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**Educational Initiative for EE/RE  
Engineering Skills  
Solar Two Student Interns**

**DRAFT FINAL REPORT**

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## **Acknowledgments**

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## Table of Contents

<b>Introduction .....</b>	<b>1</b>
<b>Student Participation and Results .....</b>	<b>2</b>
<b>Conclusions .....</b>	<b>3</b>

## Introduction

The U.S. Department of Energy, under Award No. DE-FG36-96GO10156, sponsored five student interns from the University of California, Riverside, College of Engineering to work during the summer of 1996 at the Solar Two energy facility in the Mojave Desert. Through the DOE intern program, engineering students supported the Solar Two Project under the supervision of engineers from Southern California Edison. The prime purpose was to provide outreach and educational support for expanding interactions with university students to increase awareness of careers in renewable energy and energy efficiency fields.

The College of Engineering-Center for Environmental Research and Technology (CE-CERT) coordinated this project. CE-CERT is primarily a research facility focusing on air pollution and energy efficiency. CE-CERT serves undergraduate and graduate students by employing them on research projects, supporting them in the research and experimentation required for Senior Design Projects, and sponsoring them in student engineering competitions. A student team from CE-CERT won first place in the Department of Energy Solar Thermal Challenge in 1994.

The students who participated in this internship opportunity were:

John L. Zeller

Gabe Phan

Shahriar Sheybani

Michael Smith

Cheng Xiong

After completing their internships, they provided CE-CERT with brief reports on their experience. These reports have been compiled for this Final Report.

## 1. Student Participation and Results

After receiving basic safety training, the student interns were assigned to a variety of tasks at the Solar Two facility. They worked under supervision of engineers from Southern California Edison and Sandia National Laboratory during their time at the facility.

The following describes the work they performed.

### Survey of Mirrors

The Solar Two facility uses more than 2,000 tracking mirrors, or heliostats, to reflect the sun's energy to a central receiver. Shahriar Sheybani and Gabe Phan were assigned to work with Sandia under Hugh Reilly to determine the reflectance of each of heliostat. The amount of dirt, rust, or corrosion on the heliostats, and the effect on reflectivity, was determined.

### Testing Design and Software

Working with Southern California Edison's Joe Simpson and Rocky Gilbert, student interns Mike Smith and Cheng Xiong created tests for the plant and wrote computer programs for implementing these tests.

John Zeller and Cheng Xiong were assigned to write a computer program on the highest temperature, gradient, and the time of day the gradient started for the receiver for each day in operation.

### Solar Receiver

John Zeller, working with Edison's Paul Sutherland, researched and drafted a report to the California Energy Commission on the Solar Two's receiver. He also worked on a report on a Radio Frequency report.

### Mirror Positioning

John Zeller worked with Rocky Gilbert of Edison to learn about the mechanics of the systems that control the positioning of the mirrors. The B string of was changed from "mark" to "stow" (or from standby, with mirrors perpendicular to the ground, to inactive, with the mirrors parallel to the ground). He was assigned to create a heliostat format worksheet.

Subsequently, John was assigned to help determine which heliostats had bad azimuth and elevation settings. He created an Excel spreadsheet for calculation of the distances and angles of the known correct elevation markers to the positioning units and the receiver tower. He assisted in surveying the field and making the calculations.

## **Troubleshooting**

Subsequent to the mirror positioning work, John Zeller was taught to troubleshoot and repair both mechanical and electrical problems in the positioning units. He was able to troubleshoot and replace circuitry parts and bad computer chips in positioning unit boxes, or completely remove entire boxes and replacing them. He learned how to use the lift to get up to the limit switches and encoders on top of the positioning units. Most of the problems were in the limit switches, and he was able to either adjust or replace them. Sometimes, intense heat would damage the computer chips in the encoders. He would either replace the chips or replace the encoder itself.

A communications problem developed between the coolant tower control room, the main control room, and the water flow system. The students participated in troubleshooting this problem, which was traced to a bad GDH module — the unit that controls computer communications.

## **2. Conclusions**

All of the students found the Solar Two work to be interesting and rewarding. One of the students (John Zeller) has since graduated with a bachelor's degree in Environmental Engineering and is pursuing opportunities in alternative energy.

The University appreciates the opportunity to have participated in this program and looks forward to working with the Department of Energy on similar projects in the future.