TECHNICAL ASSISTANCE REQUEST

The SolarSPOT collector will revolutionize and revitalize solar thermal, but only after research, testing, product development, and marketing. The national laboratories, private industry, and small business support organizations can all help with these efforts. The immediate need is for technical assistance in

fluidic diode design testing,
proof-of-concept testing,
prototype testing,
full system testing, and
field testing.

A New Mexico Small Business Assistance (NMSBA) project for the fluidic diode design testing is already underway with Sandia National Laboratories. The other four areas need would also benefit from technical assistance.

A fluidic diode is not an off-the-shelf item. It must be custom-made for each application.

PROOF-OF-CONCEPT TESTING

In the proof-of-concept testing, we will build (3D print) a vertical slice of the collector, and test it to ensure that the fluidic diode and the collector will function as required. The fluidic diodes on the back side of the collector slice will stop normal upward fluid flow, so that all upward fluid flow will be upward through the front/glazed side. This upward flowing fluid is being heated by the sun and pumped to a heat exchanger in a water storage tank. The requirement is that 1% or less of the flow go through the back side of the collector slice. When the pump is turned off, we expect natural circulation within the collector slice to commence. Flow continues upward through the front/blazed side, but now flows downward through the fluidic diode. The entire back side of the collector slice convects and radiates heat to the ambient air and nearby surfaces. Thus, while the front side is being heated by the sun, the back side is being cooled by heat transfer. The antifreeze density difference, corresponding to the temperature difference, between the front and back sides, drives the natural circulation, or thermosyhoning.

In the testing we will vary the forced circulation flow rate, the ambient air temperature, the angle of the collector slice and the solar insolation intensity. We will measure temperatures, pressures, and flow rates throughout the system. Should the collector slice not function as required, for example, natural circulation not adequate to keep the antifreeze from boiling, the first step would be to redesign the fluidic diode. That would involve a repeat of the

computational fluid dynamics (CFD) calculations. The redesigned fluidic diode would be inserted into the collector slice, and the tests repeated.

The national laboratories are very capable of creating the required testing environment, making the measurements, and performing the CFD calculations. They have all the instrumentation and data acquisition systems at the ready, while we have only basic capabilities. We have no capability to do CFD calculations. Further, on-sun testing conducted at Sandia National Laboratories, with its long history of solar research, would add significant credibility to the results and help with later marketing.

PROTOTYPE TESTING

In the prototype testing, we will build (3D print) an entire collector and put it through the same testing as above for the proof-of-concept testing. However, we will also examine the basic collector performance in terms of efficiency in anticipation of certification by the Solar Rating & Certification Corporation (SRCC). Again the national laboratories, especially Sandia National Laboratories, will be instrumental in the technical assistance in the testing and diagnostics they can provide.

FULL SYSTEM TESTING

In the full system testing, we will build an entire solar water heating system, including the collector, the forced circulation T-Clip™, the heat exchanger, the water storage tank, expansion tank, etc. We will be testing that the antifreeze in the system stays below boiling in all normal and off-normal situations. Again the national laboratories, especially Sandia National Laboratories, will be instrumental in the technical assistance in the testing and diagnostics they can provide.

FIELD TESTING

In the field testing, we will install a SolarSPOT solar water heating system in a new house, test the system in place, and monitor it for a year. The national laboratories and others can assist with this effort as well.

The national laboratories and others will be instrumental in the technical assistance contributions to the SolarSPOT solar thermal collector.