FESC
Florida Energy Systems Consortium

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Florida Energy Systems Consortium

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Upcoming Events:

Financing the Commercialization of Biofuels and Bio-based Chemicals: The Tutorial —July 30th-August 1st, 2012 , Orlando, FL USA

Florida Energy Summit—August 15 – 17, 2012 — Rosen Shingle Creek, Orlando, FL

Cleantech to Spacetech: MegaWatt Ventures, I2 CAP & FL-CAN Showcase—September 20-21, 2012 —Florida Hotel, Orlando, FL

Algae Biomass Summit— September 24-27, 2012 - Sheraton Denver Downtown Hotel Denver, Colorado

University of Florida Physicists set new Record for Graphene Solar Cell Efficiency

GAINESVILLE, Fla. — Doping may be a no-no for athletes, but researchers in the University of Florida's physics department say it was key in getting unprecedented power conversion efficiency from a new graphene solar cell created in their lab.

Graphene solar cells are one of industry's great hopes for cheaper, durable solar power cells in the future. But previous attempts to use graphene, a single-atom-thick honeycomb lattice of carbon atoms, in solar cells have only managed power conversion efficiencies ranging up to 2.9 percent. The UF team was able to achieve a record breaking 8.6 percent efficiency with their device by chemically treating, or doping, the graphene with trifluoromethanesulfonyl-amide, or TFSA. Their results are published in the current online edition of Nano Letters.

"The dopant makes the graphene film more conductive and increases the electric field potential inside the cell," said Xiaochang Miao, a graduate student in the physics department. That makes it more efficient at converting sunlight into electricity. And unlike other dopants that have been tried in the past, TFSA is stable — its effects are long lasting.

The solar cell that Miao and her co-workers created in the lab looks like a 5-mm-square window framed in gold. The window, a wafer of silicon coated with a monolayer of graphene, is where the magic happens.

Graphene and silicon, when they come together, form what is called a Schottky junction — a one-way street for electrons that when illuminated with light, acts as the power conversion zone for an entire class of solar cells. Schottky junctions are

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Tips for Becoming a Water-Wise Floridian

This fact sheet is seen in The Carbon Challenge Series *and gives detailed ways to save water as well as protect it's quality. The following is the list of 10 ways to save water in an abridged format . The full work , including the 10 ways to protect Florida's water quality is found here:*

10 Ways to Save Water

1. Start keeping track of your water use.
Consciously tracking your water consumption is the first step to reducing it. If you are on a public water supply, look at your water bill. Most water utilities in Florida measure and bill water use in 1,000 gallon, or kilogallon (KG) increments.

You can also estimate your daily personal use by dividing your monthly household use in gallons by the number of days in the payment period and the number of people in your household. If you are really curious about understanding your daily water use patterns precisely, you can also take note of the reading on your water meter at the start and end of a typical day. Be sure to consider both weekdays and weekends.

If you get your water from a private well, you can install a meter on the well to monitor your use, or you can estimate it with an online home water use survey, such as the one at this website: http://www.sjrwmd.com/waterconservation/survey.html. This survey is a fun, interactive way to learn how your household practices contribute to your overall water use.

2. Follow Florida-Friendly Landscaping techniques.
Follow the recommended schedule for watering shrubs and trees through establishment and remember that once they are established, watering can be discontinued for most trees and shrubs. For details, consult http://hort.ifas.ufl.edu/irrigation/Results.shtml. If lawn areas are a personal priority, choose grass that is hardy and requires less watering. Also, when mowing, cut grass at the highest setting on your mower and allow the cuttings to stay where they fall. This will encourage deeper root growth and reduce the water and fertilizer needs of the grass.

3. If you use an irrigation system, maintain it regularly.
For an automatic sprinkler system, make sure the rain shut-off device (required by Florida law) is in working order and is not blocked by roof overhangs, shrubs or trees. Also, set your automatic irrigation system to apply no more than one-half to three-quarters of an inch of water each time you irrigate. Most importantly, irrigate only when needed. Instead of watering on a schedule, set the system to manual operation and turn it on only when half of your lawn area shows signs of wilting — leaf blades folded in half, blue-gray color and footprints that remain on the lawn. If you have an old in-ground sprinkler system, consider retrofitting to a new system. . Consider replacing older sprinkler heads with more efficient models such as rotary nozzles or replacing sprinkler head zones with microirrigation in landscaped beds. These actions can reduce your water use as newer systems are more efficient. Abide by regional and local water restrictions.

4. Harvest rainwater.
Rainwater harvesting is an age-old technique that is being rediscovered as a useful water conservation tool. You can harvest rainwater from your rooftop in several ways, from installing a large cistern above or underground to placing rain barrels at the end of your gutters or downspouts. Collecting rainwater for watering plants spares potable water for other important uses and reduces stormwater runoff from your yard. See the Florida Yards and Neighborhoods document "How to Build a Rain Barrel" at http://fyn.ifas.ufl.edu/materials/FYN-HowToBuildARainBarrel.pdf for more information.

5. Check and maintain your toilet.
Indoors, toilets are the largest water user for a typical household. Toilets made before 1994 use anywhere from 3.6 gallons per flush (gpf) to 8 gpf, while low-flow toilets are currently mandated by federal law to use 1.6 gpf or less. Even better are high efficiency toilets (HETs), which use 20% less water than the federal standard. Check to see if your water utility offers any rebates for replacing old, inefficient toilets with new ones. See EPA's WaterSense Partnership Program rebate finder at http://www.epa.gov/watersense/rebate_finder_saving_money_water.html for more

information. Look for the EPA's "WaterSense" label to find toilets and other plumbing fixtures that use even less water than the federal standard. If you want to learn more about performance standards for new toilets, visit this website: http://www.cuwcc.org/MaPtesting.aspx.

Here are some tips for maximizing your current toilet's water efficiency:

• Regularly check for and repair toilet leaks.

• Avoid using caustic toilet bowl cleaners such as toilet tank tablets. (These products can alter the pH of water in your toilet tank and damage plastic and rubber toilet parts, causing severe leaks.)

• Don't use your toilet as a trash can. Dispose of only human waste in the toilet.

6. Stop those leaks!

Check both indoor and outdoor systems for leaks. Studies have shown that more than 10% of the water a home uses can be wasted due to leaks, which costs both homeowners and the environment. Even "minor" leaks are important to catch: a leak as small as 10 drops per minute equates to 43 gallons of water wasted in a month.

Reading the meter yourself is one way to check for leaks. Be sure to wait for any tank style water heater to refill, turn off the ice-cube maker, and wait for regeneration of any water softeners to occur before taking the initial water meter reading and checking for leaks. Turn off all the taps in your house and then look at your meter. If the meter is still turning, chances are you have a leak somewhere and you will need to investigate further to find the source. For help on reading your meter, visit http://h2ouse.org/resources/meter/index.cfm or contact your local utility.

Indoors: Recent research on water use in homes identified leakage as being responsible for a large amount of water loss. Faulty toilet flush valves were the leading causes of leaks – a leaky toilet can waste up to 200 gallons of water per day. Rubber, poly pipe, and often times copper hoses have a finite life and will spring leaks over time. Replace hoses from service lines to appliances/fixtures with hoses that are armored, Pex (cross-linked polyethylene) or metal (but not copper).

Outdoors: Inspect your sprinklers and drip sprayers for leaks. Puddles and broken sprinkler heads are clues to leaks.

7. Save water while laundering.

Your washing machine is the second largest water user in your home. You can save both water and energy when you make your next washer purchase by selecting an ENERGY STAR® rated washer. These washers use about a third less energy and half the water of non-ENERGY STAR® machines. Search for an ENERGY STAR® qualified clothes washer at http://www.energystar.gov/index.cfmfuseaction=find_a_product.showProductGroup&pgw_code=CW.

If you have a newer model washing machine or cannot replace your older model, you can still save water by following the tips below:

• Check hoses regularly for cracks that could result in leaks.

• Pre-treat stains to avoid rewashing.

• Operate the washer with full loads only – even if the machine has an adjustable load setting. If your washer has a variable water volume setting, select the minimum amount of water required per load.

• Use the shortest wash cycle for lightly soiled loads.

8. Install faucet aerators and low-flow showerheads.

After checking for and repairing leaks, the most effective and inexpensive way to reduce your faucets' water use is by installing faucet aerators. Aerators are circular screened disks that screw on to the faucet. The flow number is stamped on the rim of the aerator. For bathroom faucets, low-flow aerators typically allow flows of 1.0 gallon per minute (gpm). For kitchen sinks, they can reduce flow to 1.5 gpm, compared to the Florida Building Code maximum flow rate of 2.2 gpm for new kitchen faucets. Some aerators can restrict flow to less than 1.0 gpm, however restricting faucet flows below 2.2 gpm may cause an increase in the "wait" time for hot water to travel from the water heater to the fixture.

To maximize the efficiency of your water use when bathing, take short showers, use low-flow showerheads and reserve baths for special occasions. (A full bath tub holds 36 gallons and a full "garden tub" holds more than 65 gallons.) All new showerheads manufactured in the U.S. must restrict flow to 2.5 gallons per minute (gpm) or less. A water-saving technology that offers an alternative to aerators is a laminar flow control. These devices deliver a constant rate of flow regardless of line pressure by dividing the water flow into a series of parallel streams. For more information about laminar flow fixtures, consult http://www.toolbase.org/Technology-Inventory/Plumbing/laminar-flow-fixtures. In addition, here are some tips for

maximizing shower efficiency:
• Take shorter showers. A typical shower lasts about 8 minutes and uses 17 gallons, whereas an efficient shower lasts 3 or 4 minutes and uses 7.5 gallons. A recent study showed that water use in showers has increased from 30 to 34 gallons per household per day
9. Buy a shower timer if you have trouble keeping showers short and need a visual cue to conserve.

- Look for the WaterSense label on new fixtures/ accessories: http://www.epa.gov/WaterSense/about_us/watersense_label.html

9. Wash dishes efficiently.
If you wash dishes by hand, don't keep the water running while you're working, and don't fill the sink with more water than necessary to do the job. If you use a dishwasher, run it only when it's full. Newer models of dishwashers run with a full load can use less water than washing the same number of dishes by hand. In addition, many newer dishwashers require little or no advance rinsing of dishes. Read the instruction manual for your machine to determine other ways to minimize rinse water usage. Finally, limit use of your in-sink waste disposal, and if you do use it, try not to run a lot of water in the process, as many homeowners waste water when operating the device. Composting is a good alternative for disposal of many food scraps.

10. Use green lodging.
To cut down on water used for laundering when traveling, choose a green hotel or green lodging option that allows you to reuse sheets and towels when you stay longer than one night. Most "green" lodging facilities also have low-flow showerheads and faucet aerators to conserve water. The Florida Department of Environmental Protection designates hotels in Florida that meet their *Green Lodging* criteria at http://www.dep.state.fl.us/greenlodging/lodges.htm.

Department of Energy awards UF $800,000 to improve nuclear power safety

GAINESVILLE, Fla. — The nuclear engineering program in the University of Florida' s department of materials science and engineering was recently awarded an $800,000 research grant by the U.S. Department of Energy.

As part of DOE's ongoing commitment to support university-led nuclear research and development, the department is awarding a total of $19.9 million in fuel cycle research and development in 32 U.S. universities and colleges including the UF College of Engineering, the Massachusetts Institute of Technology and Case Western Reserve University.

"This grant recognizes the outstanding research that is being conducted at the University of Florida's Laboratory for Development of Advanced Nuclear Fuels and materials," said James S. Tulenko, professor emeritus in the nuclear engineering program and principal investigator on the grant. "We aim to make strides in making nuclear fuel a safer and more efficient energy for America and the world."

Tulenko is an expert in nuclear fuel processing and performance, engineering application of radioisotopes, nuclear fuel cycle economics, radioactive wastes, reactor analysis and system analysis.

Tulenko and his team will study the use of diamond nanoparticles composite material on fuel pellets to improve the thermal conductivity of the nuclear fuel resulting in reduced fuel temperatures, fuel thermal expansion, thermal cracking and fission gas releases. This would produce a better performing, higher burn-up and more accident tolerant fuel. The research team has extensive experience in researching nano-diamond particles as an addition to the reactor coolant for improved plant thermal performance. Additionally, an economic study of the benefit resulting from the higher discharge burn-up expected with this fuel will also be conducted.

New Breakthrough shows Promise for Affordable Plastic Solar Energy Cells

GAINESVILLE, Fla. --- University of Florida researchers report they have achieved a new record in efficiency with a prototype solar cell that could be manufactured using a roll-to-roll process.

"Imagine making solar panels by a process that looks like printing newspaper roll to roll," said Franky So, UF professor in the department of materials science and engineering.

Industry has eyed the roll-to-roll manufacturing process for years as a means of producing solar cells that can be integrated into the exterior of buildings, automobiles and even personal accessories such as handbags and jackets. But, to date, the photovoltaic sheets cannot muster enough energy per square inch to make them attractive to manufacturers.

The UF team has crossed the critical threshold of 8 percent efficiency in laboratory prototype solar cells, a milestone with implications for future marketability, by using a specially treated zinc oxide polymer blend as the electron charge transporting material. The full report outlining the details of their latest laboratory success in solar cell technology is published in the Dec. 18 online version of Nature Photonics.

The researchers said the innovative process they used to apply the zinc oxide as a film was key to their success. They first mixed it with a polymer so it could be spread thinly across the device, and then removed the polymer by subjecting it to intense ultraviolet light.

John Reynolds, a UF professor of chemistry working on the project, said the cells are layered with different materials that function like an electron-transporting parfait, with each of the nano-thin layers working together synergistically to harvest the sun's energy with the highest efficiency.

Reynolds' chemistry research group developed an additional specialized polymer coating that overlays the zinc oxide polymer blend.

"That's where the real action is," he said. The polymer blend creates the charges, and the zinc oxide layer delivers electrons to the outer circuit more efficiently."

Reynolds' chemistry research team is aligned in an ongoing collaboration with So's materials science team which they call "The SoRey Group."

The most recent fruit of their collaboration will now go to Risø National Laboratory in Denmark, where researchers will replicate the materials and processes developed by the SoRey Group and test them in the roll-to-roll manufacturing process.

"This sort of thing can only happen when you have interdisciplinary groups like ours working together," said Reynolds.

So and Reynolds plan to continue their collaboration with Risø National Laboratory, and expand it to include researchers from the Georgia Institute of Technology where Reynolds is now moving. Their work is funded by a grant from the Office of Naval Research.

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Spintronics Steps Forward

Researchers show how to "set" the spin for spintronics applications important to faster electronic devices.

USF News

TAMPA, Fla. (May 9, 2012) - A team of physicists from the University of South Florida and the University of Kentucky have taken a big step toward the development of practical spintronics devices, a technology that could help create faster, smaller and more versatile electronic devices.

The research funded by the U.S. Department of Energy was led by USF Physicist Sergey Lisenkov and Professor Madhu Menon at Kentucky's Center for Computational Sciences. Their findings were published this week in *Physical Review Letters*.

Lisenkov said an important step toward fabrication of the "holy grail" of spintronics is finding a semiconductor that has a net 'spin' at room temperature. The biggest challenge, however, is how to set the spin and in what material.

The USF-Kentucky team showed that a simple combination of metal atoms and a flat sheet of one atom- thick layer of pure carbon called graphene can be suitably engineered and used for this purpose.

Graphene is a relatively tangible material that can be made by peeling ordinary graphite (the same material in lead pencils) with common transparent tape. Graphene boasts properties such as a breaking strength 200 times greater than steel. It is of great interest to the semiconductor and data storage industries, electric currents that can blaze through it 100 times faster than in silicon.

Spintronic devices are hotly pursued because they promise to be smaller, more versatile, and much faster than today's electronics and use less energy.

Spin is a quantum mechanical property with directional values "up" or "down". This is analogous to the "on"' or "off"' values used with binary digital coding in modern computers. The advantage of spintronic devices is once the direction of the spin is set, no energy is required to keep it going. The spin-based data storage doesn't disappear when the electric current stops.

Using state-of-the-art theoretical computations, the research team demonstrated that by placing cobalt atoms in graphene holes - created by removing one or two nearby carbon atoms - it is possible to set the spins in a controlled manner. That, the researchers said, is the key to practical spintronics application for graphene.

*To read their complete paper, click **here.***

UF Researchers develop Plant-Based Technology that Helps Biofuels, may fight Cancer

GAINESVILLE, Fla. — For the first time, University of Florida researchers have developed plant-based technology that could reduce America's dependence on foreign oil and may also help treat cancer.

Known as lignin nanotubes, these cylindrical containers are smaller than viruses and tiny enough to travel through the body, carrying cancer patients' medicine. They can be created in biorefineries from lignin, a plant substance that is a byproduct of bioethanol production.

Bioethanol is a renewable alternative to fossil fuel created by fermenting sugar — such as that from sugarcane and sweet sorghum juices, stalks and stems.

"We're looking at biomedical applications whereby these nanotubes are injected in the body," said Wilfred Vermerris, an associate professor in UF's agronomy department and Genetics Institute who was part of the team that developed the nanotubes. The team's work is described in a March issue of the journal Nanotechnology.

Carbon-based nanotubes, which are the kind used today, cost around $500 a gram, and nanotechnology drug delivery has been projected to be a $220 billion market by 2015.

Nanotubes offer an advantage over radiation or traditional chemotherapy because they have a protective shell that keeps the drugs they contain from affecting healthy parts of the body, such as hair or intestinal lining, said Vermerris, a member of UF's Institute of Food and Agricultural Sciences.

As with current carbon nanotubes, cancer-fighting drugs can be enclosed in the plant-based nanotubes and sent to target specific tumors, he said.

But, the researcher said, unlike currently used carbon nanotubes, lignin nanotubes are flexible and lack sharp edges. That means they're expected to have fewer, if any, of the toxicity issues associated with current varieties.

"It is also much easier to chemically modify the lignin nanotubes so that they can locate their intended targets like homing devices," he said.

Vermerris envisions nanotubes as a way to reduce the cost of biofuel production.

"By selling the nanotubes for biomedical applications, an additional revenue stream is generated for the biorefinery that can offset some of the processing costs," he said. "That essentially reduces the price of the fuels and makes them more competitive with petroleum-based fuel."

Luisa Amelia Dempere, an associate engineer and director of the Major Analytical Instrumentation Center in UF's College of Engineering, guided the analysis and characterization of the lignin nanotubes as part of the research team.

She called the development of the lignin nanotubes "quite significant" and noted their ability to break down in the environment as another advantage over current nanotubes.

"They are taking something from the waste stream, like lignin is for a lot of industries, and making it into something that can be useful and then can degrade back into the environment," Dempere said. "This is probably a material that can be called green and sustainable because it comes from nature and goes back to nature."

UF has applied for a patent on the technology.

Vermerris said his research is now testing the technology in living cells in the lab as a first step toward tests in humans in the near future.

The research was funded by IFAS and the U.S. Department of Agriculture.

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New IRSC Brown Center combines Innovation with Entrepreneurship to Create Jobs

FORT PIERCE, FL -- With the opening of the Brown Center for Innovation and Entrepreneurship, Indian River State College (IRSC) is connecting training in energy and technology with services for business start-ups to create a powerful launching pad for new jobs on Florida's Research Coast. Over 500 community leaders attended the recent Dedication of the multi-purpose energy-efficient Center at the IRSC Main Campus in Fort Pierce. Centered on the theme, "Energizing the Economy," the Dedication Ceremony featured activities related to biofuels, solar and fuel cell technologies, sustainable building construction, geothermal systems, nanotechnology and its marketable applications. Attendees toured the Center's technologically advanced laboratories which develop the skills necessary for employment or entrepreneurship and learned how the Center's business services help fledgling companies leverage expertise into successful businesses.

"The Brown Center for Innovation and Entrepreneurship is an unprecedented resource for the development of Florida's Research Coast," said Dr. Edwin R. Massey, IRSC President. "Developed with the 'idea to market' approach, this unique facility fosters new ideas, new businesses and new jobs."

Adam Putnam, Florida Commissioner of Agriculture, the featured speaker, said the new facility speaks volumes about the Treasure Coast's metamorphosis from farmland to a research hub.

"Florida has tide power, wind power, solar power and biomass capabilities, but we need a workforce to participate in that – and that workforce development will occur right here at IRSC and the counties that circle it," Putnam said.

Education in alternative energy and sustainability is central to the mission of the Brown Center for Innovation and Entrepreneurship. Students learn how to produce biofuels, construct photovoltaic cells, experiment with light technologies and gain hands-on experience in all aspects of energy efficient building construction. Students and entrepreneurs eager to transform this knowledge into new businesses get the help they need from the Innovation Incubator.

Students in the College's highly successful Power Plant Technology Institute gain hands-on experience in the FPL Energy Suite where a flow loop simulator will soon replicate the operations of a nuclear power plant. IRSC's record of success in nuclear energy education was recognized with a prestigious National Science Foundation grant to develop a Regional Center for Nuclear Education and Training (RCNET) serving 18 states and now based in the Brown Center.

IRSC also received a $3.9 million Economic Development Administration Grant from the US Department of Commerce to support the economic development of the region through the training of students for high skill/high wage jobs in the new Brown Center.

The $21.5 million facility itself is a learning environment. The 65,000 square foot building is constructed to Silver LEED standards of environmental design with recycled materials as a model of green construction. About 30% of the power for the three-story building is generated by a 150 solar panel field and three wind turbines, with energy usage displayed on lobby monitors.

The David and Barbara Hefflebower Alternative Energies Laboratory *Brown Center Continued on page 5*

Graphene Solar Cell Continued from page 1

commonly formed by layering a metal on top of a semiconductor. But researchers at the UF Nanoscience Institute for Medical and Engineering Technologies discovered in 2011 that graphene, a semi-metal, made a suitable substitute for metal in creating the junction.

"Graphene, unlike conventional metals, is transparent and flexible, so it has great potential to be an important component in the kind of solar cells we hope to see incorporated into building exteriors and other materials in the future," said Arthur Hebard, distinguished professor of physics at UF and co-author on the paper. "Showing that its power-converting capabilities can be enhanced by such a simple, inexpensive treatment bodes well for its future."

The researchers said that if graphene solar cells reach 10 percent power conversion efficiency they could be a contender in the market place, if production costs are kept low enough.

The prototype solar cell created in the UF lab was built on a rigid base of silicon, which is not considered an economical material for mass production. But Hebard said that he sees real possibilities for combining the use of doped graphene with less expensive, more flexible substrates like the polymer sheets currently under development in research laboratories around the world.

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provides a high-tech setting for production of biofuels and study of solar and fuel cell technologies. Students also repair and maintain electric and hybrid vehicles.

The H.J. High Construction Sustainable Building Design Laboratory creates a multi-faceted environment for instruction in energy efficiency for heating/air conditioning, appliances and commercial and residential applications. A portion of a 640-square foot "net zero" house is contained in the lab as a hands-on resource. Students use thermal cameras to determine energy leaks, learn how to weatherize and insulate, test for gases and evaluate hot water systems.

The study of nanotechnology and its marketable applications is the focus in the Advanced Materials Laboratory where students tap into emerging technologies. The adjacent Optics and Photonics Laboratory illuminates the use of light technologies and careers in this growing field.

In the business wing, the Innovation Incubator offers a wide range of resources, opportunities for collaboration and accessible and affordable space for new businesses to work, learn and connect. Membership provides one-on-one consulting, high-speed wireless Internet, discounts on seminars and workshops, working offices equipped with computers and meeting rooms, strategic planning and conference rooms. The College's Corporate and Community Training Institute (CCTI) and Small Business Development Center are also based in the Brown Center. For more information about the Innovation Incubator visit www.IRSCbiz.com or call 1-888-283-1177.

For more information about IRSC programs and services in the Brown Center for Innovation and Entrepreneurship, visit www.irsc.edu or call 1-866-792-4772.

World Energy News

A123 Announces Advance in Battery Technology

This past month, A123 released information regarding its new lithium ion battery technology. This battery is rated to deliver 20% more power, work in temperatures ranging from -30 degrees Celsius to 60 degrees Celsius, and the manufacturing process should be just as simple as A123's current designs. This new design has experts relieving that A123's battery, the Nanophosphate EXT as it's called, can be just the development lithium ion batteries are looking for to push electric cars from a niche product to a mass-market mode of transportation.

Very little is known about the battery's specific areas of improvement. The chemistry is identical to the lithium-ion phosphate recipe that has been in consumer use for the past few years. A123 says the improvements appear in changes to the electrodes as well as the electrolyte, but little else has been disclosed. In any case, this technology is something to keep an eye on as more is released.

The articles featured below cover this advancement in energy:

Technology Review:Battery Maker A123 Announces New Tech to Jump-Start Its Business

Scientific American: Better Lithium Ion Battery Aims to Re-Energize Electric Cars

A123 Systems Introduces Breakthrough Lithium Ion Battery Technology That Optimizes Performance in Extreme Temperatures

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.

- **NSF 09-596:** NSF/DOE Partnership in Basic Plasma Science and Engineering
  Application Deadline: October 05, 2012
  More information

- **PD- 12-1639:** Sensors and Sensing Systems
  Application Deadline: October 7, 2012 05:00 PM
  More information

- **NSF:-12-562:** International Collaboration in Chemistry between US Investigators and their Counterparts Abroad
  Preliminary Proposal Due Date: August, 01, 2012 05:00 PM
  Full Proposal Deadline: October 16, 2012 05:00 PM
  More information

- **DE-FOA-0000740: Solar Energy Evolution and Diffusion Studies (SEEDS)**
  Concept Papers due (required): July 13, 2012
  Full Applications due: September 17, 2012
  More information

Two Researchers receive Prestigious National Science Foundation CAREER Awards

Two rising stars on the Florida State University faculty are recipients of highly competitive National Science Foundation research grants totaling nearly $1.6 million.

M. Elizabeth "Beth" Stroupe

M. Elizabeth Stroupe, an assistant professor in the Department of Biological Sciences, has won a five-year NSF Faculty Early Career Development Award, also known as a CAREER Award, totaling $997,000 to advance her research into what the "Structure and Function of Sulfite Reductase Teach About Fundamental Biology."

Kenneth L. Knappenberger Jr., an assistant professor in the Department of Chemistry and Biochemistry, has received the same award in the amount of $600,000 to advance his research into "Structure-Specific Nanoscale Dynamics Studied by Nonlinear and Magneto-optical Spectroscopy."

NSF CAREER Awards are designated for scientists who are still in the early stages of their academic careers and are intended to help them build upon previous accomplishments in their areas of research.

"I am excited to be the recipient of this award because it affords me the opportunity to do what I love the most about this job — teaching students about science from the point of view of research," Stroupe said.

Kenneth L. Knappenberger Jr.

Knappenberger said it was an honor to be selected for an NSF CAREER award.

"Receiving this award reflects well on the high quality of work being done by the students studying in my laboratory," Knappenberger said. "It is also an indication that the problems we are trying to solve are important to the scientific community and to the general public."

Tom Roberts, chair of Florida State's Department of Biological Science, called Stroupe's NSF CAREER award a "tangible acknowledgment of the outstanding potential that we saw in her when we recruited."

Stroupe conducts research into the relationship between the structure of molecules found in biology and their functions in the cell.

"Specifically, we are interested in a protein molecule called sulfite reductase, which is involved in transforming the element sulfur into the form that can be used by organisms to build molecules and create energy," Stroupe said.

Using Florida State's state-of-the-art Titan Krios electron microscope — one of about 20 in North America and Europe — Stroupe is able to take pictures of the components inside cells and reconstruct the shapes and structures in three dimensions to hypothesize about how they function.

Stroupe's award has two components. The first supports her basic research. The second uses the results from her experiments to illustrate basic biological concepts in the classroom, such as which molecules in biology are responsible for which activities.

"Beth is a remarkably versatile scientist who is able to use her expertise in protein biochemistry, X-ray

crystallography, and cryo-electron microscopy to explore biological problems in ways that few other investigators can match," Roberts said.

Stroupe earned a doctorate in structural biology from the Scripps Research Institute in 2002 and held a postdoctoral fellowship at Brandeis University and Howard Hughes Medical Institute from 2003 to 2009.

Tim Logan, professor and chairman of Florida State's Department of Chemistry and Biochemistry, praised Knappenberger's research as among "the most meritorious science ideas submitted by young scientists from around the country."

Knappenberger's research uses sophisticated laser equipment to unravel the molecular processes following absorption of light by tiny clusters of gold atoms called nanoparticles, according to Logan.

Nanostructured materials offer great potential for novel ways to utilize, store and transport energy over much of the solar spectrum. These opportunities arise because nanomaterials often display unique properties that depend on particle shape, size and orientation. The award will allow Knappenberger and his research group to develop advanced measurement technologies to systematically investigate the interplay between nanoparticle structure and function. In particular, the group will work to develop an optical imaging and spectroscopy platform capable of extraordinarily high spatial resolution. This research has the potential to affect several technical areas: solar-energy conversion, national security, trace-level analysis and high-contrast biomedical imaging.

The award also recognizes a researcher's commitment to teaching and the inclusion of others in the enterprise of science.

"Although Ken is a relatively new faculty member, he has already involved numerous undergraduates in his research, with one even leading the effort on a project that was published in the *Journal of Chemical Physics*," Logan said. "It is this dedication to research and to teaching students about research in a laboratory that made Ken successful in his grant application."

Knappenberger earned a doctorate in chemistry from Pennsylvania State University in 2005. He held a postdoctoral fellowship with the University of California, Berkeley, and Lawrence Berkeley National Laboratory from 2005 to 2008.

A video of the interview with Knappenberger can be viewed here.

Florida ranks No. 35 in Affordable Energy

A report titled "Energy Cost Index 2012," which evaluates the affordability of energy, placed Florida No. 35 out of all states. The study tracked the cost of gas, electricity and other energy in all 50 states plus the District of Columbia.

Florida's ranking places it in the lower third of states for affordability. The publication was conducted by a Washington, D.C.-based nonprofit advocacy and research organization called the Small Businesses and Entrepreneurship Council.

In a statement, SBE Council Chief Economist Raymond J. Keating, author of the report, stressed that high energy costs affect consumers and businesses of all sizes. "Energy cost differentials between states speak to the competitiveness of each state in terms of attracting and keeping businesses," he said in the statement.

JEA recently lowered the fuel rate, which in turn reduced monthly electric charges

Florida lags Behind Other States on generating Solar Energy

Ask state lawmakers why Florida doesn't focus more on solar energy and they'll complain about too many clouds.

So with little political will to aggressively tap the sun, Florida now lags behind other not-as-sunny places such as Massachusetts, Ohio, New York and New Jersey in developing more solar capacity.

New Jersey installed the most new solar in the first quarter of 2012, according to a report released Wednesday by the Solar Energy Industries Association. Florida ranked 14th.

The difference was huge. New Jersey added almost 174 megawatts from January to March. At that rate, the state would add the equivalent of a mid-sized nuclear reactor to its electrical capacity by the end of the year.

Florida added just 2.8 megawatts.

California still led in overall solar generation (1,662 megawatts). Florida ranked a distant 10th with less than 6 percent of California's total, according to the solar industry report.

Why is the Sunshine State falling behind in development of solar electricity? Several reasons.

The primary one, experts say, is a lack of a state requirement or even a goal for increasing the amount of solar electricity. Florida is one of just 14 states — almost all in the southeast United States — without a renewable energy policy standard or goal.

"Fundamentally, it's a policy issue," said Tom Kimbis, a vice president at Solar Energy Industries Association, during a conference call about the report. "If you look at where solar gets installed, it's the states that have the right policies in place."

James Fenton, director of the Florida Solar Energy Center at the University of Central Florida, put it this way: "Florida itself does not have a vision for its future. That's true on everything in Florida, but particularly in regard to energy."

Rep. Will Weatherford, R-Wesley Chapel, and the incoming speaker of the House, said that renewable energy standards require subsidies to corporations to entice them to generate more electricity from sources like solar or wind. He said he believes solar will play "a larger part of energy production in Florida and across the world," but he would rather the falling price of solar dictate whether to invest in it rather than government mandates.

"Subsidies mean people have to pay more," Weatherford said. "It's essentially a tax. I don't think it's necessarily a bad thing that we don't have a standard."

In 2006, former Gov. Charlie Crist pushed for a policy that would have required 20 percent of the state's energy to come from renewable energy sources by 2020, but that effort died.

State lawmakers scuttled the idea, saying Florida's "intermittent cloud cover," or essentially clouds that come and go, would disrupt solar power generation and make it unreliable. It's a claim lawmakers echo today.

"I heard that for 10 years ... intermittent cloud cover," said Susan Glickman, a lobbyist for the environmental group Southern Alliance for Clean Energy. "A good number of states have set targets for renewable energy and that helps to create a market where renewable energy can thrive and Florida policy makers have not done that."

Tim Leljedal, a spokesman for Progress Energy, said solar is a part of Florida's energy solution but that it is only "a piece of the puzzle."

"We need to make sure we build and install capacity that meets needs at all times," Leljedal said. "When you look at solar generation, it is by its very nature ... intermittent."

Progress Energy offers rebates and assistance to customers who want to install solar, and the utility pays for installation of solar at schools throughout its Florida service territory.

But the state has only once offered a major incentive for utilities to build large-scale solar. Florida Power & Light, the state's largest utility, snatched it up to build three solar electric power sites. FPL was allowed to recover the costs by adding 25 cents per 1,000 kilowatt hours of usage to customers' bills each month. (The average residential customer uses about 1,000 to 1,200 kilowatt hours a month.)

FPL is now the largest solar energy producer in the state, though solar accounts for less than 1 percent of its total power generation.

Another factor hindering the growth of solar in Florida: In other states, the cost of solar is the same or cheaper than other sources. In Florida, it's not, at least yet.

Last year, Fenton presented a state-by-state breakdown of the average cost to produce a kilowatt of electricity based on 2009 figures during a forum about solar energy.

With the cost of solar running about 16 cents a kilowatt, Fenton said, it is less than what utility customers in Massachusetts pay for electricity at 17.4 cents and those in New Jersey at 16.6 cents.

"Their existing rates for electricity are more expensive," Fenton said. "They're suffering. They have pain. They're looking for options... and solar's prices are coming down."

In Florida, the cost of solar remains higher than the average cost of retail electricity. Based on Fenton's numbers, Florida's average was 12.3 cents in 2009.

But because the price of solar continues to drop, it will eventually make economic sense, he said.

"If you have a choice between building a natural gas plant or solar, from a utility standpoint, you're going to choose natural gas," Fenton said. But he predicts that "solar will be cheaper than natural gas by 2022."

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How New Jersey became a solar energy leader

The state that led an 85 percent uptick in solar installations nationwide during the first quarter of 2012 compared with a year earlier was far from the largest or the sunniest.

"That title belonged to New Jersey," Tom Kimbis, of the Solar Energy Industries Association, announced on a conference call Wednesday.

Since 2006, the Garden State has made solar energy a key part of its energy generation plan when the New Jersey Board of Public Utilities expanded its requirement for renewable energy sources.

The state with the most dense population in the country set a standard for the utilities to produce 20 percent of their energy from renewable energy sources by 2020 — a mandate Florida once considered but later rejected — with a minimum of 2 percent from solar.

But it wasn't just the mandates that have driven up New Jersey's growth in solar installations.

"Their existing rates of electricity are more expensive" than solar said James Fenton, director of the Florida Solar Energy Center.

With solar and other renewables at parity with the cost of other energy sources, installations are soaring.

The result: New Jersey now has spent more than $363 million on almost 16,000 solar installations.

Study: Seeping Arctic Methane has Serious Implications for Florida Coastline

The ancient reserves of methane gas seeping from the melting Arctic ice cap told Jeff Chanton and fellow researchers what they already knew: As the permafrost thaws, there is a release of methane, a powerful greenhouse gas that causes climate warming.

The trick was figuring out how much, said Chanton, the John W. Winchester Professor of Oceanography at Florida State University.

The four-member team — whose findings were published in the respected journal *Nature Geoscience* — documented a large number of gas seep sites in the Arctic where permafrost is thawing and glaciers receding (they found 77 previously undocumented seep sites, comprising 150,000 vents to the atmosphere). Until recently, the cryosphere (frozen soil and ice) has served to plug or block these vents. But thawing conditions have allowed the conduits to open, and deep geologic methane now escapes.

The team studied the link between natural gas seepage and the melting ice cap, using aerial photos and field data to figure out the number — and location — of seep holes.

So, here's the rub: The more the ice cap melts, the more methane is released into the atmosphere — and the more the climate warms.

Why should this matter to you?

People who live in coastal areas of Florida could be directly affected, said Chanton, who analyzed the methane and dated it to more than 40,000 years old.

All this seeping methane causes more melting ice, Chanton said, which causes sea levels to rise and could affect coastal real estate values — sooner rather than later.

How soon?

Possibly over the next 50 to 100 years, Chanton said.

"Methane is a very strong greenhouse gas that's grown three times faster than carbon dioxide since the industrial era," Chanton said. "As the Arctic warms, the ice caps melt and the fissures open, so methane escapes and causes more warming."

This phenomenon causes sea levels to rise, which is particularly problematic in Florida:

"Along the flat Florida coastline, a 1-foot rise in sea level could cause anywhere from 10 to 100 feet of shoreline retreat — erosion," Chanton said. "For us here in Florida, this is really important because we can expect the coast to recede."

That beach house, he warned, might be in peril: "It may not be there for your grandchildren."

SU Researchers Produce Light from Fireflies

SYRACUSE, N.Y. -- There may soon come a time when you don't need an electrical outlet or batteries to turn on lights. Researchers from Syracuse University are studying how fireflies make their own light in an attempt to reproduce that type of energy.

Assistant Chemistry Professor Mathew Maye says the firefly is ideal to work with because it is so bright. He has been working for more than a year with an enzyme taken from the insect. That enzyme combined with a chemical produced in the laboratory creates a glowing light.

Assistant Chemistry Professor Mathew Maye said, "It gives off a very bright burst in the first few seconds just like a firefly. Then it slowly decays over the time of 10 to 15 minutes. We're trying to work out how exactly to sustain that light."

In the lab, the light was orange, but Maye said other colors can be made.