

KEY FESC RESEARCH

Enhancing Energy Efficiency and Conservation

Zero Energy Homes

Developing Florida's Biomass Resources

Liquid Fuels from Biomass

Harnessing Florida's Solar Resources

Solar Thermal Power

Rectifying Antenna Solar Power

Clean Water using Advanced Solar Energy Detoxification

Ensuring Nuclear Energy and Carbon Constrained Technologies for Electric Power in Florida

Exploiting Florida's Ocean and Wind Energy Resources

Securing our Energy Storage and Delivery Infrastructure

Power Generation Expansion

Establishing PV Industry in Florida

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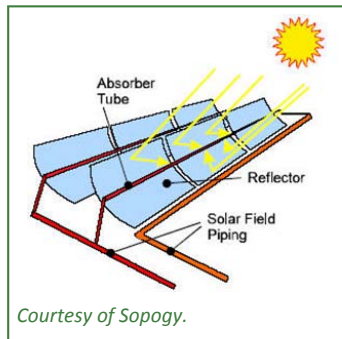
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Concentrated Sunshine

A green light is shining on the Clean Energy Research Center's (CERC) mission to build a concen-



Courtesy of Sopogy.

trating solar power (CSP) plant on the USF Tampa campus adjacent to the Research Park. FESC PI and CERC co-director, Yogi Goswami's aim is making solar energy available 24 hours a day at affordable prices.

CSP is used to focus the sun's rays generating heat and electricity. When combined with heat storage CSP plants can then produce climate-friendly electricity around the clock, even when the sun is not shining.

A vital area of the CSP research is developing

and demonstrating a thermal energy storage (TES) system based on materials that absorb heat when changing from a solid to a liquid and release heat when changing from a liquid to a solid. The objective is to create a TES system based on encapsulated phase change materials to meet the utility-scale base-load CSP plant requirements at much lower system costs

Phase change material pellets developed by Goswami's research team.



compared to existing TES concepts.

TES will be a game changer for the entire energy industry. Hoping to put together storage that will be up to 5 times cheaper than what is available right now, CERC's re-

search will bring solar power to grid parity, which means it will cost the same as traditional fossil fuels -- when that happens solar power will be the preferred fuel as it doesn't cause environmental problems.

Such a power plant has sparked a great deal of interest by industry as well as academia. John Ramil, President and CEO of TECO energy, feels the facility will provide wonderful teaching and research benefits.

With multiple funding sources, the stage is now set for Goswami's CSP research to blossom. At the forefront of the field, this research will impact the future of solar energy.



FESC Universities



The Florida State University System provides the backbone of renewable energy expertise for the Florida Energy Systems Consortium. Member universities include:

- University of Florida
- Florida State University
- Florida Atlantic University
- University of Central Florida
- University of South Florida
- University of West Florida
- University of North Florida
- New College of Florida
- Florida International University
- Florida Gulf Coast University



"We need to get behind innovation.

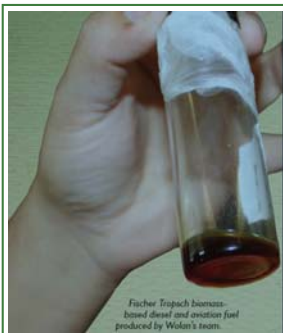
That's how we'll meet the goal I set ... making sure 80 percent of America's electricity comes from clean energy sources by 2035."

US President Barack Obama

Thermo-chemical Conversion

Florida produces more biomass than any other state in the U.S. Given our dependence on imported oil, developing methods to convert this resource to fuels is vital. FESC is pursuing microbial and gasification routes to produce this carbon-neutral fuel. Of the 13 FESC projects in this area, USF's progress into thermo-chemical conversion is producing exciting results.

In fact, "Production of Liquid Fuels Biomass via Thermo-Chemical Conversion Processes" earned an Honorable Mention at the Global Venture Challenge in 2010. The competition is sponsored by the U.S. Dept. of Energy and leading technology and venture capital organizations. The USF research team includes: PI Babu Joseph; Co-PI's Yogi Goswami, Venkat Bhethanabotla, John Wolan, Vinay Gupta.



Fischer-Tropsch biomass-derived diesel and aviation fuel produced by Wolan's team.

The objective is to develop technology for the economical thermo-chemical conversion of lignocellulosic

biomass (such as agricultural waste, bagasse from sugar mills, citrus peels, switch grass, municipal green waste) to clean burning liquid fuels.

The thermo-chemical conversion of lignocellulosic biomass to clean burning liquid fuels requires an efficient catalyst. Joseph's team performed catalyst design by using density functional theory simulations in the molecular scale.

The testing moved up to bench scale, producing a liquid product with a yield in the diesel and jet fuel range. The fuel produced using this process is similar to those derived from petroleum unlike ethanol-derived fuels which have at least a 25% lower energy content. This is accomplished via fast chemical reactions unlike the slow biological reactions for fermenting alcohol, and the process does not require large amounts of water.



The thermo-chemical fuel project uses an ultra-high vacuum analytical tool which identifies the chemical species on the catalyst.

USF FESC RESEARCH

Campus Solar Park

A pilot solar thermal power plant and a zero energy home which will demonstrate and teach students new research in renewable energies and RE technologies will soon find a home at a newly developing Solar Park to be located off of Alumni Drive. This is an exciting arena for the USF, which is fast becoming a solar energy mecca for the Tampa Bay.

The innovative pilot solar thermal power plant will generate 100 KW of electricity from renewable/sustainable energy. This electricity will be used for USF's needs and will be fed into the

utility's electricity grid. The power plant utilizes the ground breaking science of concentrated solar power and high temperature thermal energy storage capsules. (See related story, "Concentrated Sunshine," pg. 1).

A zero energy building ("Zero Energy Learning Center") will also be built on the Solar Park site. This "Flex House" will be built by "Team Florida," made up of architecture students from the Univ. So. Florida, Florida State Univ., Univ. Central Florida, and Univ. of Florida, is entered into the National Solar Decathlon competition in Washington, DC scheduled for September. After the competition it will be brought back to the USF campus. "Zero Energy" does not

mean that no energy is used — it produces the same amount of energy that it uses. The energy produced is from RE; when it produces more energy than is needed that energy will be fed directly into the utility grid; and those times it produces less energy than it requires, energy will be drawn from battery storage devices or from the grid.



Park site between Alumni Dr. and Spectrum Blvd.

USF FESC RESEARCH

Flex House

USF is leading the Zero Energy Home Learning Center (ZEHL) project in collaboration with FSU and the Florida Solar Energy Center, construction and interior design experts from UF, and industry partner Palm Harbor Homes. The project is in the design and development phase. Prof. Stan Russell and his team have developed a hybrid envelope that can be opened during the cooler/dryer months of the year and closed when temperature and humidity

levels are too high to achieve an acceptable comfort range in the house. Informed by FSEC studies that have shown that the majority of heat gain comes through the roof of Florida homes, the ZEHL employs a shading device that covers the entire roof and the east and west walls to reduce heat



A conceptual model of Team Florida's Flex House.

gain by eliminating direct solar radiation through the building envelope.

The building will use PV solar electricity and solar domestic hot water heating systems using the grid as an energy storage system, producing more energy than needed during the day and relying on the grid at night. Plug-in hybrid automobile technology offers a promising means of providing distributed energy storage for such homes but has not been sufficiently tested. Using a systems approach to couple zero energy home technology with PHEVs, Russell's team will explore opportunities to develop marketable products that meet Florida's energy and environmental goals.

See <http://www.flex.house.org>

Visitors

Investors from Sybac Solar, exploring clean energy as avenues for possible manufacturing operations in the Tampa area, visited CERC during the Summer. The tour was arranged by the Tampa Hillsborough Economic Development Corporation. Sybac Solar is a leader in the design and installation of high performance solar PV systems. Sybac Solar is the US subsidiary of Sybac Germany, one of the largest solar integrators in Germany.



Dr. Don Morel (R) explains his innovative PV research to Artur Madej and Markus Franz of Sybac Solar.

Student Winner

During the USF's Interdisciplinary celebration week "Research One" in October, FESC-sponsored undergraduate Lucky Landrigan won First Place for his poster "Exploiting Metal-support Interaction to Optimize Dispersion and Reducibility of a Highly Active and Selective Fischer-Tropsch Synthesis Catalyst." Landrigan was awarded a \$500 travel grant. The annual event highlights the projects of faculty, students, scientists and scholars. His advisor is Dr. John Wolan.





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The USF FESC management team is led by CERC's Prof. Yogi Goswami as Director. Ms. Barbara Graham coordinates communications and publications. For more information: <http://cerc.eng.usf.edu>

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Energy Summit: Efficiency

More than 260 people attended the second annual FESC Summit, held September 28-29, 2010 at the University of Central Florida's Student Union. Participants represented a broad cross-section of energy interests, ranging from government and industry to research, development, and education.

The Summit is organized yearly to bring together energy experts in the State University System of Florida to share their energy-related research findings and to promote future collaboration.

The keynote address, entitled "Energy Efficiency and Renewable Energy: the 2020 Vision," was presented by Mr. John Lushetsky, Manager of the U.S. Department of Ener-

gy's Solar Energy Technology Program (SETP) with responsibility for all solar technology development, grid integration, and market transformation activities under the Solar America Initiative announced by President Bush in 2006.

The Summit's second day began with more technical sessions, then moved to a panel discussion, "Florida's Energy Needs and Opportunities." Serving as panelists were Sen. Mike Haridopolos, Rep. Steve Precourt, and James Murley, Chair of the Florida Energy and Climate Commission.

The complete program can be accessed at the FESC Website: <http://www.floridaenergy.ufl.edu/wp-content/uploads/>

Faculty Honors, Awards, Activities

Global Venture: Dr. John Wolan, grad student Syed Ali Gardezi and Jaideep Rajput of the USF Patents and Licensing, earned an Honorable Mention for their biomass fuel reactor which converts common organic materials into fuel, at the Global Venture Challenge 2010.

Excellence in Design Awards: Dr. Stanley Russell garnered an Honor's Award for excellence in architectural design for the Zero Energy House Learning Center, during the 2010 Design Awards ceremony of the American Institute of Architects, Tampa Bay Chapter in August.

Presented: Dr. Bob Weisberg of USF-St. Petersburg gave an invited presentation on "Alternative Power Generation for Florida by Mechanical and Solar Means" at the Florida Atlantic University Alternative Energy Conference in November.

Presented: Drs. Sarina Ergas, Yu Zhang, James Milhelcic, and John Wolan gave a presentation on the integration of algal biofuel production into recirculating aquaculture systems at the Water Environment Federation Nutrient Recovery and Management Conference in Miami in January.

Mentioned: Dr. Matthias Batzill's work on advancing graphene electronics was reported in *Nature Nanotechnology*. Graphene appears to be the material that will overcome the fundamental physical limitations of silicon.

Round Table Discussions



Solar PV:
Thermal
Group –

Prof. Yogi
Goswami (R)



Biomass
Group –

Prof.'s Babu
Joseph and
John Wolan
(Center)



Carbon
Capture
Group –

Prof. Mark
Stewart
(Center)