"When life gives you lemons, make lemonade" is one of my favorite sayings, in no small part because it applies not only to life in a general sense but also to engineering in particular. Any technology option (as you all already know well) consists of a set of tradeoffs; no single candidate is optimum for every possible implementation. As engineers, one of your key roles (in partnership with your marketing counterparts) is to intimately understand the technologies at your disposal, both their respective strengths and shortcomings, and identify applications and customers that enable you to accentuate the strengths while playing down the shortcomings.

I was recently reminded of this saying in the context of an email conversation with Rick Orlando. Rick and I go back a long way; he was a competitor of sorts while at Xicor and then Exel Microelectronics, back when I was in Intel's flash memory group, and I then covered his company Summit Microelectronics after I transitioned to EDN. One of Rick's more recent gigs is Vice President of Business Development at Brite Solar, a company whose name is reflective of its photovoltaic aspirations, albeit with a somewhat unique twist.

Solar cells, in conjunction with batteries, super-capacitors, or other charge storage technologies that enable the electrons to keep flowing after dark, are one of the more promising approaches available to enable energy harvesting and in the process, wean humanity off natural gas, coal, oil, and other traditional greenhouse gas-generating energy sources. Deserts are in many respects ideal locations for large solar energy "farms:" they get plenty of sun exposure, are otherwise unused, and offer large expanses of fairly flat terrain. Unfortunately, they also tend to be remotely located relative to the dense cities and industrial sites that consume the generated energy, thereby leading to expensive and lossy transmission topologies between sources and destinations.

Alternatively, of course, you can locate a solar cell array in close proximity to its consumption partner; on a residence roof, for example, or in its back yard. Impact-resistant solar cell arrays can even be used as an alternative to traditional asphalt in constructing roads and parking lots. And then there are windows ... wait, solar cells in windows? Wouldn't the necessary transparency be ... err ... thrown out the window in the process? Not necessarily. Recently-promoted R&D projects, as Orlando explained to me, leverage glass-embedded transparent light guides or other schemes to route inbound-photon energy to photovoltaic material located at the windows' edges, for example.

Then there's Brite Solar's approach, which leverages inkjet-deposited titanium dioxide nanotechnology. The resultant PanePower material is only around 75% transparent (and then only in certain visible wavelengths), is also reddish in perceived tint, and is only about 5% power-efficient (versus around 20% with traditional opaque solar cells). But these characteristics aren't necessarily showstoppers; you just need to find the right application for the approach. Brite Solar's first candidate is the greenhouse. As Orlando noted in one of his emails, "75% transparency in the correct
wavelengths is what is needed for photosynthesis in plants in the greenhouse."

"The reddish tinge ... is better for the plants," he also suggested, along with offering that "we also block 98% of the UV light, which has significant benefits to the plants as well as reducing the insect population." Along with fueling "grow bulbs" for use after dark, the electricity generated by Brite Solar-enhanced glass can also power a 24 hour/day hydroponics system. And where might the water come from? Orlando has some particularly appealing ideas for the drought-stricken US West here, too: "Untraditional uses for the electricity generated could also include powering a desalinization plant to provide water for the greenhouse cultivation. Greenhouse agriculture uses up to 90% less water than traditional farming."

Here are some other quotes from the company's promotional materials:

A greenhouse requires large areas of land and significant amounts of energy to be productive. PanePower allows the land under glass to be dual use, cultivation of crops as well as solar electricity generation. The economic benefits are realized with your monthly electricity bill.

PanePower panels cost about 4-5X more than the equivalent traditional glass panels. The best financial return will be in the utilization of PanePower panels in new greenhouse construction. In this case, the IRR [internal rate of return] based on a typical installation in North Carolina would be 24.7%. In the case of upgrading existing greenhouses, one has to add the cost of the PanePower panels to the initial cost of the greenhouse, and the cost basis is increased by the cost of the original glass panels. In this case, the typical IRR is 21.3%.

- PanePower Output = 50 Watts/Sq Meter of Glass
- 10 Acre Greenhouse = 2.6MWp Capacity
- 20 Year Operation
- PanePower Installation Qualifies for Renewable Energy Tax Credits
- PanePower Panels are Omni-directional: Electricity is Generated by Light Striking the Panel from Any Direction
PanePower Panels are Identical to Traditional Glass in Form Factor and Insulating Characteristics

I'm admittedly intrigued both by the initial greenhouse application for PanePower and for what follow-on uses and customers Brite Solar may come up with (if you have any ideas, I'm sure the company would welcome your suggestions in the comments). And I'm inspired, as well, by this latest in a long litany of examples of human ingenuity I've encountered over the years in my tech journalism career. Kudos, engineers!

**Also see:**

- Energy harvesting
- Solar Musings
- Cutting the carbon-energy cord: Is the answer blowin' in the wind?
- Power electronics on a chip: The Solar Charger