



Florida Energy Systems Consortium

September 2013 Issue

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## September 2013 Issue

FESC Highlights

Florida Energy News

Funding Opportunities

U.S. Energy News

World Energy News



The University of Central Florida (UCF) has signed a license agreement with an award-winning student-led spin-out company that is looking to expand the market for its spray-on battery coatings. Mesdi Systems specializes in the production and implementation of advanced spray equipment used to manufacture nano-materials and ultra-thin coatings. Click the image to read more.

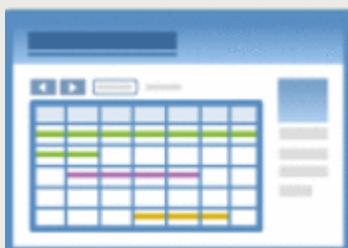
### Upcoming Events

**Oct 14-15** FESC and Florida Energy Summit Orlando, FL at the Rosen Shingle Creek.

**Oct 16-17** FAU's 2nd Annual Sea Level Rise Summit Fort Lauderdale, FL.

**Nov 12-14** Renewable Energy World Conference & Expo North America Orlando, FL.

**Mar 6-7** iiSBE Net Zero Built Environment 2014 Symposium Gainesville, FL.



## Marine Lab Research Vessel Returns from Voyage with Rare Catch

A Florida State University research ship has returned from its first extended voyage, collecting more than 400 fishes in the north-eastern portion of the Gulf of Mexico in an effort to study the effects of the Deepwater Horizon oil spill on marine life.

The highlight of the RV *Apalachee's* trip was the first documented Gulf catch of a Greenland shark, a cold-water shark typically found in Arctic waters.

"No one has ever caught one in the Gulf of Mexico," said Dean Grubbs, RV *Apalachee* chief scientist and associate director of

*Marine Lab Research continued on [page 2](#)*

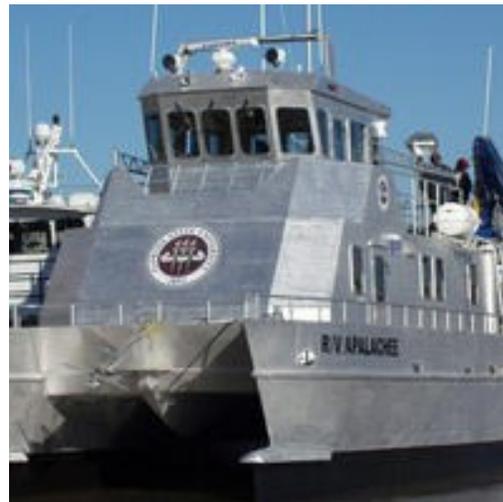
*Marine Lab Research continued from [page 1](#)*

Florida State University Coastal & Marine Laboratory research.

After a choppy start through rough water that left a few crew members seasick, Florida State's cutting-edge research vessel proved to be a stable platform during the seven-day expedition, Grubbs said.

"The ship performed great," he said of the nearly 65-foot-long vessel that hosted Grubbs, Florida State research professor Chip Cotton and graduate student Johanna Imhoff, University of North Florida graduate students Arianne Leary and Amanda Brown, volunteer Allison Ferreira, captain Rosanne Weglinski and assistant captain Hugh Williams.

Their mission was to study deep sea marine communities and examine these animals for exposure to toxins. Tissues and other samples were collected to determine if these animals are metabolizing toxins to which they may have been exposed as a result of exposure to oil and other pollutants during the 2010 oil spill.



**The RV Apalachee.**

This is part of a larger study being conducted by the Deep-C Consortium, led by Florida State University and funded by the Gulf of Mexico Research Initiative, to understand the impact of the oil spill on the Gulf of Mexico ecosystem.

Grubbs and his crew logged more than 1,750 miles and caught 31 species of bony fish and 13 species of shark. The bony fishes ranged from the 3-inch-long snail fish to the 8-foot-long snake eel and sharks ranged from 12-inch catsharks to the 12-foot-long Greenland shark.

More than 20 measurements and samples were taken from each animal. The samples will be used in a variety of studies of taxonomic relationships, reproductive systems, life-history patterns, food webs and diets, mercury bioaccumulation and toxicology.

The Greenland shark is a member of the Family Somniosidae, the sleeper sharks, typically found in Arctic waters. Though these sharks do travel south, no one knows how far, Grubbs said. Due to the warmer surface water temperatures in southern regions, Greenland sharks are found at great depths here, where water temperatures are close to Arctic temperatures.

This sleeper shark was captured on a baited longline nearly 6,000 feet deep and only 15 miles from the site of the Deepwater Horizon blowout. The water temperature there was 4.12 degrees Celsius, or 39.4 degrees Fahrenheit, comparable to temperatures that Greenland sharks are used to in shallow waters in Canada, Grubbs said.

Genetic samples of the 12-foot-long juvenile female shark have been sent to colleagues at the University of Windsor in Canada, who are studying the global population structure of Greenland sharks, for genetic verification.

Grubbs and the researchers also collected samples of bile from the gall bladder, liver tissue and blood to examine potential exposure to toxins associated with the oil spill.

Grubbs noted that although his team pulled off the first documented capture of a Greenland shark in the Gulf of

*Solar Cells Continued on [page 3](#)*

*Marine Lab Research continued from [page 2](#)*

Mexico, video footage from 2001 indicated the presence of an unconfirmed species of sleeper shark in the Gulf. A remotely operated vehicle inspecting oil and gas prospecting structures recorded a large shark believed to be a Greenland shark off the Texas coast.

## **FAU's Southeast National Marine Renewable Energy Center Celebrates Key Milestone to Establish the World's First Offshore Test Site to Capture Ocean Current Energy**

BOCA RATON, Fla. (August 12, 2013) – Florida Atlantic University’s Southeast National Marine Renewable Energy Center (SNMREC) has been notified by the U.S. Department of Interior’s Bureau of Ocean Energy Management (BOEM) that a final Environmental Assessment (EA) with a finding of no significant impact (FONSI) has been published to the Federal Register for SNMREC’s proposed offshore ocean current turbine testing facility. The next step is to negotiate a five-year lease to conduct testing activities on the U.S. Outer Continental Shelf.

With close to \$20 million in funding from the U.S. Department of Energy, the state of Florida and private companies, researchers at FAU’s SNMREC have been working since 2007 to establish the world’s first offshore ocean current turbine test site.

“Environmental, socio-economic and technical factors have all been addressed during the planning process,” said Susan Skemp, SNMREC executive director. “It has been a fulfilling experience to engage a diverse group of disciplines and agencies to help prepare the first environmental assessment of ocean current energy generation.”

The project involves the installation of multiple anchored floating “test berths” to evaluate ocean current turbine designs. Each test berth will consist of a buoy anchored to the sea floor 13 miles (22 km) off Fort Lauderdale, to measure ocean conditions and allow ocean current turbine prototypes to be deployed from vessels moored in the Gulf Stream. The first technology to be tested will be a research turbine designed and built at FAU that will collect unprecedented drive-train performance and reliability data valuable to commercial developers and regulatory agencies alike.

“This initiative demonstrates the multidisciplinary nature of marine renewables research and FAU’s international leadership in the field,” said FAU Acting President Dennis Crudele. “The partners that SNMREC has brought together are looking forward to taking part in the groundbreaking research opportunities enabled by this important regulatory step.”

The SNMREC will perform additional benthic surveys and a final sea trial of the buoy before installing the first test berth in early 2014. FAU’s research turbine is scheduled to be deployed in the Gulf Stream for the first time in mid-2014 after a series of towed tests.

The revised EA and FONSI, as well as FAU SNMREC's lease request can be accessed on BOEM's website by clicking [here](#) . For more information, contact Susan Skemp at 561-297-2339 or [sskemp@fau.edu](mailto:sskemp@fau.edu).

## New Research Group Sees Bright Future in Solar Energy

Florida State University has recruited three leading energy-focused researchers to push innovation in solar cell-related technology while helping to build on the university's recent designation as a pre-eminent university.

Hired as part of a new strategic faculty hiring initiative in energy and materials, the three researchers left their posts at other prestigious universities and laboratories to pursue their scholarly efforts in FSU's collaborative, STEM-focused environment. Their research interests center on specialized materials used for energy production, conversion, storage and utilization.

"Achieving our goals as a major research institution is about investing in the right people and giving them the supportive environments they need to make the next big breakthrough," said FSU Provost and Executive Vice President for Academic Affairs Garnett S. Stokes. "Each of these individuals brings with them tremendous expertise in the materials and energy areas, and we look forward to what they will be able to accomplish in the years ahead."



The new researchers are:

**Hanwei Gao**, assistant professor in the Department of Physics: A former postdoctoral research fellow at the University of California, Berkeley, Gao will be studying the interactions between light and solid-state materials, as well as the behaviors of electrons and photons at the atomic and molecular levels of materials.

"Development of renewable energy sources, such as solar panels that harvest energy from the sun, is undoubtedly crucial toward a sustainable environment on Earth," Gao said. "I'm focused on understanding how light interacts with certain materials and how electrons migrate across those materials so that we can improve the performance of solar cells to a point where they supplement, and even replace many existing non-renewable energy sources."

**Kenneth Hanson**, assistant professor in the Department of Chemistry & Biochemistry: A former postdoctoral associate at the University of North Carolina at Chapel Hill, Hanson's primary research focus is making new molecules and testing their behavior in solar cells. By manipulating the dyes and structures in these solar cells he will be able to find out how to make them more efficient, eventually leading to devices that will generate more electricity given the same amount of sunlight.

"I envision my research contributing to the development of efficient, inexpensive solar cells that are seamlessly incorporated into our day-to-day lives," Hanson said. "Also, the information we gain about the interaction between light and molecules could inform a range of technologies not necessarily related to energy, ranging from photodynamic therapy (using light to treat diseases) to making thinner TV screens."

**Biwu Ma**, associate professor in the Department of Chemical and Biomedical Engineering: A former staff scientist and principal investigator at the Lawrence

*Bright Future continued on [page 5](#)*

*Bright Future continued from [page 4](#)* Berkeley National Laboratory, Ma will be developing new types of functional materials with a particular focus on materials that can improve solar energy conversion devices, energy storage devices, light emitting devices, transistors and sensors.

"The purpose of my research is to study the underlying chemical and physical properties of new materials so I can better understand how they obtain their unique properties and what affects their performance in certain devices," Ma said. "Increasing our understanding of these materials will help us design newer, better and more efficient materials for a wide range of technological areas."

As part of the interdisciplinary nature of the Energy and Materials initiative, the new researchers will combine their different areas of expertise to approach the overall research effort in unique ways, thereby increasing the likelihood of scientific breakthroughs. The researchers will also be leveraging existing strengths in academic departments in the College of Arts and Sciences and the College of Engineering, and interdisciplinary entities such as the Aero-Propulsion, Mechatronics and Energy Center, Center for Advanced Power Systems, High Performance Materials Institute, National High Magnetic Field Laboratory and FSU's association as a core partner university with Oak Ridge National Laboratory.

FSU selected these leading researchers from a pool of more than 400 applications and nominations from around the globe and plans to recruit additional researchers for the initiative over the course of the 2013-14 and 2014-15 academic years.

The researchers could also play a major role in the development, organization and success of new energy-focused, FSU-based spinoff companies, current examples of which include Bing Energy and General Capacitor.

"From grants and contracts that feed local and state economies, to licensing revenue from breakthroughs and inventions, university researchers are a significant economic driver for our nation," said FSU Vice President for Research Gary K. Ostrander. "Of course, it takes talent and passion to properly fuel this economic driver, and I'm confident these new additions to the FSU research family will bring those attributes in abundance as they work to improve solar cell technology and its application throughout the world."

## **UF/IFAS Study Finds Algal Cells Create Fat more Quickly than Thought, could Aid Biofuel Research**

GAINESVILLE, Fla. — Many scientists see great promise in algae as a new source of oil — a sustainable, environmentally sound way to break the world's fossil fuel dependence.

Algal lipids from microalgae are one of the best sources for biofuels — algae grow quickly, tolerate extreme weather conditions, and do not pose the same issues as biofuel crops that are grown both for fuel and food.

*Algal Cells continued on [page 6](#)*

Many research teams in academia and private industry are struggling, however, with one vexing problem with algae as a fuel source: The conditions that promote algal growth aren't the same as the conditions that allow the algae to create the maximum amount of oil.

In short: If algae are deprived of nitrogen, the cells become stressed and begin to produce lipids, but their growth rate slows. And if alga is ever to become a commercially viable fuel source, scientists must ensure that not only can it produce as many lipids as possible, but also that it can grow at the fastest rate possible.

Bala Rathinasabapathi, a professor in the University of Florida's horticultural sciences department, and graduate research assistant Elton Goncalves decided to look into how nitrogen starvation stress induces lipid accumulation in green algae, also called chlorella.

Their findings, described online this month in the journal *Planta*, show that lipid accumulation in algal cells begins just hours after they are starved of nitrogen – not days, as scientists previously believed.

They also found that about 30 percent of lipids produced under nitrogen stress occurred as the membrane began to degrade inside each cell, the cell recycling the membrane lipids to oil.

"Our hope is that what we have done will be helpful to understand what's going on in cells under nitrogen starvation and might help us to tweak the technique where we can use the cells to make lipids but not necessarily stop growth – that's our long-term goal," Rathinasabapathi said.

The next step for the researchers is to begin looking at genes and proteins involved during the cellular-stress stage, he said.

"We're working to understand that genetic network, which is important for turning on lipid accumulation," he said. "That's our next goal."

The study was not grant-funded, but Goncalves' work was supported by the Plant Molecular and Cellular Biology program, part of UF's College of Agricultural and Life Sciences. The college is part of UF's Institute of Food and Agricultural Sciences.

## **Shorter, Faster, Stronger: Advancing U.S. Strength in Lasers**

The UCF researcher whose team developed the world's shortest laser pulse last summer has received a \$6.9 million grant from the U.S. Defense Advanced Research Projects Agency to make those pulses 1000 times stronger.

Professor Zenghu Chang, from the Department of Physics and the College of Optics and Photonics, is leading a team comprised of researchers from the University of Ottawa, (Professor Paul Corkum) and the University of California, Berkeley, (Professors Steve Leone and Dan Neumark) to help the federal agency better understand the interaction of electrons in solids and, ultimately, create ultrafast sensors and detectors.

Chang said the funding builds from the 67-attosecond pulse of extreme ultraviolet laser light that his team at UCF generated last summer. That find gives scientists a new tool to view quantum mechanics in action – comparable to timing a flash on a camera to see some of the fastest electronic processes on Earth.

DARPA PULSE (Program in Ultrafast Laser Science and Engineering) is interested in going a step farther –

investigating whether attosecond pulses of laser light can be applied to something like building electronic devices with ultimate speed.

“There have been a lot of new discoveries made in attosecond lasers in the last 12 years,” Chang said. “Now an opportunity has arrived to do something that has previously only been done in principle.”

Attosecond laser pulses can help scientists understand how energy can be harnessed to transport data or build stronger and more conductive materials. However, the intensity of the previous attosecond light was too low for many applications.

Consequently, a strong femtosecond laser has to work together with an attosecond pulse in experiments. The new attosecond light source to be built will be strong enough to both excite

and probe electron dynamics, which is considered to be the Holy Grail of attosecond science.

The first stage of the project will focus in building a new femtosecond laser capable of producing higher energy, pulses to drive the process of attosecond pulse generation. The laser will be housed in a 2400 square-foot space comparable to four standard labs in UCF’s Physical Science building and still, the laser beam will have to be “folded” multiple times to achieve the power the DARPA project is seeking, Chang said.

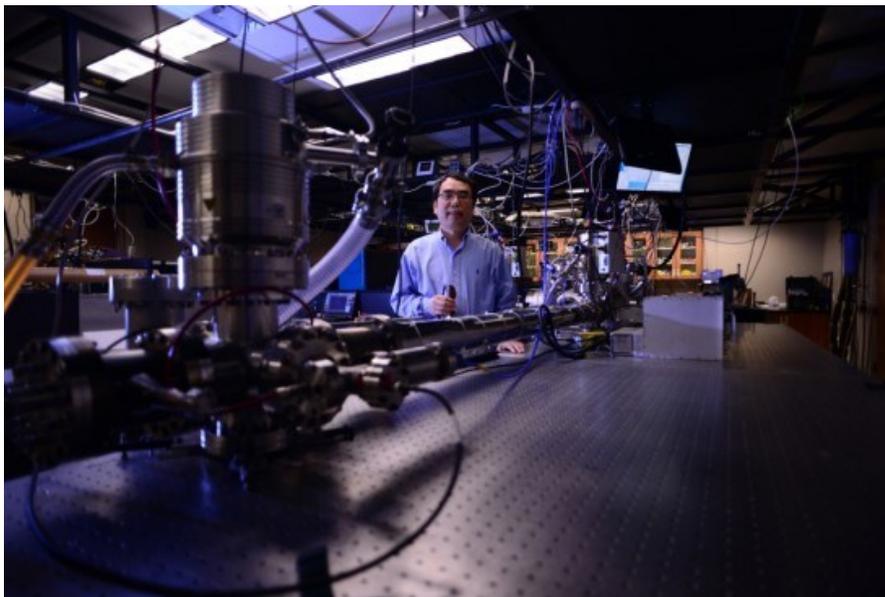
Such a facility will help the U.S. compete more effectively with European countries that have thus far dominated the landscape for attosecond laser research infrastructure.

DARPA, which is responsible for developing cutting edge technologies for the military, has increasingly set its sights on the power and potential of ultrafast lasers. A study last year by the National Research Council titled Light for America’s Future emphasized the imperative role optics and photonics will play in developing the technologies of the future and strongly recommended that the U.S. pursue becoming a global leader in the field.

UCF is buttressing its strength in the area as well and has recently announced the creation of an Institute for the Frontier of Attosecond Science and Technology (FAST) directed by Professor Chang to allow researchers from the Department of Physics and UCF’s College of Optics & Photonics/Center for Research and Education in Optics and Lasers to work closely together to compete for cutting-edge projects such as the DARPA grant.

“Attosecond science is addressing problems that are more and more complex,” said Chang. “By establishing an institute for collaborative research on attosecond science we create the potential for major breakthroughs in our understanding of the role of ultrafast electron dynamics.”

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## "Oscars of Innovation" recognize Gator Engineering Faculty

Dr. Kelly Jordan, assistant professor of nuclear engineering in the Department of Materials Science and Engineering, along with collaborators at Adelphi Technology, were recognized for their "High Flux Neutron Source" beam instruments in this year's R&D 100 Awards.

R&D Magazine has covered research and development news for scientists and engineers for over 50 years. Each year, their editors recognize the top 100 technology products of the year with the R&D 100 Awards. Known as "the Oscars of Innovation," these awards have – since 1963 – identified revolutionary technologies from a wide-range of industries, including telecommunications, optics, high-energy physics, materials science, chemistry and biotechnology. They have spanned industry, academia, and government-sponsored research.

Dr. Jordan's work specializes in nuclear security – making sure potentially dangerous materials can be easily identified and safeguarded – as well as radiation detection and nonproliferation. He received his Ph.D. in nuclear engineering from UC Berkeley in 2006 and worked as a reactor physicist at the Paul Scherrer Institute in Switzerland until he came to UF in 2011. In addition to teaching, he serves as the director of the University of Florida Training Reactor (UFTR).

The award-winning DD-109X is a microwave-driven neutron generator that provides high fluxes of fast neutrons to small samples of nuclear materials. This is useful for determining the composition of nuclear materials, for identifying them. Jordan equates the technology leap to a scenario where airport security have for many years tried to determine if passengers' shoes pose a public safety risk, and then suddenly they receive an x-ray machine.

"You can't just sweep your finger across [nuclear materials] and taste them to figure out what they are. You can't even lift the lid and look at them. This is a technology that simplifies how we are able to identify a very complex substance," Jordan explains.

Few among us are tasked with keeping tabs on the world's supplies of plutonium, but for those who are, the DD-109X – and the technology it harnesses, makes the job of identifying plutonium a lot easier. And that translates to everyone, everywhere being a lot safer.

Other recognized technologies this year include an electron microscope capable of recording movies, a device that harnesses power from viruses, a robotic glove and an underwater vehicle that can operate both with and without a human crew. In addition to UF, this year's list of innovators represent several of NASA's research centers, Argonne National Laboratory, Sandia National Laboratories, Lawrence Livermore National Laboratory, and many other top research facilities.

Winners will be recognized at the R&D 100 Awards Banquet on Nov. 7, 2013, in Orlando, Fla. The full list of this year's winners is available at [2013 R&D 100 Awards](#).



**Dr. Kelly Jordan is an associate professor of nuclear engineering in the Department of Materials Science & Engineering, and is the director of the University of Florida Training Reactor. His latest research was recognized in the R&D 100 Awards, known as the "Oscars of Innovation."**

## The World's only Undersea Research Lab

Aquarius Reef Base – the world's only undersea research lab – has come back to life under the auspices of Florida International University.

On Wednesday, FIU researchers celebrated the completion of a NASA training mission, "Sea Test II," the first since FIU took over Aquarius operations earlier this year, and offered the public a peek inside the habitat that allows scientists to live, work and train 63 feet under the sea for weeks at a time. Aquarius is located off Conch Reef in the Florida Keys National Marine Sanctuary.



"Today we celebrate the re-birth of Aquarius," said FIU President Mark B. Rosenberg. "We are grateful to our partners in the federal government and so many others who have made it possible for us to rescue this unique scientific gem and put it back to work for the benefit of the global community."

Aquarius, deployed in 1993 by the National Oceanic and Atmospheric Administration (NOAA), was slated for decommissioning this year, when FIU stepped forward with a plan to keep the reef base operational.

The special diving capability of Aquarius, called saturation diving, allows scientists to work underwater up to nine hours a day without fear of getting the bends, compared to one hour if they were diving from the surface. Increased research time is the key element that enhances scientific productivity beneath the sea. Aquarius is also used by NASA to train astronauts and develop engineering concepts, since the undersea environment is similar to conditions in space.

Jim Fourqurean, Aileen Soto and Christian Lopes pose under the wet porch of Aquarius.

"Our team has worked very hard over the past year to save Aquarius because we know the great work that has been done here, and we believe in the reef base's potential as a source of new scientific understanding and student discovery," said Kenneth G. Furton, dean of the College of Arts & Sciences. "We have an aggressive business plan in place and will continue to pursue financial viability through grants, gifts and underwritten missions."

The latest NASA mission, which ended last week, focused on proof-of-concept engineering demonstrations and refining space communication techniques.

"After many years of working at Aquarius, we are very happy that FIU has taken over the operations," said Bill Todd, project lead for NASA's Sea Test and NEEMO projects. "All of the staff were very well prepared and allowed us to complete another successful astronaut training and engineering mission. The teamwork between NASA and its international partners, the U.S. Navy and FIU on this very first mission under FIU leadership was exemplary."

*Undersea Research Lab continued on [page 10](#)*

When not simulating outer space, Aquarius will be busy helping scientists learn about the oceans. FIU researchers from the School of Environment, Arts and Society, which runs Aquarius, specialize in ocean acidification, predator/prey relationships, coral reef health and the overall health of the oceans. They plan to extend research programs to study issues critical to the sustainability of the world's oceans. Plans also call for additional educational programs for K-12 students, as a way to increase interest in Science, Technology, Engineering and Math (STEM) careers.

## Innovation Concourse of the Southeast - The 2013 Event

On September 24-25, UCF hosted the first Innovation Concourse of the Southeast event that combined



MegaWatt Ventures, the Florida Cleantech Acceleration Network in partnership with Florida Energy Systems Consortium (FESC) and the newly formed Innovation Concourse of the Southeast. This unique event unveiled new energy and environmental technologies and products with an over-arching goal to develop the innovation ecosystem throughout the Southeastern United States. The event brought together up-and-coming small technology businesses, innovative university researchers, industry leading corporations and numerous regional resources that enabled substantial exposure of these small businesses and university researchers to large

**On behalf of the University of Central Florida and MegaWatt Ventures, a grant for \$100,000 is presented to Bio-Adhesive Alliance. Pictured left to right: Mahour Parast, Daniel Oldham and Elham Fini, Jennifer Garson, Program Manager at U.S. Department of Energy and Dr. Tom O'Neal, Associate VP of Research and Commercialization at UCF.**

commercial opportunities.

The University of Central Florida hosts these programs that support companies working in the energy and environment technologies arena through funding by the U.S. Department of Energy and Economic Development Agency.

The MegaWatt Ventures business plan competition encompassed the first day of the event. Six months ago, ten teams each won a \$10,000 seed grant, access to coaching and mentorship to compete for a grand prize of \$100,000. The result of the exciting 2013 MegaWatt Ventures Competition and recipient of the grand prize is Bio-Adhesive Alliance, Inc. from Greensboro, North Carolina. Bio-Adhesive Alliance utilizes swine waste to create a durable construction adhesive that enhances pavement performance and other floor adhesive applications. The technology and student participants hail from North Carolina Agriculture and Technology State University. The University of Central Florida also had two finalists – HySense Technology, a faculty-led

*Innovation Concourse continued on [page 11](#)*

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spin-out from the Florida Solar Energy Center producing color-changing pigments to identify dangerous gas leaks and Talawah Technologies, a UCF alumni-led spin-out and UCF Business Incubator client developing low power, long range operating sensor devices.

The exhibition continued for a second day and concluded with a keynote speech from Patrick Sheehan, Executive Director of the State of Florida Office of Energy. Following his presentation, he met with exhibitors and commented that he had never before witnessed such camaraderie and support between the exhibiting companies, the coaching teams and conference organizers from the Innovation Concourse of the Southeast.

The Innovation Concourse of the Southeast event provided exciting connection opportunities for customers, investors and various strategic partners, including some of the country's largest technology companies, to advantageously develop, support and inspire an innovative technology ecosystem in this region. Event attendees had a firsthand opportunity to meet technical scouts and venture capitalists from Fortune 1000 companies such as Boeing, Dow, BASF, GE, Siemens, and others. The exhibitors demonstrated a wide array of pioneering technologies that address today's critical energy and environmental concerns such as soil and groundwater contamination, fracking, indoor air quality, high energy/power density storage, hydrogen leak detection and many more that have endless applications.

The Innovation Concourse of the Southeast will be a recurring program and host events to showcase companies and technologies from 10 states of the US. The next event held June 3 – 4, 2014, will exhibit innovations in manufacturing and safety.

To see more details about the participating companies or future efforts, please visit [www.InnovationConcourse.com](http://www.InnovationConcourse.com)

## **Siemens Energy Opens New Wind Service Training Center in Orlando**

ORLANDO, Fla.--(BUSINESS WIRE)--Joined by state and local government officials, customers and special guests, Siemens Energy today formally inaugurated its new, state-of-the-art wind service training center in Orlando, Florida, USA. The event marks the official grand opening of the center that provides highly advanced technical and safety training for installation and service technicians working at wind energy projects located throughout the Americas region.

Florida Governor Rick Scott and Orlando Mayor Buddy Dyer joined Randy Zwirn, president and CEO of Siemens Energy, Inc. and CEO of the Energy Service Division, and Tim Holt, CEO of Siemens Energy Service Renewables, for today's inauguration.

"Our investment in this new training facility underscores our strong commitment to supporting the long-term continued growth of the wind industry in the Americas region," said Zwirn. "As renewable energy continues to grow as part of the world's energy mix, our customers depend on us for highly skilled technicians who are committed to helping insure the long-term reliability of their assets. We would like to thank the State of Florida and the City of Orlando for their support."

Governor Scott said, "The announcement that Siemens is adding 50 jobs in Orlando is more proof that the steps we are taking to create jobs in Florida are working. With nearly 370,000 private-sector jobs being

*Siemens Energy continued on [page 12](#)*

created in the past two years, and our unemployment rate below the national average, it's clear that Florida is headed in the right direction."

"Siemens' decision to locate the Wind Service Training Center in Orlando confirms their commitment to our community and furthers Orlando's reputation as a leader in the clean energy industry," said Orlando Mayor Buddy Dyer. "Orlando was able to compete for this project in large part because of our well connected international airport and world renowned hospitality industry."

The new \$7 million facility is an important milestone for Siemens as the company's wind service business continues to grow and the need for skilled technicians increases. Siemens currently provides service and maintenance for more than 3,000 installed turbines in the Americas region and 6,800 globally, with a combined generating capacity of 15 gigawatts (GW). As more wind energy projects come online in the U.S. and across the region, highly skilled technicians will be needed to provide the long-term service and maintenance required to help insure the turbines operate at peak production, availability and reliability levels. The new Orlando training center contributes to that long-term need, providing trainees with the industry's highest level of safety training and equipping them with the advanced technical skills needed to service and maintain wind turbines. Siemens will also train the technicians who work on the installation of wind turbines in the Americas, with training specifically designed to address the installation process and related safety requirements. In addition, the advanced training at the center will be made available to technicians from Siemens' wind power customers.

Built based on LEED Gold green-building standards, the new 40,000-square-foot building is located close to the global headquarters of Siemens' Energy Service division and features the latest Siemens' wind technologies which are used in the hands-on safety and technical training. Two full-size nacelles (the generator portion of a wind turbine), three 30-foot high climbing towers, ladder structures, electrical and hydraulic modules, and a service crane station are located within the center, making training, safety and rescue simulations as realistic as possible. A number of technologically equipped training labs and flexible space to accommodate varying class sizes are also available at the training center.

The new center will host more than 2,400 trainees annually from the U.S. and the Americas and is located close to Orlando International Airport, allowing for easy access for visiting technicians. Siemens committed to creating 50 new full-time jobs associated with the training center, and 49 have already been filled. Close to 25 percent of these positions are currently held by military veterans. Many of the unique logistical and technical skills, as well as the physicality and discipline, acquired during military service can be successfully transferred to this type of work. Over the last two years, Siemens has hired over 1,000 veterans across its U.S. businesses and is an active participant in the White House Joining Forces initiative as well as Still Serving Veterans to increase training and employment opportunities for returning service members.

In the past two years, Siemens global wind service business has grown from approximately 1,600 employees to well over 2,700 today, including more than 500 in the U.S., and those numbers are expected to increase as the industry matures.

The Orlando wind training center is one of four Siemens wind service training facilities globally, joining Brande, Denmark; Bremen, Germany; and Newcastle in the United Kingdom. All four training centers are

certified by the Global Wind Organisation (GWO) as offering the industry's highest level of safety training. Additional information and photos of Siemens' Orlando Wind Service Training Center can be found at: <http://inr.synapticdigital.com/siemens/orlandowind/>.

The Siemens Energy Sector is the world's leading supplier of a broad spectrum of products, services and solutions for power generation in thermal power plants and using renewables, power transmission in grids and for the extraction, processing and transport of oil and gas. In fiscal 2012 (ended September 30), the Energy Sector had revenues of EUR27.5 billion and received new orders totaling approximately EUR26.9 billion and posted a profit of EUR2.2 billion. On September 30, 2012, the Energy Sector had a work force of almost 86,000. Further information is available at: [www.siemens.com/energy](http://www.siemens.com/energy).

## First Class Completes Startup Quest Challenge

Startup Quest is an entrepreneurial training program out of the University of Florida for degree-holding professionals who are either underemployed or unemployed. The participants are taught how to be entrepreneurs and



**Local Workforce Investment Boards in Gainesville, Jacksonville, Daytona, Brevard, Ft Lauderdale, Tampa, St. Pete and Tallahassee have joined together in a consortium to expand a pilot program. This is made possible through a nearly \$12 million five year grant from the Department of Labor**

develop a business plan to present to investors. At the Center for Business Excellence's inaugural Startup Quest Challenge on August 13, participants pitched their business plans to a panel of judges who posed as potential investors. The Syntech Diagnostics team won first place for its plan to launch a business that markets AccendoScope, a medical device that can make cancer diagnoses without a biopsy. Participation in the Startup Quest program not only teaches participants how to start a business, but it can also create opportunities for finding employment or better-paying jobs for the underemployed workers.

## Microbial Team turns Corn Stalks and Leaves into Better Biofuel

ANN ARBOR—A fungus and E. coli bacteria have joined forces to turn tough, waste plant material into isobutanol, a biofuel that matches gasoline's properties better than ethanol.

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University of Michigan research team members said the principle also could be used to produce other valuable chemicals such as plastics.

"We're hoping that biofuels made in such an efficient way can eventually replace current petroleum-based fuels," said Xiaoxia "Nina" Lin, assistant professor of chemical engineering and leader of the research.

Gallon for gallon, isobutanol gives off 82 percent of the heat energy gasoline provides when burned, compared to ethanol's 67 percent. Ethanol also has a tendency to absorb water, corroding pipelines and damaging engines, but isobutanol doesn't mix easily with water. While ethanol serves as a mixer in the gasoline infrastructure today, many researchers argue that isobutanol could be a replacement.



**The biofuel isobutanol, in the vial, was produced by a microbe community feeding on corn stalks and leaves or switchgrass, shown in the flasks behind.**

Equally important, this system makes isobutanol from inedible plant materials, so fuel production won't drive up food costs. Lin's team used corn stalks and leaves, but their ecosystem should also be able to process other agricultural byproducts and forestry waste.

While much previous research has focused on trying to create a "superbug" that could tackle the whole job of processing waste plant materials into biofuels, Lin and her colleagues argue that a team of microbial specialists can do better.

The fungus *Trichoderma reesei* is already very good at breaking down tough plant material into sugars. *Escherichia coli*, meanwhile, is relatively easy for researchers to genetically modify. James Liao's lab at the University of California-Los Angeles provided *E. coli* bacteria that had been engineered to convert sugars into isobutanol.

The Lin group put both microbe species into a bioreactor and served up corn stalks and leaves. Colleagues at Michigan State University had pre-treated the roughage to make it easier to digest.

"If you've ever had puffed rice cereal, it's somewhat analogous," said Jeremy Minty, first author of the paper to be published in the Proceedings of the National Academy of Sciences and a recent doctoral graduate in Lin's lab.

The fungi turned the roughage into sugars that fed both microbe species with enough left over to produce

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isobutanol. The team managed to get 1.88 grams of isobutanol per liter of fluid in the ecosystem, the highest concentration reported to date for turning tough plant materials into biofuels. They also converted a large proportion of the energy locked in the corn stalks and leaves to isobutanol—62 percent of the theoretical maximum.

The harmonious coexistence of the fungi and bacteria, with stable populations, was a key success of the experiment.

Jeremy Minty, a recent doctoral graduate in Nina Lin's lab at U-M, adjusts the bioreactor in which the fungus and bacteria convert tough plant materials to biofuel. Image credit: Joseph Xu "A lot of times, one species will dominate the culture and the other will die off," Minty said. "This is a common problem when you're trying to create these systems."

Convincing the microbes to play nicely pays off.

"You can put everything in one pot," Lin said. "The capital investment will be much lower, and also the operating cost will be much lower, so hopefully this will make the whole process much more likely to become economically viable."

Lin's team used game theory to analyze the relationship between the fungi and bacteria. Breaking cellulose down into sugar is hard work, so *T. reesei*'s tendency to do this and then share the spoils mark it as a cooperater. Meanwhile, the *E. coli* use the sugars without offering the fungus anything in return, which makes it a cheater.

Even so, the bacteria didn't take over the colony because the fungi produce the sugars near their cell membranes, which gives them the first crack at using the sugars. The researchers can control *E. coli*'s advantage by tweaking how quickly the bacteria grow.

Minty and others in Lin's group are now trying to improve on their energy conversion rate and increase the tolerance of the *T. reesei* and *E. coli* to isobutanol. The fuel is toxic, but higher concentrations will drive down the cost of isolating the fuel.

## Energy Department Reports U.S. Wind Energy Production and Manufacturing Reaches Record Highs

"We're really excited about this technology," Minty said. "The U.S. has the potential to sustainably produce 1 billion tons or more of biomass annually, enough to produce biofuels that could displace 30 percent or more of our current petroleum production."

Moreover, by engineering the bacteria differently, they believe their system could produce a variety of petroleum-based chemicals in a sustainable way.

A paper on this research, "Design and characterization of synthetic fungal-bacterial consortia for direct production of isobutanol from cellulosic biomass," will be published online in the Proceedings of the National Academy of Sciences early edition the week of Aug. 19. The work was funded by the National Science Foundation, the Department of Energy and the U-M Office of the Vice President for Research. The university

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is seeking commercialization partners to help bring the technology to market.

WASHINGTON – The Energy Department released two new reports today showcasing record growth across the U.S. wind market -- increasing America's share of clean, renewable energy and supporting tens of thousands of jobs nationwide. According to these reports, the United States continues to be one of the world's largest and fastest growing wind markets. In 2012, wind energy became the number one source of new U.S. electricity generation capacity for the first time – representing 43 percent of all new electric additions and accounting for \$25 billion in U.S. investment.

In the first four years of the Obama Administration, American electricity generation from wind and solar power more than doubled. President Obama's Climate Action Plan makes clear that the growth of clean, renewable wind energy remains a critical part of an all-of-the-above energy strategy that reduces harmful greenhouse gas emissions, diversifies our energy economy and brings innovative technologies on line. The Obama Administration has committed to another doubling of the renewable electricity generation from energy resources like wind power by 2020.

"The tremendous growth in the U.S. wind industry over the past few years underscores the importance of consistent policy that ensures America remains a leader in clean energy innovation," said Energy Secretary Ernest Moniz. "As the fastest growing source of power in the United States, wind is paving the way to a cleaner, more sustainable future that protects our air and water and provides affordable, clean renewable energy to more and more Americans."

The tremendous growth in the overall U.S. wind industry has led directly to more American jobs throughout a number of sectors and at factories and power plants across the country. According to industry estimates, the wind sector employs over 80,000 American workers, including workers at manufacturing facilities up and down the supply chain, as well as engineers and construction workers who build wind installations.

#### Wind Technologies Market Report

The Energy Department and Lawrence Berkeley National Laboratory today released the 2012 Wind Technologies Market Report– detailing the latest trends in the U.S. wind power market.

Last year, over 13 gigawatts (GW) of new wind power capacity were added to the U.S. grid – nearly double the wind capacity deployed in 2011. This tremendous growth helped America's total wind power capacity surpass 60 GW at the end of 2012 – representing enough capacity to power more than 15 million homes each year, or as many homes as in California and Washington state combined. The country's cumulative installed wind energy capacity has increased more than 22-fold since 2000.

At the same time, the proportion of wind turbine components such as towers, blades, and gears made in America has increased dramatically. The report estimates seventy-two percent of the wind turbine equipment installed in the U.S. last year was made by domestic manufacturers, nearly tripling from 25 percent in 2006-2007.

The report also finds that nine states now rely on wind power for more than 12 percent of their total annual electricity consumption – with wind power in Iowa, South Dakota and Kansas contributing more than 20 percent. Additionally, Texas added over 1,800 megawatts of wind power last year, more than any other state. On a cumulative basis, Texas remains a clear leader with over 12 GW installed at the end of 2012 -- more

than twice as much as California, the next-highest state.

Also according to the Energy Department's 2012 Wind Technologies Market Report, technical and design innovation allowing for larger wind turbines with longer, lighter blades has steadily improved wind turbine performance and has expanded wind energy production to less windy areas. Since 1998, the average capacity of wind turbines in the U.S. has increased by 170 percent. At the same time, wind project capital and maintenance costs continue to decline, lowering the cost of wind energy to near-record lows. The price of wind under long-term power purchase contracts signed in 2011 and 2012 averaged 4 cents per kilowatt hour – making wind competitive with a range of wholesale electricity prices seen in 2012.

#### Distributed Wind Market Report

For the first time, the Energy Department and Pacific Northwest National Laboratory today issued the 2012 Market Report on Wind Technologies in Distributed Applications – highlighting strong growth in the U.S. distributed wind energy market.

Compared to traditional, centralized power plants, distributed wind energy installations directly supply power to the local grid near homes, farms, businesses and communities– helping to improve grid reliability and efficiency. Turbines used in these applications can range in size from a few hundred watts to multi-megawatts, and can help power remote, off-grid homes and farms as well as local schools and manufacturing facilities. Over the past ten years, the U.S. distributed wind market has grown more than five-fold.

The report finds that distributed wind in the U.S. reached a 10-year cumulative installed capacity of more than 812 megawatts (MW) at the end of 2012 – representing more than 69,000 units across all 50 states. Between 2011 and 2012, U.S. distributed wind capacity grew by 175 MW, with about 80 percent of this growth coming from utility-scale installations. At the state level, Iowa, Massachusetts, California and Wisconsin led the nation in new distributed wind power capacity in 2012.

Still, most distributed wind buyers continue to choose small wind turbines, which have a rated capacity of no greater than 100 kilowatts. Last year, domestic sales from U.S. wind suppliers accounted for nearly 90

### **New Center of Excellence to Receive \$40 million FAA Funding for Alternative Jet Fuels R&D and Environmental Goals**

percent of new small wind generation capacity. Broadly, nine out of the top ten wind turbine models installed last year in U.S. distributed applications were made in America.

The wind sector's growth underscores the importance of continued policy support and clean energy tax credits to ensure that wind manufacturing and jobs remain in America. The 2012 Wind Technologies Market Report expects 2013 to be a slow year for new capacity additions, due in part to continued policy uncertainty and project development timelines. While the report notes that 2014 is expected to be more robust, as developers commission projects that will begin construction in 2013, it also notes that projections for 2015 and beyond are much less certain.

The FAA is to provide \$40 million over 10 years towards a new Air Transportation Center of Excellence (COE) for alternative jet fuels and the environment. The public-private programme will be led by

*Alternative Jet Fuels continued from [page 17](#)*

Washington State University and the Massachusetts Institute of Technology and will explore ways to meet the environmental goals that are part of the NextGen upgrade to the US air transportation system. Core partners include 14 other universities and the team will focus on goals for noise, air quality, climate change and energy, with areas of study to include new aircraft technologies as well as sustainable jet fuels. FAA Administrator Michael Huerta said the FAA's goal was to improve the energy efficiency of the National Airspace System by at least two per cent per year, with a target of one billion gallons of alternative jet fuel in use by 2018.

The FAA's COE programme is a cost-sharing research partnership between academia, industry and the federal government and the FAA anticipates providing this new COE with \$4 million a year for each of the programme's 10 years.

"This innovative partnership supports President Obama's national plan to address climate change," announced US Transportation Secretary Anthony Foxx. "The Center of Excellence will tap talented universities to help us take environmentally friendly, alternative jet fuel technology to the next level. Airlines and their customers will both benefit from their work developing cleaner fuel that supports the environment and continued aviation growth."

The selected universities all have nationally recognised collegiate environmental and aviation-related education programmes, says the FAA. Research projects will be performed through a partnership of senior scientists from these universities, which will also engage both graduate-level and undergraduate students in their research activities.

The COE industry and other organisational partners include a range of airlines, aerospace manufacturers and biofuel companies such as Airbus, Boeing, GE, Rolls-Royce, Safran, Gulfstream, Pratt & Whitney, Alaska Airlines, Cathay Pacific Airways, Delta Air Lines, Gevo, Honeywell UOP, LanzaTech, Metron Aviation, NREL and the US DoD - AFRL.

Air Transportation Centers of Excellence were authorised by Congress under a 1990 Act that enables the FAA to work with universities and industry partners to conduct research in airspace and airport planning and design, environment and aviation safety, as well as to engage in other activities to assure a safe and efficient air transportation system. The FAA has established COEs with more than 75 universities conducting research in a number of other topic areas, including aircraft noise and aviation emissions mitigation

## **Vestas Begins Operating Wind Industry's Largest Test Bench**

Measuring in at a whopping 42 metres long and 9 metres wide, Vestas' new wind industry test bench is the most powerful test bench in the world, and has recently started operation at Vestas' global testing centre in Aarhus, Denmark.

The 20 MW test bench is able to test the full nacelle of a Vestas V164-8.0 MW, testing its performance, robustness, and reliability over a simulated 25-year period.

"Vestas has invested in the industry's most powerful test bench to ensure the turbine will perform in challenging conditions for 25 years," said Chief Technology Officer Anders Vedel. "The superior testing expertise we have accumulated over the last decade is a key part of giving confidence to our customers that the machine is of the high quality that they expect from Vestas."

*Vestas continued on [page 19](#)*

Unsurprisingly, testing the critical components and systems of the V164-8.0 MW turbine is critical to Vestas' "process to ensure the highest possible industry leading quality and reliability." Such is their diligence to this goal that Vestas has invested in several unique testing capabilities over the past two years which cover all the V164-8.0 MW's critical components.

The test bench weighs nearly 700 tonnes, and it better, as it includes the weight of the test bench itself, as well as motors, wind simulator, and generators. Due to its massive weight, Vestas has installed fifty metre-deep concrete foundations to support the weight. The motors which power the test bench are able to produce 20 MW – the equivalent of 26,820 brake horsepower — and the torque exerted on the components of the turbine can be up to a massive 18 meganewton metres.

While the test bench is likely to be of significant use for Vestas, the outcomes could very well be of benefit to the whole industry. Much like Vestas' involvement in the Scaled Wind Farm Technology (SWiFT) facility recently launched at Texas Tech University to study how turbine spacing within a wind farm affects turbulence, aerodynamic losses, equipment damage, and overall wind energy generation efficiency.

And Vestas need to keep ahead of the game, if they intend to stay at the top of the game. A report released earlier this year from Bloomberg New Energy Finance found that Vestas (tied with GE) was the leading supplier of wind energy installations in 2012.

Japan has become one of just five countries to have achieved 10 gigawatts of installed solar photovoltaic capacity when at the end of August it reached 10.5GW.

Germany was the first country to achieve this milestone, followed by Italy, and then in the last few months China and the US.

## **Japan Installs 10GW of Solar PV Capacity, Set to Become World Leader**

Japan was actually the dominant force in the PV market a decade ago, becoming the first country to install 1 gigawatt of combined solar power capacity in 2004, and then claiming the largest capacity of installed PV power in the world in 2005.

The country's solar development then petered out in the mid-2000s as a new ten year energy plan, developed in 2002 and which favoured the expansion of Japan's nuclear power sector, began to take more effect. The plan set a target of increasing nuclear capacity by 30% by 2011.

Then in 2011 the tsunami and earthquake hit, causing the accident at the Fukushima Daiichi nuclear power plant, and bringing the Japanese population together in protest against the entire nuclear industry. This was solar energy's time to shine again, as the government began to focus on renewable energy generation.

In an attempt to rapidly encourage investment in renewable energy, the government introduced feed-in-tariffs in June 2012 that pushed the prices for solar power down to 42 yen (\$0.53) per kilowatt-hour, even less than the rate offered in Germany. Recent research by NPD Solarbuzz, attributes the rapid growth in Japan's PV market to the generous feed-in-tariffs.

Growth in the solar market, as well as other renewable energies such as wind, are expected to continue into the future, and Japan is expected to become the world's dominant market for all renewable energy.

One question raised in the face of Japan's ambitious expansions into solar energy, is its ability to support the demand. Supply shortages have already been met as domestic PV panel producers are unable to keep up with orders, and many are fully occupied until 2014.

There are even concerns that the Japanese electrical grid will not be able to support the predicted expansion in renewable energy generation capacity.

## Recent Funding Opportunities

FESC office tracks the energy related funding opportunities, shares them with faculty and industry partners, facilitates the submission of multi-faculty, multi-SUS university competitive proposals in response to solicitations for major research programs. The most recent funding opportunities are listed below. For a complete list please visit the [funding opportunities](#) page on the FESC website.

- **DE-FOA-0001010 : Energy Frontier Research Centers**  
Application due date: January 9th, 2013  
[More Information](#)
- **NSF 13-598 : Small Business Technology Transfer Program Phase I Solicitation FY-2014 (Release 2)**  
Full Proposal Deadline: December 4th, 2013  
[More Information](#)
- **NSF 13-599 : Small Business Innovation Research Program Phase I Solicitation FY-2014 (Release 2)**  
Full Proposal Deadline: December 2nd, 2013  
[More Information](#)
- **DARPA-ST13B-003 : Multiferroic Materials for RF Applications**  
Application due date: September 25th, 2013  
[More Information](#)