to Curved Roof

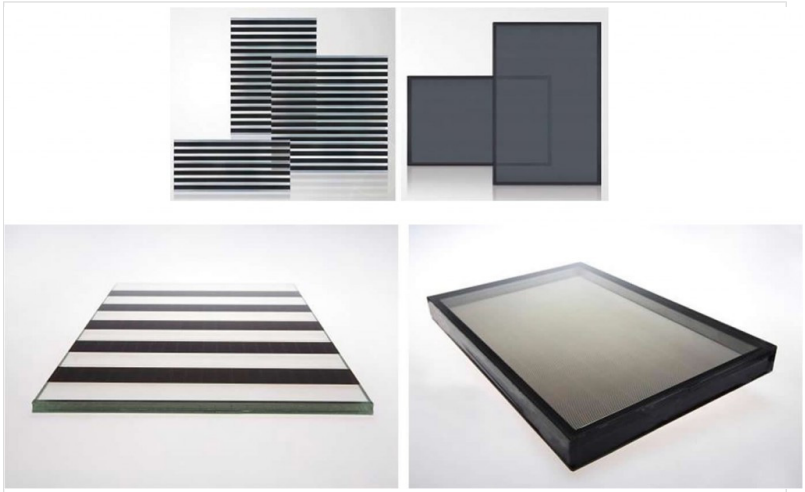
Transparent Solar Strips Attached to Glass

Viewed through this lens, all of a sudden solar opens up a wide range of applications that not only result in environmentally friendly building designs, but also introduce new realms of aesthetics. Smart and sexy? Very much so, just look at these examples.

Windows to the World of Energy

Traditionally Solar PV has been a silicon-based industry since silicon-based panels provide the maximum efficiency (typically 16 to 18%) in converting light into electricity. These are the typical panels you commonly see on rooftops, which are manufactured by putting silicon-based solar cells under a glass substrate and connecting them in series. However, aesthetically these panels have their own unique look, which may or may not blend in with your building design. As such, they are best installed on the rooftop, where they are less likely to intrude with the building façade.

In the last ten years or so, a new technology has taken over the solar PV industry by a storm. This technology started by depositing thin layers of amorphous silicon (A-Si) on a glass substrate, thus called "thin film" technology, and it is also a lot less expensive. The downside is that thin films are much less efficient and take more space and weight (A-Si starts at 6%, and although newer technologies using CIGS or CDTe are approaching 12%, they tend to be more expensive). The upside is that thin film has a better appearance since it looks like tinted glass, and it also allows the flexibility of adjusting the transparency of the glass. This has given rise to a new industry of using solar thin film-laced glass panes for your building windows.



BIPV Window Glass Panes with Solar Strips or Blended

You are going to have windows in your building anyway. Why not go the extra mile and use BIPV windows? Of course, you have to consider the added cost, but you also need to consider the electricity cost offset by the BIPV windows. Ultimately, it becomes a matter of environmentally-friendly design. BIPV windows take your building a few steps closer to achieving zero-energy design concept.

A Powerful Roof over Your Head

John F. Kennedy once said – "the time to repair the roof is when the sun is shining". This couldn't be truer when it comes to solar PV as a roofing material. The first approaches in this area have been actually taking the silicon-based mono-crystalline panels and using two transparent glass substrates on both sides to frame them. The result is a great-looking roofing material that will give your sun room or building porch or awning a stunning look, while generating electricity at the same time.

Monocrystalline Panels with Transparent Glass Substrates

Solar Roof at California Academy of Sciences, San Francisco

Other approaches for solar roofing include solar tiles which involve either coating tiles with PV material (similar to thin film deposited on glass), or attaching solar cells no top of flat tiles.

Blue Solar Roof Tiles with Coated PV Material

Flat Roof Tiles with Solar Cells Integrated

Another cost-effective approach for installing solar on the roof (and also on top of tents or any stretchable surface) is to use flexible solar rolls. These rolls utilize solar thin film “printed” on top of flexible yet durable material, which makes it very light, and extremely easy to transport and install. All you need to do is unroll them on top of your roof surface and attach either using adhesives or tie-ins, and these flexible rolls essentially hug the surface they are installed on.

Solar Rolls Being Laid Out On Building Rooftop

Flex your Organic Solar Muscles

This brings us to the latest and greatest in BIPV – organic solar PV material that not only rolls but is great on stretchable surfaces. “Organic” means using carbon-based PV material instead of silicon-based, and the advantage is that they don’t need sunlight to fall perpendicular on them to produce energy (as required by silicon-based panels). Even though their conversion efficiency is less than both crystalline and thin film panels (currently around 3%), they are great in low-light conditions, and they make much better use of reflected light. As such, they start producing electricity at full capacity much earlier in the morning, and go later into the evening – increasing the overall productivity.

But it is their flexibility that enables designers to cut and attach them to any type of surface. A recent example is the “wave design” roof implemented on top of public bus stop shelters in San Francisco:

San Francisco Bus Stop Shelter at Daytime (left) and at Night (right) with Flexible Solar PV “Wave” Roof

You can further extend this approach and apply the flexible solar PV “strips” on any stretchable surface like window or door awnings, large beach-style umbrellas, parking lot shades, tents, etc. Since the material is extremely light, it lends itself to create lightweight structures that produce shade in the outdoors and generate energy at the same time.

Flexible Organic Solar PV on Curved Parking Lot Carports and on a “Solar Tent”

Parting Thoughts

Beautiful architecture needs to combine both art and science. Aesthetics matter as much as underlying technology. Form matters as much as functionality. Just like an artist’s repertoire is enhanced by artistic tools such as instruments and colors palette, an architect always benefits from having access to wide array of building materials. It is no surprise that the energy crisis in Nepal has necessitated designing buildings that are not only extremely energy efficient, but also lend themselves to electricity production on-site. Solar PV technology has already proven itself in this regard as an extremely effective technology in terms of rooftop energy production. With BIPV, solar PV goes into the realm of building materials, where you now have solar PV as windows glass panes, roofing material, or just plain flexible material with which you can build electricity-producing surfaces in any imaginable dimensions — bringing the sexy back in your building design with BIPV.

Note: All solar products cited in this article are available from Gham Power. For further information, please contact Gham Power at contact-at-ghampower-dot-com, or call +977-1-4004545

About the Author

Sandeep Giri is the President of Gham Power, fastest growing solar company in Nepal using #1-ranked American solar PV technology. Mr. Giri lives in San Francisco, California (USA), where helped launch several technology companies, including a software company in Kathmandu. When his Nepal office was impacted by the load-shedding crisis in Nepal, he decided to launch Gham Power with American collaboration, providing quality solar technology for Nepali homes and businesses at affordable prices. Mr. Giri holds a Master’s degree in Computer Science and a certificate in Solar Energy from University of California at Berkeley.

By pritika, on December 15th, 2010 |