University of Central Florida

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 and certify 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.
Universities: UCF/FSEC

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.

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 newerthin-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.

Figure 1. Spire 4600 solar simulator

Figure 2. PV multi-tracer

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.

2010 Annual Report

Project Impact:

The U.S. PV industry has been growing at a rate of 52% per year (increasing from 271 Megawatts in 2007 to 412 Megawatts in 2008). In 2009, the industry growth was slowed by the global recession and reduced incentives. However, the predictions for future growth show solid increases for the next few years. The states with major PV markets are California, New Jersey, New York, Arizona and Texas. The present U.S. PV industry is primarily comprised of eight companies with manufacturing facilities in Arizona (2), California (2) and one each in, Michigan, Maryland, Massachusetts and New Mexico. (Florida has a better solar resource than any of these states except Arizona and has doubled the solar resource of the world's largest PV market – Germany).

Yet, in spite of the vast potential, photovoltaic generators currently provides only about one-millionth of the world's total electricity supply. The huge gap between our present use of PV and its enormous undeveloped potential presents a grand challenge in energy research. As Edison suggested in 1931, sunlight is a compelling solution to our need for clean, abundant sources of energy. It is readily available, secure from geopolitical tension, and its use poses no threat to the environment or climate through pollution or emission of greenhouse gases.

Solar PV creates more jobs per MW of capacity than any other energy technology. Since PV has no fuel cost, instead of sending money out of state to buy fossil fuel for power plants, a PV solar initiative will create high-quality jobs and a more robust state economy. Estimates have shown that a 4 GW solar program would generate approximately 54,000 direct job-years in Florida in 12 years.

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.