

Thrust Area 4: Solar (Low Cost PV Manufacturing)

Enhanced and Expanded PV Systems Testing Capabilities at FSEC

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Description: An important FSEC function is consumer protection from poorly designed and manufactured PV modules and systems. FSEC’s test capabilities were established over 10 years ago and were adequate at the time to test PV modules for certification. However, PV costs have fallen and competing electric utility rates have risen. In the last two years, these curves have crossed under some economic scenarios and incentive programs, and the demand for PV module testing and system certification has jumped. Thus, this task will provide for enhanced and expanded PV testing and certification capabilities. The task will also be done in close coordination with FSEC’s work with the U.S. Department of Energy’s PV program.

Budget: \$132,398.00

Universities: UCF/FSEC

External Collaborators: Sandia National Labs and US Department of Energy

Progress Summary

The objective of this project is to provide for enhanced and expanded PV testing and certification capabilities at the Florida Solar Energy Center. Using funding from the Consortium, this project has been used to either purchase or leverage the purchase of photovoltaic test equipment that will be used to expand the research and commercial testing capabilities at FSEC.

Commercial testing capabilities at FSEC have been improved with the equipment purchased under this project. Performance testing times have been reduced and PV modules using newer technologies can be evaluated accurately. Moisture intrusion is a common failure mode in these newer PV module technologies such as thin-film. PV manufacturers are particularly interested in testing new products at FSEC under the rigorous test conditions created by Florida’s hot and humid weather.

Research capabilities at FSEC have attracted significant outside funding for applied research. Work with Sandia National Labs has continued in the area of test and reliability of PV equipment. The research involves PV modules and all system components including inverters and balance of system parts. High quality module and weather data is critical to Sandia’s PV performance modeling.

FSEC has been recently been selected by the Department of Energy as the location for one of three Regional Test Centers for PV research and development. The FSEC/UCF capabilities and location were critical to the selection. This is a long-term project that involves building on the foundation and recent enhancement of the PV test capabilities that were made possible by this program.



Figure 1: PV module testing with flash simulator

2011 Annual Report

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A state of the art long-pulse simulator has been purchased that will decrease the turn-around time for commercial testing and will allow more accurate testing of newer thin-film and multi-junction modules. The new solar simulator was installed in the newly enclosed and remodeled PV test facility. The PV test facility improvements have nearly doubled the throughput capabilities.

The outdoor test area for PV module, inverter, and system testing at the FSEC site has also been expanded. Additional module I-V multi-tracers have been installed and have expanded the number of modules that can be tested concurrently. This allows short-term testing of commercial production modules to be conducted concurrently with the long-term testing of different modules for research without conflict or interruption.

Space has been allocated for expanding the fixed module exposure area to increase the available rack space for outdoor testing. This expansion has already been successful in attracting additional contract research for side-by-side module testing of small PV systems. An area is also designated for installation of a dual axis tracker to enhance the existing test capabilities.



Figure 2: PV multi-tracer

Project Description:

The demand for PV products is driven by three major forces: the recent “boom” in green energy awareness, the globalization of the solar industry with many previously uncertified overseas manufacturers and the rapid change in PV cell and module technologies. Thus, these reasons dictate the need for providing enhancement and expansion of FSEC’s PV testing and certification capabilities. The testing capacity will implement by the following plans:

- Enclose and outfit a permanent PV Module and Inverter Test Area

- Upgrade and expand test and analysis equipment and software that includes permanent outdoor test stations with I-V curve tracing equipment
- Purchase a long-pulse simulator for indoor PV testing
- Install and instrument a 3-axis tracking platform
- Construct additional fixed rack space for outdoor testing

In addition to these specific equipment improvements, FSEC intends to enhance the general testing infrastructure to include improved instrumentation, documentation and test procedures.

Testing Instrumentation

The instrumentation used for PV testing has been adequate for the previously pace of testing, and the emphasis on research testing. However, for the high-throughput commercial testing now needed, it will be necessary to completely rebuild the wiring and instrumentation setup, with a focus on organization, quick connect/disconnect ability and flexible configurations.

Reporting and Certification

With more automated test data gathering and processing resulting from the upgraded laboratory instrumentation and computational capabilities, PV Test Reports will be more expeditiously completed. In addition, the format of the test reports is to be improved for more accuracy, rapid preparation and ease of use.

Certification Application Documents

Along with reporting and certification tasks, FSEC will also improve the format and content of the Application Forms submitted by the clients. These improvements are geared to both simplify the client's tasks in preparing the Application, aid the client in better defining their products and improving the facilitation of the preparation of the resulting test report.

The instituting of the advancements summarized above will require approximately six months for implementation of the procedural and general infrastructure (non-capital) improvements. It is the Center's goal to aid the PV industry by responding as quickly as possible to the new and growing markets with the essential constraints of reliable and credible high quality testing and certification.

Deliverables:

Expanded Testing Facilities for PV modules and systems, with proven capabilities:

- Long-pulse solar simulator for new multi-junction cell designs
- One 3-axis tracking platforms for maximum exposure and aging testing
- Stationary I-V curve tracers, with flexible connection systems
- Doubling of fixed test rack space
- Improve certification process and minimize time requirements

Industry Support:

This task will be strongly supported by the PV manufacturers. Many such companies have already contracted with FSEC for testing in our uniquely hot, humid and lightning-prone environment. Further, the US DOE is expected to continue support FSEC's PV test program with contract work for accelerated aging, high voltage and generalized testing.