



FLORIDA SOLAR ENERGY CENTER®

Creating Energy Independence

The State of FSEC

FSEC Advisory Board Meeting

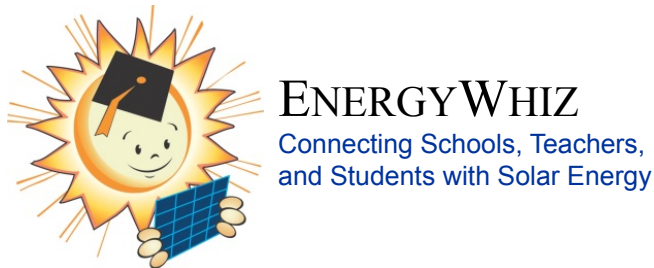
March 30, 2018

FSEC Advisory Board Meeting

AGENDA

10:00 a.m.	Welcome and Introductions	Dave Winslow, Chair
10:10 a.m.	Approval of October 30, 2017 Meeting Minutes	Dave Winslow, Chair
10:15 a.m.	Status of FSEC Programs	Jim Fenton
10:30 a.m.	Discussion of Federal and State Energy Policy	Louis Rotundo Colleen Kettles Kelley Smith Burk
	Report of Florida Energy Office	
11:00 a.m.	Overview of UCF Energy (Blue Ribbon Energy Panel)	Elizabeth Klonoff
11:10 a.m.	PV and energy storage (V2G, fuel cells) of FSEC buildings	Paul Brooker
11:35 a.m.	Disney/Reedy Creek 50MW Solar PV Facility	John Giddens, Disney/Reedy Creek
11:50 a.m.	Orlando Energy Update, Smart Energy Innovation Network (Orlando/OUC/FSEC/NREL/RMI) Affordable Housing	Chris Castro
12:00p.m.	Lunch (Buffet)	
1:00 p.m.	Transportation Electrification – Land and Air	K. Rajashekara, Univ. Houston
1:40 p.m.	Board Business <ul style="list-style-type: none"> ▪ Election of Chair and Vice-Chair ▪ Date and Agenda for Next PAB Meeting ▪ Other Board issues 	Dave Winslow, Jim Fenton

Collaborative Partnerships



PV, EVs, Energy Efficient Buildings, Load Management, Batteries, Alternative Fuels, Hydrogen, Fuel Cells, Smart Grid Electronics, V2X, Training & Education



Recent DOE-Funded Industrial Collaborative Partnerships



- PV Manufacturing Research, *Kris Davis*
- PV System Research Impacting LCOE, *Joe Walters*
- Reliability and Power Degradation, *Sub from CWRU*
- Improving Solar Panel Durability, *Sub from Brightspot Automation*

- Solar Energy Innovator Program, *Paul Brooker at OUC*



- Orlando: Renewable and Resilient, *Sub from City of Orlando*



- Air Quality Field Study in New US Homes, *Eric Martin*
- Integrated HVAC with Mini-Split Heat Pumps, *Karen Fenaughty*



Orlando: Renewable and Resilient

- City of Orlando: 100% renewable energy for *municipal* buildings by 2030, 100% citywide by 2050.
- Investigate approaches for deploying photovoltaic (PV) and PV plus storage to increase resiliency of municipal operations and electric grid.
- Partnership:
City of Orlando, Orlando Utilities Commission (OUC), National Renewable Energy Lab, Rocky Mountain Institute, UCF'S FSEC
- Funded by:
U.S. DOE, Solar Energy Innovation Network



Solar Energy Innovator Program

- Department of Energy is funding UCF's Dr. Paul Brooker to carry out research at OUC on innovative solutions to the challenges faced by electrical utilities, energy service providers, and electric public utility commissions as solar energy and other distributed energy resources increase on the electrical grid.



SOLAR ENERGY
TECHNOLOGIES OFFICE
U.S. Department Of Energy



Opportunities



- Power and Energy Readiness for Robotic and Autonomous Systems: UCF, Army, GM, Protonex and Proton Energy
- National Science Foundation: Engineering Research Center (NSF ERC)
- Collective Impact : Orlando Affordable Housing
- UCF Blue Ribbon Energy Panel: Encompasses FSEC, Facilities, two Energy Faculty Clusters, Engineering and Science departments



Power and Energy Readiness for Robotic and Autonomous Systems (RAS)



Boeing Insitu ScanEagle®
(Protonex fuel cell)



GM fuel cell SURUS
(Silent Utility Rover Universal Superstructure)
Solar



UNIVERSITY OF
CENTRAL FLORIDA

Partners

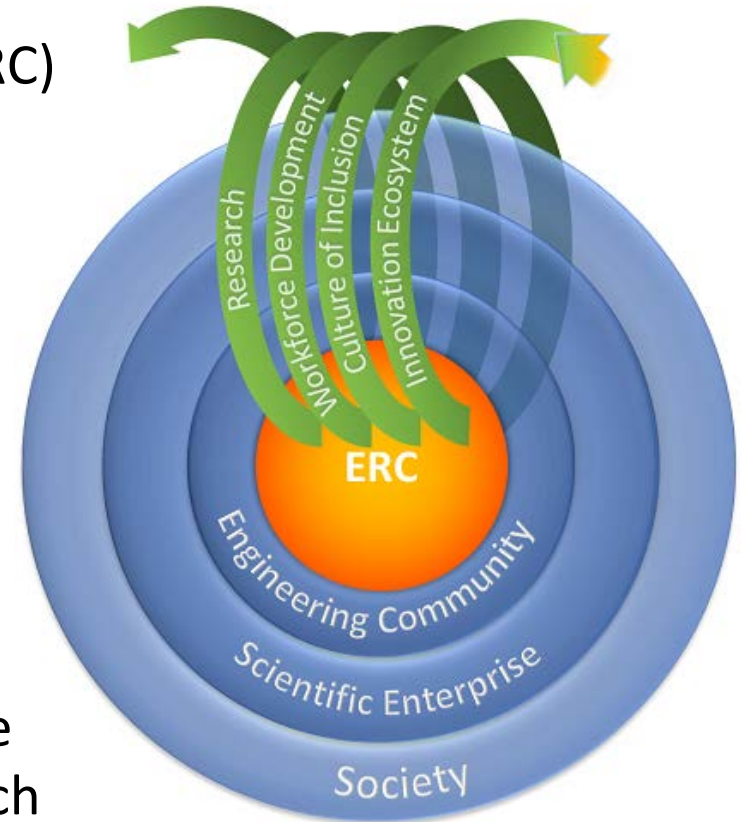
Army, GM, Protonex,
Proton Energy



GM fuel cell truck

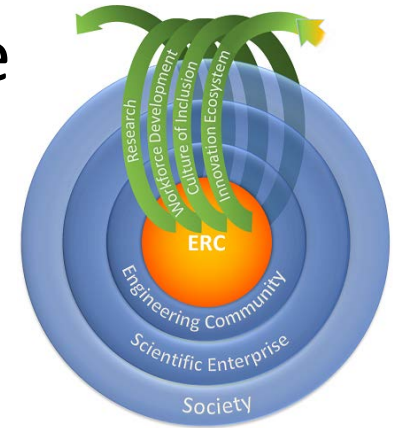
Change in Focus of NSF ERC

- Previous National Science Foundation (NSF) Engineering Research Centers (ERC) focused on fundamental issues.
- “The ERC program is placing greater emphasis on research that leads to societal impact, including convergent approaches, engaging stakeholder communities, and strengthening team formation, in response to the NASEM study recommendations.”
- Planning grants (30-40 @ \$100k) will be awarded to support convergent research team formation, due June 6, 2018.



UCF-Led NSF ERC Concept

- Research and develop technologies that enable increased adoption of renewable energy within the community while securing and stabilizing the grid
- Potential impacts of ERC research
 - Improved disaster response
 - Improved health effects (reduced pollution)
 - High power quality with high renewable penetration
 - Increased energy efficiency across residential, commercial and transportation sectors
 - Job creation through technology-driven markets



UCF-Led NSF ERC Team

Current Partners

- **Universities:** University of Central Florida [Lead], Case Western Reserve University, Georgia Tech University, New Mexico State University, Washington University St. Louis, Illinois Institute of Technology
- **National Laboratories:** National Renewable Energy Lab, Idaho National Lab, Argonne National Lab, and Sandia National Lab
- **Community Partners:** Orlando, Cleveland, Atlanta, Chicago, Denver, Indian Reservations

Need to Identify Industrial Partners:

Building Controls, ESCOs, PV w/ Power Electronics, Batteries, H₂ Electrolyzers, Fuel Cells, EVs, EV infrastructure, Fleets, Large Building Owners, Utilities



R&D Partnerships

FSEC Offers

- Holistic and integrated approach for new and emerging energy systems (PV, Storage, EVs and Buildings)
- Real world performance, analysis and durability

Benefits

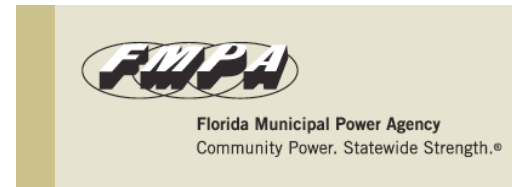
- Response moves from reactive to proactive
- Provides deeper insight into field performance
- Improved LCOE of an energy system
- New market opportunities through integration of multiple energy systems
- Aids grid integration of new energy systems



Partners

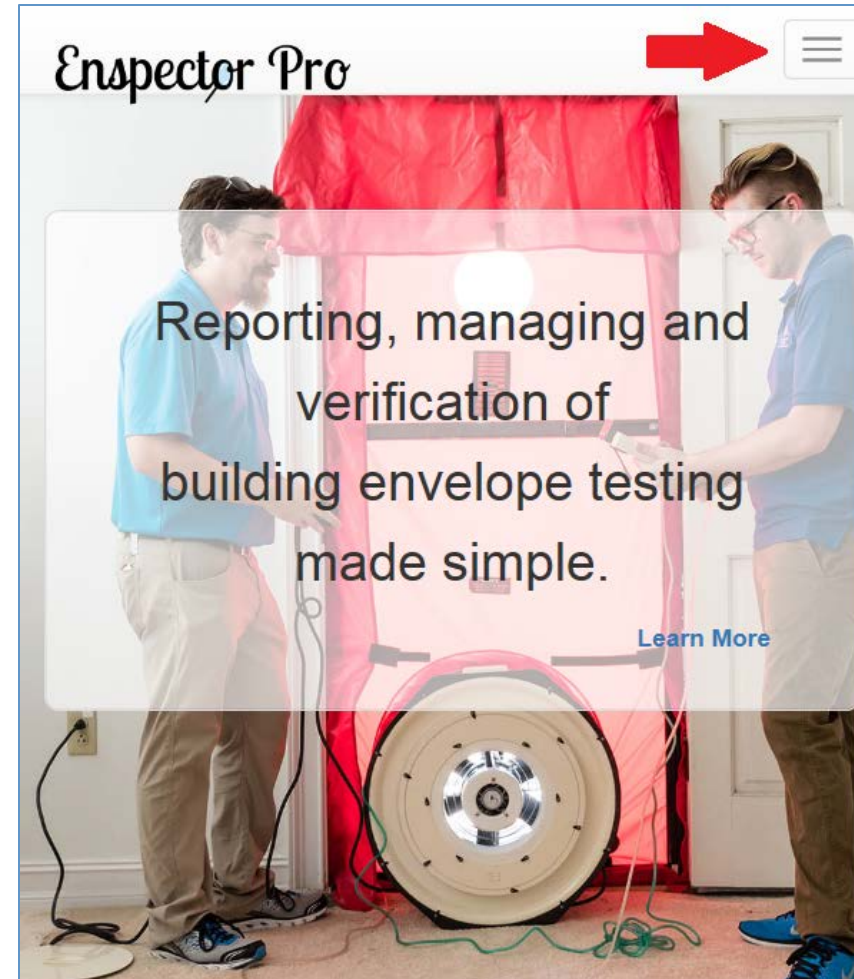


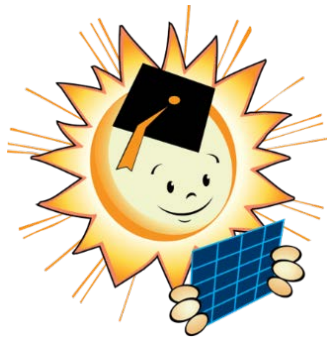
C.T. HSU + ASSOCIATES, P.A.



Blower Door Test Reporting Made Easy at EnspectorPro.com

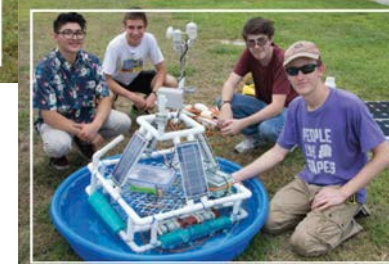
- Blower Door Testing has been required by Florida Building Code – Energy Conservation since July 1, 2017
- Who is qualified to perform the test?
- How can a tester quickly report results so houses can get certificate of occupancy?
- How can the building code officials keep track of qualified testers?
- How can the building code official verify the measurement is correct?





Educational Partnerships and EnergyWhiz

- EV Ed Partnership with UC-Davis PHEV Transportation Center
- Middle School Science Bowl
- Federal funding for *Junior Solar Sprint* by Army Education Outreach Program (AEOP)
 - STEM Enrichment
- EnergyWhiz, Sat., May 12
 - State and Regional Expos
 - Seeking Sponsors
 - **Need Volunteers**
 - Contact Susan Schleith
321-638-1017



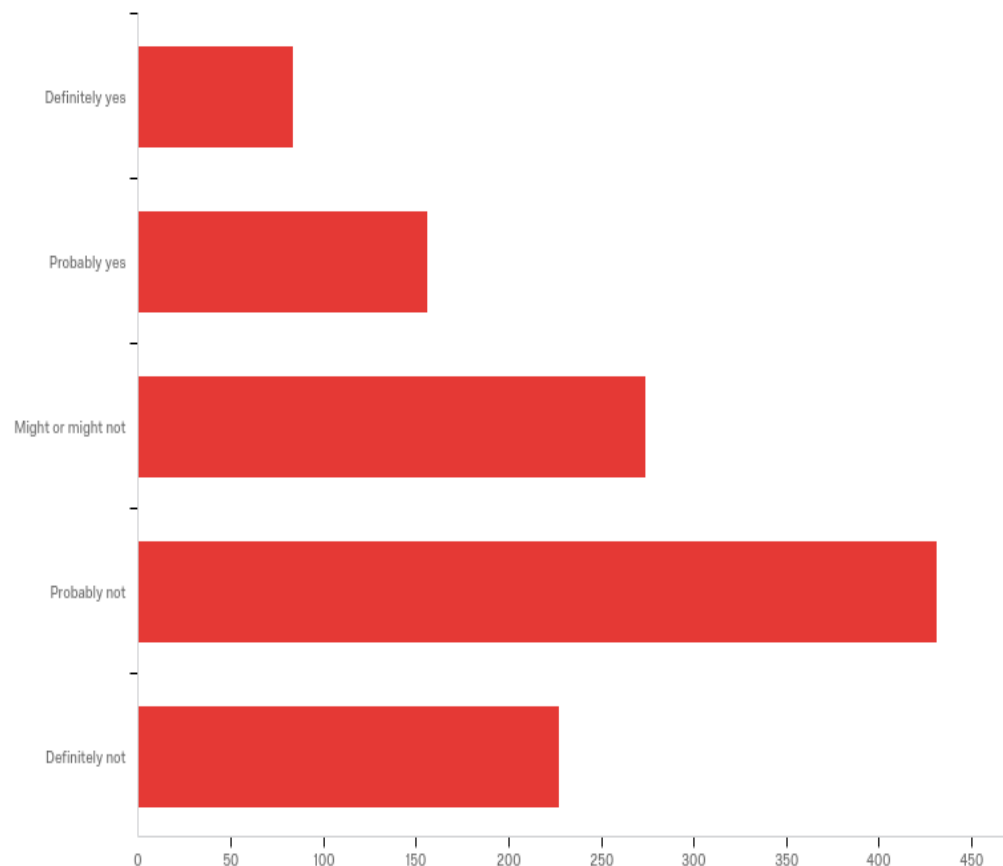
MS in Energy Systems

- Planning to increase offerings in graduate curriculum in efficiency and renewable technology.
 - MS degrees
 - Certificates
- Sample of degrees at other Universities
 - Solar Energy Engineering and Commercialization, ASU
 - Renewable & Sustainable Energy, University of Colorado
 - Master of Professional Studies in Renewable Energy and Sustainability Systems, Penn State University
 - M.Sc. in Alternative Energy, University of Rochester
 - M.A. in Global Sustainability, USF



Email Survey (Conducted November 2017)

Q8 - Are you interested in pursuing higher education/training in the field of energy sustainability?
[From Nov. 2017 survey sent to 73,000 related professionals]



Recurring Questions

- Benefit to FSEC?
- Engineering or Graduate Studies?
- Professional Science Master vs. Research Master's Program?
- Certificates, Master's, PhD?
- How Much Curriculum Should be Online?
- If Graduate Studies, How Much Cooperation Will We Get From Professors in Various Colleges?
- Is Demand Sufficient?



Curriculum Focus

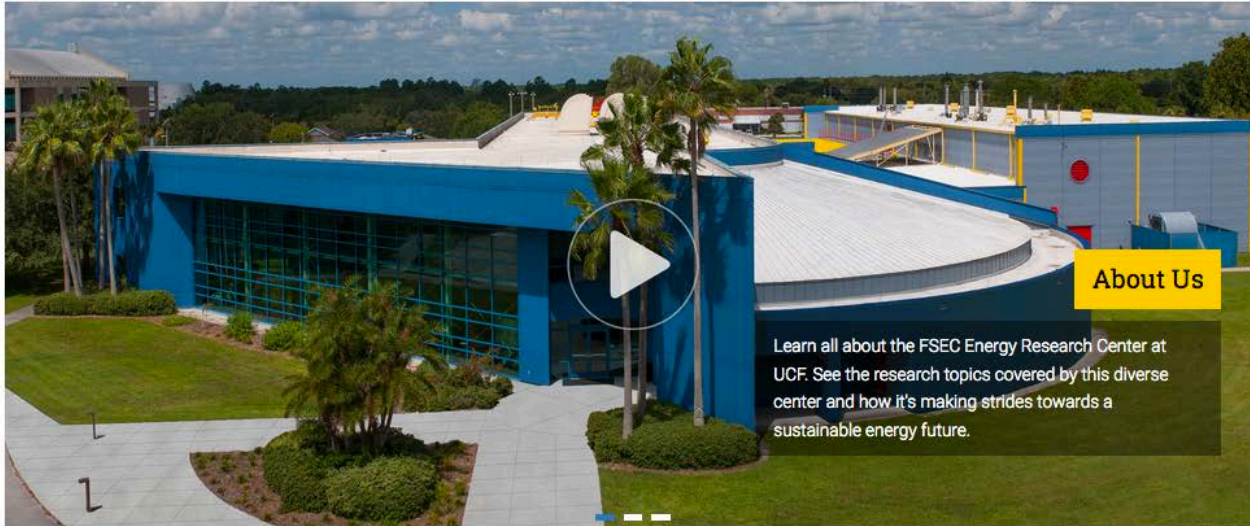
- Paul Brooker wrote a rough draft of what we think should be covered and circulated it for comments
 - Most topics do not have current courses
- 107 current graduate course list was reviewed and some were found to be helpful but probably not main core of an energy focused program



FSEC Energy Research Center

A Research Center of the University of Central Florida

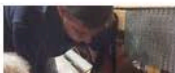
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Featured Content



The Energy Research Center



Smart Vent Tech Improves IAQ and Saves Money, Energy

By Jennifer Josey National Renewable Energy

UCF Today



Energy-Research Meeting Seeks Research Ideas

Have some ideas about what UCF should be exploring in the area of energy research? Then plan
















Questions?



EXTRA SLIDES



RAS Needs Electrification to Fight and Win

Internal Combustion	Batteries	Fuel Cells Fueled by Hydrogen
 High power for long durations	 Short duration of operation	 High power for long durations
 Power (size of engine) separated from energy (size of tank)	 Power not separated from energy	 Power (size of engine) separated from energy (size of tank)
 Strong noise and thermal signatures	 Low observability	 Low observability
 Low efficiency, High maintenance	 High efficiency, Low maintenance	 Round-trip efficiencies twice that of ICEs, Low maintenance
 Convoys provide diesel fuel	 Requires frequent replacements, High storage losses	 On-site production capability, Low storage losses

Transition



- Driven by DOE solicitations to **Industrial-Funded Collaborative Partnerships**
 - Value-added research for utilities, diverse state and federal agencies, manufacturers of energy-saving technology and industries that process and consume energy
 - Working groups that cooperatively steer FSEC into carrying out collaborative research that provides funding for FSEC researchers and is beneficial to the members of the Working group [Win-Win]
 - Opportunities with EV/PV/Energy Storage RD&D

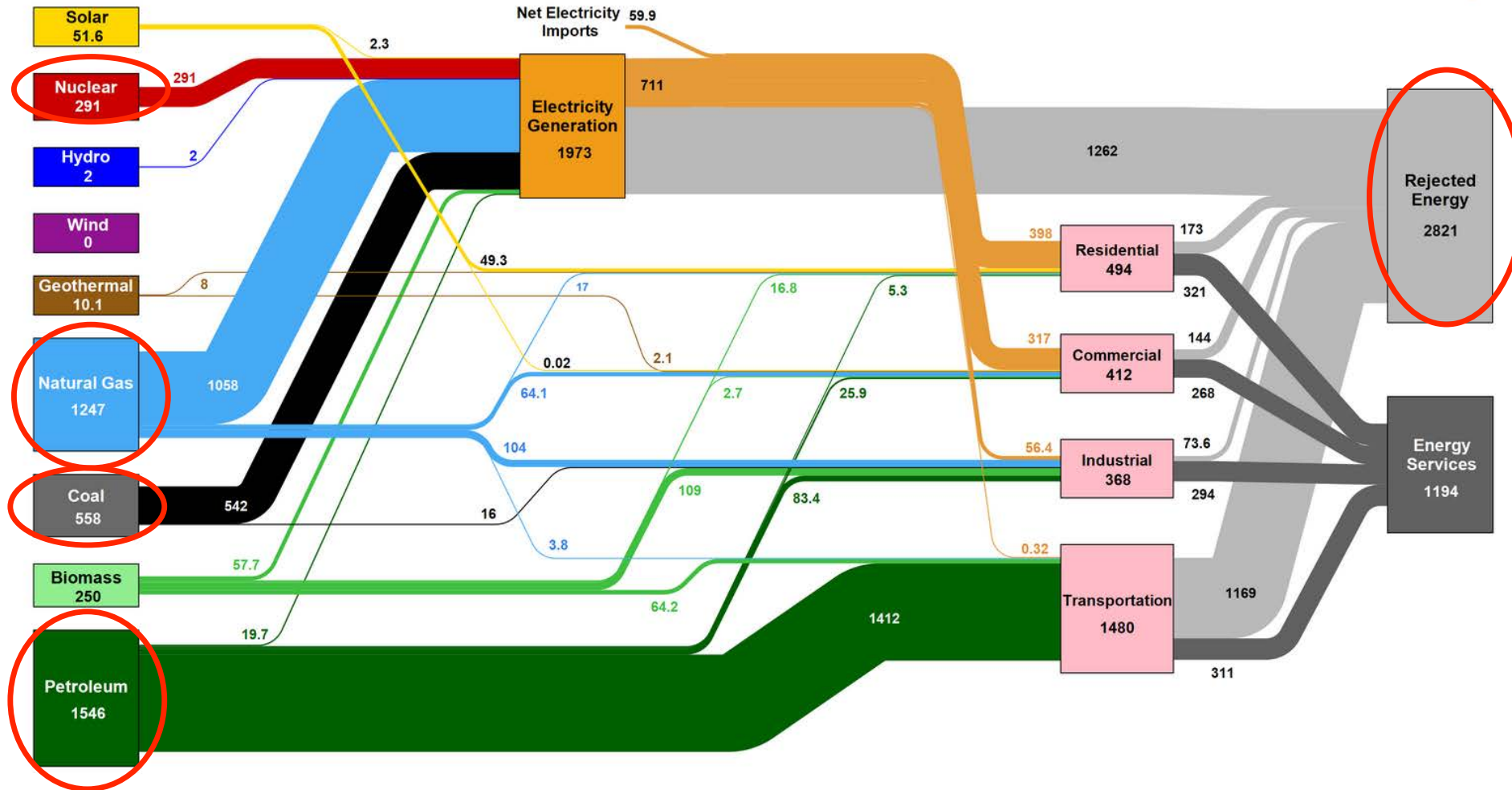


Florida spent \$56 Billion on Energy

70% of primary energy is wasted!

(Almost all from imported coal, oil, gas and nuclear)

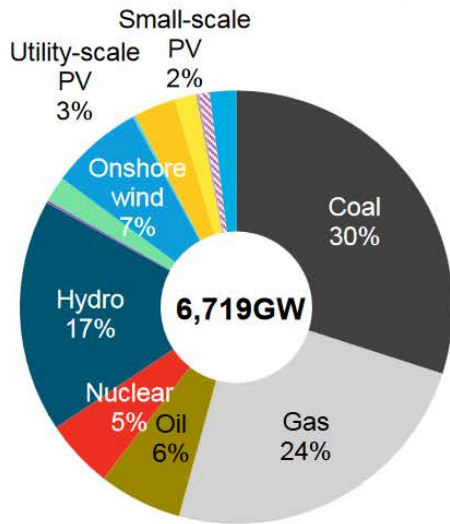
Florida Energy Consumption in 2014: ~ 4015 Trillion BTU



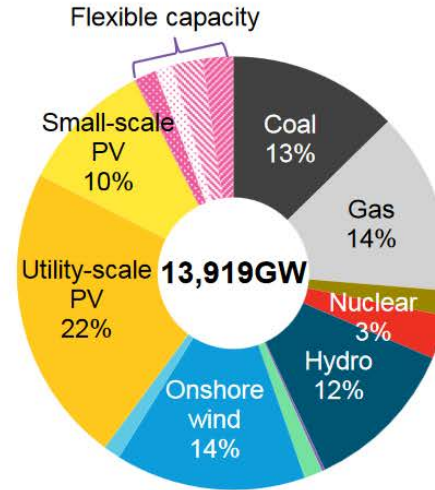
Source: LLNL July, 2016. Data is based on DOE/EIA SEDS (2014). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent Rounding. LLNL-MI-410527

Solar and wind dominate the future of electricity

Global cumulative installed capacity:
2016

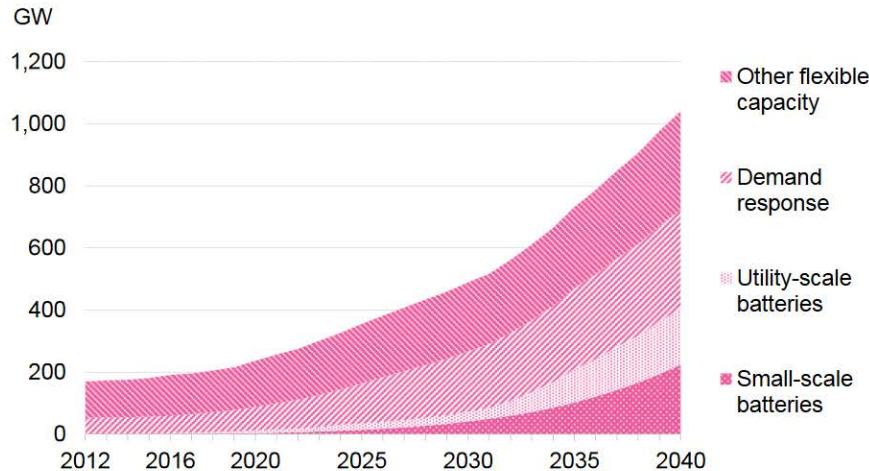


Global cumulative installed capacity:
2040



Source: Bloomberg New Energy Finance, *NEO 2017*

Demand response and batteries meet peak and balance the grid



Top 5 markets in 2040	
China	343GW
U.S.	200GW
India	127GW
Japan	62GW
Germany	30GW



Source: Bloomberg New Energy Finance



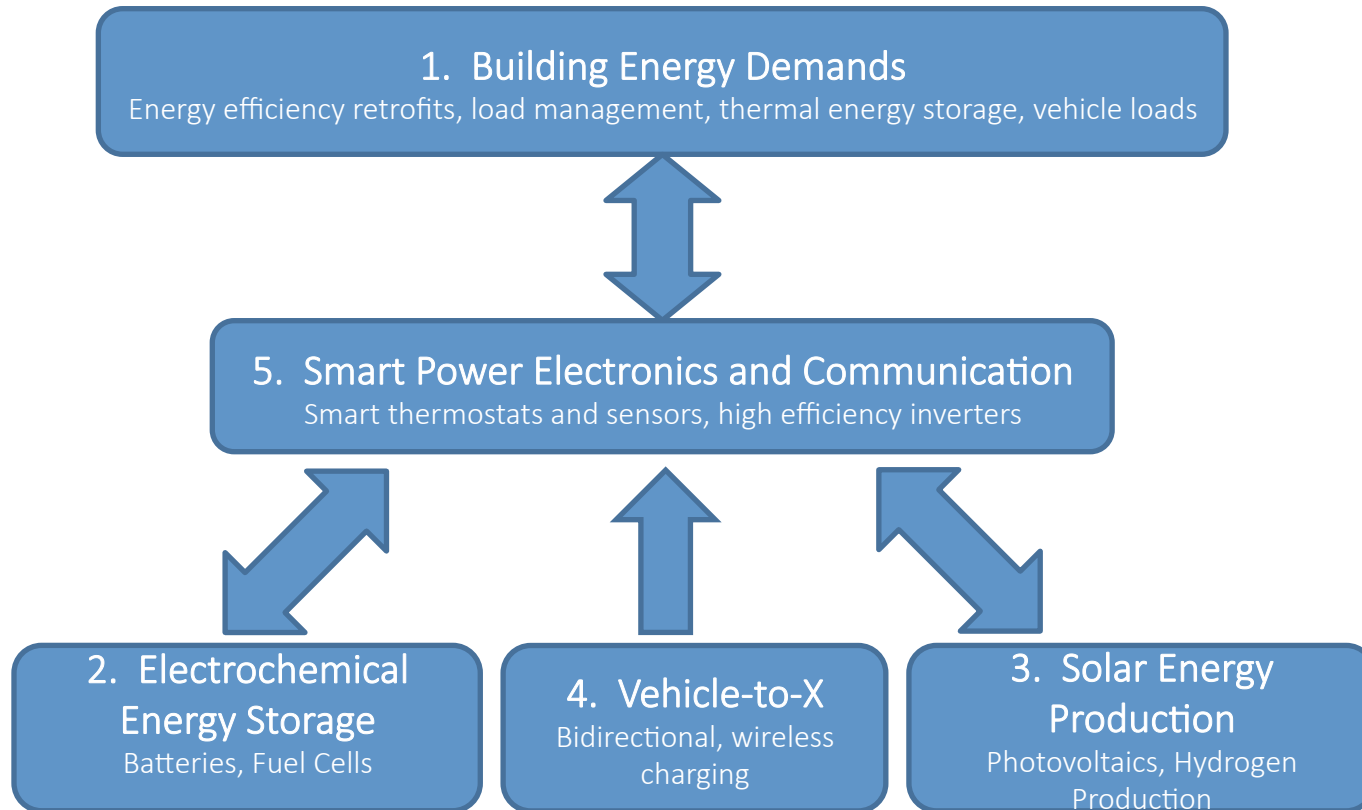
Vision for FSEC and for NSF ERC

Integrated Smart Building Energy Storage

Create the tools and processes for Net-Zero Energy Communities through the integration of next-generation smart energy storage, solar energy production, electric vehicles and advanced high frequency and efficient power-electronics systems, for increased shared-energy efficiency of community buildings and transportation, and improved grid resiliency.



Integrated Smart Building Energy Storage (IS-BEST) NSF ERC *Creating the tools and processes for Net-Zero Energy Communities*



Cross Cutting Research Areas

- Wide-Band Gap Semiconductors
- Materials, Packaging and Durability
- Electrochemistry and Solid State Science
- Hardware in the Loop
- Grid Integration
- Engineering Education
- Education for non-STEM community



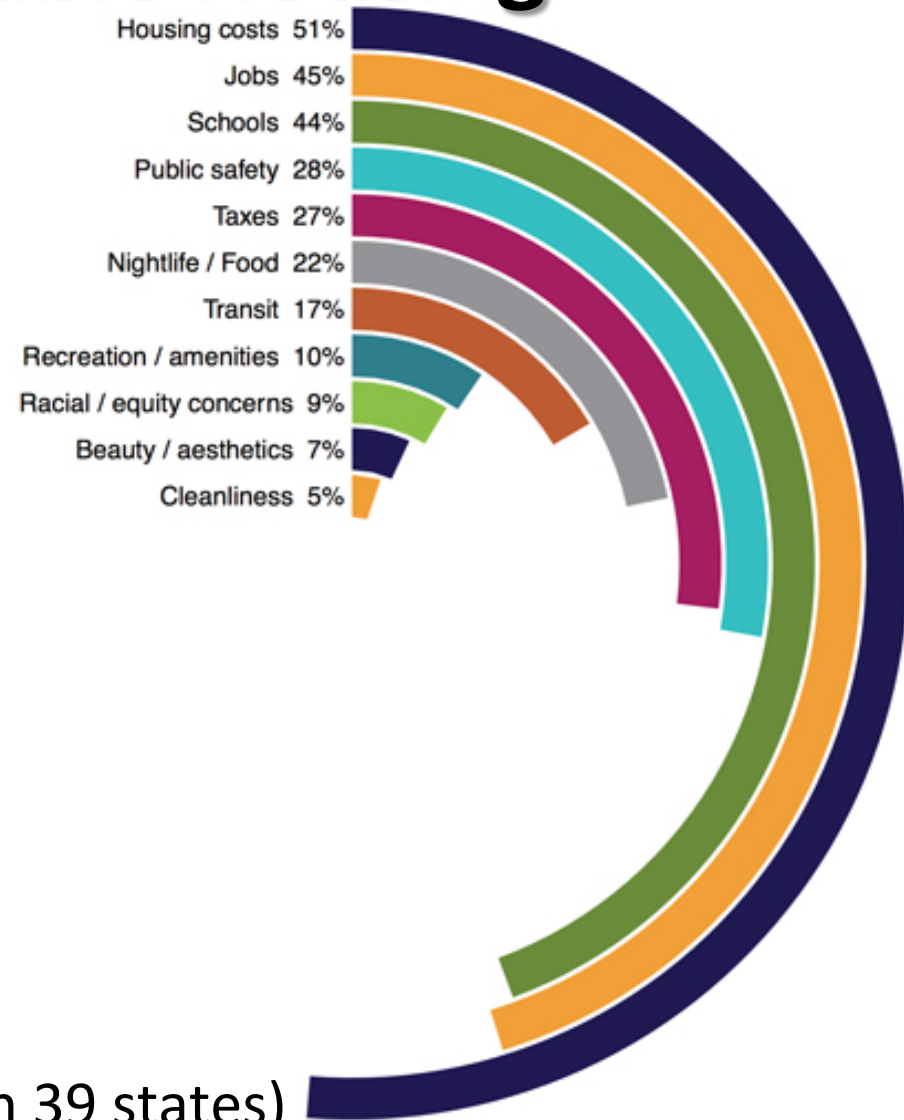
IS-BEST NSF ERC Team

- **Universities:** University of Central Florida [Lead], Case Western Reserve University, Georgia Tech University, New Mexico State University, Washington University St. Louis, Illinois Institute of Technology
- **National Laboratories:** National Renewable Energy Lab, Idaho National Lab and Argonne National Lab
- **Community Partners:** Orlando, Cleveland, Atlanta, Chicago, Denver, Indian Reservations
- **Industrial Consortium:** Modeled after: cSi-PVMC, FEEDER, Drive Electric Florida, SEMATECH, SEPA
- **Industry Partners:** Building Controls, ESCOs, PV w/ Power Electronics, Batteries, H₂ Electrolyzers, fuel cells, EVs, EV infrastructure, Large Building owners, Utilities



Leaders of US Cities Worried about Lack of Affordable Housing

Over half cited house costs as top factor prompting residents to move away. Outpacing jobs, schools and public safety.



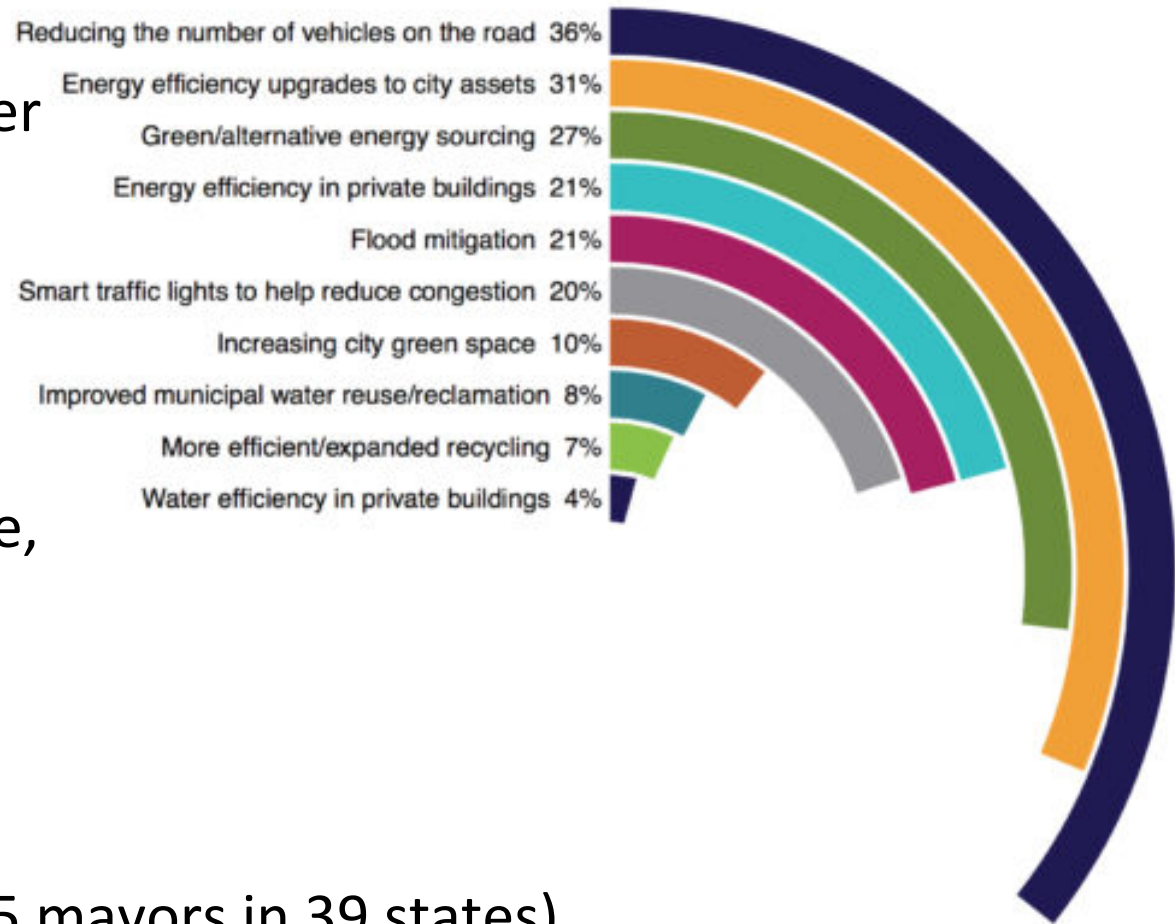
(115 mayors in 39 states)



Mayors propose steps cities could take to mitigate climate change

Top three were

- Reducing the number of vehicles on the roads,
- Energy-efficient upgrades, and
- Green, or alternative, energy sources



(115 mayors in 39 states)



Orlando's affordable housing crisis is about to implode

Posted By [Colin Wolf](#) on Thu, Mar 15, 2018 at 12:16 pm



Monivette Cordeiro

Back in December, Florida Gov. Rick Scott touted that **Orlando leads the state in job growth**, which is certainly something to be proud of. But Orlando doesn't have a job shortage – it has a shortage of well-paying jobs and places for these people to live.

According to the **National Low Income Housing Coalition's** annual report, the Orlando-Kissimmee-Sanford area currently ties for second worst in the country for available affordable housing, offering only 17 available and affordable units per 100 renters.

<https://www.orlandoweekly.com/Blogs/archives/2018/03/15/orlandos-affordable-housing-crisis-is-about-to-implode>

America's Affordable Housing Crisis Is Driving Its Homelessness Crisis

There's a clear link between a lack of places to live and the number of people sleeping out of doors at night. And the solution is clear, too: Cities need to double down not just on homeless services, but on building more affordable housing, and quickly.



[Photo: Justin Sullivan/Getty Images]

<https://www.fastcompany.com/40504605/americas-affordable-housing-crisis-is-driving-its-homelessness-crisis>

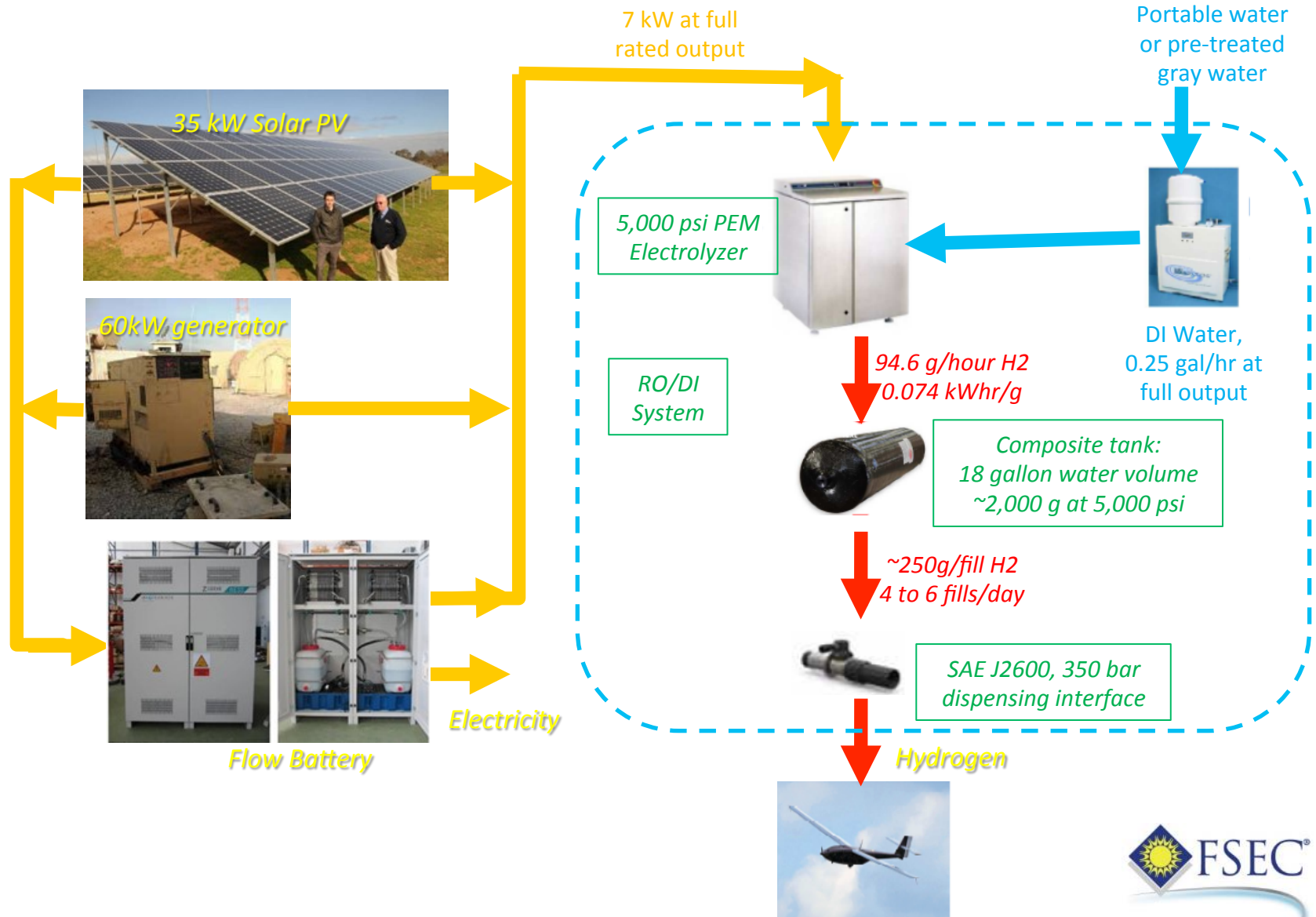
FEBRUARY 20, 2018, 7:00 PM

Puerto Rican evacuees urged **Orange County** officials on Tuesday to back a state law that would protect affordable housing funds, just a month before FEMA hotel vouchers for nearly 1,000 displaced families are set to expire.

<http://www.orlandosentinel.com/news/breaking-news/os-orange-county-puerto-rican-evacuees-20180220-story.html>



Task 4: Demonstration Modular Solar PV/ Flow Battery/Hydrogen Storage System



Task 1: Create Consortium for Electric/ Hydrogen Refueling Infrastructure

To meet the needs of evolving RAS (2017-2040)

- Identify OEMs for infrastructure needs
- Employ consortium model to address pre-competitive research needs
- Consortium members identify relevant research projects



Topic	Subtopics
Renewable Energy Systems	<ul style="list-style-type: none"> • Overview of renewable and alternative sources of energy • Overview of enabling technology for energy generation and utilization
Building energy systems	<ul style="list-style-type: none"> • Green Buildings • HVAC • Chilled water • Energy efficiency
Controls and Communications	<ul style="list-style-type: none"> • Building Energy management systems • Role of Information Technology – IoT
Energy Storage	<ul style="list-style-type: none"> • Electrochemical (fuel cells, batteries, supercapacitors) • Mechanical (CAES, pumped hydro, flywheels)
Distributed energy systems	<ul style="list-style-type: none"> • Integrating Renewable sources/ systems • Storage Smart-grids Micro-grids • Energy management systems
Centralized energy systems (i.e. existing grid)	<ul style="list-style-type: none"> • Thermal generators (Nat. Gas, Coal) • Transmission/distribution systems
Sustainable Environment: Resource management	<ul style="list-style-type: none"> • Principles of environmental sustainability • Water Waste Global warming • Environmental ethics
Sustainable Transportation	<ul style="list-style-type: none"> • Electric vehicles • Fuel cell vehicles • Electrifying heavy duty vehicles
Energy and Environmental Policy and economics	<ul style="list-style-type: none"> • Financial models
Materials for renewable energy	<ul style="list-style-type: none"> • Materials for renewable energy storage and conversion • Materials for renewable fuel production • Materials for energy efficiency • Advanced materials characterization techniques



Junior Solar Sprint: Connecting Communities with Opportunities for Success



STEM Savvy
Educators

STEM Literate
Citizenry

Sustainable
Infrastructure

