Concentrated Solar Power Generation Systems: The SAIC Dish
Concentrating Solar Dishes

Work has been underway at UNLV’s Center for Energy Research since 2001 in the use of concentrating solar dishes for electrical power generation.

One of these solar dishes was marketed by Science Applications International Corporation (SAIC). The dish powered a Stirling engine.

This project, originally funded by the U.S. Department of Energy, had several goals including:

- Train students in the theory and operation of dish systems,
- Improve reliability of these types of units, and
- Improve the design and operational characteristics of the system.

The original project ended in December 2002. However, two new but related projects were then pursued, both funded by the National Renewable Energy Laboratory.

The original configuration for this concentrated photovoltaic solar dish, having stretched membrane facets.
Concentrating Solar Dishes

With this type of solar dish, the sun is reflected off of an array of mirrors onto a target. The dish moves constantly throughout the day to track the sun, resulting in a very high intensity solar beam on the target. This beam can be used to power a photovoltaic cell array or a thermal system.

This unit develops about 25 kWe at maximum operational conditions, and the generated power is fed into the Nevada power grid. NV Energy cooperated with the project, and furnished the interconnection equipment.
SAIC Dish Modifications

SAIC’s solar dish recently has been refitted with fixed-focus mirrors.
SAIC Dish Modifications

Several modifications to the SAIC dish in 2003 included the replacement of the stretched membrane facets it originally had with a hexagonal fixed-facet design.
SAIC Dish Modifications

Another modification was that a photovoltaic (PV) receiver, shown at right mounted on a boom, replaced the original Stirling engine. This unit has an air-cooled radiator unit to draw heat from the PV receiver. A cell cooling unit under construction is shown below.
Testing

In one of the recently conducted tests, a small configuration of the PV cells of the receiver was surrounded by high-temperature insulation (left) was irradiated with the reflected beam. At right, a flux map of the sun on the receiver shows the various temperature zones.
In a joint project with Tianjin University in China, cells were mounted in a tube through which water flowed for cooling, then irradiated with the dish. It was found that the cell temperatures could be quite accurately controlled. Some degradation of cell performance occurred over time, which was assumed to be due to the mounting method.

**Key**

1. Glass tube assembly
2. Assembled unit with reflective shroud and insulation
3. Insulation
4. Bare tube
<table>
<thead>
<tr>
<th>Sponsors and Project Participants</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Applications International Corporation (SAIC)</td>
<td><a href="http://www.saic.com">www.saic.com</a></td>
</tr>
<tr>
<td>NV Energy</td>
<td><a href="http://www.nvenergy.com">www.nvenergy.com</a></td>
</tr>
<tr>
<td>U.S. Department of Energy</td>
<td><a href="http://www.doe.gov">www.doe.gov</a></td>
</tr>
</tbody>
</table>
Publications


▪ Yong Sun, Li Zhu, Yiping Wang, Robert F Boehm, Aaron M Sahm and Zhengjian Zhao. Performance of Liquid-Immersed Silicon Solar Cells under Highly Intensified Illumination. The International Conference on Concentrating Photovoltaic Systems CPV-7, 4-6 April, 2011, Las Vegas, USA

▪ Li Zhu, Robert F. Boehm. Water-Immersion Cooling of Photovoltaic Cells in High Fluxes. 14 April 2011, SPIE Newsroom. DOI: 10.1117/2.1201103.003564


For More Information

Center for Energy Research at UNLV
100 Taylor Hall
University of Las Vegas, Nevada
Box 454027
Las Vegas, NV 89154-4027
Phone: (702) 895-1125
Fax: (702) 895-1123

Director:
Robert F. Boehm, Ph.D., P.E.
Phone: (702) 895-4160
Email: bob.boehm@unlv.edu

Co-Directors:
Yahia Baghzouz, Ph.D., P.E.
Phone: (702) 895-0887
Email: yahia.baghzouz@unlv.edu
Yitung Chen, Ph.D.
Phone: (702) 895-1202
Email: yitung.chen@unlv.edu