# Report: Two Solar Technologies That Will Thrive; Two On the Demise

For every revolutionary advance in solar, there are countless evolutionary dead-ends — technologies that were well worth exploring, but ones that ultimately failed to live up to the mantra of "cut costs or die."

These are the Solyndras of the world. Their science may have raised the bar, but ultimately they were judged by the market, which measures the bar on cost alone. From that perspective, it’s more like a limbo line — “How low can you go?”

For an industry struggling to get to price stability because of factors unrelated to technology, it can be a difficult exercise to envision which advancements will get to move on and which will be referred to only in the past tense.

In a new report titled “Searching for Game Changers in Photovoltaics Materials Innovations,” Lux Research details the emerging technologies that will thrive and those that will eventually sputter out. Along the way, the report gives us a couple new acronyms to squirrel away as we consider the ROI on our R&D.

The basis for much of the research is the volume of development funding we’re seeing right now, and the forecast that the industry will return to double digit margins by 2014. Conceivably, once those margins return, many of the innovations in the background today will be ready to step into the market. The formula to get there is based on solid economics — the technologies that succeed will offer both a low cost per watt and the ability to scale using existing PV infrastructure.

The report also offers a fair warning to those who assume that the U.S. will continue its role as innovators while China takes on the function of manufacturing. Many of the technologies that currently dominate PV were developed in American laboratories and academic institutions. But China is making significant investments within its own universities and government research institutes. The end result, says Lux, is that the innovation gap will soon close.

**The Technology Winners**

Epitaxial-Si: The report calls this technology the last nail in the amorphous silicon (a-Si) coffin. Uni-Solar has gone bankrupt and Oerlikon has sold its a-Si thin film business. The problem with a-Si has been the lower efficiencies achieved when compared with other thin film technologies like CdTe and CIGS. Epitaxial Si (epi-Si), which is thin monocrystalline silicon, has the potential for higher efficiencies, and it could replace a-Si infrastructure.

CZTS: Copper zinc tin sulfide cell technology has been receiving interest over the past few years because of its ability to replace CIGS with with cheaper materials. Indium and gallium, both used in CIGS, are rare metals, which mean they're expensive and subject to shortages. Some big names are looking into this technology, such as IBM and Dupont. Another exploring CZTS is Solar Frontier, which has made big inroads recently with its CIS operation. Lux expects CZTS, which still faces issues of thermal instability, to reach commercial scale and competitive thin-film prices within the next five years.

**The Technology Losers**

Ion Implantation: There's been lots of buzz lately about ion implantation and how the tools needed for this technology can save lots of money compared to the current wafering technology. But the tools themselves are big-ticket items. According to Twin Creeks, each 350-square-foot tool would put out the quivalent of 6 MW of cells per year. That output is certain to go up with new generations, but according to Lux, the capex with ion implantation is still too high. Additionally, throughput for wafering is lower than the traditional wire-saw techniques and the exfoliated wafers that come from these tools require an additional step. SiGen and Twin Creeks have yet to report cell efficiencies. Solexel, meanwhile, recently moved away from ion implantation.

Quantum Dots: Quantum dots and nanowire cell technologies have drawn investment from academic researchers because both require less material than current thin-film technologies. But both quantum dots and nanowire structures result in larger surface areas, which are hard to passivate. And the cell efficiencies recorded thus far are well below what you'd need for commercialization. Without an unexpected breakthrough, neither technology will be commercialized any time soon, says Lux.

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June 04, 2012

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