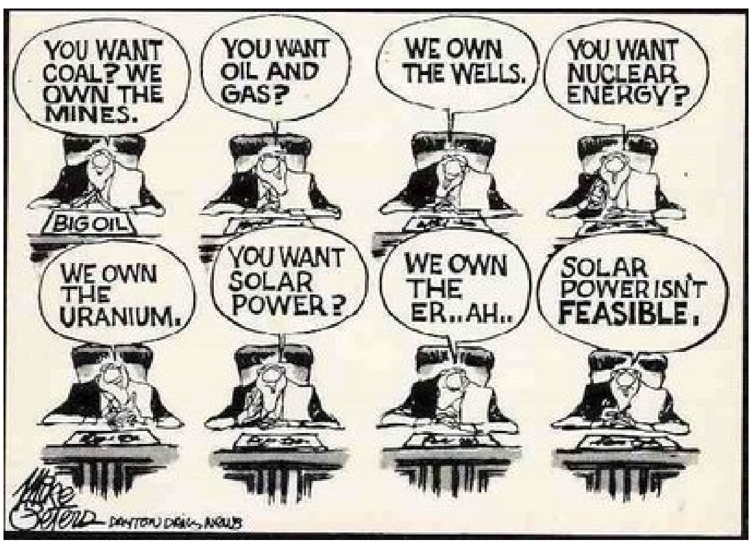
Thin Film Solar Power - Cheaper than Coal ?

Posted by Big Gav on January 8, 2008 - 2:00pm in The Oil Drum: Australia/New Zealand
Topic: Alternative energy
Tags: cigs, nanosolar, solar power, thin film solar [list all tags]

Thin film solar company Nanosolar has now shipped its first solar panels, leading to speculation that the (direct) cost of solar power is now cheaper than coal (and falling).

The company also began an auction for the second panel produced, however this was cancelled by eBay because Nanosolar decided to donate the purchase price to charity. The third panel has been donated to the Tech Museum in San Jose, California.

While it is still too early to tell whether or not Nanosolar can meet their goal of selling solar cells at $1 per watt, the fact that the company has constructed a manufacturing plant and begun shipping the product to a paying customer (in Germany) is a good sign.



The first plant is reportedly capable of producing 430 megawatts a year of cells, which is a respectable amount compared to the total amount of photovoltaic manufacturing capacity currently in place.

Nanosolar's cells are made of Copper Indium Gallium Selenide (CIGS). They aren't the only company working in this area - competitors include Heliovolt and the struggling Miasole. Other thin film solar manufacturers are working with materials like Amorphous Silicon (a-Si) - for example Sharp, Power Film, XSunX and United Solar Ovonic - or Cadmium Telluride (CdTe) - for example First Solar. Konarka also sell "power plastic" (soon to be marketed in Australia by Skyshades) using "Graetzel cells" based on a thin coating of ruthenium and organic bipyridine molecules over a titanium substrate.

One potential issue to watch as manufacturing volumes are scaled up is the availability of the various materials that make up thin film cells.

Availability and price of Tellurium are already concern to analysts of First Solar, though there is speculation that copious amounts of Tellurium can be mined from deep sea ridges.

There appear to be similar concerns about availability of indium in particular (and to a lesser extent gallium) for CIGS cells, though as usual concrete data on total reserves for these seems to be in short supply as well.

Nanosolar's technology is reportedly capable of achieving higher efficiency rates (up to 19.5%) than are achieved with other thin-film technologies. However, these efficiency rates have only been seen under laboratory conditions so far. Mass produced CIGS solar cells usually have efficiency rates of 12%-15% – making them about half as efficient as their silicon PV counterparts.

> The centerpiece of Nanosolar's technique is a proprietary ink developed by the company, which is used to print the semiconductor of the solar cell. The ink is based on various proprietary forms of nano-particles and associated organic dispersion chemistry. Once it is deposited on a flexible substrate, the ink's nano-components align themselves via molecular self-assembly, creating a homogenous mix of nano-particles that ensure the perseverance of the correct atomic ratios of the elements involved even across large areas of deposition. This approach is extremely different from the traditional vacuum deposition processes where one effectively has to "atomically" synchronize various materials sources – a complex process, which significantly limits production efficiency.
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> The material on which the cells are printed is a highly conductive metal foil substrate . The metal foil is 20 times more conductive than the stainless steel often used in the industry. The company says this property enables major cost reduction on the solar cell's thin-film bottom electrode. "A thin-film solar cell consists of an absorber semiconductor layer, sandwiched between the top and bottom electrode layers. If the thin films of a solar cell are deposited directly onto a highly conductive metal foil (as opposed to glass or stainless steel), then the bottom electrode gets much simpler because the substrate can do the job of carrying the current" – explained the scientists.
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> In conventional silicon solar technology, wafer cells are sorted into performance bins according to their electrical characteristics before the cells are assembled into panels. Nanosolar says that this sorting process may result in grouping poorly-matched cells, because cell transitions are created through scribing after they are already deposited on the glass substrate. In contrast, the company claims that their new approach optimizes the accuracy of cell-matching, resulting in better panel efficiency distribution and yield.
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> The main advantages of Nanosolar's technique are its relatively high speed and the highly precise manufacturing process. According to the company, its thin-film solar films are more than 100 times thinner than silicon-wafer cells and therefore, have correspondingly lower materials costs – between 10%-20% of the current industry standard per kilowatt. The "printing" technique is executed in a "roll-to-roll" manner, in which meters-wide and miles-long rolls of solar panels are created and cut to a desirable size, much like the way in which newspapers are printed at printing houses. As opposed to the method of processing separate wafers or glass plates, a roll-to-roll printing process can be maintained for the entire length of the roll, eliminating undesirable start-ups and other cycle overhead costs – a key advantage, according to the company.