UCF | FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

HIGHLIGHTS

As Florida's statewide energy research center, FSEC has a 45-year history of basic and applied research excellence, which has grown in scope to include all aspects of renewable energy, energy storage, electric vehicles, and energy efficiency technologies. FSEC's education and outreach programs have trained thousands of energy practitioners and informed energy consumers.

The University of Central Florida's FSEC Energy Research Center in Cocoa has 45 years of excellence in energy research.

SOLAR RESEARCH

FSEC's solar energy research, testing and demonstration programs validate the performance of small- to large-scale photovoltaic (PV) systems; identify cell-level manufacturing improvements; and, issue code-compliant PV system certifications for solar installers. These programs provide quality control and assurance that PV technologies perform reliably in the field.

FSEC conducts small and large-scale performance testing of photovoltaic systems.

PV systems floating on water bodies (Floatovoltaics) are the latest innovation in PV system deployment. FSEC was selected by the U.S. Department of Energy to lead a team that will monitor the performance of floating solar systems around the nation and compare them to their land-based counterparts. Of particular interest is their impact on the water ecosystem and validation of the theory that the cooling effects of the water body improve PV system performance.

FSEC is leading a nationwide research project on floating solar systems like this one located in Orlando. Photo: Orlando Utilities Commission

BUILDINGS RESEARCH

FSEC's building research is extensive. FSEC regularly receives contracts from federal and state agencies to research the effectiveness of building codes and methods for improving the codes. FSEC staff has tested many innovative HVAC systems that focus on high efficiency, greater moisture removal, or reducing duct system heat gains and losses. FSEC has also studied the poor reliability of whole-house residential ventilation systems to operate as designed, while also conducting many lab and field measurements as to the effectiveness of various residential whole-house ventilation strategies so as to improve indoor air quality.

FSEC specializes in all aspects of building science, including indoor air quality. Mechanical ventilation testing is shown here.

FSEC conducts research in the laboratory and with innovative builders to determine reliable, cost-effective measures for incorporating in today's energy efficient homes. The FSEC-led Building America Partnership for Improved Residential Construction is the nation's leading university/industrial-based Building America partnership. FSEC works with developers, builders, Habitat affiliates, suppliers, and utility research partners throughout the United States to foster adoption of systems engineering principles leading to enhanced energy efficiency in new and existing housing, and in enhancement to local and national building energy codes and standards.

FSEC researches a variety of energy system improvements to homes in a hot-humid climate using, two onsite, heavily-instrumented and identical side-by-side homes with simulated occupancy.

FSEC created the nation's first Zero Energy Home in Lakeland Florida in 1998. Today, major builders are building Zero Energy Home's throughout the U.S. in models from starter homes to luxury homes.

FSEC is working with utilities, municipalities and developers to examine the resiliency of key buildings under different climate or utility interruption scenarios. Work includes solar-generated hydrogen storage, batteries, vehicle to grid-technology and natural gas combined heat and power.

FSEC has been developing and testing innovative water heating technologies for more than 40 years—from electric and natural gas systems to solar thermal, and now solar PV systems. Our patented PV-assisted heat pump technology has been shown to be 90% more efficient than standard water heaters under stringent laboratory test conditions that simulate residential hot water draw patterns.

FSEC's Hot Water Systems Lab is used to evaluate a variety of hot water systems simultaneously and side-by-side to compare energy performance and time of day electric loads.

FSEC has extensive expertise in user-specific development and enhancement of third-party models such as the U.S. Department of Energy's flagship building simulation tool, EnergyPlus. FSEC has been helping with the development and enhancement of EnergyPlus for two decades through winning competitive contracts with the Energy Department. The program is used for analyzing building energy performance across the globe.

TRANSPORTATION

The Electric Vehicle Transportation Center at FSEC is researching and developing the transportation infrastructure to accommodate the influx of electric vehicles and their power demands. FSEC supports the Central Florida Clean Cities Coalition and Drive Electric Florida, collaborative working groups of industry professionals, utility representatives, manufacturers and national labs and agencies for the purpose of accelerating alternative fuel vehicle acceptance and adoption.

TECHNOLOGY TRANSFER

FSEC has 117 patents, 38 of which are licensed. The Gossamer Wind ceiling fan is UCF's largest royalty generator (greater than $2M), developed out of FSEC's building energy research. This fan is the basis of the ENERGY STAR® ceiling fan program, and it is sold at The Home Depot stores. More than 2 million fans have been sold with each saving over $20 on electricity leading to more than $40 million in energy savings per year for its customers.

UCF's most productive patent—the Gossamer Wind ceiling fan—was developed at FSEC and is sold at The Home Depot stores.

A hydrogen detection safety tape, which was developed in partnership with NASA KSC and licensed by UCF start-up HySense Technology, was internationally recognized by the R&D 100 Awards program as one of the most technologically significant products to enter the marketplace in 2013. It is UCF's first R&D 100 Award winner.

A hydrogen detection safety tape developed at FSEC, in partnership with NASA, provides a visual indication when hydrogen (odorless and colorless) is leaking.

FSEC's technology transfer efforts include curriculum development and training for the energy workforce, including solar installers and developers; energy rating and weatherization technicians; home builders, designers, and allied trades; code officials; and, related practitioners. The classroom and laboratory-based short courses have trained thousands of workers in the energy industry over the years and provide the basis for certification and licensing by public and private organizations.

Laboratory-based instruction is a vital component of FSEC's training.

FSEC maintains national RESNET accreditations as Home Energy Rating System (HERS) Training Provider, HERS Quality Assurance Provider and HERS Software Tool Provider. FSEC has trained and certified more than 1300 Home Energy Raters who have conducted more than 90,000 Home Energy Ratings in Florida and across the nation. FSEC's EnergyGauge® building energy simulation and analysis software suite for both energy code compliance and HERS energy ratings is widely used across Florida and in many other areas of the country.

FSEC developed and maintains the SunSmart E-Shelter program that installed over 100 Solar+Storage systems throughout the state on schools that serve as emergency shelters. FSEC's *Solar Matters* curriculum allows teachers to include renewable energy in K-12 students' STEM learning experiences. Supported by Florida's electric utilities and state office of energy, hands-on activities are facilitated with the distribution of specially designed energy education kits for each grade level.

The SunSmart E-Shelter Schools Program installed more than 100 solar systems at emergency shelter schools throughout Florida and included a renewable energy curriculum with hands-on STEM learning experiences.

EnergyWhiz is FSEC's statewide forum for students to demonstrate their science, technology, engineering, art and mathematics skills (STEAM) capabilities through project-based, energy-focused learning. Held each Spring, hundreds of students across Florida converge at FSEC to participate in renewable energy themed events. Professional development workshops for teachers are held throughout the year to enable them to serve as coaches and mentors for EnergyWhiz participants.

Each spring, nearly 1000 students, teachers and parents—from Florida's Panhandle to the Keys—converge at FSEC to watch students show off their solar cars, cookers and inventions at EnergyWhiz.

FOR MORE INFORMATION

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