SOLAR CELLS

Photovoltaic conversion, in which sunlight is converted directly into electricity, is a promising alternative energy source but further cost reductions are essential to its widespread use. To promote broader adoption of photovoltaic, or solar cell systems, the Department of Energy (DoE) is sponsoring research toward reducing the cost to a point where this form of energy would become practicable for many commercial, industrial and residential applications. NASA support of the DoE program is provided by Jet Propulsion Laboratory (JPL), the organization with primary responsibility for developing advanced photovoltaic technology and finding ways to cut costs.

Solar cells are made by "growing" silicon crystals in a furnace. In standard production, the crystal emerges as a long, salami-shaped cylinder; the crystal is then sliced into thin wafers, to which metal contacts are added to create the solar cell. Because the crystal is cylindrical, the solar cell is round. But one of JPL's contractors—Crystal Systems, Inc., Salem, Massachusetts—has come up with an innovative technique that combines low-cost processing with square-shaped wafers that produce higher power from less surface area than is possible with circular cells;

therefore, fewer modules are needed for the desired power output and the cost of the complete solar array is substantially reduced.

Called HEM—for Heat Exchanger Method—the Crystal Systems process produces high-efficiency crystal ingots in an automated, well-insulated furnace that offers low equipment, labor and energy costs. At right is the company's high-temperature ingot-growing furnace; the technician is using a mirror to peer inside the furnace and monitor the melting process. The photo above illustrates the various steps in creating a photovoltaic system: silicon-bearing rock or "meltstock"; a large crystal ingot; a bar cut from the ingot; wafers (foreground) made by slicing the bar; and, in the background, a module composed of square solar cells.

The HEM process is in production status at Crystal Systems; the square wafers it produces are sold to other companies manufacturing solar panels. In another facet of its work, Crystal Systems is developing a method of reducing the cost of converting ingots to wafers by a multi-slicing technique that should be commercially available in two years.