

# TECHNOLOGY DEVELOPMENT PROJECT FACT SHEET

## RT004: Concentrating Technologies Multi-junction Concentrator System

For large, utility-scale electricity generation, multi-junction solar cells are being evaluated in the Concentrating Technologies micro dish. In multi-junction solar cells, a sandwich of exotic semiconductor materials is used to absorb different parts of the solar spectrum. Multi-junction solar cells produced by Spectrolab,



Inc. ([www.spectrolab.com](http://www.spectrolab.com)) are the most efficient solar cells in the world, with a record efficiency of 39%; this is roughly twice what is possible with silicon solar cells. However, until recently, the high cost of the semiconductor materials has restricted their use to space applications such as for powering satellites.

Using a high concentration of sunlight means that only a small quantity of semiconductor material is needed, making a multi-junction concentrator system cost effective. The Concentrating Technologies (CT) micro dish module installed at the APS Solar Test & Research (STAR) facility in Tempe, AZ is equipped with Spectrolab's concentrator solar cells. This is the first demonstration of multi-junction cell technology in a grid-connected concentrator system.

In this system, CT has used reflective optics and distributed small multi-junction cells in a 56-element array. This innovative distributed approach allows for the cells to be passively cooled, a significant cost advantage over concentrator systems that require active cooling. A micro array of mirrors focuses the light on individual Power Conversion Units (PCUs). Each PCU has a secondary optical element to homogenize the light before it falls on the cells, and a heat sink attached to the back of the PCU radiates heat to the surrounding air. The output in this initial demonstration is about 1 kW; reliability data gathered from this system will allow for scale-up of the multi-junction cell concept to larger systems.