

## **Southwest Region Solar Experiment Station Support for Photovoltaics**

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The Southwest Region Solar Experiment Station (SWTDI) is an integral laboratory within the NCPV. SWTDI has supported the DOE PV Program and Sandia for the past 20 years addressing critical needs in the areas of PV system reliability, codes and standards, international development, system performance and characterization, as well as training and information outreach. In 2001, SWTDI completed work in all of these major areas with the common emphasis for safe, reliable PV systems, capable of attaining long lifetimes.

As the U.S. PV industry works to meet its goals for market growth by the year 2020, the need for public/private partnerships – both domestically and internationally - will continue to grow and SWTDI will continue to assist industry and DOE in meeting the challenge. SWTDI programs support activities include the

- Accurate characterization of fielded systems;
- Better trained installers and inspectors;
- Improved quality procurements and installations;
- Reliability database performance analyses;
- Promoting PV productive uses and markets;
- Assessing new PV applications; and,
- Leveraging existing development programs and multilateral bank support for PV deployment.

Among the successful programs supported by SWTDI have been training and technical support for the Navajo Tribal Utility Authority off-grid PV program; national and international code workshops; PV systems test and evaluations performed in National Parks, DOD installations, and support for USAID and international market development, especially in Latin America.

### **NATIVE AMERICAN SUPPORT**

SWTDI is providing multi-year support for Native American Tribes on behalf of Sandia. These efforts include support of the Navajo Tribal Utility Authority (NTUA) with 4 electrician and customer support training workshops, systems evaluations of over 20 residential systems, data acquisition (DAS) and evaluation, as well as assisting the NTUA with a

\$4.8M RUS/USDA PV award. SWTDI has also provided a DAS and public information kiosk to the Indian Pueblo Cultural Center in Albuquerque. SWTDI has assisted with systems tests and technical outreach to 4 tribes and Pueblos in New Mexico (Zuni, Torreon Navajo, Santa Ana Pueblo, Ramah Navajo). SWTDI maintains a database of PV systems installed on the Navajo Reservation. SWTDI is also using this information in a partnership with Sandia in the production of a new document, *The Solar Way*, an annotated compendium of PV systems used by American Indian Tribes.

### **FEDERAL AGENCY SUPPORT**

SWTDI works closely with the Sandia PV systems program in providing support to a variety of Federal agencies, including the National Park Service and U.S. Coast Guard. For instance, SWTDI has tested, monitored, and repaired numerous PV systems for the Park Service in Grand Canyon National Park, Joshua Tree National Park, Natural Bridges National Monument, Sleeping Bear Dunes National Lakeshore, Canyonlands National Park, and the Mojave National Preserve. SWTDI has also worked with the Department of Defense in new applications for PV powered systems.

### **INTERNATIONAL DEVELOPMENT**

The U.S. PV industry depends on international market sales, representing more than three-fourths of all U.S. PV sales. Although worldwide sales of PV modules have increased over 25 percent per year in recent years, U.S. world market share has dropped dramatically from 44 percent in 1996 to less than 20 percent in 2001, thus the U.S. industry must increase international market focus to remain viable.

With its largely bilingual staff, SWTDI has played a key role with Latin America PV dissemination since 1992 working. Besides numerous activities in Central and South America, a key focal point has been in Mexico with Sandia, which has led to the installation of over 500 PV pilot projects in 18 Mexican states. These efforts have resulted in new public/private partnerships that have led to improved system designs and installations, better maintenance

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practices and availability of spare parts; and increased consumer confidence. They have also led to new technology improvements with industry to meet local market needs, such as water purification, PV ice-making, and direct drive refrigeration with battery storage, as well as improved PV lighting systems for widespread rural electrification. SWTDI also maintains a reliability database of installed PV systems in Mexico. SWTDI has conducted PV training seminars for health and education provided to policymakers and engineers in Central America including the installation of the first PV powered secondary schools in Guatemala and Honduras.

An important SWTDI collaboration has been with a Mexican agricultural extension agency under the federal Secretariat of Agriculture (SAGARPA) called FIRCO (Fideicomiso de Riesgo Compartido), which has built partnerships with industry, academia, and other institutions in the development community to foster sustainable new markets for photovoltaic applications. Through the strengths of these partnerships, the Mexican government is now implementing a US\$31 million program for the world's first-ever Renewable Energy for Agriculture program with sponsorship from the Global Environment Facility (GEF) and World Bank.

### CODES AND STANDARDS

The development and implementation of codes and standards assist in achieving the desired goals of safe, reliable and durable PV systems with lifetimes approaching 25-30 years. These activities also serve to increase performance while reducing life cycle costs. The NCPV with NREL, Sandia, FSEC and SWTDI have been prime movers in the development of IEEE and UL standards and the National Electrical Code (NEC). These standards and codes provide road maps for PV equipment manufacturers and installers that allow them to design, build, and install PV systems that have the same levels of outstanding safety and performance achieved by other electrical power systems. In particular, a team of PV industry experts lead by Sandia and SWTDI have consistently made accepted improvements to Article 690 of the NEC over the last four three-year code cycles. SWTDI, with technical direction by Sandia, has published over 25 articles and papers on PV and the NEC, and has made code presentations to over 1,200 electrical inspectors, electrical contractors, and PV professionals over the last three years in the U.S., Mexico, and Central America. Technical assistance (telephone and e-mail) has been provided an average of 75 times per month to PV vendors, PV installers, electrical inspectors, and PV users. Numerous large

and small systems have been inspected for code compliance and suggestions made for correcting deficiencies.

### SUMMARY

SWTDI is dedicated to assisting the widespread dissemination of PV technologies domestically and globally. The U.S. must overcome several challenges to increase PV's contributions to the national economy, including

- Cost reductions for PV-generated power;
- Increase the efficiency of PV systems;
- Extend the lifetime of PV systems; and,
- Develop domestic markets and recapture global market share.

As PV system costs gradually decline, the range of system uses will expand from today's high-value consumer products and remote applications to eventually grid-connected building systems, grid-distribution support, utility peaking power, and bulk power applications.

Contributions by SWTDI to the NCPV have included 1) the improvement of PV modules as a result of testing, evaluation, performance characterization, durability research, and long-term exposure; 2) Improvement of batteries, charge controllers, and other system components by both destructive and non-destructive testing; 3) Improved engineering through testing, performance verification and field validation; 4) Creation of design tools, processes, and computer software; 5) International market development and new PV applications; 6) Development of procurement specifications; 7) Development of system acceptance test procedures; and, 8) Domestic and international training on design, installation, codes, operation, and troubleshooting.

SWTDI provides critically needed research, testing, evaluation, and engineering in support of the U.S. PV industry. SWTDI also promotes economic development by promoting U.S. PV manufacturing and local productive uses for PV. The SWTDI program is active internationally to help increase U.S. exports considering that over two billion people in the world do not have grid electricity representing large markets for PV. Finally, SWTDI typically employs a dozen students at any one time and thus provides a training ground for university students to serve in future leadership roles in the U.S. utility and PV industries. Many SWTDI alumni are now employed by the PV industry and utilities.