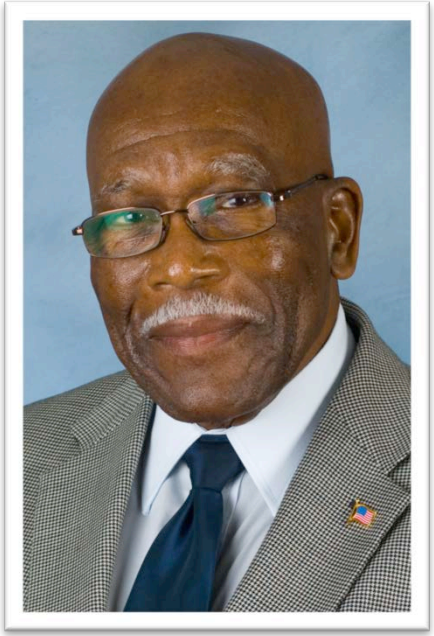
# In Memory Of



**John Anderson**
1927 – 2020

# FSEC Advisory Board Meeting — AGENDA

| | | |
|---|---|---|
| 9:30 a.m. | Welcome and Introductions<br>Roll Call | Chris Castro, Chair<br>Sherri Shields |
| 9:40 a.m. | Approval of April 16, 2020 Meeting Minutes | Chris Castro |
| 9:45 a.m. | Status of FSEC Programs | Jim Fenton |
| 10:05 a.m. | Florida Energy Office Report<br>Florida Legislative Session Report | Kelley Smith Burk<br>Louis Rotundo |
| 10:20 a.m. | Strategic Plan Update | Bill Grieco |
| 10:35 a.m. | City of Satellite Beach Energy Study | Nick Sanzone, Environmental Programs Coordinator, City of Satellite Beach |
| 11:00 a.m. | Energy Outlook | Tom Lawery, Manager, Wholesale/ Renewable Energy, Duke Energy |
| 11:25 a.m. | State of the Solar Industry | Justin Vandenbroeck,<br>2nd VP FlaSEIA |
| 11:55 a.m. | Date and Agenda for Next AB Meeting (TBD) | Chris Castro |
| 12:00 p.m. | Adjourn | Chris Castro |

# The State of FSEC

**Jim Fenton, Director**

*Advisory Board Meeting*

October 29, 2020

FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA

# FSEC IN THE NEWS

Builder

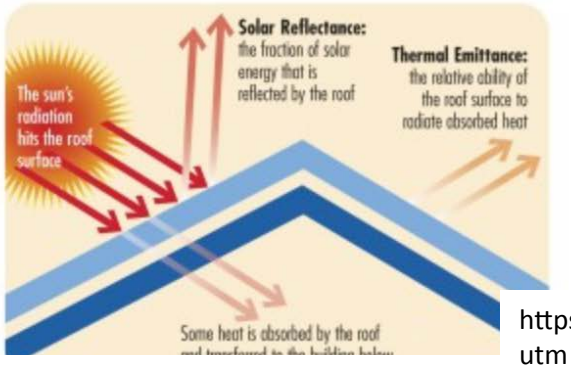
BUILDER

# MANAGING SOLAR GAIN

## In southern climates, the sun's heat is a load to be minimized.

By Ted Cushman

In the northern U.S., designers of high-perfor
beneficial source of heating energy. Passive so
reap heat during the winter.




### Reflective Walls

Studies indicate that reflective roofing can cut cooling costs by as much as 20%, particularly for houses with poor ceiling insulation or with leaky ductwork in the attic space. Given that, researchers have also considered whether reflective walls could have a similar benefit. The Florida Solar Energy Center (FSEC) has investigated this question by studying a set of test buildings in Cocoa, Fla. Painting the exterior walls a reflective white color resulted in a cooling energy savings of about 10% on an annual basis, compared with the original beige-colored walls.

FSEC researchers extrapolated this result using building energy simulations to estimate the benefits of white reflective walls in other locations. According to the modeling, going from dark walls to white walls could save about 12% on cooling costs in cities like Orlando, Miami, New Orleans, or Houston.

https://www.builderonline.com/building/building-science/managing-solar-gain_o?utm_source=newsletter&utm_content=Article&utm_medium=email&utm_campaign=BP_102320&



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SCAM OR NOT

The New York Times

# Is Air a Scam?

We love air! But boiling herbs and buying more plants will not improve your indoor air quality. Find out what will.

**By Katharine Gammon**

Oct. 5, 2020

For essential oils, the problem is similar: They are emitting compounds into the air that can react with the complex existing air chemistry to create irritating offshoots.

"There is no evidence that suggests that the oils improve air quality," said Tanvir Khan, an air quality engineer and researcher at the Florida Solar Energy Center, part of the University of Central Florida. "Other pollutants, like ozone, which comes from outside to inside, can react with V.O.C.s to create secondary pollutants which are harmful."

https://www.nytimes.com/2020/10/05/style/self-care/how-to-clean-air-filter.html



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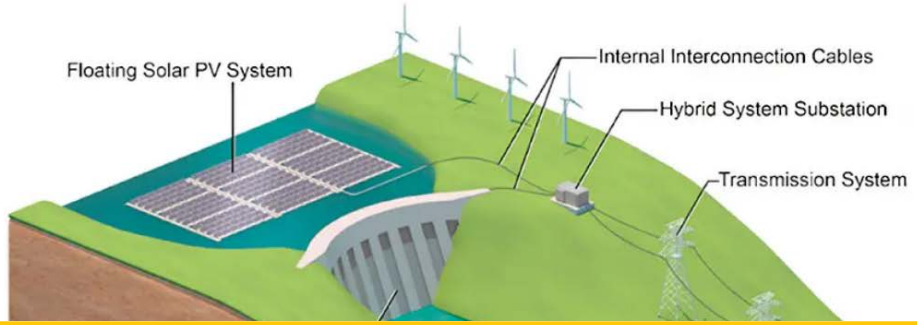
# DOE Says Combining Floating Solar With Hydroelectric Could Provide 40% Of The World's Energy Needs

CleanTechnica

October 5th, 2020 by **Steve Hanley**

A **study by the National Renewable Energy Lab** Department of Energy, suggests that if floating solar pa 379,000 hydro reservoirs globally, the resultant hybrid from 16% to 40% of the world's demand for electricity. adding floating solar panels to bodies of water that are could produce as much as 7.6 terawatts of potential pov alone. That's equivalent to 10,600 terawatt-hours of electricity annually. In comparison, global final electricity consumption was just over 22,300 terawatt-hours in 2018, the most recent year for which statistics are available, according to the International Energy Agency.

Actually, some researchers think that 40% number is more than a little optimistic. They suggest the number should be closer to 16% than 40%. John Sherwin, program director at the University of Central Florida's Solar Energy Center, tells **E&E News** there are variables that need to be researched first, such as how solar panels respond to the stress of being on the water. In an e-mail to *E&E News*, he said "the actual potential [of solar-hydro pairings] would be more conservative and be on the middle to lower end of the range."




https://cleantechnica.com/2020/10/05/doe-says-combining-floating-solar-with-hydroelectric-could-provide-40-of-the-worlds-energy-needs/



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**Janet McIlvaine**, buildings analyst, and **Colleen Kettles**, Director of Workforce and Business Development at FSEC, discuss green jobs: integration into construction, home energy rater, green building programs, certificate programs, solar career map, apprentice programs, alternative fuel vehicles.

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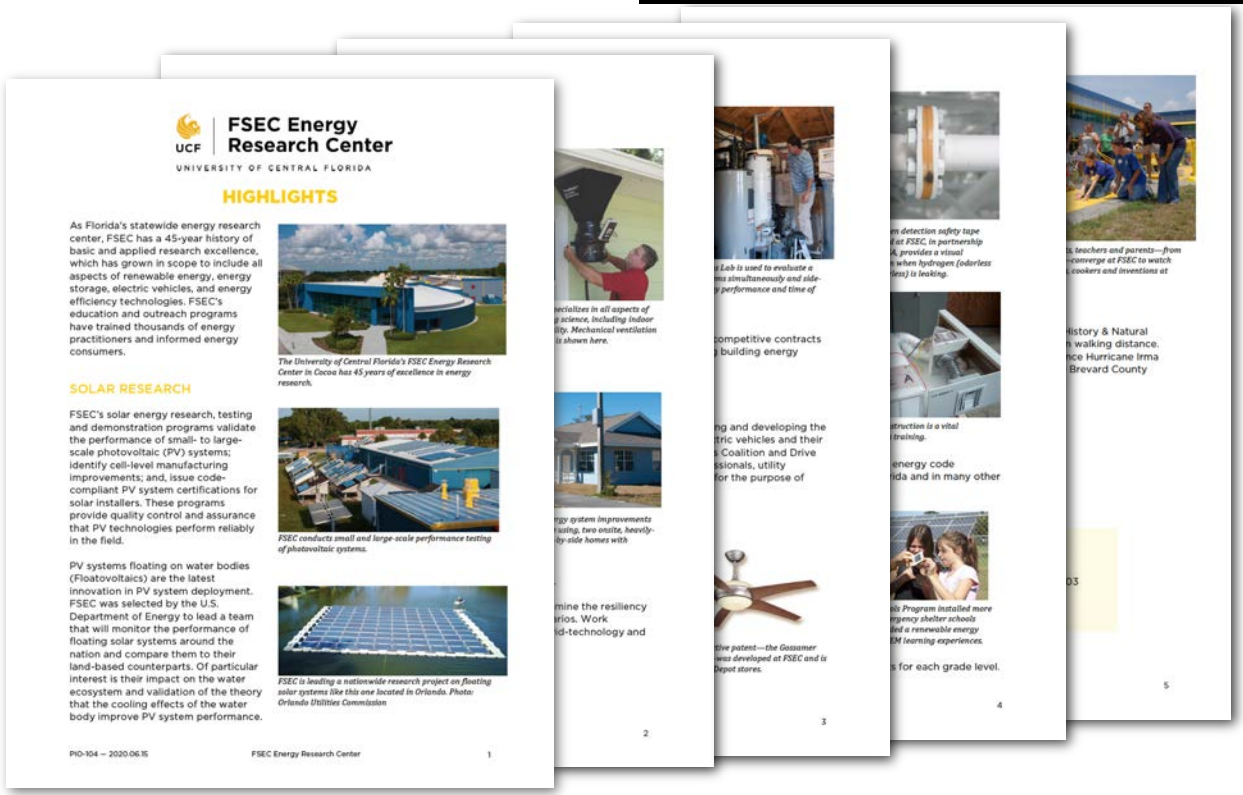
# FSEC ERC Highlights

**Available at:**
energyresearch.ucf.edu/

- About Us
- Working With Us



FSEC Energy Research Center
UNIVERSITY OF CENTRAL FLORIDA

HIGHLIGHTS

As Florida's statewide energy research center, FSEC has a 45-year history of basic and applied research excellence, which has grown in scope to include all aspects of renewable energy, energy storage, electric vehicles, and energy efficiency technologies. FSEC's education and outreach programs have trained thousands of energy practitioners and informed energy consumers.

The University of Central Florida's FSEC Energy Research Center in Cocoa has 45 years of excellence in energy research.

SOLAR RESEARCH

FSEC's solar energy research, testing and demonstration programs validate the performance of small- to large-scale photovoltaic (PV) systems; identify cell-level manufacturing improvements; and, issue code-compliant PV system certifications for solar installers. These programs provide quality control and assurance that PV technologies perform reliably in the field.

FSEC conducts small and large-scale performance testing of photovoltaic systems.

PV systems floating on water bodies (Floatovoltaics) are the latest innovation in PV system deployment. FSEC was selected by the U.S. Department of Energy to lead a team that will monitor the performance of floating solar systems around the nation and compare them to their land-based counterparts. Of particular interest is their impact on the water ecosystem and validation of the theory that the cooling effects of the water body improve PV system performance.

FSEC is leading a nationwide research project on floating solar systems like this one located in Orlando. Photo: Orlando Utilities Commission

PIO-104 – 2020.06.15 FSEC Energy Research Center 1

https://energyresearch.ucf.edu/wp-content/uploads/2020/10/PIO-104_FSEC-Highlights-2020.pdf

# EnergyWhiz 2021

## A Week-Long Virtual Conference

- Elementary to high school student events
  - **Junior Solar Sprint**
  - **Energy Transfer Machine**
  - **Energy Innovations**


https://vimeo.com/434436180

# 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*

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# 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*

# 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



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# Current Contracts

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

- Demonstration of Cable Based Capacitor Technologies in Renewable Energy Sector

- SRCC Portal Development

- Technical Support

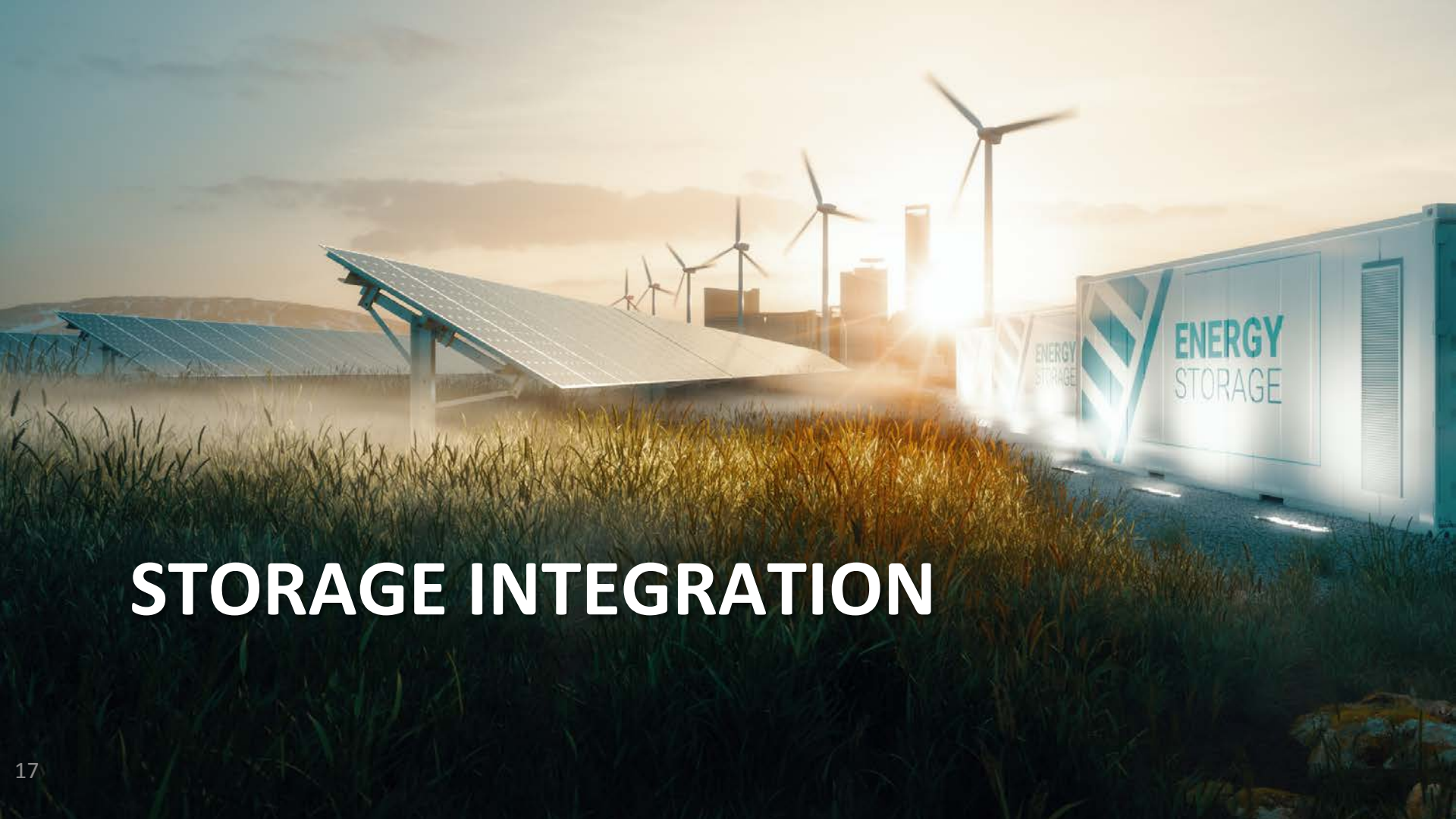
**SEI Associates**

- Trane Trace 3D Plus Software Development Support

**Tactical Energy**

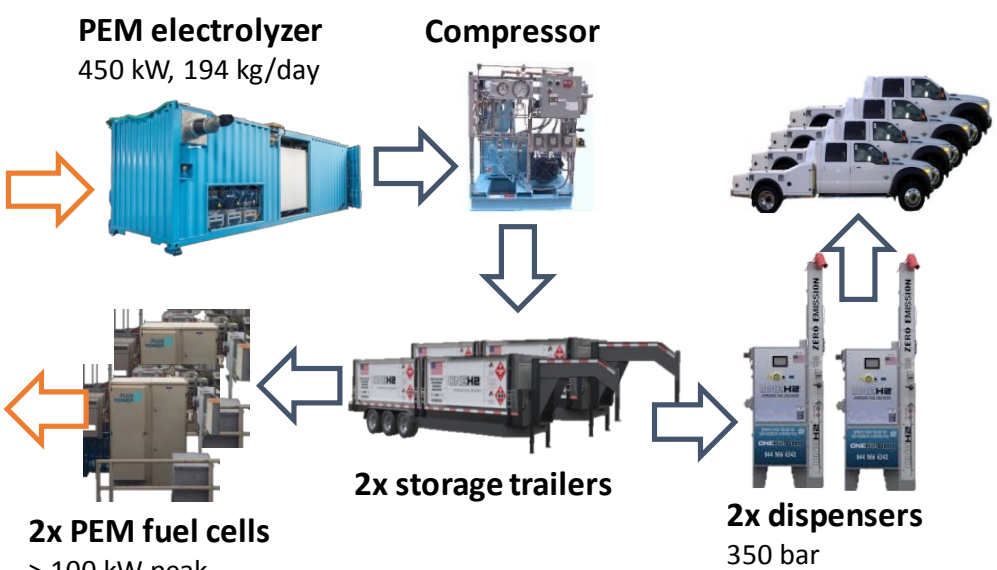
- Comparison of Real World Assisted Living Buildings with Baseline Models

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




# STORAGE INTEGRATION

# STORAGE: Renewables

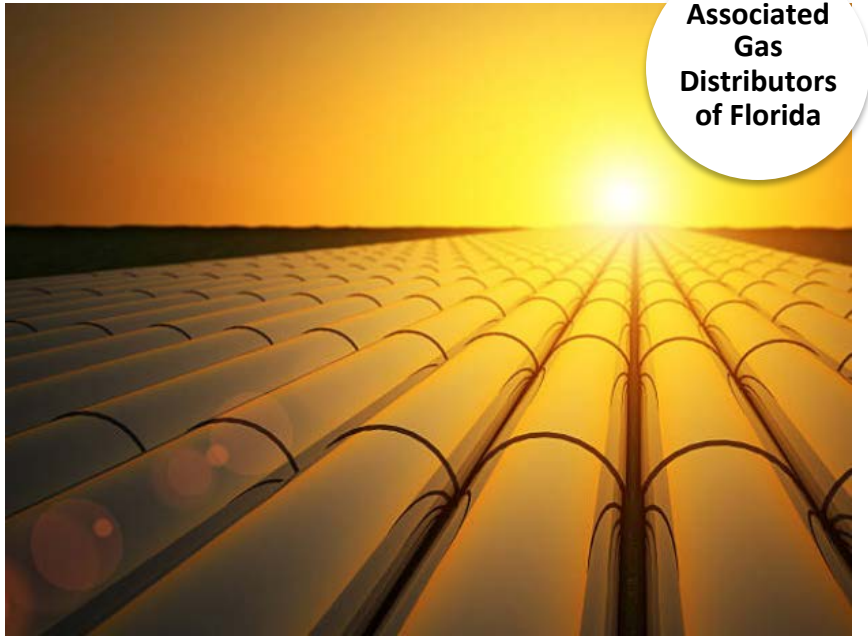



U.S. DEPARTMENT OF ENERGY

PLUG POWER

Demonstration of Integrated Hydrogen Production and Consumption for Improved Utility Operations

SUMMARY: Develop integrated system incorporating PEM-based electrolysis for $H_2$ production/storage and $H_2$ fuel for refueling FCEVs




Commercialization of Renewable Natural Gas in Florida

SUMMARY: Determine the feasibility of obtaining pipeline quality resource from solid waste, agricultural waste and landfills.

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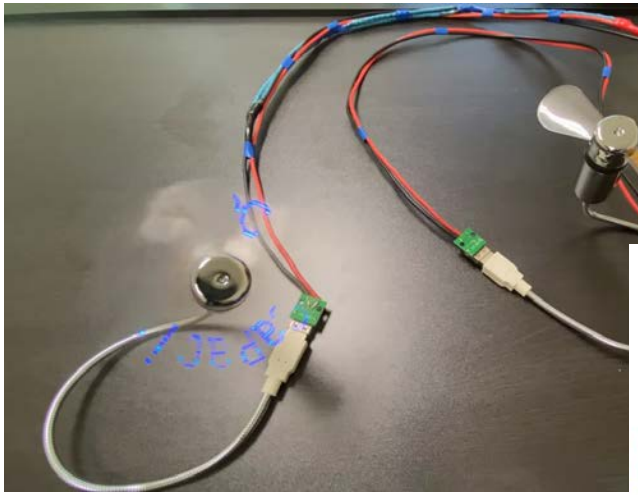
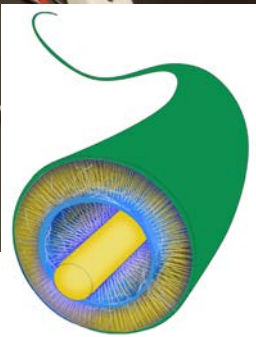
# STORAGE: Electric

SunSmart Schools E-Shelter Maximization Project – Phase 1

SUMMARY: Inspect, test and diagnose each SunSmart E-Shelter 10-kW photovoltaic system with battery back-up.

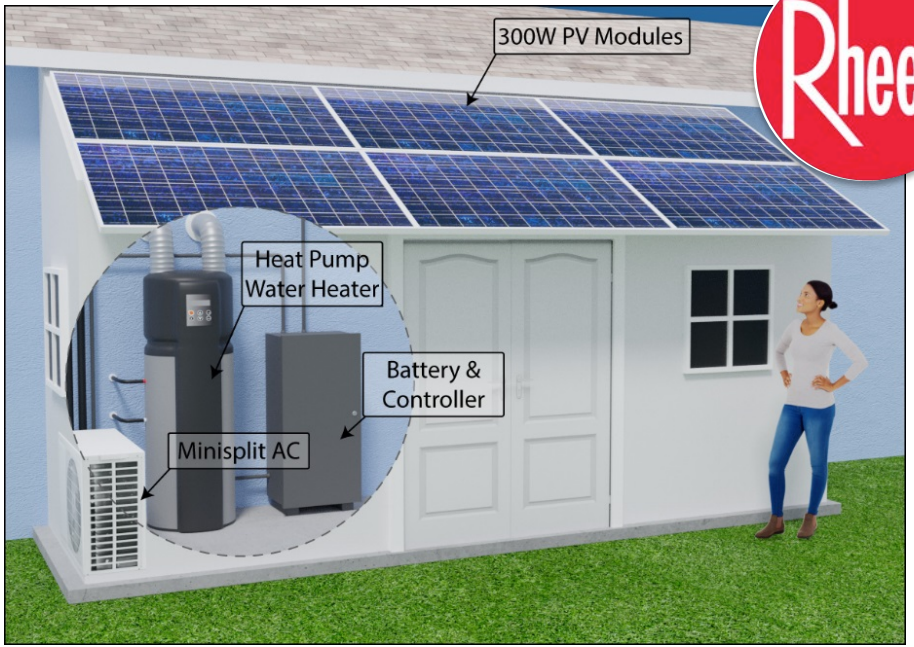




Demonstration of Cable-Based Capacitor Technologies in Renewable Energy Sector

SUMMARY: Research cable-based ultra-capacitors for photovoltaic firming & storage and in the role of providing current surge to battery-based inverters with difficult start-up loads.

# STORAGE: Heat Pump WH




## PV GEMS: PV-Powered, Grid-Enhanced Mechanical Solution

SUMMARY: A pre-packaged retrofit solution targeting 75% reduction in space conditioning and water heating energy.

## DOE Connected Heat Pump Water Heaters Field/Lab Study

SUMMARY: Demonstrate the viability of HPWHs in providing load shifting in the Southeast.

# NEW AWARDS & PENDING CONTRACTS

# Lab Home Testing of Residential Isolation Space Control to Minimize Infectious Disease Transmission in Existing Single-Family Homes

**Primary goal:** Using a single-family, detached laboratory home with simulated occupancy, determine zonal pressure and airflow impacts of ASHRAE's guidance for creating isolation space and protected spaces to minimize infectious disease transmission.

- Funding Source: **National Renewable Energy Laboratory**
- Total Budget: **$51,947.00**
- Timeline: September 2020 – January 2021

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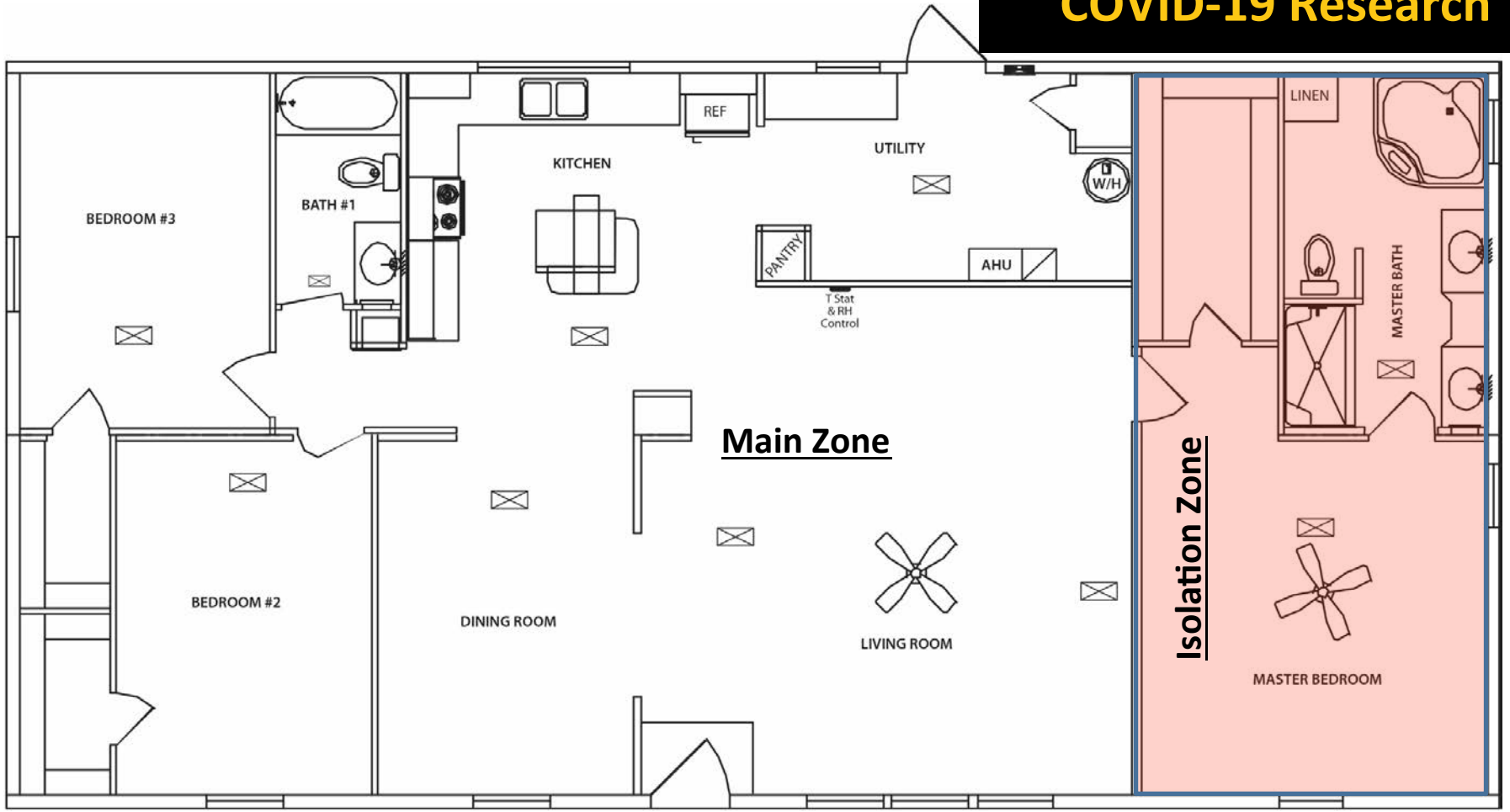
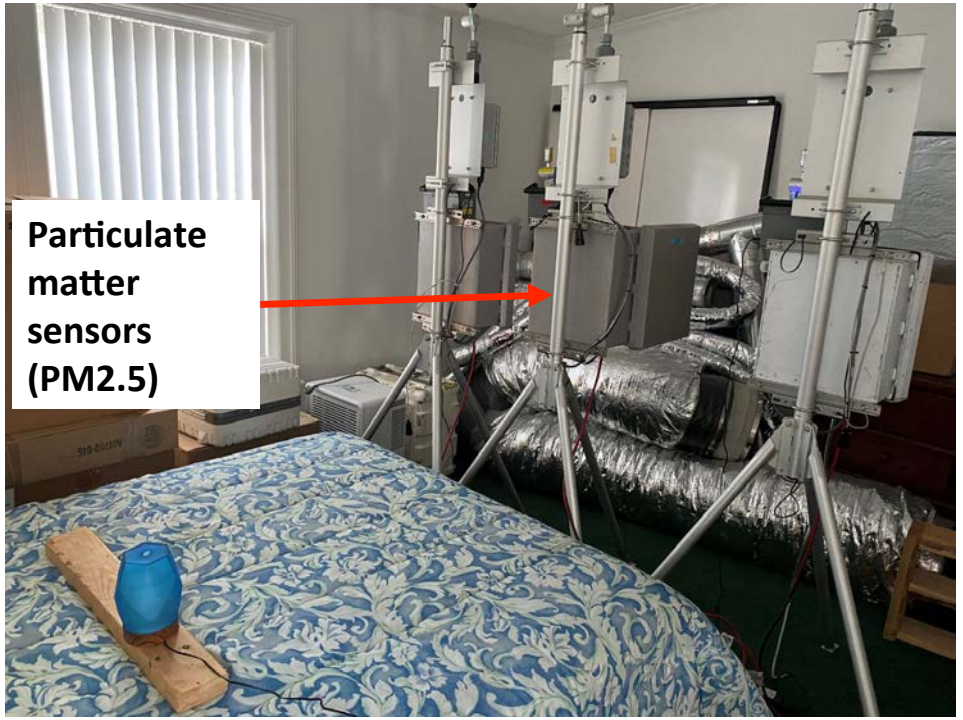



**FSEC Manufactured Housing Laboratory Floorplan.**

# Experimental Set-up in the Manufactured Housing Laboratory Isolation Space (Master Bedroom Suite)




**Aerosol concentration measurements are taken in the isolation zone and in the main zone simultaneously.**

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# New Awards

## SOLAR

- SunSmart Schools E-Shelter Maximization Project, Phase 1 —
  Florida Department of Agriculture Consumer Services: $118,667 — S. Schleith

## STORAGE

- Commercialization of Renewable Natural Gas in Florida —
  Associated Gas Distributors of Florida: $107,770 — C. Colon
- DOE Connected Heat Pump Water Heater Field Study —
  PNNL: $100,000 (add-on to existing award) — K. Fenaughty
- Demonstration of Cable Based Capacitor Technologies in Renewable Energy Sector — CapaciTech Energy: $32,586 — H. Seigneur



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# New Awards

## BUILDINGS

- HVAC for New Manufactured Housing — Slipstream, Inc./US Department of Energy: $468,751 — D. Chasar
- Lab and Field Evaluation of Condensation Potential in Buried Ducts in Vented Attics Located in the Hot and Humid Climate Zones — Owens Corning: $168,857 — E. Martin
- Whole Building Modeling and Simulation Software — NREL: $240,000 (add-on to existing award) — L. Gu
- Characterization of Indoor Air — US DOE: $100,000 (add-on to existing award) — E. Martin
- 7th Edition (2020) Florida Building Code Updates (multiple awards) - Florida Department Business & Professional Regulation: $75,000 — J. Sonne
- Comparison of the 7th Edition Florida Building, Energy Conservation Code with IECC 2021 & ASHRAE 90.1-2019 — Florida Department Business & Professional Regulation: $75,000 — B. Nigusse



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# New Awards

## BUILDINGS

- Residential Buildings Subject Matter Expert Technical, Outreach and Research and Development Support — NREL: $25,000 — E. Martin

## TRANSPORTATION

- Statewide Alternative Fuel Resiliency Plan — Florida Department of Agriculture & Consumer Services: $67,727 — C. Colon
- *DRIVE EVs in the USA: Developing Replicable, Innovative Variants for Engagement (DRIVE) for Electric Vehicles in the USA — East Tennessee Clean Fuels Coalition: $100,000 — C. Kettles (Begins Jan. 2021)*
- *EV Ecosystem: Electric Vehicle Preparedness Toolkit and Expanded Online EV Training Courses to provide Nationwide, Multi-Disciplinary Community Outreach Education — National Fire Protection Association: $33,451 — D. Kettles (Begins Jan. 2021)*

## WORKFORCE

- Code Official Education and Training — Interstate Renewable Energy Council, Inc./US DOE: $87,500 — C. Kettles
- *AMC Power SURGE: Southeastern U.S. Resources for Growing Entrepreneurs — NREL: $295,057 — C. Kettles*

# American Made Challenge — Power SURGE: Southeastern U.S. Resources for Growing Entrepreneurs

**Primary goal:** Support American Made Challenge via **event management, outreach, team support, network support and partnerships**.

- Funding source: **National Renewable Energy Laboratory**
- Total Budget: **$300,000**
- Timeline: 3 years
- PIs: Colleen Kettles, Robin Phelps


*AMC Power SURGE fulfills a key element of the FSEC ERC strategic plan to promote the rapid transition to a sustainable energy economy through renewable energy and energy efficiency research, demonstration and education.*

UCF

# PROPOSALS

# DOE SETO 2020 FOA 2243

Delayed response from DOE due to COVID-19

- Funding to begin (if awarded) 1/1/2021
- Proposal Titles
  - Storm-Resilient PV modules: Measuring and Mitigating Weather-Induced Thermomechanical Loading for Improved Performance and Durability
    - PI Hubert Seigneur FSEC, request $2.5M, 3 years
  - Developing PID susceptibility models for Bifacial PV module technologies
    - PI Hubert Seigneur FSEC, request $2.5M, 3 years
  - Gaining Fundamental Understanding of Critical Failure Modes and Degradation Mechanisms in Fielded Photovoltaic Modules via Multiscale Characterization
    - Prime: Kris Davis, UCF, request $2.5M, 3 years
    - Sub: FSEC PI Hubert Seigneur, request $421k, 3 years
  - Locating and Classifying Defects in PV Modules and Quantifying Performance Impacts with Semantic Segmentation of EL Images
    - Prime: Kris Davis, UCF, request $707k, 2 years
    - Sub: FSEC PI Hubert Seigneur, request $257k, 2 years



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# DOE SETO 2020 FOA 2243 *(Cont.)*

Delayed response from DOE due to COVID-19

- Proposal Titles
  - Integrated Raman Micro-Spectroscopy/ Light Beam Induced Current Metrology Platform for Process Quality and Reliability Assurance in PV Module Manufacturing Lines
    - PI Hubert Seigneur FSEC, request $250k, 1 years
  - Growing Agriculture and Solar in the Sunshine State
    - Prime: PI April Combs, FL Dept. of Agriculture and Consumer Services, $2.5M, 3 years
    - Sub: FSEC PI Hubert Seigneur, request $177k, 3 years
  - Integrated PV System Design and Management Platform for the Co-Optimization of Regenerative Cattle Grazing and PV Solar Generation
    - Prime: Michael Baute, Silicon Ranch, request $2.5M, 3 years
    - Sub: FSEC PI Hubert Seigneur, request $125k, 3 years

# Proposals Pending

## BUILDINGS

- WHS Semi-mobile Structures Monitoring Project- World Housing Solutions: $120,557 — C. Withers
- *[Sub]* Integrated Thermostat Pilot, strategic advisor on a project for Efficiency Maine: $50K (est.) — E. Martin

## WORKFORCE

- Code Official Education and Training — Interstate Renewable Energy Council, Inc./ US DOE: $87,500 — C. Kettles

## STORAGE

- Field Validation of Commercial Natural Gas Heat Pump Water Heaters and Signal-Controlled Electric Heat Pump Water Heaters: Florida Department of Agriculture Consumer Services/US DOE: $1,396,517 — B. Nigusse

# Field Validation of Commercial Natural Gas Heat Pump Water Heaters and Signal-Controlled Electric Heat Pump Water Heaters

Control Number 2324-1515
Requested Federal Funds: $1.0 M, Cost Share: 0.43M

## TEAM

**Prime:** Florida Department of Agriculture and Consumer Services
**PI:** Tony Morgan, Deputy Director, Office of Energy

**Subrecipients**

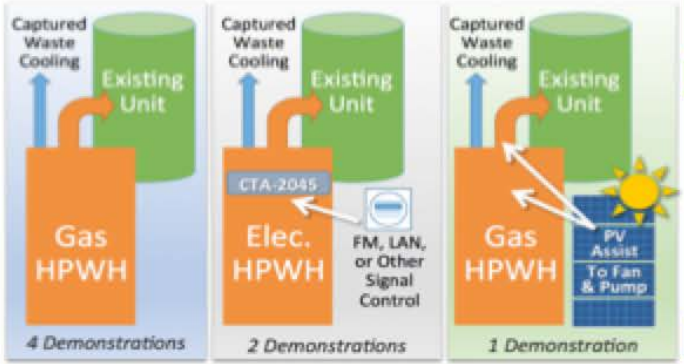
FSEC Energy Research Center, UNIVERSITY OF CENTRAL FLORIDA
gti
MISSISSIPPI STATE UNIVERSITY

## PARTNERS

- Atmos Energy
- Florida City Gas
- Florida Green Lodging Program
- Florida Natural Gas Assoc.
- Orlando Utilities Commission
- TECO/Peoples Gas
- Utilization Technology Development NFP
- Nyle Corp.
- Rheem
- Robur Corp.
- SMTI
- 6 Host Sites

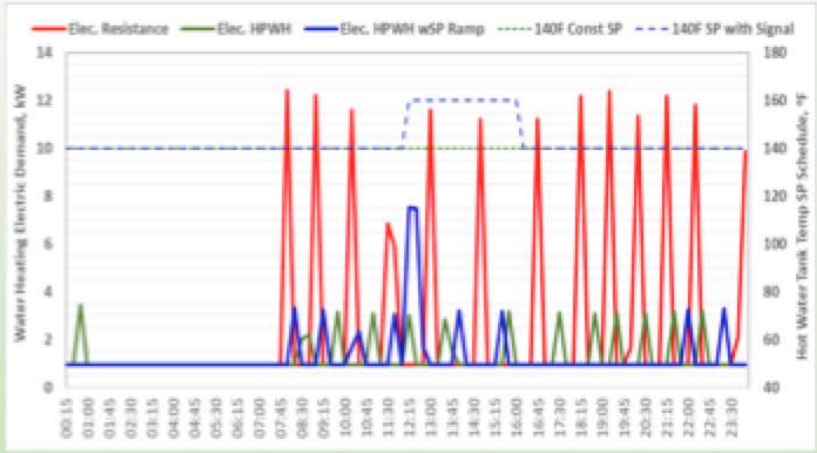
## OBJECTIVE

Document the energy and demand savings from transforming industries with significant water heating loads to the latest natural gas and electric HPWH technologies. The field validation will demonstrate installation requirements, demand and annual savings. These are key parameters for impacting facility and utility decision makers.




## IMPACTS

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




## ENERGY SAVINGS

| | | |
|---|---|---|
| Gas COP Current: 0.8 | Gas COP HPWH: 1.4 | National Potential Commercial Site Energy Savings 255 TBtu weighted for NG storage water heater systems |
| Electric COP Current: 0.95 | Electric COP HPWH : 3.5 | National Potential Commercial Site Energy Savings 45 TBtu weighted for electric storage water heater systems |
| **Total Potential** | | **300 TBtu** |

# Questions?

FSEC Energy Research Center

UNIVERSITY OF CENTRAL FLORIDA