

Spectrolab's Solar Breakthrough

BY AL SENIA



A SOLAR CELL ENERGY RESEARCH

breakthrough that has attracted national attention could open the door to the production of cost-competitive solar power within a decade, according to researchers involved in the effort.

Spectrolab Inc., a subsidiary of Boeing, recently demonstrated the ability of a photovoltaic cell to convert 40.7 percent of the sun's energy into electricity, a significant step in reducing solar energy's cost. Most current photovoltaic cells, like those used on rooftops, convert less than 20 percent of the sun's rays into useable energy. Company executives say they expect further efficiency improvements in the technology during the next few years, which could reduce the eventual cost for solar energy to 5–7 cents per kilowatt-hour, making the power source much more cost-effective than it is currently. It now costs about 16–20 cents per kilowatt-hour for solar energy and the systems are priced at about \$6 per kilowatt-hour.

The technology developed by Spectrolab utilizes a high-efficiency metamorphic multi-junction concentrator cell to achieve the high-efficiency conversion rate. That approach involves a powerful new technology for designing super-efficiency,

multi-junction solar cells. The new prototype solar cell, which could go into commercial production within eight months, is a triple-junction device, which means it uses three layers to convert the sunlight into solar energy. According to officials, when sunlight concentrated up to 240 times the normal sun's intensity is focused onto the cell, nearly 41 percent of the solar energy is converted into electrical energy. Previously, such prototype research efforts had been limited to a conversion rate of about 32 percent. The 8 percent leap in efficiency is considered a significant breakthrough. And the expectation is that the latest Spectrolab achievement will, during the next few years, lead to four-, five- and six-layer cells that will convert more than 50 percent of the solar energy into electricity.

"It's an extremely important breakthrough for the concentrator community because it shows we can push further and further along and not be limited in solar efficiency," said Dr. Martha Symko-Davies, research senior supervisor for the National Renewable Energy Laboratory, the Department of Energy research lab that is funding research into the technology. "It means you can leverage the technology to keep reducing the cost of the energy produced." She believes efficiency levels could reach 50 percent or more in less than

Spectrolab is working with a company in Melbourne, Australia to test energy output from triple junction concentrator cells.

PHOTOS COURTESY OF SPECTROLAB.



a decade. Symko-Davies estimated that NREL has invested more than \$3 million in developing the technology since 2000. Most of that money has gone to Spectrolab.

"There has not been a lot of competition in this area," she noted. "People really weren't convinced multi-junction concentrator technology was really going to be cost-effective. But now we are seeing a pop in the number of solar companies trying to find a niche market."

David Lillington, Spectrolab's president, explained that the multi-junction cells have a great efficiency advantage over conventional silicon cells used in concentrator systems because fewer cells are needed to reach the same power output. He noted that the solar energy performance level of the company's solar cell is the highest efficiency level any photovoltaic device has ever achieved. The company's customers for the technology are solar energy system providers that include the cells in the systems they manufacture, not traditional utility companies. Spectrolab works closely with domestic and foreign solar concentrator manufacturers.

"We've always been on the lookout to find options to grow our business, and for the last 10 years we have made a substantial commitment to improving the commercial efficiency of space and terrestrial solar cells," Lillington explained.

Dr. Richard King, principal scientist for Spectrolab, said further, steady efficiency improvements in the technology are likely during the next few years.

Spectrolab, based in Los Angeles, is the world's leading

provider of space solar cells, solar simulators and high-intensity lighting products. It provides products to the commercial satellite industry, the U.S. Defense Department, NASA and aerospace companies. For more than a year, the company's terrestrial concentrator photovoltaic solar cells have been used to deliver power to the electricity grid in Arizona and in Australia. The company's high-efficiency terrestrial concentrator solar cell technology has won a number of awards since 2001 from agencies such as the National Science Foundation and NASA.



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