FSEC Advisory Board Meeting

March 31, 2021

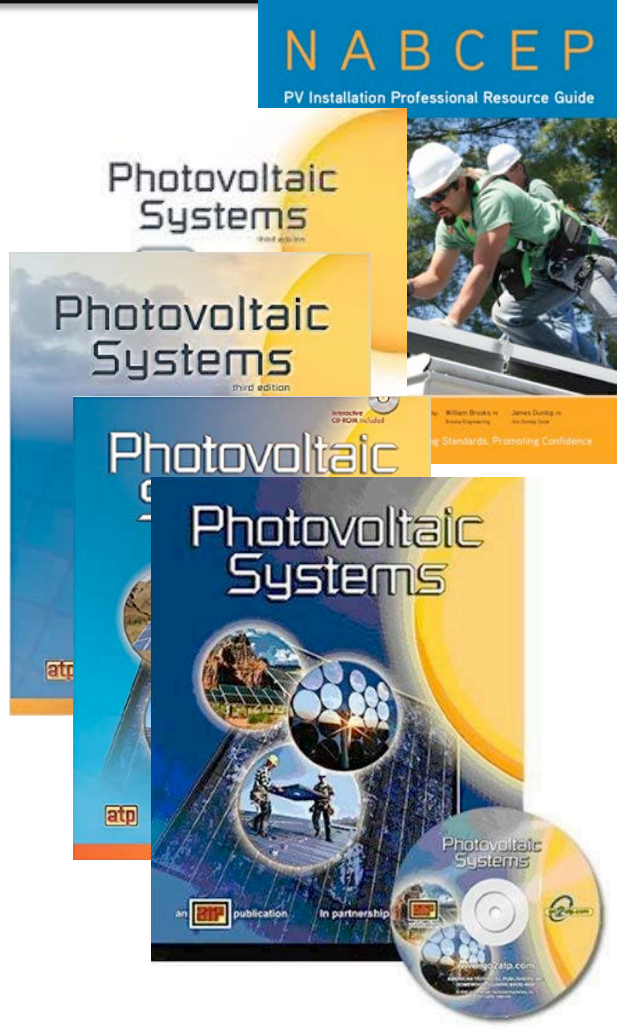
FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

In Memory Of

Jim Dunlop
1959 – 2021

"Jim's contributions were of great substance, and the most worthy of achievements. They touched so many, reflected most favorably on FSEC, and significantly advanced the commercialization of PV systems technology. Most importantly, he made a huge difference from which we all benefit, and leaves a legacy to be admired." — Jerry Ventre



FSEC Advisory Board Meeting — AGENDA

9:30 a.m.	**Welcome and Introductions** **Roll Call**	**Chris Castro, *Chair, FSEC Advisory Board*** **Sherri Shields**
9:40 a.m.	Approval of October 29, 2020 Meeting Minutes	Chris Castro
9:45 a.m.	Status of FSEC Programs	Jim Fenton
10:05 a.m.	Altamonte Electric Utility (AEU) and Floating Solar	Frank Martz, City Manager, Altamonte Springs, FL
10:20 a.m.	BREAK	
10:25 a.m.	Hydrogen's Future in Florida	Monjid Hamdan, VP of Engineering, Electrolyzer Systems, Plug Power
10:50 a.m.	Electric Vehicles in Florida, Today and in the Future	Jennifer Szaro, *Chair, Drive Electric Florida;* *President & CEO of AESP*
11:10 a.m.	Florida Energy Office Report Florida Legislative Session Report Strategic Plan Update: Metrics	Kelley Smith Burk, *Director, Office of Energy, FDACS* ~~Louis Rotundo,~~ ~~*Principal, Louis Rotundo and Associates*~~ Bill Grieco, *Vice Chair, FSEC Advisory Board;* *CEO, RAPID Manufacturing Institute™*
11:45 a.m.	New Business/Discussion Date and Agenda for Next AB Meeting (TBD)	Chris Castro, *Chair, FSEC Advisory Board*; *Director, Sustainability, City of Orlando*
12:00 p.m.	Adjourn	Chris Castro

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11:10 a.m.	Florida Energy Office Report Florida Legislative Session Report Strategic Plan Update: Metrics	Kelley Smith Burk, *Director, Office of Energy, FDACS* ~~Louis Rotundo,~~ ~~*Principal, Louis Rotundo and Associates*~~ Bill Grieco, *Vice Chair, FSEC Advisory Board;* *CEO, RAPID Manufacturing Institute™*
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Status of FSEC Programs

Jim Fenton, Director

Advisory Board Meeting

March 31, 2021

FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

New Advisory Board Members

Jacob Attala

KB Home

Karen Kicinski

LifeStyle Homes

Secondary Joint Appointments

Kristopher Davis

Materials Science and Engineering/RISES Cluster

Issa Batarseh

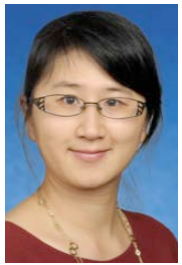
Electrical and Computer Engineering

Parag Banerjee

Materials Science and Engineering/REACT Cluster

Wei Sun

Electrical and Computer Engineering/RISES Cluster



Qun Zhou

Electrical and Computer Engineering/RISES Cluster

Kelly Stevens

Public Administration/ RISES Cluster

FSEC IN THE NEWS

UCF Researchers Selected for 4 Solar Awards from U.S. Department of Energy — Most of Any University

Issued by the Solar Energy Technologies Office, the awards total $9.64 million and will be used on projects ranging from securing our nation's power grids to optimizing solar energy.

BY LAURA J. COLE | NOVEMBER 23, 2020
ORIGINALLY PUBLISHED NOVEMBER 20, 2020

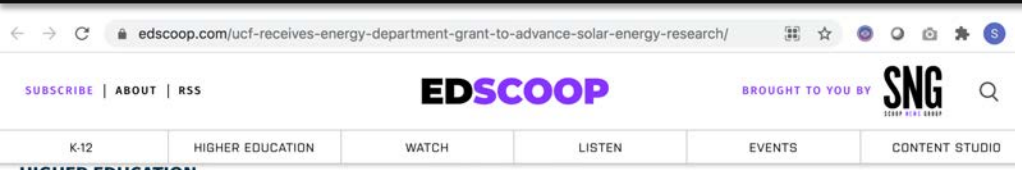
UCF was selected to receive four awards from the U.S. Department of Energy's Solar Energy Technologies Office, the most of any university this year. The awards total $9.64 million — $7 million from the DOE and $2.64 million in matches from UCF.

> "These awards amplify UCF's national leadership in solar energy research." — James Fenton, director of the FSEC Energy Research Center

"These awards amplify UCF's national leadership in solar energy research since the establishment of the Florida Solar Energy Center (FSEC) in 1975 by the Florida Legislature," says James Fenton, director of the FSEC Energy Research Center (ERC). "We are committed to advancing the rapid transition to a sustainable energy economy and collaborating with key partners. UCF 'walks the talk' by the university's commitment to being climate neutral by 2050."

UCF is increasing its leadership in solar research, having received 14 awards from the DOE since 2011 to pursue solar research and development. Additionally, FSEC ERC received a contract earlier this year from the DOE to lead a team that will monitor the performance of floating solar systems around the nation and compare them to their land-based counterparts. The recognition is part of a larger university-wide effort to prioritize energy research, including FSEC ERC and the interdisciplinary Resilient, Intelligent and Sustainable Energy Systems (RISES) faculty cluster, which brings together engineers, computer scientists and public administration experts.

https://www.ucf.edu/news/ucf-researchers-selected-for-4-solar-awards-from-u-s-department-of-energy-most-of-any-university/



HIGHER EDUCATION

UCF receives Energy Department grant to advance solar energy research

Written by Betsy Foresman

NOV 30, 2020 | EDSCOOP

The University of Central Florida is advancing its research into solar energy with new funding awarded by the U.S. Department of Energy, the school announced last week.

The $7 million grant from DOE's Solar Energy Technologies Office will support projects in solar energy research and power grid security, which aim to advance usage of sustainable energy, and help support the university's effort to prioritize energy research.

"We are committed to advancing the rapid transition to a sustainable energy economy and collaborating with key partners," James Fenton, director of the Florida Solar Energy Center at UCF said in a press release.

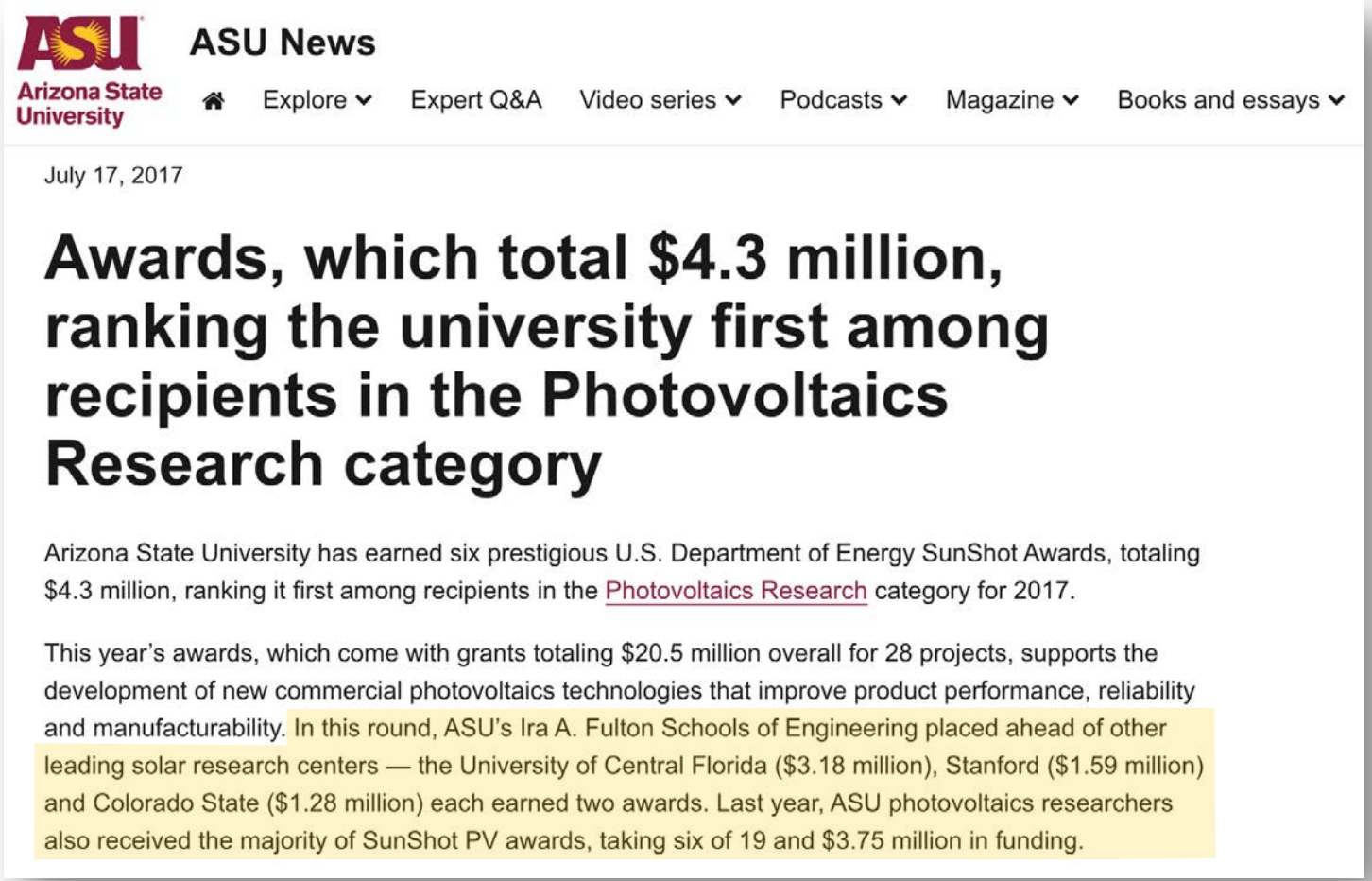
The funding will be distributed across four UCF projects, the university said. Three focus on advancing solar energy technologies, including the development fo double-sided solar panels that can generate more power. UCF is also researching solar panels that generate electricity from light and thermal energy and panels with extended life spans. The fourth project aims to help defend the nation's power grid from cyberattacks by developing new models and algorithms that will make physical power grid more secure and resilient.

UCF has received 14 other awards from the DOE since 2011 to pursue solar research and development, according to the university, and has become a leader in solar research.

"These awards amplify UCF's national leadership in solar energy research," Fenton said.

UCF's Florida Solar Energy Center also received a contract from DOE which began at the beginning of 2020 to lead a team that will monitor the performance of floating solar systems around the nation and compare them to their land-based counterparts over the next two years, according to the university.

https://edscoop.com/ucf-receives-energy-department-grant-to-advance-solar-energy-research/



ASU News

Arizona State University

Explore | Expert Q&A | Video series | Podcasts | Magazine | Books and essays

July 17, 2017

Awards, which total $4.3 million, ranking the university first among recipients in the Photovoltaics Research category

Arizona State University has earned six prestigious U.S. Department of Energy SunShot Awards, totaling $4.3 million, ranking it first among recipients in the Photovoltaics Research category for 2017.

This year's awards, which come with grants totaling $20.5 million overall for 28 projects, supports the development of new commercial photovoltaics technologies that improve product performance, reliability and manufacturability. In this round, ASU's Ira A. Fulton Schools of Engineering placed ahead of other leading solar research centers — the University of Central Florida ($3.18 million), Stanford ($1.59 million) and Colorado State ($1.28 million) each earned two awards. Last year, ASU photovoltaics researchers also received the majority of SunShot PV awards, taking six of 19 and $3.75 million in funding.

https://news.asu.edu/20170717-discoveries-asu-photovoltaics-program-six-energy-department-sunshot-awards

UCF

LifeStyle Homes

In early 2010, LifeStyle Homes was the first builder in Brevard County and the 41st builder in the nation to complete the U.S. Department of Energy's "Builders' Challenge" program. The completion of this program, in conjunction with guidance offered by the world-class scientists at the Florida Solar Energy Center (FSEC), led to the development of the LifeStyle SunSmart℠ energy initiative. All new homes built by LifeStyle Homes were guaranteed to meet at least a HERS 60 certification rating and produce 40% energy cost savings when compared to conventional homes.

LifeStyle Homes

https://buildingalifestyle.com/

Locations:
Florida

Solarserver The internet portal for renewable energies

ELECTRICITY WARMTH MOBILITY SUBJECTS Business Directory service Solar themes Contact

4-stage test protocol for photovoltaic modules checks mechanical load capacity

05.11.2020 / Solarserver/ Research / Photovoltaics

Photo: Panasonic

Test stand for the new 4-step test protocol

To guarantee the quality of photovoltaic modules, manufacturers use test methods in which the modules are exposed to physical pressure and temperature changes . However, according to researchers at the University of Florida, these tests are not enough to ensure long-term preservation of efficiency. Therefore, they have developed a new test protocol for photovoltaic modules.

According to Eric Schneller, researcher at the Florida Solar Energy Center at the University of Central Florida, PV modules are exposed to a variety of physical influences that can cause cracks. "This is due to human actions such as transportation and installation. But weather influences also play a role, such as snow, wind and extreme temperature fluctuations. "In his opinion, cracks have serious consequences:" They degrade the performance of the module and can cause non-functioning areas. These lead to voltage differences that further reduce performance. Cracks sometimes also

...of a fire

Solarserver

4-Stufen-Testprotokoll für Photovoltaik-Module prüft ...

Laut Eric Schneller, Forscher am Florida Solar Energy Center der University of Central Florida, sind PV-Module einer Vielzahl von physikalischen ...

Nov 5, 2020

https://www.solarserver.de/2020/11/05/4-stufen-testprotokoll-fuer-photovoltaik-module-prueft-mechanische-belastbarkeit/

MENU NEXT CITY

A Florida Study Showed How to Save Energy at Home. Why Aren't More Cities and States Following Suit?

CHAD SMALL JANUARY 21, 2021

Over the past few years in Florida, a more expansive retrofit experiment is investigating the viability of **deep energy retrofits** — when multiple, larger retrofits are enacted together. Since 1975, the **Florida Solar Energy Center's (FSEC) Energy Research Center** has been exploring energy use questions in the Sunshine State. Principal Research Scientist for Buildings Research and 30-year FSEC veteran, Danny Parker, describes FSEC's journey into deep energy retrofits as a bit of a thought experiment made real.

More expansive retrofit rebates, however, would not only encourage more Floridians to upgrade their homes and find energy savings, but Fenaughty and Parker both think that utility companies could actually benefit. Retrofits bring down peak daily energy loads, allowing the utility to operate more efficiently.

https://nextcity.org/daily/entry/florida-study-save-energy-home-why-arent-more-cities-states-following-suit

UCF

U.S. DEPARTMENT OF ENERGY

SOLAR DISTRICT CUP

COLLEGIATE DESIGN COMPETITION

"The Solar District Cup challenges multidisciplinary collegiate student teams to develop forward-thinking designs for optimized campus or urban district distributed energy systems that inspire students and professionals alike—and then design and model those systems."

The Class of 2021 started with 59 student-led teams from 57 collegiate institutions participating in the Solar District Cup. Then, 35 teams from 34 schools advanced as finalists.

UCF is a 2021 district use case partner.

- UCF and FSEC staff worked with the National Renewable Energy Laboratory (NREL) to create a UCF use case– an existing mixed-use urban district or campus in need of increased distributed energy development

UCF

Section of UCF campus serving as Solar District Cup use case.

Solar installations could be considered for any of the rooftops or parking areas in this space.

U.S. DEPARTMENT OF ENERGY
SOLAR DISTRICT CUP
COLLEGIATE DESIGN COMPETITION

Students teams were to also design a PV system on identified UCF land to the southeast of campus that interconnects to the substation shown *(left side of photo)*.

A floating solar solution on a retention pond east of the football stadium would also be considered by UCF.

UCF

Virtual EnergyWhiz 2021

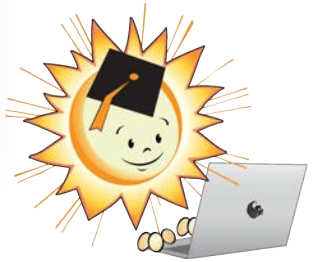
https://events.energywhiz.com/

A Week-Long Virtual Event

May 3 – 7

- Elementary to college students
  - **Junior Solar Sprint**
  - **Energy Transfer Machine**
  - **Energy Innovations**

www.fsec.ucf.edu/go/energywhiz



External Center Review

- Internal 7-year report required by end of 2021
- External review committee multi-day visit by Spring 2022
- External review committee reports results to UCF administration

CURRENT CONTRACTS

Current DOE-Funded Collaborative Partnerships

- **Fabrication of Passivating Contact Solar Cells,** *K. Davis*
- **PV System Research Impacting LCOE**, *H. Seigneur*
- **Reliability and Power Degradation**, Sub from CWRU*, K. Davis*
- **Characterization of Contact Degradation in c-Si PV Modules**, *K. Davis*
- **Low Cost Printing Techniques***, K. Davis*
- **Quantifying and Valuing Fundamental Characteristics and Benefits of Floating Photovoltaic Systems,** *J. Sherwin*
- **Developing PID susceptibility models for Bifacial Technologies**, *H. Seigneur*
- **Secure and Resilient Operations Using Open-Source Distributed Systems Platform (OpenDSP)**, *W. Sun*

UCF

Current DOE-Funded Collaborative Partnerships

- **Investigation of the Prevalence and Energy Impacts of Residential Comfort System Faults – Hot Humid and Hot Dry Climates,** *E. Martin*
- **PV-GEMS: Photovoltaic Powered, Grid Enhanced Mechanical Solution,** *E. Martin*
- **Indoor Air Quality Field Study in New US Homes,** *E. Martin*
- **Energy Codes: Comparing Performance in a Changing Technological Environment,** *P. Fairey*
- **EnergyPlus Development,** *L. Gu*

UCF

Current Contracts

- Residential Buildings Subject Matter Expert Technical, Outreach and Research and Development Support
- Lab Home Testing of Residential Isolation Space Control to Minimize Infectious Disease Transmission in Existing Single-Family Homes
- Whole Building Modeling and Simulation Software

- DOE Connected Heat Pump Water Heater Field Study

- PV Lifetime Hot and Humid Climate Flash Testing

- Enabling large-scale adaptive integration of technology hubs to enhance community resilience through decentralized urban food-water-energy nexus decision

- Comparison of the 7th Edition Florida Building, Energy Conservation Code with IECC 2021 & ASHRAE 90.1-2019
- 7th Edition (2020) Florida Building Code Updates

- Alternative Fuel Resiliency Plan
- SunSmart Schools E-Shelter Maximization Project

Current Contracts

ADI AIR DISTRIBUTION INSTITUTE MANUFACTURING EXCELLENCE

- Lab Home Measurement of Space Conditioning Energy Use with Flexible and Metal Duct Systems

ASU Arizona State University

- Reliability Evaluation of Bifacial and Monofacial Glass/Glass Modules with EVA and Non-EVA Encapsulants

American Chemistry Council℠

- Survey of Unvented Attics in Climate Zones 2-3

Associated Gas Distributors of Florida

- Commercialization of Renewable Natural Gas in Florida
- Updating AGDF Model Costs and Equipment

ASHRAE®

- Estimating Internal Moisture Generation Rates in Occupied New Homes

ATLANTIC HOUSING PARTNERS

- Calculate Multifamily Utility Allowances and Support Existing PV Operations and New Installations

PLUG POWER

OUC The *Reliable* One®

- Demonstration of Integrated Hydrogen Production and Consumption for Improved Utility Operations

UCF

Current Contracts

- Lab and Field Evaluation of Condensation Potential in Buried Ducts in Vented Attics Located in the Hot and Humid Climate Zones

- SRCC Portal Development

- Technical Support

SEI Associates

- Trane Trace 3D Plus Software Development Support

Tactical Energy

- Comparison of Real World Assisted Living Buildings with Baseline Models

- *[Sub-Award]* Maximizing the Effectiveness of Ductless Heat Pumps in Existing Homes by Demonstrating Integrated Controls

- American Made Challenge
- Power Connector

NEW AWARDS & PENDING CONTRACTS

Developing PID susceptibility models for Bifacial PV module technologies

2243-1667

SETO 2020

Topic Area 1 Correlation of Module-Accelerated Performance Testing with Field Performance Technologies

Summary Impact Idea: Testing bifacial technologies with indoor accelerated testing and outdoor extreme environmental conditions will provide better testing standards and point to better module materials selection for improved LCOE

Bifacial Technology

- n-type PERT, transparent back sheet
- p-type, PERC, framed transparent back sheet and glass back
- p-type, PERC (glass/glass without frame)
- n-type, TOCON (glass/glass)

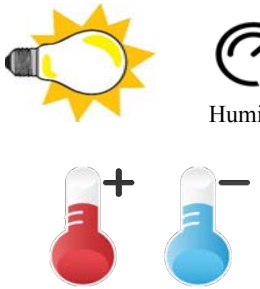
Resources ($)

Total Project	DOE Funds	Cost Share
$ 1,875,000	$1,500,000	$375,000

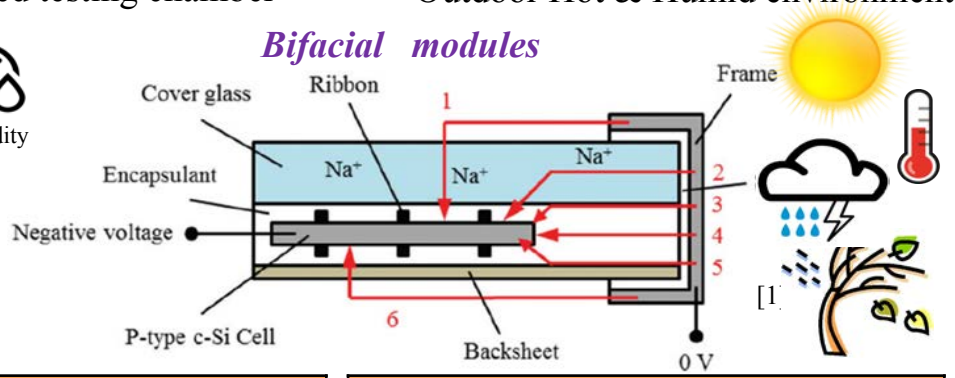
University of Central Florida

- Dr. Hubert Seigneur– UCF PI
- Dr. Peter Hacke, NREL
- Dr. Govindasamy Tamizhmani, ASU
- Dr. Jaewon Oh, Appalachian State
- Ryan Smith, Pordis
- Sanjay Shrestha, SOLV
- Dr. Christopher A. DiRubio, First Solar
- Dr. Paul Brooker, Orlando Utilities Commission

Indoor accelerated testing chamber



Outdoor Hot & Humid environment



Objectives -

- Improve the understanding of PID effects as a function of technology
- Improve the models for predicting PID based on indoor testing
- Improve the indoor testing protocols developed through outdoor high voltage testing
- Increase understanding of bifacial PID in large scale production field installations

Outcomes - (Takeaway)

- Outdoor to indoor testing correlation, informs standards testing
- 1-D cell modeling for bifacial technology, informs materials selection
- Voltage-based modeling for CdTe modules
- Weather/empirical modeling for bifacial technology, informs sensitivity
- Electrochemical modeling, informs degradation

[1] Wei Luo, Y-S Khoo, P. Hacke et. al. Potential-induced degradation in photovoltaic modules: a critical review, Energy Environ. Sci., 2017, 10, 43-68

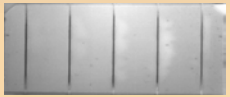
Gaining Fundamental Understanding of Critical Failure Modes and Degradation Mechanisms in Fielded Photovoltaic Modules via Multiscale Characterization

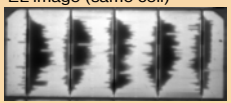
2243-1776

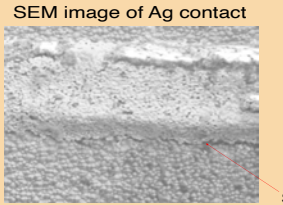
KRISTOPHER O. DAVIS / UCF

Project Summary

The University of Central Florida (UCF), the Florida Solar Energy Center (FSEC), Case Western Reserve University (CWRU), Tau Science, and BrightSpot Automation will apply multiscale characterization methods to field exposed photovoltaic modules to link observed performance degradation to specific loss mechanisms (i.e., optical, recombination, resistive) and, ultimately, to root causes (i.e., changes in chemistry and/or microstructure).







Key Personnel/Organizations

(PI) Prof. Kristopher O. Davis, University of Central Florida (UCF) Joseph Walters, UCF; Prof. Sudipta Seal, UCF; Prof. Titel Jurca, UCF; Dr. Mengjie Li, UCF; Dr. Tamil Selvan, UCF; Prof. Roger H. French, Case Western Reserve University (CWRU); Prof. Laura Bruckman, CWRU; Dr. Andrew Gabor, BrightSpot Automation; Dr. Greg Horner, Tau Science

Budget and Timeline

Federal funds: $1,999,901 Cost-share: $514,635 Total: $2,514,536

Key Milestones & Deliverables

Final:	- 25 time-series datasets analyzed and made public - New field inspection methods developed, including outdoor UV fluorescence (UVF), photoluminescence (PL), and electroluminescence (EL) imaging - UVF, PL, and EL images made publicly available for at least 30 different module types - Peer-reviewed journal publications tracing specific failure modes from the array-level to nanometer-scale films and interfaces

Project Impact

Provide fundamental insight into how and why PV modules fail in the field, provide industry with tools to catch these issues early on, and map out corrective actions when these issues are encountered.

SOLAR ENERGY TECHNOLOGIES OFFICE U.S. Department Of Energy

UCF

FSEC

CASE WESTERN RESERVE UNIVERSITY EST. 1826

Tau Science Built for Solar

BrightSpot Automation

Secure and Resilient Operations Using Open-Source Distributed Systems Platform (OpenDSP)

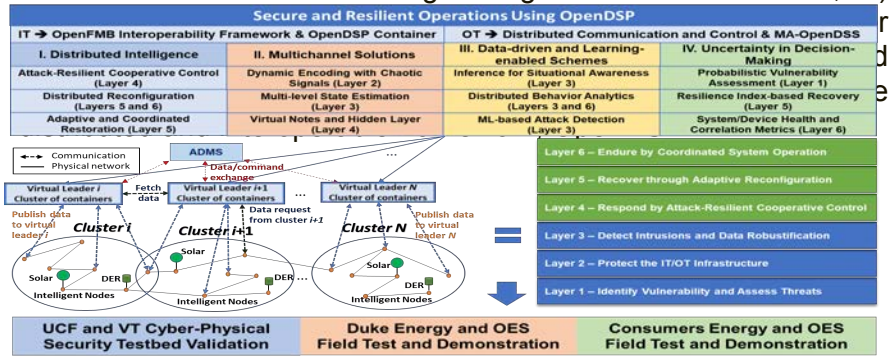
DR. WEI SUN / UNIVERSITY OF CENTRAL FLORIDA

2243-2052

Project Summary

Technology Summary: This university-utility team aims to address cybersecurity gaps by developing a comprehensive cyber-physical defense and survival mechanism for operating distribution networks with high penetration of DERs. The proposed technical solutions achieve proactive defense (vulnerability assessment, communication protection, and attack detection) and adaptive self-healing (attack-resilient control, adaptive recovery, and resilient survival) at both information/operation technology (IT/OT) layers.

Project Objectives/Goals: i) Identify/quantify major vulnerabilities in both IT and OT; ii) Develop a multi-channel robustification scheme to protect the communication infrastructure; iii) Extend situational awareness to the grid edge for attack detection; iv)



Key Personnel/Organizations

Prime Recipient: University of Central Florida (UCF)

Principal Investigator: Dr. Wei Sun, Associate Professor, Department of Electrical and Computer Engineering, UCF

Key Participants: University of Central Florida (**UCF**), Virginia Tech (**VT**), Duke Energy (**Duke**), Consumers Energy (**CE**) & Open Energy Solutions, Inc. (**OES**)

Budget and Timeline

Federal funds: $3.2M Cost-share: $1.55M Total: $4.75M

Key Milestones & Deliverables

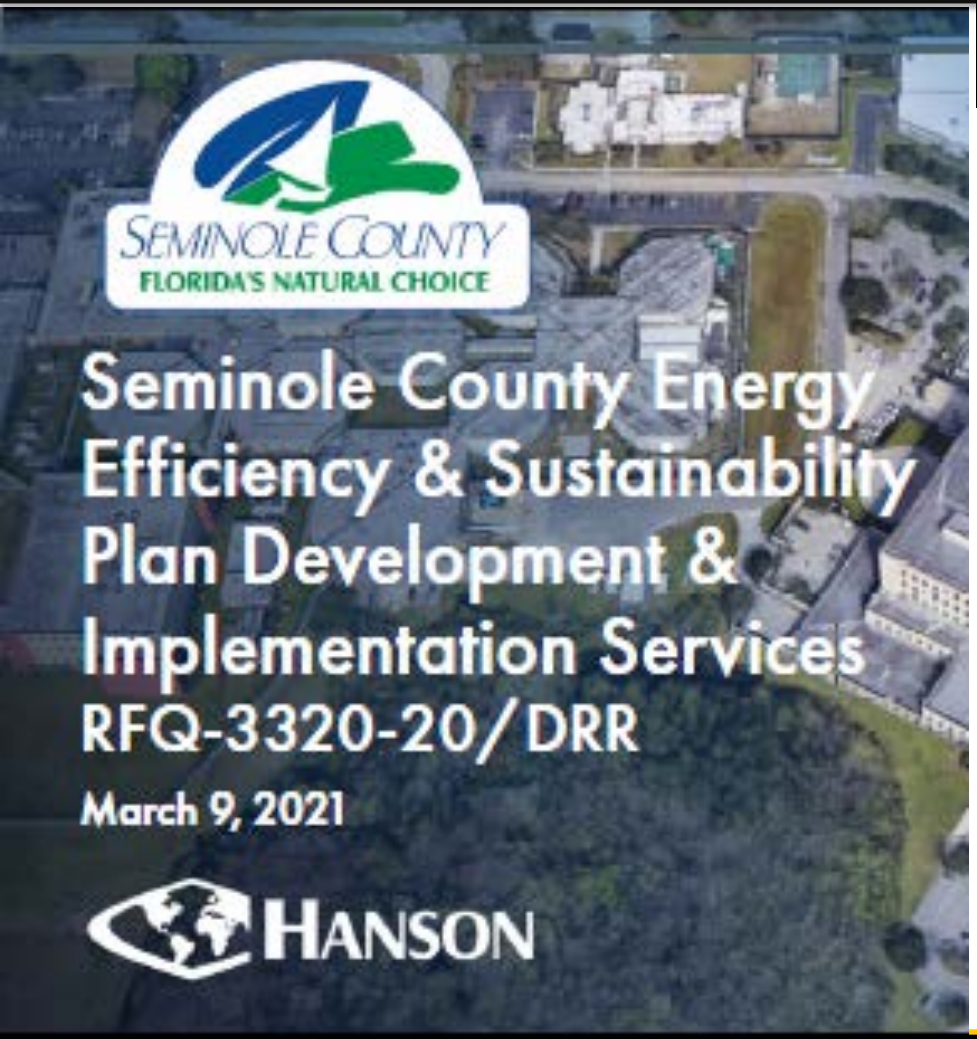
Year 1:	Attack classifier, communication robustification, multi-channel attack detection, distributed behavior analytics
Year 2:	Attack resilient control, distributed reconfiguration, adaptive restoration, OpenDSP implementation
Year 3:	Resilient survival scheme, university testbed validation, utility field test, and security enhancement in OpenDSP

Project Impact

Technology's Impact: Major innovations of distributed intelligence, multi-channel and multi-level solutions, data-driven and learning-enabled schemes, and uncertainty in decision-making, leading to robust cybersecurity enhancement solutions.

Project's Key Idea/Takeaway: Develop, validate and field test critical distributed and interoperable approaches to address the emerging cyber-security issues and enhance relevant operational platforms for DER service providers and utilities.

The multi-layer and multi-channel cybersecurity enhancement solutions aim to increase the renewable penetration while enhancing cyber-physical system security and resilience.



New Award

- Hanson Professional Services has teamed with FSEC and the Central Florida Clean Cities Coalition
- Develop an Energy Efficiency and Sustainability Plan
  - Document existing baseline information
  - Survey best practices and latest technologies for efficiency/sustainability targets and strategies
  - Establish conservation and efficiency goals
  - Quantify anticipated efficiencies in the appropriate industry measurement
  - Engage customer in briefings, strategy sessions and action items
  - Engage the public as appropriate
  - Provide recommendations w/ cost savings

UCF

SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

New Award

Education Materials for Professional Organizations Working on Efficiency and Renewable Energy Developments (EMPOWERED)

Topic 2: Safe DER Building Integration: Building, Fire, and Safety Department Officials

- **Interstate Renewable Energy Council (IREC)**
- **Project Name:** Dynamic and Responsive DER Educational Solutions for Building, Fire, and Safety Department Officials
- **DOE Award:** $2.1M
- **Cost Share:** $126,000

- **Project Summary:** IREC will establish a comprehensive online platform of information related to DER safety and develop a job-focused, interactive online training program. Educational materials and resources will focus on clean energy codes, standards, permitting, and inspection for building managers, owners, and officials interacting with solar energy and storage systems.

UCF

Pending Contract

DRIVE ELECTRIC USA

- US DOE VTO-funded project
- Dedicated to raising awareness and adoption of EVs across the U.S.
- 14 participating states
- Demonstrate how to successfully build statewide, successful EV efforts to drive the purchase and use of EVs of all sizes and by general citizens and fleets

- The DRIVE Electric USA project will create a replication playbook based on outputs and lessons learned and build successful long-term continuation through funding and partnerships. Additionally, a 28-member Project Advisory Committee (PAC) will provide input and guide the coalitions and their statewide efforts to break down barriers as quickly as we can towards accelerating EV adoption in our states.

UCF

PENDING PROPOSALS

FSEC Energy Research Center
UNIVERSITY OF CENTRAL FLORIDA

Dynamic Demand Response for Grid Services in a High PV Penetration Feeder

Control Number 2206-1590
Requested Federal Funds: $7 M, Cost Share: $4.4 M

Team

Prime:
University of Central Florida

PI:
Richard Raustad, Project Director

Partners

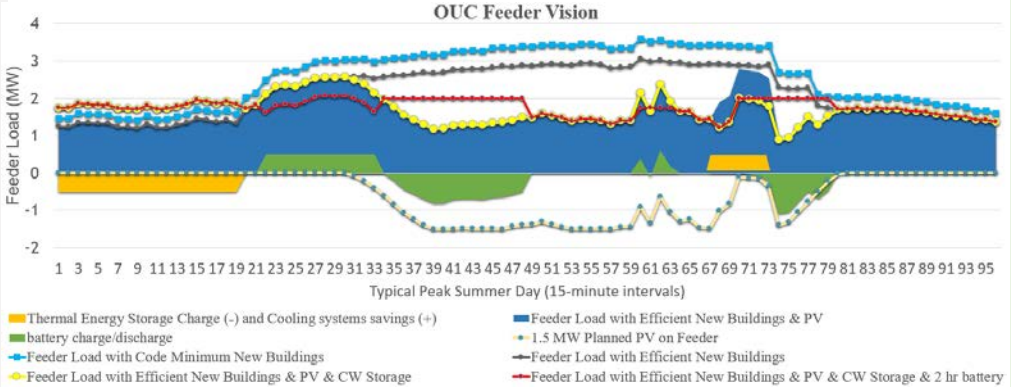
TAVISTOCK DEVELOPMENT COMPANY
OUC The Reliable One
exp.
HITACHI
ABB
SIEMENS energy

Impacts

Demonstrate methods for grid-interactive buildings to provide valuable support to the grid in a high-PV penetration scenario without compromising occupancy comfort. This will enable an increase in variable PV generation while maintaining the high level of grid reliability that utilities have demonstrated.

Summary

Shift cooling loads through chiller and air conditioner set point controls, dispatching battery energy storage, and modulating EV charging in real time via utility signals. Feeder load current 2 MW, future 4 MW, solar 1-2 MW. Evaluate TES via dynamic simulation.



Improvement Goal

Electric demand will be reduced by 15-30% and flexed by 30% through optimized infrastructure and software controls demonstrated in an urban area

The demonstration will include 3 hotels, 3 office buildings, 2 garages, a chiller plant, up to 180 EV charging stations, 1 MW of solar PV at a parking garage, and will install DC-coupled battery (500kW/2000kWh) and EV charging (8x60kW)

Evaluating Emerging Heat Pump Water Heaters with CTA-2045-B to Supply Storage for Electrical Grids

Control Number 2196-1966
Requested Federal Funds:
$3 M, Cost Share: 0.75M

TEAM

PRIME:

UCF | FSEC Energy Research Center
UNIVERSITY OF CENTRAL FLORIDA

PI: Karen Fenaughty

FFRDC

Pacific Northwest NATIONAL LABORATORY

SUB-RECIPIENTS

FRONTIER energy
neea Northwest Energy Efficiency Alliance
SkyCentrics

PARTNERS

UTILITY PARTNERS

Xcel Energy
OUC The Reliable One
Orlando Utilities Commission

MANUFACTURER PARTNERS

nyle water heating systems
GE APPLIANCES

SUPPORRTING PARTNERS

Energy Solutions
ASSOCIATION FOR ENERGY AFFORDABILITY

OBJECTIVE

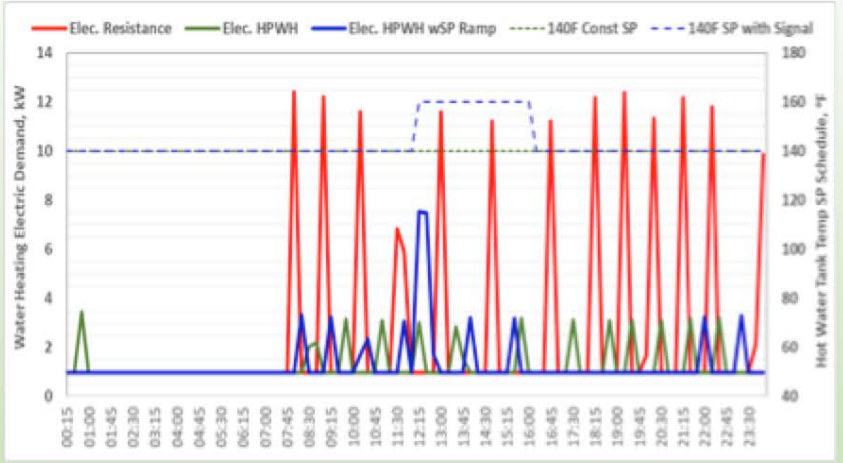
Document energy and demand savings from transforming existing gas and electric water heating systems to electric heat pumps with 2045-B technology.

Field validation will demonstrate installation requirements, demand and annual savings in five different states (FL, MN, CO, CA, WA). Minimum 10 residential and one commercial monitored install per state (Exception of CO and MN – see proposal).

Lab tests will demonstrate value of integrated mixing valve and solar predictor algorithm.

IMPACTS

Electric demand can be reduced 75% with HPWH and shifted to solar hours *(restaurant load modeled)*.



ENERGY AND DEMAND SAVINGS

Per Residential Unit vs. Electric Resistance: 998 kWh, 0.51 KW demand	Per unit vs. current HPWH: 25.5 kWh and 0.3 kW demand	**Potential to save energy nationally (residential electric resistance replacement) 54,000 GWh**

Total Potential Residential & Commercial	87,000 GWh, 79 M tonnes CO_2

Solar-Assisted Natural Gas Hybrid Tankless Water Heating

Control Number 2196-1817
Requested Federal Funds: $1.3M,
Cost Share: $330,000

TEAM

PRIME

FSEC Energy Research Center
UNIVERSITY OF CENTRAL FLORIDA

PI: Carlos Colon

SUB-RECIPIENT

gti GAS TECHNOLOGY INSTITUTE

UTILITY COLLABORATIVE

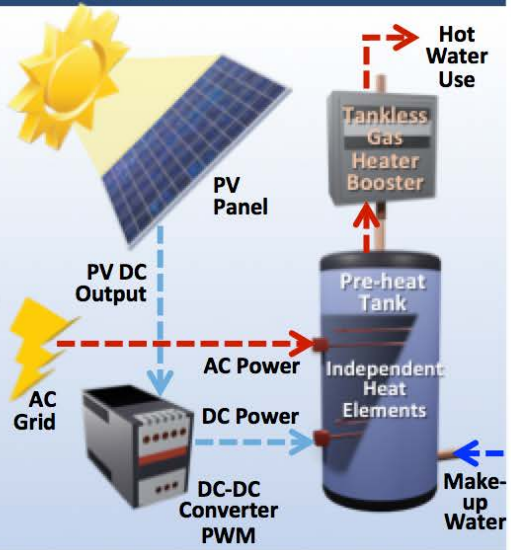
UTD. Utilization Technology Development

OEM PARTNER

Rinnai

OBJECTIVE

Develop and evaluate a low cost and an optimized solar photovoltaic tank preheat with tankless solution. The hybrid unit will addresses the gap in natural gas water heating equipment efficiency (COP) between 0.8 and 1.4 at a reasonable cost.



IMPACTS

Savings of 25% to 75% over current natural gas tankless technology.

		EnergyPlus Simulation Results					
Prototypes to be Built and Tested	Locations	Tankless Hybrid	Hot Water Gallons /day	Baseline Tankless Gas MMBtu /yr	Potential Savings from PV-generated MMBtu/yr	Potential Baseline Tankless Gas (% Saved)	Hybrid COP
1 Low-Cost; 1 Optimized	Florida	w/4 PV preheat	53	8.06	6.10	75.60%	2.12
		w/2 PV preheat	42	6.39	3.05	47.70%	1.36
1 Low-Cost; 1 Optimized	Illinois	w/4 PV preheat	53	11.94	5.43	45.4%	1.34
		w/2 PV preheat	42	10.10	2.71	26.9%	1.10

System development will maximize the solar output and avoid running the gas unit:

- Develop and test a DC (from solar) to DC (tank element) converter to maximize the solar delivery while keeping DC voltage at safe household levels (<60 VDC)
- Separate controlled 110 VAC wiring to heat water in the pre-heat upper section of tank using 1500W resistance heat element
- A refined control algorithm to reduce firing up gas unit based on preheat temperature
- Address health /safety concerns of bacteria (Legionella) in the preheat storage tank and overheating protection (vacation)

Total Potential	560 TBTU's Energy Savings

Florida Regional Energy Enterprise Development (FREED) Cluster
University of Central Florida

2425-1576

Project Summary

UCF and its regional partners will establish the Florida Regional Energy Enterprise Development (FREED) Cluster to accelerate the success of regional energy hardware entrepreneurs, start-ups, and companies. FREED builds upon the existing commercialization support resources of the UCF ecosystem, as well as new private and public infrastructure available from our partners that can be leveraged as testbeds for hardware demonstration and development by its portfolio companies. The project will support at least 45 portfolio companies through focused programming and streamlined access to the distributed resources of the partners for product development and demonstration, accelerating the path towards domestically-based production of energy hardware

Metric	Target Value
FREED portfolio companies supported	**45**
Revenues and investments secured by FREED portfolio companies	**$7,000,000**
External/Federal funding obtained by FREED portfolio companies	**$4,000,000**
New energy industry partner connections for portfolio companies	**50**
Annual non-federal sponsorship of FREED	**$600,000**

Key Personnel/Organizations

University of Central Florida – Lead Organization

Orange County Florida

Orlando Utilities Commission

City of Orlando, Florida

Florida High Tech Corridor Council

Budget and Timeline

Federal funds:	Cost-share:	Total:
$932,043	$233,284	$1,165,327

Key Milestones & Deliverables

Year 1:	Successful recruitment of 10 portfolio companies and active engagement of stakeholders
Year 2:	Successful recruitment of 15 additional portfolio companies and external funding in excess of $3 million
Year 3:	A portfolio of 45 energy technology companies in the region with an investment of $10 million of capital funding

Project Impact

Advanced energy hardware technology solutions that support grid modernization, building energy efficiency, and alternative transportation efforts will mitigate global warming. Harnessing the collective resources of researchers, entrepreneurs, and industry towards a common objective of advancing new energy technology solutions is the goal of the Florida Regional Energy Enterprise Development (FREED) Cluster.

Harnessing the collective resources of researchers, entrepreneurs, and industry towards advancing energy technology solutions

Questions?


UCF
FSEC Energy
Research Center
UNIVERSITY OF CENTRAL FLORIDA

FSEC Advisory Board Meeting — AGENDA

9:30 a.m.	Welcome and Introductions Roll Call	Chris Castro, *Chair, FSEC Advisory Board* Sherri Shields
9:40 a.m.	Approval of October 29, 2020 Meeting Minutes	Chris Castro
9:45 a.m.	Status of FSEC Programs	Jim Fenton
10:05 a.m.	**Altamonte Electric Utility (AEU) and Floating Solar**	**Frank Martz, City Manager, Altamonte Springs, FL**
10:20 a.m.	BREAK	
10:25 a.m.	Hydrogen's Future in Florida	Monjid Hamdan, VP of Engineering, Electrolyzer Systems, Plug Power
10:50 a.m.	Electric Vehicles in Florida, Today and in the Future	Jennifer Szaro, *Chair, Drive Electric Florida; President & CEO of AESP*
11:10 a.m.	Florida Energy Office Report Florida Legislative Session Report Strategic Plan Update: Metrics	Kelley Smith Burk, *Director, Office of Energy, FDACS* ~~Louis Rotundo,~~ ~~*Principal, Louis Rotundo and Associates*~~ Bill Grieco, *Vice Chair, FSEC Advisory Board; CEO, RAPID Manufacturing Institute™*
11:45 a.m.	New Business/Discussion Date and Agenda for Next AB Meeting (TBD)	Chris Castro, *Chair, FSEC Advisory Board*; *Director, Sustainability, City of Orlando*
12:00 p.m.	Adjourn	Chris Castro

Guest Speakers

Altamonte Electric Utility and Floating Solar
Frank Martz, City Manager,
City of Altamonte Springs, Fla.

Hydrogen's Future in Florida
Monjid Hamdan, VP of Engineering,
Electrolyzer Systems, Plug Power

Electric Vehicles in Florida, Today and in the Future
Jennifer Szaro, Chair, Drive Electric Florida;
President & CEO of AESP