

FSEC Advisory Board Meeting

May 10, 2023



Agenda

Time	Description	Speaker
9:30 a.m.	Welcome	Bill Grieco, Chair, FSEC Advisory Board; Chief Innovation Officer, Innventure
	Introductions (Roll Call)	Sherri Shields, Communications Director, FSEC
9:40 a.m.	Approval of November 4, 2022 Minutes	Bill Grieco, Chair
9:45 a.m.	Status of FSEC Programs	Jim Fenton, Director, FSEC
10:15 a.m.	Florida Energy Office Report	Brooks Rumenik, Director, Office of Energy, FDACS
	Florida Legislative Session Report	Louis Rotundo, Principal, Louis Rotundo and Associates
10:45 a.m.	Universal Orlando Resort Sustainability Initiatives	David Winslow, Anthony Norrow, and Brian Cresse, Universal Orlando Resort
11:15 a.m.	Hydrogen Opportunities in the Southeast	Scott McWhorter, Chair, Southeast Hydrogen Energy Alliance
11:45 a.m.	FSEC Working Groups Report	Jennifer Szaro, Vice Chair, FSEC Advisory Board; President and CEO, Association of Energy Services Professionals (AESP)
12:15 a.m.	Date and Agenda for Next AB Meeting (TBD)	Bill Grieco, Chair

New Advisory Board Members



Brooks Rumenik

Director, Office of Energy
Florida Department of Agriculture
and Consumer Services



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Status of FSEC Programs

Jim Fenton, Director

Advisory Board Meeting

May 10, 2023



Vision for Florida

**Spend Little to No Funds on Imported Primary Fuels
the Jobs and Wealth in Florida!**



100% Renewables Using Florida Energy

- Building Energy Efficiency Improvements
- Utility & Rooftop Solar
- Energy Storage
- Transportation Electrification
- Smart-charging Electric Vehicles (V2G)
- Demand Response

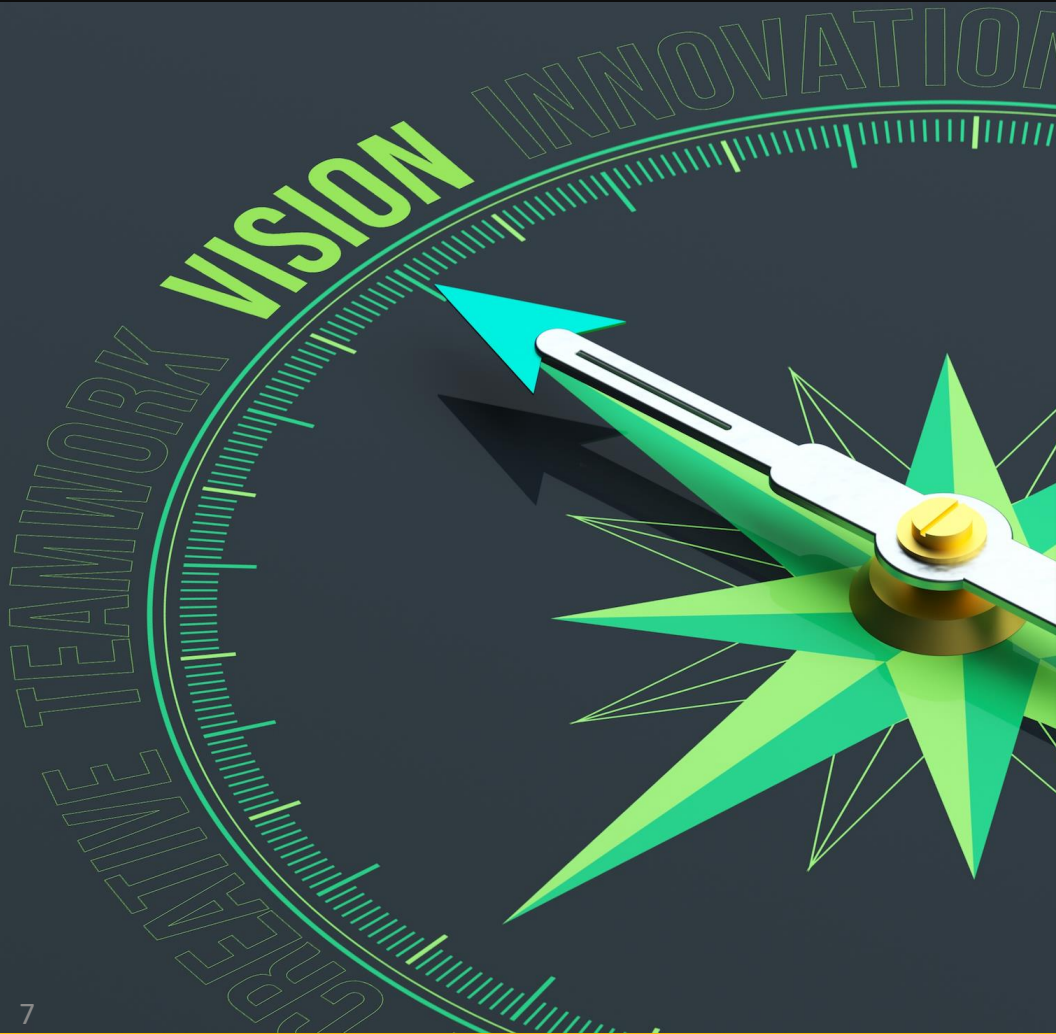
100% Renewables & Net Zero Emissions

- Sustainable aviation fuels
- High-speed electric trains
- Hydrogen as a fuel and feedstock

Clean Energy Workforce Development

- Apprenticeship Programs





VISION

Promote the rapid transition to a sustainable energy economy through renewable energy, energy efficiency, and sustainable transportation research, demonstration, and education.



MISSION

Develop, research, and evaluate energy technologies that enhance the environment and economy, and transfer the results to the public, students and practitioners.

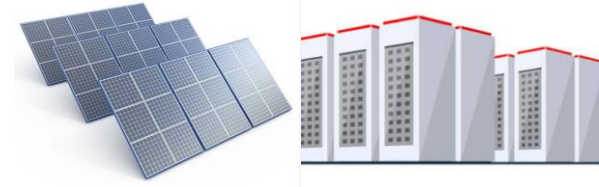
FSEC Principal Energy Programs



Energy Efficient Buildings



Grid Modernization/Energy Systems Integration



Solar Energy/Storage Systems



Electric Transportation



Hydrogen/Catalysis



Education, Service, Workforce Training, Policy



Advisory Board Partners

Energy Consumers



Builders/ Energy Providers



Electric Utilities



Manufacturers



Associations/ Government



FSEC Project Current Partners



A.F.Mensah



ATLANTIC HOUSING PARTNERS



SEI Associates



Tactical Energy



DRIVE ELECTRIC USA

Associated Gas Distributors of Florida



NEW CONTRACT AWARDS



Clean, Affordable, and Resilient Energy Systems (CARES) for Socially Vulnerable and At-Risk Communities

- **DOE Award Amount:** \$1 million
- **Awardee Cost Share:** None
- **Principal Investigator:** Kristopher O. Davis
- **Additional FSEC Researchers:** Mengjie Li
- **Project Description:** This project is developing a geospatial framework to optimize the deployment of solar-plus-storage for the most vulnerable and at-risk communities in Central Florida and the Florida Panhandle. The research team will determine the relationship between extreme weather events and grid outages to quantify vulnerability and risk before selecting the optimal location to site solar and solar-plus-storage.

<https://www.energy.gov/eere/solar/renewables-advancing-community-energy-resilience-racer-funding-program#map>



Center of Excellence for Materials Data Science for Stockpile Stewardship (MDS³)

- DOE Award Amount to Case Western Reserve University (CWRU): \$14 million
- CWRU Principal Investigator: Roger French
- UCF Subaward: \$823K
- UCF Principal Investigator: Kristopher O. Davis
- Additional FSEC Researchers: Mengjie Li, Dylan J. Colvin
- **Project Description:** The MDS3 develops, demonstrates, and deploys novel Data Science tools, frameworks, codes, and computing infrastructure to advance our understanding of materials degradation and the failure of materials, components, and subsystems using novel computer science and data science, while empowering current NNSA employees and delivering a pipeline of diverse, data-enabled workforce for the future.



<https://www.energy.gov/nnsa/articles/nnsa-awards-14-million-materials-research-case-western-reserve-university>



Photonic Curing of Printed Copper Contacts for High Efficiency and Low-Cost Silicon Heterojunctions

- **DOE Award Amount:** \$1.5 million
- **Awardee Cost Share:** \$400,000
- **Principal Investigator:** Kristopher O. Davis
- **Project Description:** This project is developing a new process for adding copper metal electrical contacts to silicon solar cells. Currently, these contacts are made with silver. Since copper is cheaper and more abundant than silver, this process has the potential to dramatically lower the cost of silicon solar cells and make the supply chain more resilient. This new process uses a laser to print and sinter lines of a copper solution. The process is potentially scalable, uses less material and energy than silver-based methods, and occurs at a low temperature so that the silicon layer is not affected.



<https://www.energy.gov/eere/solar/seto-fiscal-year-2022-photovoltaics-research-and-development-pvrd-funding-program>



Equitable Mobility Powering Opportunities for Workplace Electrification Readiness (EMPOWER)

- **Sponsor:** East Tennessee Clean Fuels Coalition; US Department of Energy
- **Award Amount:** \$73K
- **Principal Investigator:** Colleen Kettles
- **Project Description:**
 - Build a national Workplace Charging program focused on education and outreach to underserved communities
 - Engage at least 2,000 employers and obtain 650 employer commitments to install EVSE by program end
 - Strong Energy & Environmental Justice (EEJ) component is fundamental to the project
 - 40% of outreach, commitments, and installations must occur within underserved communities or at employers that benefit those communities.



Pathways to Career Opportunities Grant

- **Sponsor:** Florida Department of Education
- **Award Amount:** \$265K
- **Principal Investigator:** Colleen Kettles
- **Project Description:**
 - Supports the expansion of the Florida Solar Energy Apprenticeship Program
 - Project goals include:
 - Complete curriculum and training materials for 296 hours of Related Technical Instruction
 - Recruit a total of 10 Participating Employers
 - Recruit a total of 20 Apprentices
 - Establish working relationship with CareerSource offices in regions where employers and apprentices are located
 - Produce on-line Related Technical Instruction modules based upon the developed curriculum



Flexible Load Adaptation Training (FLAT) for Energy Professionals (DOE BENEFIT Project)

- **Award Amount:** \$30K
- **Principal Investigators:** Colleen Kettles
- **Goals:**
 - Develop a suite of interactive eLearning modules focused on demand flexibility.
 - Guide learning focus with regional contextualization options to ensure appropriate learning outcomes
 - Prepare at least 50,000 learners to enter or progress within the clean energy sector over three years.
 - Impact at least 20,000 learners living in hard to reach or underserved communities.



Ventamatic LTD

- **Award Amount:** \$209,155
- **Principal Investigators:** Jeff Sonne
- **Project Description:** FSEC is subcontractor on this DOE SBIR project developing a low-cost air flow sensor. One application of interest is control and fault detection for smart whole-house mechanical ventilation systems. FSEC is evaluating performance of prototype systems in the side-by-side laboratories.



CURRENT PROGRAMS



Current DOE-Funded Collaborative Partnerships



**SOLAR ENERGY
TECHNOLOGIES OFFICE**
U.S. Department Of Energy

- **Gaining Fundamental Understanding of Critical Failure Modes and Degradation Mechanisms in Fielded Photovoltaic Modules via Multiscale Characterization**, *K. Davis*
- **Reliability and Power Degradation**, Sub from CWRU, *K. Davis*
- **Characterization of Contact Degradation in c-Si PV Modules**, *K. Davis*
- **Fabrication of Passivating Contact Solar Cells**, *K. Davis*
- **Clean, Affordable, and Resilient Energy Systems (CARES) for Socially Vulnerable and At-Risk Communities**, *K. Davis*
- **Low Cost Printing Techniques**, *K. Davis*
- **Education Materials for Professional Organizations Working on Efficiency and Renewable Energy Developments (EMPOWERED)**, *C. Kettles*
- **Developing PID susceptibility models for Bifacial Technologies**, *H. Seigneur*
- **Quantifying and Valuing Fundamental Characteristics and Benefits of Floating Photovoltaic Systems**, *C. Kettles, M. Li*
- **Secure and Resilient Operations Using Open-Source Distributed Systems Platform (OpenDSP)**, *W. Sun*



New project

Current DOE-Funded Collaborative Partnerships



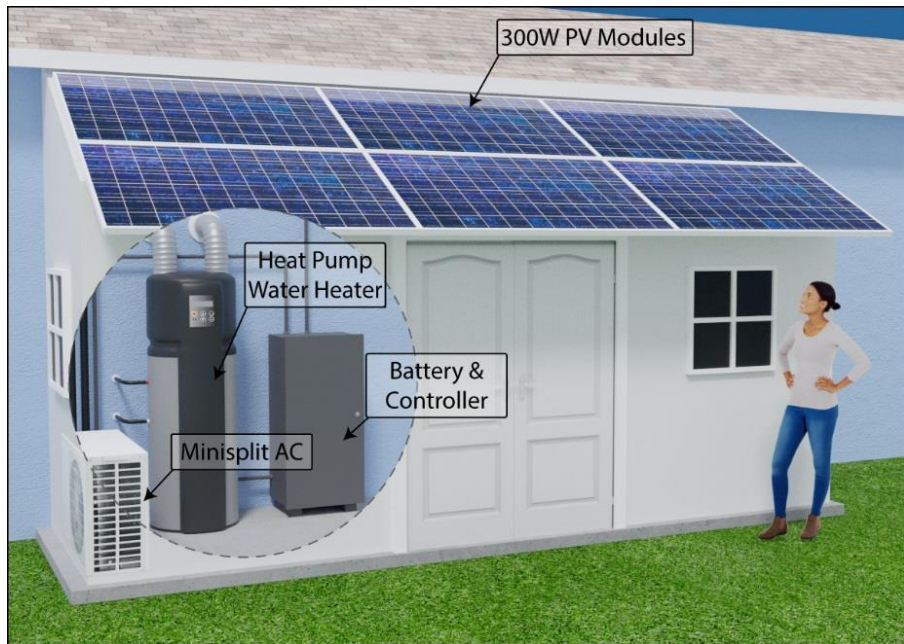
U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Buildings Technology Office

- **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, Phase 2**
E. Martin
- **Reimagining HVAC for New Manufactured Housing, Phase 2**
(Subaward from Slipstream),
D. Chasar
- **Energy Codes: Comparing Performance in a Changing Technological Environment**
P. Fairey
- **EnergyPlus Software Development and Technical Assistance**
L. Gu
- **Building Intelligence with Layered Defense Using Security-Constrained Optimization and Security Risk Detection (BUILD-SOS): A Probabilistic Approach**
Q. Sun





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

PI: Eric Martin

- PV GEMS: PV-Powered, Grid-Enhanced Mechanical Solution
- \$4.4M (\$3.6M + \$885k cost share)
- Development of pre-production prototypes. Demonstrations focused on manufactured housing.
- Currently collecting data in test facility to evaluate the viability of integrating a larger capacity, centrally-ducted heat pump instead of a small capacity ductless mini-split.
- Partners:

watsco
COOLING THE AMERICAS

ROC usa
Resident Owned Communities
BETTER TOGETHER



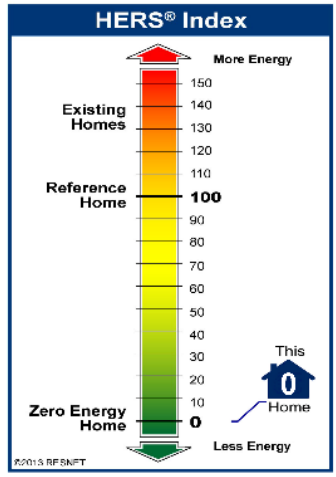
NASEO
National Association of
State Energy Officials



Getting to Zero

- Net Zero Energy IS NOT Net Zero Carbon
- Greenhouse gas emissions from electricity are quite dependent on the time of day and time of year that electricity is used.
- Principal Investigator: Philip Fairey

HERS INDEX SCORE | 0 | ANNUAL SAVINGS | \$2450 | HERS CARBON INDEX SCORE | 23

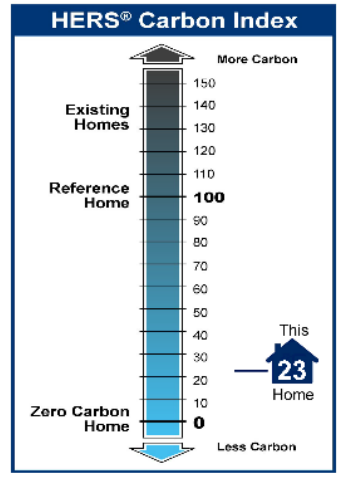


HERS and RESNET are Trademarks of Residential Energy Services Network, Inc. www.resnet.us



	This Home	Reference Home	Savings
Annual Energy Cost			
Electricity	\$1157	\$2447	\$1290
Natural Gas	\$0	\$0	\$0
LPG	\$0	\$0	\$0
Fuel Oil	\$0	\$0	\$0
On-Site Power	-\$1160	\$0	\$1160
Annual Energy Use			
Electricity (kWh/y)	9723	20564	10841
Natural Gas therms/y	0	0	0
LPG (gal/y)	0	0	0
Fuel Oil (gal/y)	0	0	0
On-Site Power (kWh/y)	-9746	0	9746
Annual Emissions			
CO2 (tons/y)	1.43	6.37	4.94
SO2 (lb/y)	-0.02	15.55	15.57
NOx (lb/y)	-0.01	12.85	12.86

EnergyGauge is a Trademark of the Florida Solar Energy Center www.fsec.ucf.edu



RC2021_6-6kW-elec_2400sf-2sty_Atlanta
 TMY: GA_ATLANTA_HARTSFIELD_INTL_AP | Design City: GA, ATLANTA_HARTSFIELD_INTL_AP

Philip Fairey 9999999

1/1/2016

Certified Rater

I.D. Number

Signature

Date

The Home Energy Rating Standard Disclosure for this home should be provided. If not or if there are other questions please contact the Quality Assurance Provider: Florida Solar Energy Center | 1679 Clearlake Road, Cocoa, Florida 32922-5703 | Phone: (321)638-1492 e-mail: engauge@fsec.ucf.edu | www.energygauge.com/usares



Energy-Efficient Florida Residential HVAC

Energy Use

Rebates

SEER2

CO₂ Reduction

Ductless



Tax Credits

Selling

Efficiency

Humidity

Proper Placement

Sponsored by



FREE Live Webinar Series

<https://courses.energyresearch.ucf.edu/hvac/>

Challenges for Florida Government Buildings: Energy Efficiency and On-site Solar Energy

- Local Governments
 - 67 County, 411 Municipal, 95 School, >1,800 special districts
- Long-run federal financial assistance is substantially increasing
- More governments are motivated to find ways to increase sustainability
- Quality building energy auditing and analysis expertise is missing piece.



- **Objective:** Enable local governments to identify and prioritize cost-effective opportunities for Energy Efficiency Measures (EEMs) and on-site solar energy
- Pilot project with FDACS to test objective
 - Identify EEM and solar feasibility
 - Create replicable process
 - Provide technical assistance on sustainable energy improvement
 - Perform Measurement and Verification (M&V)
 - Create best-practices manuals
 - Principal Investigator: Chuck Withers



SunSmart Schools Emergency Shelter Program

2010-2014

- Funded by American Reinvestment and Recovery Act (ARRA), through FEO – \$10M

2019-Present

- 118 schools inspected to-date
- 92 schools repaired
- Over \$2M from FDACS to make upgrades
- Replace batteries, upgrade inverters, or other needed repairs



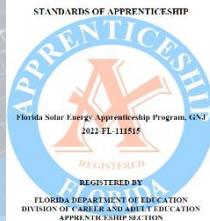
Florida

SOLAR ENERGY

Apprenticeship  Program

Solar Energy Technician

- First solar apprenticeship program in the country registered with the US Department of Labor
- FSEC and FlaSEIA partnership
- FSEC producing online training and building hands-on lab facilities
- Ten apprentices currently enrolled



<https://florasolarapprentice.com/>





MOSS

Apprenticeship Program

#MOSSolar

SOLVE THE FLARING PROBLEM AND MONETIZE TRADITIONALLY UNECONOMIC GAS STREAMS

MISSION

“Stopping flaring and venting is the single most impactful measure that can be taken to reduce methane emissions from the energy industry’s operations.”
– IEA 2023

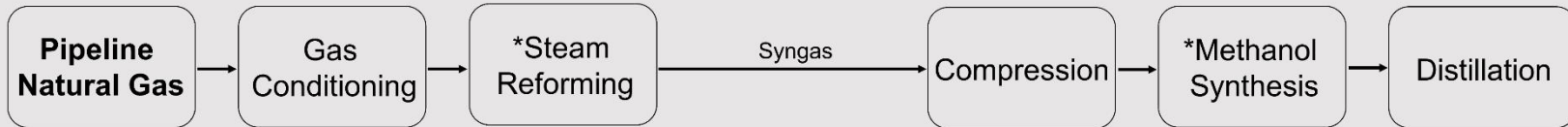
- Methane capture and conversion to liquid methanol
- 16K flare sites globally

Benchscale Reaction Data Provides Design Basis for Technology Scale-up



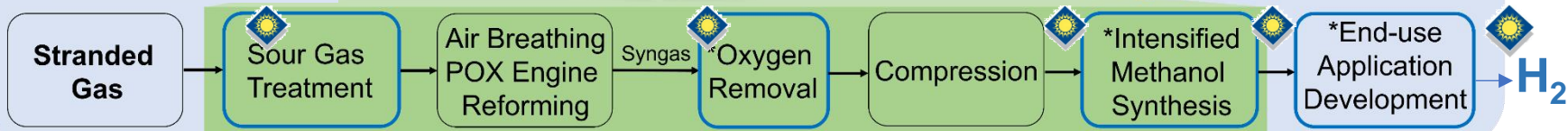
Large-scale methanol plants can produce as much as 3,000 metric ton/day (~800,000 gal/day) methanol

Conventional methanol plant
Uneconomical to reach geographically remote sites



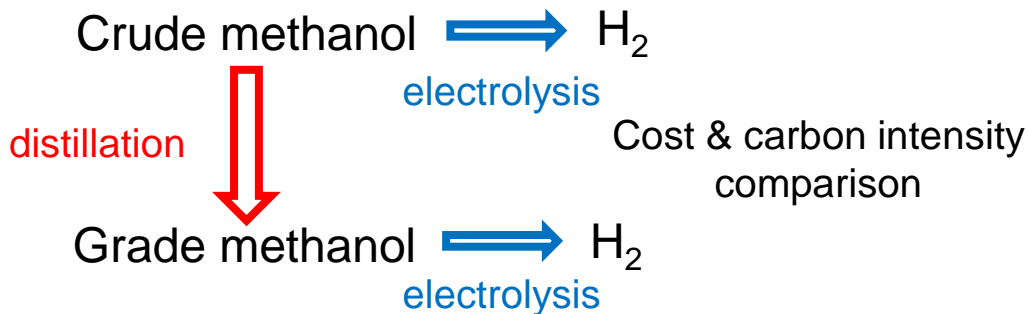
Small-scale modular gas to liquid (GTL) unit for converting 75,000 scfd stranded flare gas to 500 gal/day methanol

Intensified, modular system
Deployable with low cost at geographically remote sites



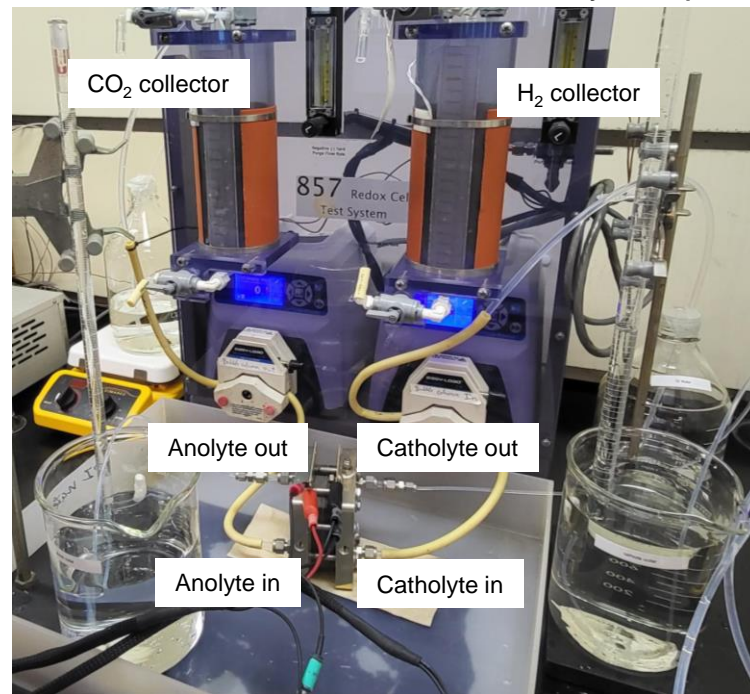
*Catalytically driven steps

End-use application development: Point-of-use hydrogen production from crude methanol electrolysis



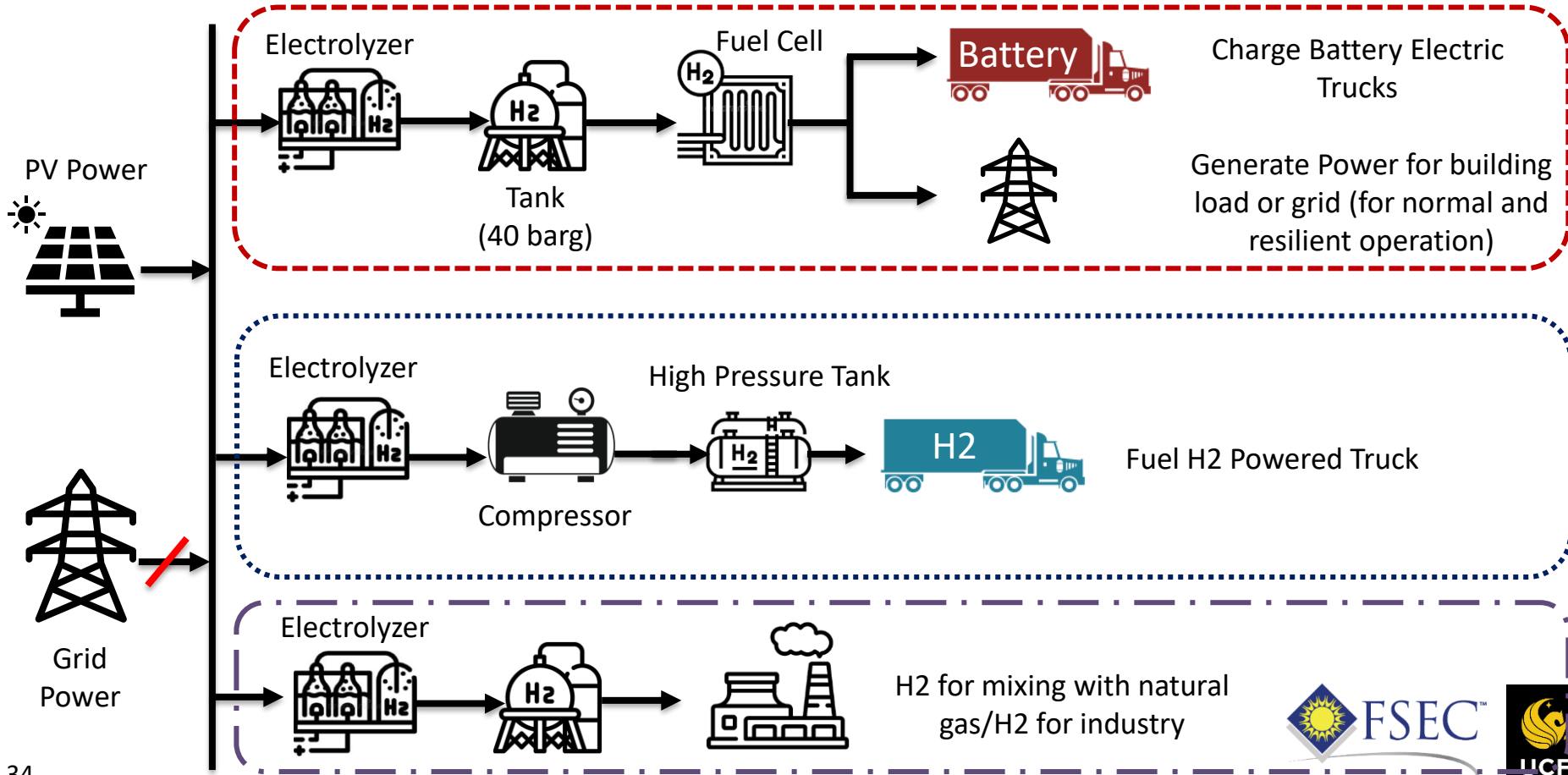
- Methanol is an advantaged, low-cost hydrogen carrier
- Crude methanol synthesized from flare gas contains trace higher alcohols
- Evaluating the effects of impurities on hydrogen production efficiency via electrolysis
- Develop other possible pathways for methanol off-take

Membrane electrode assembly setup



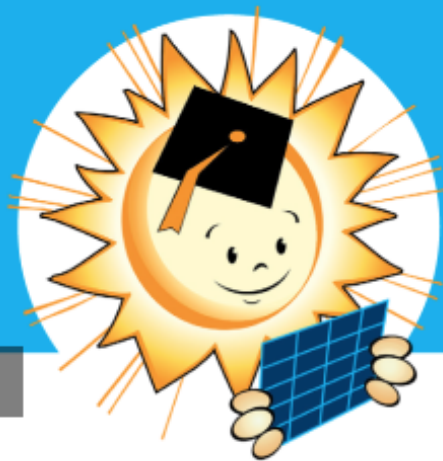
Proposed 100% Renewable Truckstop

Hydrogen



EVENTS & NEWS





ENERGYWHIZ

**Empowering Student Innovation
for a Clean Energy Future**



FSEC®
1679 Clearlake Rd
Cocoa, FL 32922

At EnergyWhiz, students demonstrate their science, technology, engineering, art and mathematics (STEAM) capabilities through project-based, energy-focused competitions.



Virtual: March 29-31, 2023
On Location: April 22, 2023

Sponsored
by





Solar Energy Cook-off



Junior Solar Sprint



Critter Comfort Cottage



Energy Inspired Art



Electrathon

STEAM ENERGY EDUCATION

EnergyWhiz: <https://vimeo.com/9522310>

FLORIDA SUSTAINABLE TRANSPORTATION & TECHNOLOGY

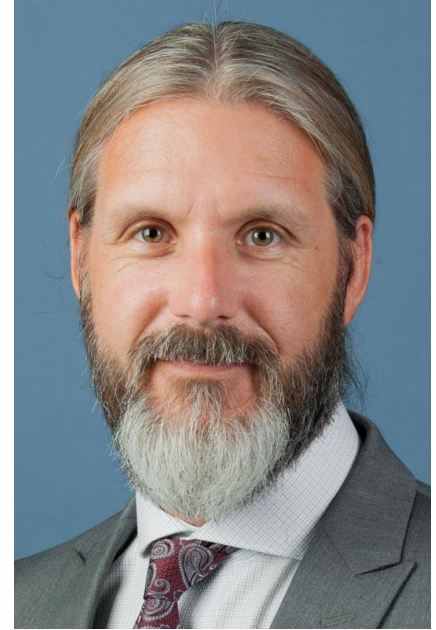
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EXPO

FEBRUARY 1-2
COCOA, FLORIDA



- **Eric Martin Wins UCF 2023 Research Incentive Award**
 - Recognizes outstanding impact of scholarly work
 - “The impact of Eric’s leadership is that today’s new residences are not only more energy efficient, but are also more healthy and durable. These enhancements, in turn, result in an advantageous investment position for both consumers and financial institutions.”



Congratulations!

- **FlaSEIA Hall of Fame 2023 Inductees**

- **Philip Fairey**,
FSEC Deputy Director
- **John Harrision**,
Former FSEC Employee
- **Peter DeNapoli**,
FSEC Board Member
- **Steve Gorman**,
Former FSEC Board Member
- **William Guiney**,
Former FSEC Employee

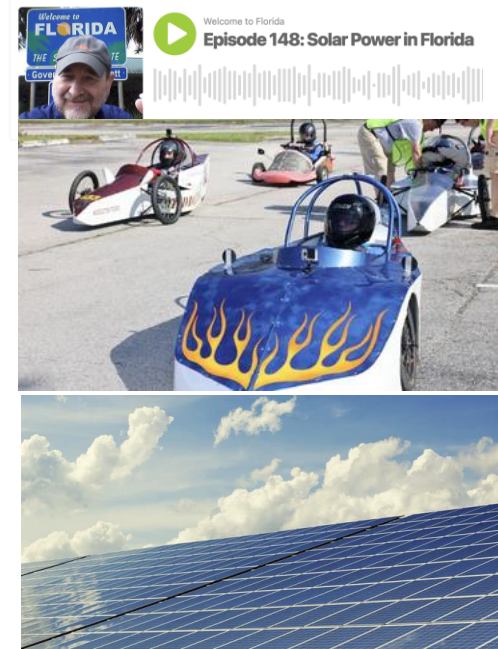


- **Podcast Interview: “Welcome to Florida”**
Episode 148: Solar Power in Florida
<https://www.buzzsprout.com/1169570/12666829-episode-148-solar-power-in-florida>
- **Earth Day: South Florida students learn about clean energy**
<https://www.wptv.com/news/protecting-paradise/earth-day-south-florida-students-learn-about-clean-energy>
- **Solar Apprenticeships Fill Workforce Needs**
[St. Petersburg College Partnership with FSEC]
<https://newsspc.wordpress.com/2023/04/27/solar-apprenticeships-fill-workforce-needs/>

Welcome to Florida

Episode 148: Solar Power in Florida

APRIL 18, 2023 CHADD SCOTT SEASON 4 EPISODE 148



- **Ahmad Esmaeilzadeh**, Research Associate, Buildings Research
- **Kathik Panchabikesan**, Assistant In, Buildings Research
- **Mengjie Li**, Assistant Professor, Photovoltaics
- **Josh Calhoun**, FIT Undergrad, Methane to X
- **Robyn McCarl**, Administrative Assistant III, Communications
- **Al Davis**, Travel/Procurement Coordinator I, Business Affairs

UCF Undergrads

- Jay Parmar, PV
- Jared Wilson, PV
- Mush Rahman, PV
- Justin Cao, Methane to X
- Nicholas Mistry, PV
- Brandon Albers, Methane to X



Buildings

- Post-Doc
- Assistant In, (simulation)
- Assistant In, (energy-efficiency)
- Training Specialist
- Energy Rater Training and Quality Assurance Specialist

Hydrogen

- Assistant Research Professor, (process analysis)

Workforce

- Academic Support Coordinator II

Business Affairs

- Contracts and Grants Specialist II

Communications

- Information Specialist

Facilities

- Manager, Facilities Maintenance II
- Maintenance Technician I
- HVAC Specialist
- Maintenance Technician III

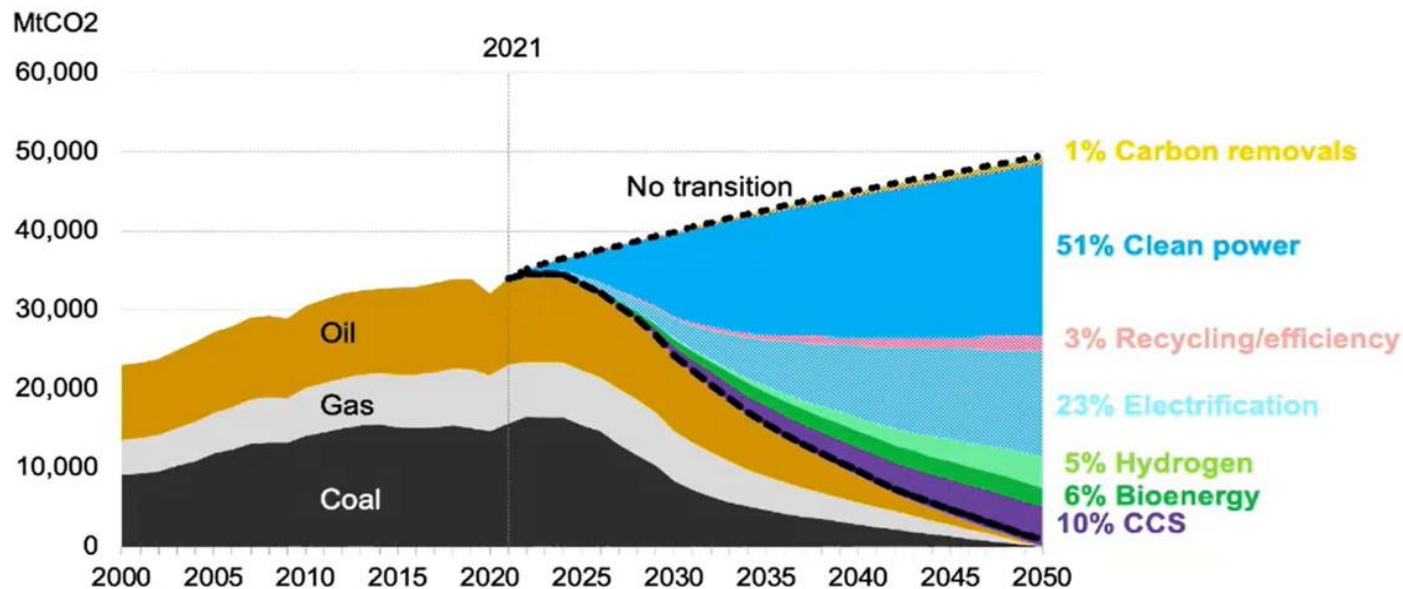
SUSTAINABILITY GOAL PARTNERSHIPS



Possible Paths to Net Zero Emissions by 2050

Clean power and electrification are the main drivers of emissions abatement

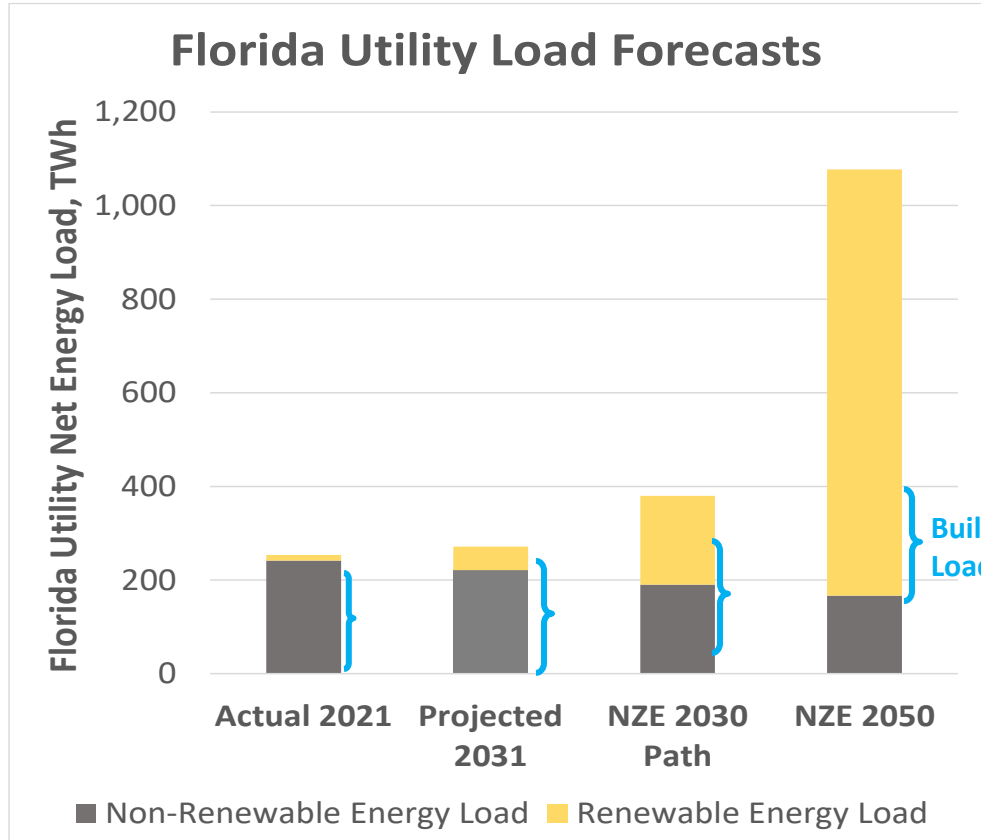
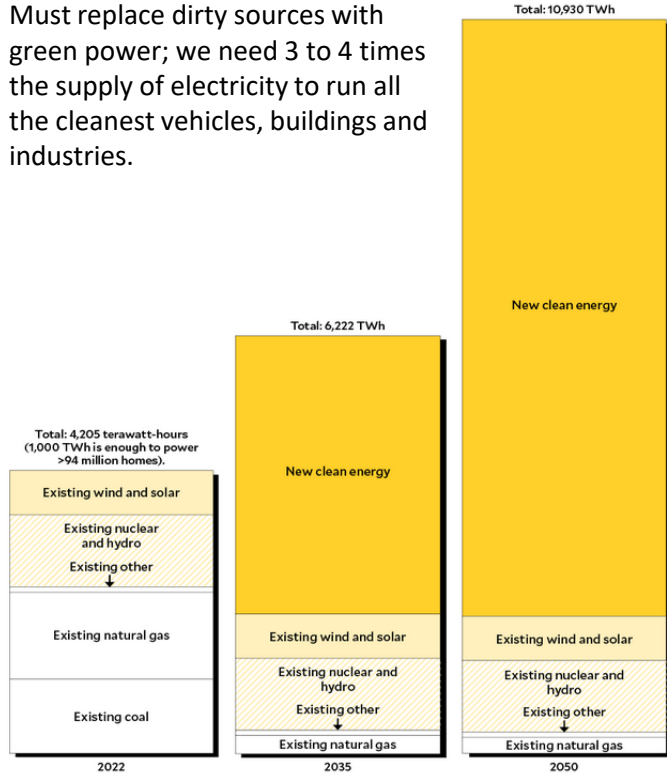
CO2 abatement by technology/type, Net Zero Scenario



Source: BloombergNEF. Note: Abatement also includes fuel switching and other abatement technologies. Values show total abatement from 2023-2050.

SMASH RECORD RATES OF SOLAR EXPANSION

Must replace dirty sources with green power; we need 3 to 4 times the supply of electricity to run all the cleanest vehicles, buildings and industries.



Florida Path to Net Zero Emissions by 2050

Utility	2021 Actual		2031 Projected		2030 NZE Path		2050 NZE Path	
	NEL	Renewables	NEL	Renewables	NEL	Renewables	NEL	Renewables
	GWh	% NEL	GWh	% NEL	GWh	% NEL	GWh	% NEL
FPL	136,757	5.26%	149,499	19.28%	205,136	50%	581,217	85%
DEF	45,065	3.44%	44,872	22.25%	67,598	50%	191,526	85%
FMPA	6,937	2.22%	6,823	11.09%	10,406	50%	29,482	85%
OUC	7,548	4.62%	8,515	55.95%	11,322	50%	32,079	85%
State of Florida	260,004	5.18%	279,454	18.12%	390,006	50%	1,105,017	84.5%
Building Loads	209,220	92.30%	257,936	92.30%		50%		
Hydrogen Production					64,351	33% Utility Renewables	541,569	58% Utility Renewables

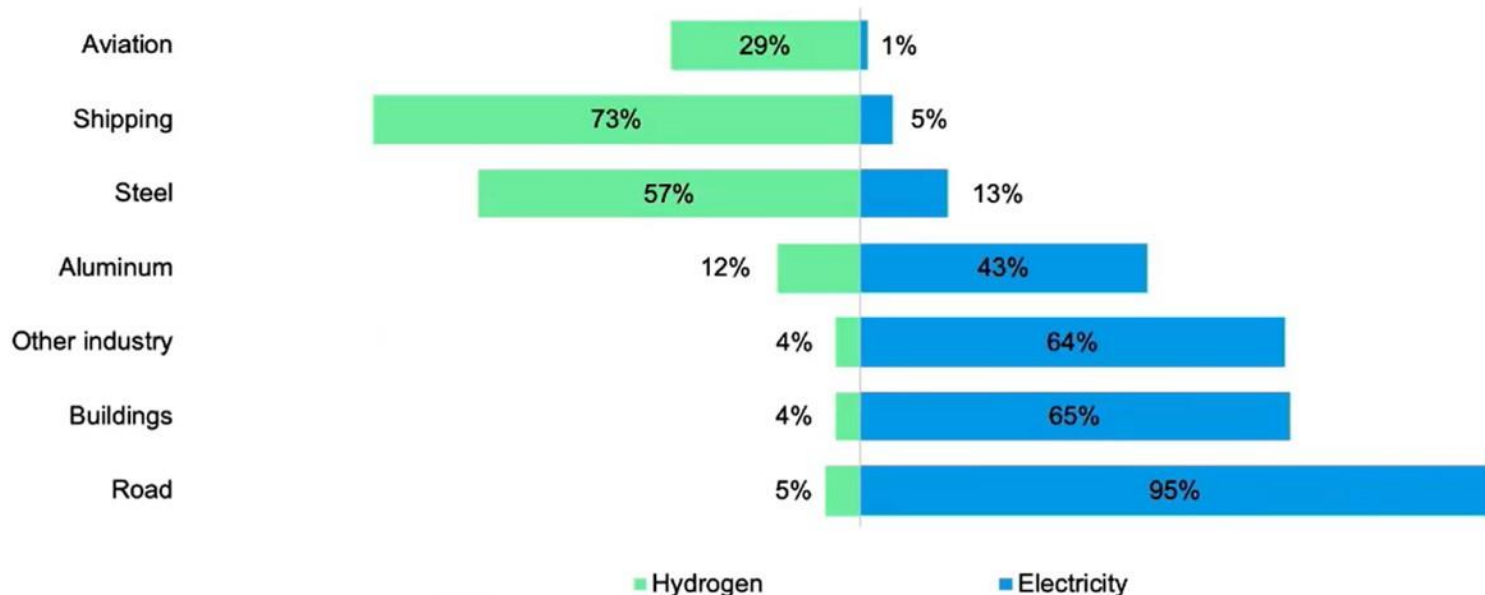
In 2030 33% of Utility Solar will produce H₂ (\$1.7 kg).

In 2050 58% of Utility Solar will produce H₂ (\$0.9 kg).



Hydrogen and electricity will generally not compete

2050 final energy demand by sector, Net Zero Scenario



Source: BloombergNEF New Energy Outlook 2022

Scott McWhorter presents later today

Regional Collaboration: SE Hydrogen Hub



5 of the U.S. Largest Utilities (Dominion, Duke Energy, NextEra, Southern Co, TVA)



3.96B GDP (20+% of U.S.)



Proven Renewables – solar, hydropower, growing wind potential



Major U.S. Ports, inland ports, largest rail system in the U.S., interstate corridors



Approximately 85M population (1/4 of the U.S.)



4 major NASA sites and over 85 military sites (22 major installations)



Cars, Light & Heavy Vehicle Manufacturing centered in SE (fuelcells!)



4 DOE National Laboratories (JLab, NETL, ORNL, SRNL)

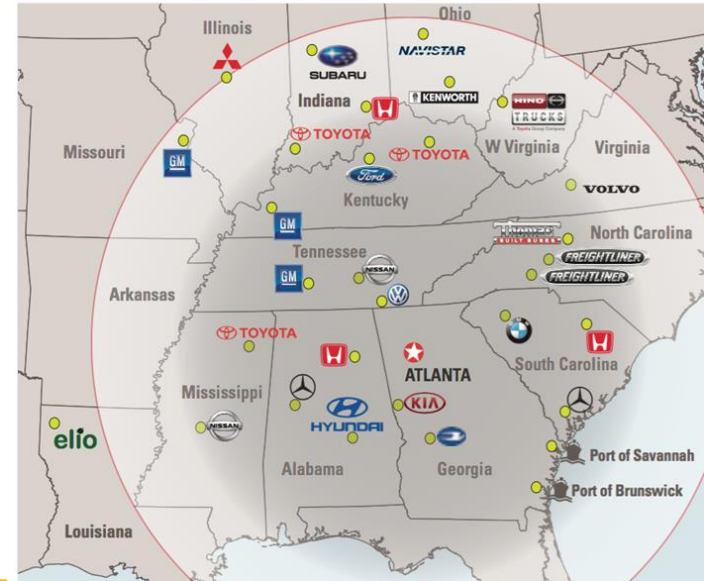
Unique natural gas and fossil pipelines (gateway to the NE)



SpacePort – Sustainable rocket fuel manufactured locally using H2



Cars, Light & Heavy Vehicles within a 500 Mile Radius



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Jennifer Szaro

WORKING GROUPS



In-Person Meetings at FSEC have Occurred

- 1. Energy-Efficient Buildings** Lead: *Rob Vieira*
- 2. Grid Modernization/Energy System Integration** Lead: *Manjunath Matam*
- 3. Solar Energy/Storage Systems** Lead: *Mengji Li*
- 4. Electric Transportation** Lead: *Rich Raustad*
- 5. Hydrogen/Biomass/CO₂** Lead: *Jim Fenton*
- 6. Education, Service, Workforce Training, Policy** Lead: *Colleen Kettles*

Invite FSEC Advisory Board Members or Designees to Attend Quarterly Virtual Meetings.

Working Group Program Area	Program Focus
Energy Efficient Buildings	Building science, indoor air quality, smart energy efficient devices and systems, load management, weatherization, affordable housing applications, and deep retrofits.
Grid Modernization/ Energy Systems Integration	Energy systems integration, including vehicle to building technology, grid-interactive efficient buildings, smart buildings, demand management, smart mobility, and resiliency. Connected Communities and Virtual Power Plants.
Solar Energy/Storage Systems	Photovoltaic systems, performance, durability, testing and certification; PV cell/module manufacturing; and, distributed energy resources. Electrochemical lithium & flow batteries, thermal storage (chilled water, water heaters).
Electric Transportation	Sustainable transportation, electric vehicles, autonomous systems, and infrastructure
Hydrogen/ Biomass/ CO₂ Valorization/ Catalysis	Hydrogen Production (electrolyzers), Consumption (fuel cells, turbines (H ₂ and H ₂ /CH ₄), use as a feedstock, gas turbine ramping with more solar on the grid, H ₂ catalysis. Using catalytic processes to convert biomass and CO ₂ to fuels (renewable natural gas, gasification, and pyrolysis) and chemical feedstocks.
Education, Service, Workforce Training, Policy	K-12 STEM education, curricula and credential development, public education, outreach and marketing, energy minors for BS/BA, MS, PhD, PV on Schools, energy policy analysis, codes and standards development and administration, apprenticeship

Outcome of Initial Working Group Meetings

- **Staff:** Increased opportunities require increased specialized staff
- **Collaboration:** Increase partnerships
- **Topics:** Big data, durability
- **Roles:** Consulting and Implementation in addition to Research and Training
- **Maintenance:** Maintain test facilities