Renewable energy is soaring. Are we ready?

Renewable energy is growing worldwide, with a six-fold increase in non-hydro renewables over the last decade from 85 GW to 657 GW.

This growth used to be limited to developed countries, but now it is happening in significant numbers in developing countries as well. Last year's record-high investment in renewable energy-$285.9 billion—was the first time investment in developing countries topped that in developed ones. China, India and Brazil alone accounted for more than half ($156 billion) of that investment commitment.

In recent months, about 30 country householders have joined a pilot project that provides a glimpse of the future of our energy grid.

The shift toward cleaner energy is here. The question is, are we prepared for it?
(Note for figure: By 2012, the level of renewable capacity was already as high as the maximum potential level in 2030 that had been projected by the IEA a few years earlier.)

5 Market Trends Explain Renewables’ Growth:

- **Costs improvements**: The price of wind and solar panels (photovoltaics) have dropped steeply. Between 2009 and 2014, prices for solar modules fell 75 percent. With falling prices, RE is likely to be cost competitive with conventional technologies much earlier than previously expected.

- **Improved Technology and Efficiency**: Technical improvements also help drive global deployment, as well as reduced costs of new technologies and decrease in material prices. For example, wind turbines are increasingly being designed for low-wind-speed environments, which allows for installation closer to areas of demand and away from areas of public and environmental controversy.

- **Fossil-Fuel Price Instability**: Rapid, dramatic swings in fossil-fuel prices—particularly from 2008 onwards—helped push the electricity sector to less volatile resources.

- **Government and Investor Support**: Since 2004, the number of countries putting in place renewable energy support mechanisms tripled from 48 to 164, and this trend is evident in both high- and low-income countries.

- **New Players**: About one-third of global solar PV’s capacity is owned by individuals.

(Note for Figure: Rise in countries by income group that have enacted Feed-in Tariff (FIT) policies since 2004.)
**How These Trends Affect Decision Making**

These trends play a role in decision making about the future of electric power, especially in countries like Brazil, China, and India, according to a new report from WRI, Prayas (Energy Group) (PEG), Regulatory Assistance Project (RAP), International Energy Initiative (IEI), and UNISON Group, The Future Electricity Grid: Key Questions and Considerations for Developing Countries. Here are three challenges that bear watching as renewable energy expands:

Technology and Infrastructure: As the use of renewable energy increases, grid system operators need to make sure that the electric grid is compatible with and is able to interconnect intermittent sources of power, such as wind and solar. They also must link the often remote places where the energy is generated with places where the energy is needed, such as in densely populated areas. Variable weather can also be a complicating factor.

In some countries such as China, the rapid growth of wind energy has made integration with the grid difficult. In areas of the country where large amounts of wind energy have been added to the grid, variability has caused system-balancing issues. Balancing issues are often dealt with by curtailing portions of wind generation, which means that power grids do not use that power even if wind plants are capable of producing it. In 2015, around 15 percent of wind power was wasted throughout the year. Upgraded, expanded power grids are essential to ensure reliable, high-quality service.

Institutional arrangements: Renewable energy is increasingly generated in a decentralized way—by individuals, commercial business owners and cooperatives—that challenges the traditional utility sector and centralized grid model. Institutions will need to think about required new skills, services and arrangements to keep up with these changes and stay financially viable. In India, utilities are under financial pressure as they lose their higher paying customers to renewables. In the southern state of Tamil Nadu, consumers purchasing renewables outside their utilities has resulted in utility revenue losses of about $250 million, which is 5 percent of total revenue requirement.

Pricing: The rise in renewable energy and the complexities associated with it are creating new concerns over electricity prices. In the United States, several states have enacted net-metering policies, where utility customers who generate more renewable power than they use can sell the excess to the electrical grid, raising concerns about how much participants should be paid. Such programs can affect utility revenues and can also disproportionately affect electricity customers who aren’t generating renewable power. Properly valuing and distributing system costs and benefits among customers will become increasingly important.

How governments, energy planners, regulators and utilities respond to these trends and monitor these challenges will determine how well they build a future grid to deliver the clean, reliable and affordable power people need to thrive. The time to take action is now.

**Mimicking Photosynthesis with Light-Harvesting Man-Made Leaves Can Cut CO2**

Scientists have long been trying to emulate the way in which plants harvest energy from the sun through photosynthesis. Plants are able to absorb photons from even weak sunlight using light antennae made from chlorophyll molecules in their leaves. This
absorbed energy is then transferred to reaction centers wherein the plants create the sugars they use as food. So far, artificial systems built to replicate this super-efficient natural process have been limited to a single reaction center with a few light absorbers, and have been unable to absorb enough energy from light sources with low photon levels such as sunlight.

Now, Osamu Ishitani at the Tokyo Institute of Technology, along with researchers from Toyota Central R&D Labs, Inc., has created an efficient, artificial light-harvesting system based on the natural two-step process of photosynthesis. The new system uses man-made 'leaves' as light absorbers, which relay energy through a metal complex to feed a final energy acceptor.

"It is difficult to make an efficient solar-energy converter using molecular devices such as so-called photocatalysts because the molecules are so small and solar light is so dilute," explains Ishitani. "Such systems would require huge numbers of molecular devices, which are expensive and time-consuming to make. Introducing devices with the ability to harvest light into solar-energy conversion would be one possible solution."

Ishitani and his team realized that building a system with multiple light absorbers feeding a smaller number of energy relay 'antennae' linked to an energy acceptor would allow more photons to be absorbed from dilute light, with less energy being lost along the way.

The researchers created a device with 440 'leaves' using tubes made from so-called periodic mesoporous organosilica (PMO) and light-absorbing biphenyl (Bp). The PMO-Bp complexes were linked to five connected rhenium metal sticks, which transferred the light energy harvested by PMO-Bp directly to a central ruthenium sphere. In this way, the photons from the light source were concentrated very efficiently, first through the rhenium sticks and then into the ruthenium reaction center, with little loss of energy en-route.

In a series of tests using the new system, Ishitani and his team found that the reaction center of their device was capable of emitting a strong light powered by the photonic energy from the man-made 'leaves'.

The new system could be used to build better photocatalysts, which can be used for a number of purposes including CO2 reduction and water oxidation photocatalysis. However, Ishitani and co-workers state that it will be some time before artificial photosynthesis becomes commonplace in such systems, because the process requires considerable further research and development.

**FESC HIGHLIGHTS**

**UCF Floats Solar Power, Given Limited Land Space**

Electricity and water might seem like a risky mix but combining them at University of Central Florida could alter solar business and power a football stadium.

A group of five mechanical engineering students has constructed a raft as a platform for solar panels. It floats on a retention pond near the school's nearly decade-old stadium at the edge of campus east of Orlando.

If the tiny power plant proves effective, durable and not harmful to its immediate environment, it could pave way for a far larger array of panels able to generate as much
energy as the 45,000-seat stadium consumes.

"This project is bringing awareness to a whole new sector of solar energy," student Rebecca Shea said.

Another team member, William Rumplik, said that's true "especially in areas with limited land."

The floating system may be the nation's first as others are in the works in California. The students learned the technology is getting a start in Europe, while Japan is the world leader.

"We hope that young professionals like us will invest their time in making solar energy more accessible," Geoffrey Gregory said.

Central Florida is speckled with lakes and retention ponds and might turn out to be an ideal setting. Orlando Utilities Commission has begun to explore the option. Group member Rubin York said he thinks the cost of floating systems compares well with solar plants on land, but prices for the wet version should drop as popularity increases.

It remains to be seen what the UCF project shows as far as upside and disadvantages. The solar raft is a senior-design project, a requirement of a mechanical engineering degree, and grew out of brainstorming with the school's department of energy and sustainability.

Solar panels on "Pond 2-H" can produce more than 5,000 watts, which is about enough to power a home.

No electricity leaves the pond. Instead, it powers a submerged pump that kicks on periodically with impressive force to aerate Pond 2-H.

Still unknown is the raft's effect on pond biology. It covers more than 700 square feet of pond, an area larger than the floor of a two-car garage. The pond is large enough at 13 acres for nearly 800 such rafts, but the raft is located in small cove of the pond. Shade cast by the raft could lessen pond evaporation and cut off sunlight needed by both beneficial and harmful aquatic plants.

The students turned to the biology department, which will observe water chemistry and ecology.

The raft is comprised of 24 main floats and many secondary floats that were assembled by the students. They likened the task to putting together enormous Lego pieces.

Solar panels are attached to the raft at upward tilt of 12 degrees for optimal exposure to sunlight. Each of 20 panels generates as much as 250 watts.

Holding it all in place are four anchors drilled into the edge of the pond and attached by cables.

The raft components were manufactured by a French company and cost about $7,000, while the panels were donated.

Total project cost was less than $9,000, which was covered by the office of energy and sustainability.
The student engineers are enthused by their project.

"Being able to put a body of water to use as a solar farm is exceptionally innovative," student Rudolph Jara said.

But the bigger project, which would cover more than two football fields, or nearly a quarter of Pond 2-H, will be taken up by the office of sustainability.

David Norvell, assistant vice president for sustainability, said an important consideration of the pilot project is whether floating solar performs better than land systems.

A panel's efficiency lessens as sunlight heats it up, but a floating panel should stay cooler and produce more power, Norvell said.

Norvell said it's possible a system producing 900,000 watts could be in place on Pond 2-H within a year and could cost between $1.5 million and $1.8 million.

But beyond price is consideration that UCF, with the nation's second largest enrollment, doesn't have much more land for development. The vast majority of its 1,350 acres is off limits as conservation zones and only a couple of 50-acre tracts remain for construction.

That land constraint could increase viability of floating solar.

"We have a lot of ponds," Norvell said.

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**FIU and FPL Unveil One-Of-A-Kind Solar Research Facility**

**Solar array powers the grid while research initiatives will help further advance solar generation in Florida**

**FIU and Florida Power & Light Company (FPL)** today unveiled a new commercial-scale solar installation at FIU’s College of Engineering and Computing – the only solar research facility of its kind that FPL has installed at a Florida university.

The 1.4-megawatt solar array is comprised of more than 4,400 solar panels on canopy-like structures that provide clean electricity to FPL’s grid and shade for about 400 parking spaces. The unique solar array incorporates a 24-foot by 12-foot FIU logo that is visible from high above.

Engineering faculty and students from the Energy, Power & Sustainability (EPS) program at FIU will use the installation to conduct important research that will help FPL advance solar energy in the state.

Through a five-year research grant, faculty and students are analyzing data from the on-site solar panels to understand the impacts of intermittent solar power on the electric grid in South Florida’s tropical climate. The researchers will also look at historic weather patterns and develop predictive models to forecast the reliability of solar power generation.

“This research project builds on our long-standing relationship with FPL,” said FIU President Mark B. Rosenberg. “We’re engaging in groundbreaking, problem-solving research to address the challenges of our region and beyond. Our students will get
hands-on experience and see how the research they conduct in the lab will have an impact in the real world – gaining skills that will help them compete for high tech 21st century jobs. This solar power facility is a win-win for FIU, FPL, and our community.”

FPL is the state’s largest generator of solar energy and operates three utility-scale, or universal, solar plants in Florida. The company is constructing three new 74.5-megawatt solar energy centers that will cost-effectively triple its solar capacity by the end of 2016.

“We work hard every day to deliver our customers electricity that is among the cleanest and most reliable in the county for a price well below the national average,” said Eric Silagy, president and CEO of FPL. “Through this innovative partnership, we will continue to make our energy infrastructure even smarter. The faculty and students working on this project are contributing to our state’s energy future – a future that includes more solar power.”

FIU researchers are looking closely at Florida’s climate as part of their research.

“Solar power depends on the sun for fuel and with South Florida’s tropical weather conditions the amount of sun can vary greatly from one moment to the next,” said Arif Sarwat, a professor in the Department of Electrical and Computer Engineering who serves as director of the FIU and FPL Solar Research Facility and EPS. “In Florida, where sunshine can vary moment to moment, our team is researching how intermittent power generation impacts the grid with an eye toward a better understanding of how to best leverage solar power.”

For more than three decades, FPL and FIU have partnered on various projects. In addition to hundreds of FPL employees who are FIU alumni, the energy company runs an on-campus customer care training center where students answer calls from customers. FPL also donated an electric vehicle from its clean fleet to FIU’s College of Engineering and Computing to further research and test wireless charging technology.

Besides conducting research on wireless charging, EPS students also work at the FPL laboratories every week to conduct high-end experiments and research on batteries and access points.

“This project further demonstrates FIU’s commitment to working with FPL to help prepare our students for addressing society’s needs for renewable energy,” said Ranu Jung, interim dean of the College of Engineering and Computing. “Our faculty and students are engaged in research related to multiple facets of power generation, and this partnership will help strengthen their contributions to making solar energy viable and economical.”

For images and videos of the solar panel installation, please click [here](#).
UF/IFAS Produce Earth Day Videos

IFAS Communications has recently produced and posted two Earth Day videos that you may be interested in to the UF IFAS Solutions Facebook page: one on reusable bags and one a short promo for the Sustainable FloridiansSM Program.

Link to Earth Day 2016 UF/IFAS Video: Reusable Bags
Link to Earth Day 2016 UF/IFAS Video: Sustainable Floridians

FLORIDA ENERGY NEWS

Duke Energy's Mickey-Shaped Solar Farm Reaches Commercial Operation

A new Mickey Mouse inspired solar farm at Walt Disney World Resort in Lake Buena Vista Florida is now part of the resort’s growing environmental stewardship program.

Duke Energy said this week that the 48,000-solar-panel, 5 MW project is now in commercial operation and will power some of Disney’s operations along with other customers in the area.

According to Disney, it works to reduce emissions from the resort activities by operating several of its attractions and service vehicles on biodiesel and compressed natural gas.

Bold Plan For Solar-Powered Babcock Ranch Development, Stalled by Recession, Hits Restart Button

A bold plan to build a new town in southwest Florida designed to run on solar power — sidelined by the recession a decade ago — hit the restart button Friday morning with a celebratory event announcing Babcock Ranch is back in business.

Located between Fort Myers and Punta Gorda and east of Interstate 75, Babcock Ranch is expected to grow to 20,000 homes ranging from $250,000 to $900,000 and include a downtown with commercial space and extensive infrastructure emphasizing the ecosystem and sustainability. In sheer land size, the project has been described as 500 acres bigger than the mammoth Lakewood Ranch community in Manatee County, and more than 3,000 acres larger than Manhattan.
There are two key features. The first is a new, 75-megawatt solar facility nearby owned by Florida Power & Light that should provide enough daytime electricity to meet most, if not all, of the town's needs.

The second is the adjacent Babcock Ranch Preserve, 72,000 acres of untouched land that will remain a buffer for the town from the rapid additional development under way in this part of Florida and will serve as an invitation for residents to enjoy natural Florida.

"We think this is something never done before," said Syd Kitson, the developer and a partner of Kitson & Partners, who conceived the idea of Babcock Ranch in Charlotte County. "A town powered by solar."

Kitson was joined Friday by FPL CEO Eric Silagy and other Florida officials including Florida Commissioner of Agriculture Adam Putnam and Audubon Florida executive director Eric Draper to showcase the planned town's emphasis on sustainability. Nearly 700 people showed up to listen.

In an interview with Kitson and Silagy, I asked if Babcock Ranch could become a prototype of new Florida communities that take more aggressive advantage of solar power and environmentally friendly design and construction.

"I hope so," Kitson said. "One of the things we are trying to be careful about is that we want to be different and great, but we do not want it to be weird." He said Babcock Ranch will feature cutting-edge infrastructure, advanced telecommunications features and even its own autonomous vehicles. But it will also focus on what people want from an aesthetic point of view.

FPL's Silagy praised Kitson for donating 400 acres of land to the power company to accommodate its solar array of 350,000 panels designed to generate 75 megawatts of electricity on sunny days. The town won't need that much power initially, since it is just getting under way, so any excess power will flow into FPL's power grid. Should the town's needs exceed the solar output, especially on cloudy days when less electricity is generated, FPL's existing service will supplement as needed. FPL's grid will also handle electricity needs at night, when there is no sunshine to power the solar facility.

Electric rates for Babcock Ranch residents and businesses will be the same as for any other customer in the utility's extensive service territory, Silagy said. (FPL historically charges lower rates than Duke Energy or Tampa Electric, the main power providers in the Tampa Bay market.)

"If (Kitson) is successful, we may have to add more solar panels," Silagy said.

Friday's unveiling of the town-to-be came close to never happening. Kitson, a former professional football player, first conceived of a solar-driven Babcock Ranch community a decade ago, announcing a plan in 2006 for a new town with sustainable features.
Kitson and his backers bought Babcock Ranch for more than $500 million in 2006 from the heirs of Edward Vose Babcock, a former mayor of Pittsburgh. Kitson then turned around and sold the state 73,000 acres. The sale, which created the Babcock Ranch Preserve, was the state’s largest land preservation deal at the time. Kitson held on to the remaining 18,000 acres or so, intending to build his new town on half of the land and leave the other 9,000 acres or so for greenways and parks.

Then the great recession hit. It would take Kitson a decade to regain the confidence in the Florida economy and consumer home buying interest to kick-start Babcock Ranch back into gear.

The revival of the town is, in part, a tale of resilience. "We never gave up on the idea," Kitson said. "It never entered my mind we would not do it." Kitson acknowledged he was lucky that his project had not yet started major investing in the town’s infrastructure before the economy stalled. "It would have made it hard for us to recover," he said.

"Did I think it would take 10 years? Not at all."

Now Kitson wants Babcock Ranch not only to grow in residents but in businesses that will help provide jobs and supplement employment opportunities in nearby Fort Myers, Punta Gorda and Estero. Kitson stressed Babcock Ranch was never intended to be some kind of gated community but a new town that he hopes will attract not only baby boomers but millennials and young families. That’s one reason the town’s planned homes range widely in price and design, from more modest urban townhomes to spacious, upscale houses on larger lots. Construction of the project’s basic infrastructure and solar array began last fall.

Babcock Ranch, said Kitson, is literally a new town with new infrastructure from the ground up. People will know exactly what they are getting, he said. "We are open for business and can get it done."

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**GE's New Clearwater factory - Where Digitization Meets Manufacturing**

GE (NYSE: GE) opened the doors of its brand new Capacitor and Instrument Transformer Advanced Manufacturing Facility in Clearwater, Florida. GE’s $60 million investment in the facility is a significant boost for economic development in the state and a reflection of GE’s ongoing commitment to advancing American manufacturing.

GE’s new 190,000 square foot Center of Excellence, an expansion of its 40-year old instrument transformer facility in Clearwater, will produce instrument transformers and capacitors for the global market. The factory opening will create 275 new jobs in the Tampa Bay region, training its employees to operate the latest technologies and digital platforms.

“We are cultivating a skilled workforce in Clearwater,” said Clearwater Mayor George Cretekos. “With the expansion of GE’s Center of Excellence, we are helping to strengthen Florida’s position as a global cleantech and manufacturing hub and thank Governor Scott and the Florida Legislature for its commitment to manufacturing facilities such as this one.”
With the Clearwater factory, GE is meeting growing global demand with a 35% increase in capacity and a 50% reduction in manufacturing cycle time. The facility ushers in a new era of manufacturing for today’s digital world as one of GE’s first manufacturing factory to use the GE Predix™ Edge software. Predix™ serves as the foundation for all of GE’s Industrial Internet applications, bringing together device connectivity, data integration and management, data analytics, cloud and mobility. At Clearwater, Predix™ will use real-time data from the site’s sensor-enabled manufacturing equipment to predict outcomes and optimize the process. This includes design engineering feedback loops to enhance product quality and performance, plant efficiency and timely delivery to customers.

As an early adopter of Predix™, the Clearwater facility will provide predictive and prescriptive analytics and actionable insights that will be transferable across all of GE’s global manufacturing facilities, increasing operational and supply chain efficiency. GE has over 450 factories around the world where we are reimagining how products are designed, manufactured and serviced. We’re combining new production processes with cutting-edge technology and digital analytics to change how we design and create.

“The world-class manufacturing center in Clearwater is a landmark for the American manufacturing industry,” said Alan Swade, General Manager for the Capacitors Business at GE’s Grid Solutions. “The equipment manufactured in Florida will maintain efficient power flows across electrical transmission and distribution networks. The Clearwater factory will serve one of the fastest growing market segments globally and enable the integration of renewable energy sources around the world.”

The Clearwater facility also boasts industry-leading product designs, including state-of-the-art drying ovens and refinery, sensor-enabled process equipment, and robotics to automate tasks, delivering more consistent, repeatable outcomes, accelerating innovation, speed and performance. Its vertically integrated operations provide for a consistent reduction of lead and cycle times across a wide variety of product configurations. With GE’s continued digital investment, Clearwater will be the state-of-the-art Brilliant Factory of the future.

Click here to view GE's new Clearwater factory image gallery.

Click here to download images from GE's new Clearwater factory.

German Solar Power Company Relocates Headquarters to South Florida

Conergy, one of the world’s largest downstream solar companies, has relocated its U.S. headquarters to Miami from Denver, according to a release.
“Miami is a unique, embracing melting pot, making it a perfect home for Conergy,” said Conergy CEO Andrew de Pass in a statement. “Miami is also a convenient geographic hub to support Conergy’s growing presence in both the U.S. and emerging markets in Latin America.”

Its majority shareholder, Kawa Capital Management in Aventura, will be a close neighbor. Founded in 1998, the German company specializes in the design, finance, construction and long-term asset management and ownership of solar power systems. The solar industry is divided into two segments: upstream, which includes installation and finance, and downstream, which includes manufacturing, installation and finance.

Conergy has pioneered the expansion of solar energy globally, providing more than 1.5 gigawatts of solar power across six continents, it said. To put that into context, consider that the Hoover Dam is a 2-gigawatts facility.

According to the release, Conergy’s relocation will add at least 60 high-paying jobs to Miami within the next three years.

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**Gulf Power Expands Wind Energy Investment**

Gulf Power is expanding its wind energy output.

The company filed a petition Monday asking the Florida Public Service Commission to approve adding 94 megawatts of wind energy from the Kingfisher Wind farm in Oklahoma.

The diversification of the energy sources that Northwest Florida customers use to power their homes means less price fluctuations as a result of natural disasters like hurricanes or extreme heat or cold.

"I for one don’t want us to forget that those price spikes can happen," said Stan W. Connally Jr., Gulf Power chairman, president and CEO. "Our customers are happiest when the price of our product is stable. A balanced portfolio with diverse fuels is our way of doing that."

The original Kingfisher Wind project went online in January and has been producing 178 megawatts of wind-generated energy. Gulf Power is seeking approval of a second
agreement of that wind project that would add 94 megawatts of wind energy to its energy mix, for a total of 272 megawatts.

“Gulf Power is committed to renewable energy that makes economic sense for our customers,” Rick DelaHaya, a Gulf Power spokesman said in a written statement. “Our renewables team worked very hard to make these projects affordable. These smart renewables, like Kingfisher Wind, can actually put downward pressure on prices.”

The Kingfisher Wind project has 136 wind turbines capable of producing enough energy to power about 77,150 homes for a year.

Gulf Power is moving away from coal power and toward more natural gas and renewable energy sources.

In 2002, about 80 percent of Gulf Power's energy came from coal and 20 percent from natural gas. This year, it is projecting that 75 percent will come from natural gas, 20 percent from coal and 5 percent from renewables, Connally said.

The hope is that next year, as Gulf Power's military solar projects at Eglin Air Force Base, Saufley Field and Holley Field are completed, the share of renewables will climb closer to 10 percent.

The transition away from coal has been as a result of costly federal environmental regulations and low natural gas prices, Connally said.

Kingfisher is Gulf Power's sixth renewable energy project following the Perdido Landfill Gas-to-Energy Facility, which has produced more than 100 million kilowatt hours of electricity since 2010.

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**NASA Makes Leaks Easy to Spot on Tape**

From Apollo through the Space Shuttle, NASA has relied on liquid hydrogen to fuel the upper stages of its launch vehicles. Hydrogen is the most efficient propellant there is: measure for measure, it provides more thrust when burned than any other fuel source. Harnessing that energy, however, requires a great deal of technical know-how. For one, there is the challenge of keeping hydrogen from evaporating by maintaining it at temperatures below minus 423 degrees Fahrenheit.

There's also the ever-present threat of leaks. Hydrogen, the smallest and lightest atom in existence, escapes through the tiniest of cracks - a significant hazard considering that it's also highly flammable, to the point where certain high-pressure leaks can cause combustion. Knowing all of this this, NASA has long taken serious precautions to monitor the miles of pipelines carrying hundreds of thousands of gallons of rocket fuel to the launch pad.
In the early days of the space program, inspectors held brooms to the pipes as they slowly walked the lines. If the broom's head began to burn, they knew there was a leak burning. Later, during the launches of the 1980s and '90s, they used ultraviolet sensors to detect flames; to find non-burning leaks they began utilizing electrochemical and combustible gas sensors.

**Chemistry Class Revisited** These methods, however, were imprecise, as they could only suggest a general area from which the hydrogen was originating. That was especially problematic in areas where multiple transfer lines intersected. For this reason, Kennedy Space Center collaborated in the mid-2000s with the Florida Solar Energy Center (FSEC) at the University of Central Florida to come up with something a little smarter.

The team of researchers started with a Japanese patent for a hydrogen-detection tape that changes color when exposed to the substance, but they wanted to make the color change more noticeable. The team tested different combinations of the two active chemicals in the tape, palladium oxide and titanium oxide, to find a mix that had the right color contrast, could create a fast reaction and could be applied to a silicone-based tape.

Two years later, another team of scientists and engineers from Kennedy improved the tape to make it robust enough to withstand harsh conditions ranging from shuttle launches to unruly weather.

**From Launch Pad to Store Shelves** The tape got its first real-world test with the launch of STS-118 in 2007, where it quickly proved its worth: Kennedy's area sensors detected the presence of hydrogen on the launch pad, and the hydrogen tape pinpointed the exact location of the leak so that crews could address it. Afterward, the tape was used for every launch through STS-134 in 2011, the program's penultimate mission.

NASA and FSEC entered into a Space Act Agreement and a licensing agreement to sell the tape commercially, resulting in the creation of Rockledge, Florida-based HySense Technology.

Nahid Mohajeri, a chemist at FSEC who founded HySense Technology, says the advantages of the color-changing tape are easy to see. "Stationary sensors have a shelf life and, depending on where they're located, they might not be able to detect every area that's susceptible to a leak," she says. "And the handheld sensors require technicians to walk around and listen for a beeping sound."

The 2014 R and D 100 Award-winning technology is now being used across industry, from chemical plants to gas producers and stainless-steel manufacturers. The technology has also attracted interest from automotive manufacturers that are developing hydrogen-fuel-cell automobiles.
San Francisco Just Became the First Big US City to Require Solar Panels On New Buildings

San Francisco may be known for its fog, but the city wants to turn the sunny days it does get into power for its buildings.

The San Francisco Board of Supervisors on Tuesday unanimously passed legislation that would require new construction that is shorter than 10 floors to install solar panels or solar water heaters on top of both new residential and commercial buildings.

According to California law, all new buildings with 10 floors or less must have at least 15% of their rooftops designated as solar ready — meaning not in the shade. San Francisco now requires those buildings to actually use it for solar panels.

The new rules also make San Francisco the first major US city to mandate solar panels on new construction, although other California towns like Lancaster and Sebastopol have instituted similar laws.

"By increasing our use of solar power, San Francisco is once again leading the nation in the fight against climate change and the reduction of our reliance on fossil fuels," said Supervisor Scott Wiener, who put forth the legislation, in a statement. "Activating underutilized roof space is a smart and efficient way to promote the use of solar energy and improve our environment."

The new rules don't go into effect until January 1, 2017, after which any construction that falls under the state law to include solar-ready space will have to actually install it.

If a developer isn't happy about adding in solar, Wiener has a backup plan. He's also introducing legislation that would allow people to add a living roof like a garden on top instead of the solar installation.
Researchers Have Stumbled Upon A Battery Breakthrough That Could Change Energy Storage Forever

There's serious demand for longer-lasting batteries.

Better battery storage can advance all sorts of technology from phones to electric cars — but increasing battery life is no easy feat.

Luckily, researchers hailing from the University of California Irvine may have accidentally discovered a solution that could change energy storage forever.

Fifth-year PhD student Mya Le Thai stumbled upon the solution when she decided to create an electrolyte made of gel to replace the liquid electrolyte found in some batteries "so it'd be more affordable," she told Tech Insider. It just so happened that the gel she created can also greatly increase battery life.

Here's how the solution works: for a long time researchers have sought to use nanowire-based batteries over lithium batteries. That's because nanowires are more powerful and boast greater energy storage than their lithium counterparts.

Lithium batteries slip in performance over time after being continuously charged (think of your phone: that battery life is great at first and slowly gets worse until it's a shell of its former self.)

But what has prevented researchers from using nanowires is they are extremely fragile, meaning they can't be charged repeatedly without breaking. For that reason, electronics makers have stuck with traditional lithium batteries.

But Thai's gel solution could change that.

Gold nanowires. University of California Irvine
The researchers coated a gold nanowire with Thai's gel solution and found that the nanowire-based battery cell had far better storage capacity than typical lithium ion batteries.

The gel electrode went through 200,000 charge cycles over three months without losing any capacity or power. For reference, batteries typically die after 5,000 to 7,000 cycles.

The gel solution was published in the American Chemical Society’s Energy Letters.

"For this research right now the plan is to understand the mechanisms of how this gel electrolyte could prolong the cyclibility so well," Thai said. "The future bigger plan would be to optimize these gel electrolytes to see if it can improve even more."

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**Solar Plane Touches Down in Oklahoma**

The [Solar Impulse 2](https://en.wikipedia.org/wiki/Solar_Impulse) on May 12 touched down in Tulsa, Okla., after an 18-hour flight from Phoenix, Ariz. The Solar Impulse 2 completed the 11th leg in its journey across the world powered only by the sun. The Solar Impulse 2 ground team had arrived earlier in the day from Phoenix via commercial airline, and two of their own airplanes. The ground crew is in charge of everything from social media, media relations, navigation, plane maintenance, and planning.

The Solar Impulse 2 is equipped with 17,248 solar cells built into the wings that power the four batteries (38.5kWh per battery) that in turn power the four electric engines (13.5kW/17.5hp each) and the propellers. The Solar Impulse 2 is a single-seater aircraft made of carbon fiber, has a wingspan of 72m/236ft (larger than a Boeing 747: 68m/223ft) and weighs (empty) 2300kg/5100lb, with a cruising speed of 45-55km/h / 28-34mph and a max altitude of 8’500m/28,000ft.

The Solar Impulse 2 has to depart early in the morning and arrive late at night to avoid winds so that it can ascend and descend without interruptions. The pilot for this leg of the journey was Bertrand Piccard. Piccard may be alone in the plane but he is always in contact with the Mission Control Center in [Monaco, France](https://en.wikipedia.org/wiki/Monaco). The MCC team is comprised of air traffic
controllers, meteorologists, the Mission Director, mission engineers, mathematicians, and CAPCOM (Captain Communication—the direct contact with the flying pilot). The Mission Control Center maps out where the solar plane will land on each leg of the journey. The pilot is also always in contact with social media through, Facebook, Twitter, Instagram, Google+, Vine, LinkedIn, YouTube, Snapchat, Flickr, and Periscope.

After the sun went down and the Solar Impulse 2 was descending, Tulsa media outlets began receiving calls about “UFOs”. The outlets were quick to identify the flying object to concerned Okies. You can watch live video from inside the plane when it is flying from this link.

Andre Borschberg, Co-founder and CEO said, “Thanks to oil and the products that came from oil the plane is so energy efficient.” Borschberg was referring to the components of the plane being byproducts of oil. While in Tulsa the Solar Impulse 2 will be staying in an American Airline hanger out of the elements and the Mission Control Team will be monitoring weather and determine where the plane will travel when it leaves from Tulsa. The team usually knows only a day or a few hours in advance as to where they will go next. The Solar Impulse 2 ground team expect to be in Tulsa for about a week, as there will be some weather coming through the state within the next few days.

10 Cool Facts:

1. Andre Borschberg set the record for a five-consecutive-days-and-nights flight over the Pacific Ocean.

2. The pilots use fatigue management through self-hypnosis and meditation techniques.

3. Daily requirement for nourishment includes 2.4 kg (5.2lbs) of food, 2.5l (84.5oz) of water and 1l (33.8 oz) of sports drinks.

4. Living space of 3.8m³ fitted with a couchette seat and integrated toilet. (The pilot seat reclines and doubles as a toilet).

5. There is a live satellite connection to the Mission Control Center at all times.

6. The cabin is not pressurized and unheated.

7. The pilot uses an oxygen mask and multiple layers of clothes to stay at cruising altitude.

8. Maximum indicated air speed of 90 km/h (49kts).

9. It’s estimated that there will be 16 stages to complete the journey around the world.

10. The Mission Control Center is where all the decisions are made.

Why is ATJ Renewable Jet Fuel Rockin' It?

If you’ve seen the astonishing leap in Gevo’s valuation over the past two weeks and the jump in Amyris’ value this week, you might have noticed they have one important element in common: both are making major announcements regarding supply of renewable jet fuel.
**Gevo to Alaska Airlines, Amyris to Cathay Pacific.** Quantities are small, but these are for operational flights rather than testing and certification, and renewable jet fuel is hot with investors.

There are many pathways from biomass to jet — right now, the hottest is ATJ, or alcohol to jet. In the case of Gevo, they want to convert first-gen ethanol projects to making isobutanol, and upgrade that jet fuel to jet fuel. In cases such as Vertimass and Byogy, they start with ethanol as a feedstock — strictly as an offtaker, and upgrade to jet fuel directly from ethanol.

Other routes make jet fuel directly from vegetable oils (as with HEFA fuels), or from syngas (produced, in the case of Fulcrum Bioenergy, by gasifying municipal solid waste).

**Why ATJ At All?**

There are skeptics, for sure. Jonathan Lewis at Lee Enterprises Consulting wrote in *The Digest* this week:

*The approved ASTM D-7566 ATJ pathway produces Butanol (BuOH) from Ethanol (EtOH) via fermentation and subsequently dehydrates the BuOH to C2 –C5 olefins, then oligomerizes the olefins to C8 –C16 iso-olefins, then hydrotreats them and finally, fractionates the resulting product to RJ. In the first step (EtOH fermentation → BuOH), there is a maximum efficiency of around 20%. Therefore, for every metric tonne (335+ gallons) of EtOH input, the maximum output of butanol, the ATJ precursor, will not exceed about 67 gallons. At today’s price of $1.70/gallon, this means that about 268 gallons ($455) is lost before any RJ is even produced...And in the best case scenario, the 67 gallons must be priced at least above the MT price of EtOH to make up for the loss. Thus, a gallon of ATJ cannot cost less than $8.50, even before adding in the rest of the processing costs...for most airlines, this is simply not viable.*

Or, as Aemetis CEO Eric McAfee noted, ATJ runs into the “Natural Law of Alternative Commodity Markets” — which states that “the value of any intermediate products produced in any process must be significantly exceeded by the value of the end product, or the end product will not be produced.” How does that work with ATJ?

1. Produce non-food, advanced biofuels such as cellulosic ethanol worth $4 per gallon ($2.50 ethanol + $0.45 advanced fuels RIN + $1.01 tax credit).

2. Recombine ethanol molecules in a reaction that makes about 1 molecule of jet fuel from 2.5 molecules of ethanol.

3. The value of the total molecule is now about $7 as corn ethanol and $10 as cellulosic ethanol, but only $3.50 as unsubsidized jet fuel.

4. Repeat at high production volumes to achieve “economies of scale”.

5. Invoke the Defense Production Act to allow direct investment by the military in building a full-scale plant.

6. Shut down the production of jet fuel when less expensive direct conversion technologies enter the market.
7. Sell the plant to someone else, who happily and profitably produces cellulosic ethanol, due to the high cost of cellulosic ethanol feedstock for jet fuel relative to the alternative use of the feedstock as motor fuel.

8. Wonder why the spreadsheet looked so good.

**So, What's Changed? Technology, For One**

Vertimass CEO Charles Wyman notes: [In the Vertimass process], the maximum mass yield of hydrocarbon fuels is 28/46 x100 = 60.9 percent. The volume ratio of ethanol input to hydrocarbon output depends on the mass density of the product vs. ethanol but should be about 1.6 volumes of ethanol/volume of hydrocarbon fuel on average for diesel, gasoline, and jet.

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**Ethanol and Jet Prices, For Another**

Accordingly, the value of the molecule is around $2.68 as corn ethanol, $6.20 as cellulosic ethanol. If California begins accepting jet fuel within its Low Carbon Fuel Standard program (and the values are the same per BTU as cellulosic ethanol), then the value of the jet fuel molecule would be around $5.12.

If jet fuel and ethanol priced the same on a BTU basis (right now, jet is far cheaper, per BTU), then the value of the jet fuel molecule would be $6.60 per gallon — yet the airline pays for the competitively-priced jet fuel molecule.

Now, that’s based on Vertimass ethanol-to-jet ratios — and Vertimass is not a scaled-up, commercially-produced tech. And it’s based on California accepting jet fuel within the LCFS program and for jet and ethanol prices to normalize. None of which may happen.
But you get the idea how the Natural Law of Alternative Commodity Markets would not be violated — and still a market for jet fuel might emerge.

Not to mention the possibility that cellulosic ethanol may not easily find a market outside of California due to competition with conventional ethanol, while the total pool is challenged by E10 saturation. So, producers may be looking for viable markets even if cellulosic fuel prices are higher for those gallons.

Think of it as a series of Windows, as we have in the movie business. First, producers saturate the high-priced theatrical market, the land of $14 tickets and $8 popcorn. Then, the $12 per room pay-per-view market, then streaming and DVD, and so on until the movie can be seen for free on commercial television.

In fuels, the first window might well be the road transport market. After saturation, it’s then on to the jet market. So long as the molecules provide a viable return to the producer, they will be produced. Even if market #2 doesn’t pay as much as market #1.

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**Breakthrough: mPower Launches Portable Solar Generator for Outdoors and Blackouts, and Aims to Power Millions of Families without Electricity**

mPower Solar Generator, a provider of clean and mobile electricity, today announced the launch of an Indiegogo campaign to unveil its M24 and M12 portable solar generators and a path to providing electricity to the one billion people in the world who do not have access to it. The Indiegogo campaign follows mPower’s “Buy 1—Donate 1” business model, enabling buyers to provide clean electricity to those in need around the world, with no increase in the retail price because of the donation.

“We are excited for the official launch of our revolutionary solar products and doing business focused on good purpose,” said Will Perego, CEO of mPower Solar Generator.

In parallel with the crowdfunding campaign, the company also announced its challenge “Travel with Purpose—Help Us Light Up the World.” The focus of the challenge is to find an ambassador who will represent the mPower brand in 2017. The mPower Ambassador is a one-year, salaried position, where the representative will travel with mPower and its partner Techo.org to deliver solar generators to developing countries through the “Buy 1—Donate 1” program. The company plans to deliver approximately 5,000 units in 2017.

“We are excited for the official launch of our revolutionary solar products and doing business focused on good purpose,” said Will Perego, CEO of mPower Solar Generator. “The Indiegogo campaign and ambassador search are vital in supporting our ‘Buy 1—Donate 1’ business model and our mission to provide clean solar energy on a global level. Customers can now buy the lightest and most powerful solar generator on the market to power their outdoor activities or their next blackout while, at no extra cost, helping families in need.”

The mPower Solar Generator is all-in-one, with two solar panels, plus battery, plus inverter, to allow users to have AC and DC power anytime, anywhere. Up until now, gas generators
have provided off-grid electricity, but users complain of the noise, weight, difficulty in refilling the generator and that they have a high carbon footprint. mPower Solar Generators solve these problems by utilizing sunlight, solar panels and batteries to provide electricity day and night. mPower Solar Generators are the first all-in-one solution that are easy to set up, carry and use.

On the mPower Indiegogo page, customers can purchase the M24 and the M12 generators at a limited, highly discounted introductory price, or make smaller contributions to support the organization’s purpose: sustainable energy for all.

Visit the Indiegogo campaign page to help bring electricity to families in need, participate in the challenge or buy a solar generator.

About mPower Solar Generator

mPower Solar Generator is funded by GreenTech Endeavors, an incubator of revolutionary cleantech startups. The mPower Solar Generator is the first product to market out of the incubator. For more information on mPower Solar Generator visit the Indiegogo page.

These Five Battery Companies Want to Take You Off the Grid

At-home batteries combined with advancements in solar technology have the potential to provide people with a whole new way to store and control the energy used in their home.

It’s for that reason that an increasing number of companies are working on at-home batteries to change the modern home into a sustainable vision for the future.

Here’s five at-home battery makers on the market today:

We would be remiss to make a list of at-home battery makers and not include Tesla toward the top. The $3,000 Powerwall can store solar energy and provide backup power for your home.
The roughly 200-pound lithium ion battery can connect to the internet to create "smart microgrids" that could potentially power a home off the grid entirely. It costs $3,000.

Reuters/Patrick Fallon

The Powerwall supplies 6.4 kWh of power. To help put that into perspective, the average person in the US uses about 30 kWh of power a day.

Tesla says on its website that the 6.4 kWh battery is sufficient to power most homes during the evening using the solar energy captured during the day. However, multiple batteries can be installed in homes that need more energy.
Start-up Orison is an at-home battery system that comes in form of a plug-in unit that looks like a lamp and a flat wall panel that weighs just under 40 pounds.

**Orison**

The $1,600 unit holds significantly less power — 2.2 kWh versus 6.4 kWh for the Tesla Powerwall. However, the main perk to Orison is you don't need a trained electrician to install it.

**Orison**

Powervault is an at-home battery system only available in the United Kingdom. The most powerful model allows for 4 kWh of energy and costs around $4,500.
Like the Tesla Powerwall, the Powervault must be installed by a trained electrician. But unlike Tesla's at-home battery, the inverter and control unit are included in the Powervault's $4,500 cost.
SimpliPhi Power is an at-home battery maker that's been around since 2002 when it was originally named LibertyPak Company. They offer four different battery options, each with different energy saving abilities.

**Simpliphi**

Their most powerful model is the PowerBank, which delivers 5.2 kWh of power. It needs to be installed by an electrician and offers off-grid applications.

**Simpliphi**

The company has never publicly disclosed the cost of a unit and did not reply to multiple requests for comment.
Sunverge offers battery systems providing between six and 23 kWh of energy storage. Weighing around 500 pounds, the battery has to be installed by a trained Sunverge specialist.

Sunverge comes with a corresponding app so you can monitor your solar energy storage and see electric grid costs at different times. A Sunverge unit can cost between $8,000 and $20,000, depending on the size you get.

The app is sold separately.

Sunverge
US Federal Regulators to Examine Barriers to Energy Storage Participation in Markets

Staff of the U.S. Federal Energy Regulatory Commission (FERC) last week said the agency intends to examine whether barriers exist to the participation of energy storage in the capacity, energy and ancillary service markets, and whether those barriers could lead to unjust and unreasonable energy rates.

In a presentation during FERC’s April 21 open meeting, Michael Herbert, Energy Industry Analyst with the Office of Energy Policy and Innovation, said the investigation stems from the increase in electric storage assets in the PJM Interconnection territory and California, as well as developments in technology and an increase in the number of FERC proceedings relating to energy storage.

As part of FERC’s efforts, Herbert said staff will consider whether tariff changes are warranted.

To support the investigation, FERC issued data requests to obtain information from the six U.S. transmission operators (TO) about the rules in each of their markets that affect the participation of energy storage resource. Herbert said: “the information requested includes, but is not limited to, the eligibility of electric storage resources to participate in each [TO] market, the technical qualification and performance requirements for market participation, bid parameters for different types of resources, and treatment of energy storage resources when they are receiving electricity for later injection into the grid.”

Comments from the TOs are due May 2.

Herbert also said it has issued a request for comments to the public seeking information on market rules that affect energy storage participation in the TO markets. Comments from the public are due May 23.

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.

DEPARTMENT OF ENERGY

DE-FOA-0001579- Next-Generation Transformers - Flexible Designs
Application Due Date: July 24, 2016

DE-FOA-0001535 - Fiscal Year (FY) 2016 Vehicle Technologies Multi-Topic
Funding Opportunity Announcement
Application Due Date: August 29, 2016

DE-FOA-0001414 - FY 2016 Continuation of Solicitation for the Office of
Science Financial Assistance Program
Application Due Date: September 30, 2016

H2 Refuel H-Prize Competition
Application Due Date: October 31, 2016

DE-FOA-0001578 - Notice of Intent- Modular Chemical Process Intensification
Institute for Clean Energy Manufacturing
Application Due Date: TBA

NATIONAL SCIENCE FOUNDATION

NSF 16-564 - NSF/DOE Partnership in Basic Plasma Science and
Engineering
Full Proposal Target Date: October 21, 2016

NSF 16-561 - Physics Frontiers Centers (PFC)
Preliminary Proposal Due Date (required) (due by 5 p.m. submitter's local
time): August 01, 2016
Full Proposal Deadline (due by 5 p.m. submitter's local time): January 30, 2017

Read more at our website>>
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UPCOMING EVENTS

Bioenergy 2016
July 12th - 14th, 2016
Washington, D.C.

On July 12-14, 2016, the U.S. Department of Energy's (DOE's) Bioenergy Technologies
annual conference-Bioenergy 2016: Mobilizing the Bioeconomy through Innovation. In
Research and Education Foundation (CEREF), this year's conference will focus on oppor
supplies and break through technology barriers to achieve a stronger bioeconomy.
Click here for more information.

ESCC 2015: 3rd International Conference on Energy, Sustainability and Climate Change
July 10th - 16th, 2016
Marathon, Athens, Greece
ESCC series aims on bringing together leading experts in the fields of optimization and computational methods to discuss recent advancements and trending topics. 

Click here for more information.

The MISO Market Symposium
August 18 - 19th 2016
Indianapolis, Indiana

The MISO Market Symposium will bring innovators, thinkers and industry visionaries together to discuss how wholesale market solutions can increase value for a transforming industry.

Click here for more information.

Short Rotation Woody Crop Science & Technology in an Uncertain Global Marketplace
October 11-13, 2016
Fort Pierce, Fl

Short rotation woody crops (SRWC) are being developed as a sustainable supply of woody biomass for the production of bioenergy, biofuels and bioproducts as well as for traditional solid wood and fiber products. Recent developments in short-rotation hardwoods and pine, are of interest. Also, discussion of emerging market opportunities, expanded utilization potential, and remaining challenges will be emphasized at the conference, as well as environmental and social implications.

Topic areas include:
• SRWC to Advance Social and Environmental Sustainability
• Attributing value to external benefits of SRWC systems
• Creative uses of SRWC to achieve environmental and social goals
• Improvements in harvesting technology and productivity
• Adding value throughout the biomass supply chain
• Stabilizing, upgrading, and standardizing SRWC feedstock quality
• Genetic and tree improvement status of today's crops
• Optimizing SRWC production systems

Click here for more information.

Electric Vehicle Summit
October 17 - 20th, 2016
University of Central Florida Solar Energy Center
Cocoa, FL

Response to last year's Summit was overwhelmingly positive, with 100% of surveyed attendees requesting a follow-up EV Summit in 2016. The 2015 EV Summit featured presentations from 18 speakers on topics that included transportation planning, EV and grid technology and fleet management. This year's Summit will focus on updates to the technologies, planning and policies needed to accelerate the deployment of electric vehicle transportation. Topics include transportation policy and planning, fleet management, wireless and workplace charging and the life-
discussions and EV battery technology workshops are also planned for the Summit. Click here for more information.

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**Algae Biomass Summit**

October 23-26, 2016
Phoenix, Arizona

The 10th annual Algae Biomass Summit will take place October 23 - October 26, 2016 at the Renaissance Glendale Phoenix Hotel & Spa in Phoenix, Arizona. This dynamic event unites industry professionals from all sectors of the world’s algae utilization industries including those involved financing, algal ecology, genetic systems, carbon partitioning, engineering & analysis, biofuels, animal feeds, fertilizers, bioplastics, supplements and foods. Click here for more information.

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**Production of Renewable Ocean Energy for Small, Non Grid Connected Applications**

November 2-3, 2016
Portsmouth Courtyard Marriot, New Hampshire

This conference is bringing together professionals who are developing power system technologies capable of producing small, remote and distributed power for many applications. Considering the many assets that MTS has in mooring systems measurement; and current, tidal, wave, salinity, and thermal measurement system technologies, a gathering on this topic would serve as a valuable contribution to the ocean energy community as well as to the MTS community. The daylong conference will begin with a panel of users representing the Department of Defense, National Oceanographic and Atmospheric Administration and indigenous peoples, followed by selected presentations. Click here for more information.

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**Note from the Editor**

Thank you for reading Florida Energy Systems Consortium Newsletter and sharing this newsletter with your colleagues. We try to highlight developments in renewable energy technology and research all across Florida and the world. If you have any news you would like to see featured in the Newsletter, or events you would like to announce, feel free to e-mail floridaenergysystems@gmail.com for posting in the next newsletter and on the FESC website: www.floridaenergy.ufl.edu