FSEC Advisory Board Meeting

November 9, 2023

New Advisory Board Members

Carrie Black

Chief Sustainability & Resilience Officer, Orange County

Linda Dubea

External Affairs Manager, Florida Power & Light

Status of FSEC Programs

Jim Fenton, Director

Advisory Board Meeting

November 9, 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

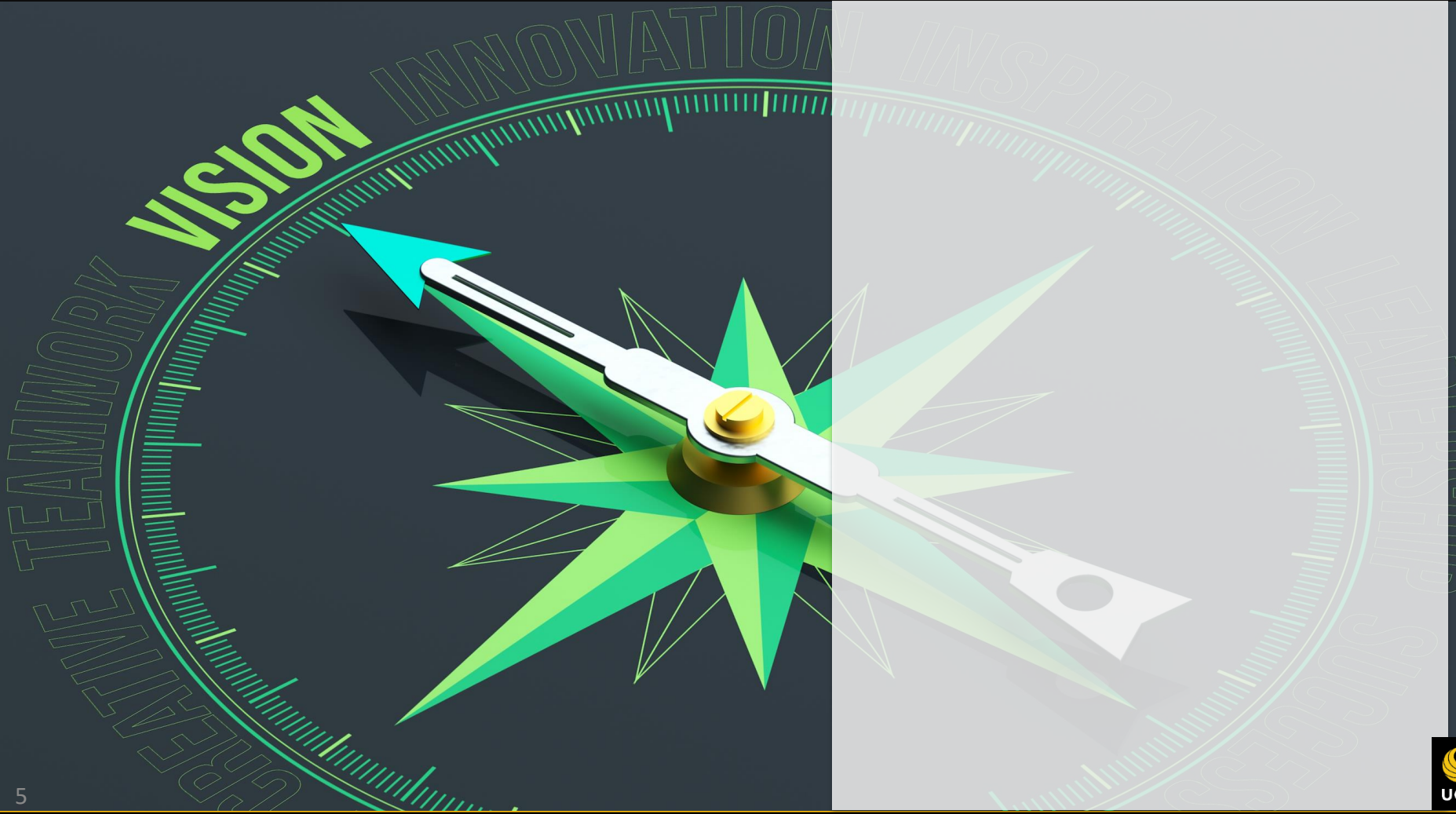
100% Renewables & Net Zero Emissions

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

Clean Energy Workforce Development

- Apprenticeship Programs

FSEC™ UCF


VISION
INNOVATION
INSPIRATION
PASSION
DRIVE
CREATIVE TEAMWORK

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

BranchPattern

CITY OF ORLANDO

ORANGE COUNTY GOVERNMENT FLORIDA

Publix

UNIVERSAL ORLANDO RESORT

The Walt Disney Company

Builders/ Energy Providers

C.T. HSU + ASSOCIATES, P.A.
ARCHITECTURE • PLANNING • INTERIOR DESIGN

kb HOME

LifeStyle SINCE 1984 solar-powered HOMES

Nova EV CHARGE Empowering The Future

Palm Harbor Homes

esa

Electric Utilities

DUKE ENERGY

FMPA MUNICIPAL POWER

FPL

KUA KISSIMMEE UTILITY AUTHORITY

OUC The Reliable One

Manufacturers

innventure

HITACHI Inspire the Next

JinKO Solar Building Your Trust in Solar

MITSUBISHI ELECTRIC COOLING & HEATING

saft

TRANE TECHNOLOGIES watsco

Associations/ Government

AESP

DRIVE ELECTRIC FLORIDA

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

FlaSEIA Florida Solar Energy Industries Association

GULF COAST ENERGY NETWORK

SHEA SOUTHEAST H2 ENERGY ALLIANCE

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FSEC Project Current Partners

Buildings Technology Office

SEI Associates

Tactical Energy

Associated
Gas Distributors
of Florida

NEW CONTRACT AWARDS

New Contract Awards

- **2023 Solar Roof Installation Research Project FSEC Flexible Residential Test Facility** | GAF Energy LLC | 5/17/23 - 10/31/25 | $65,000 | J. Sonne
- **Trane Trace 3D Plus Software Development Support |** S.E.I. Associates | 7/17/23 - 7/18/24 | $144,000| R. Raustad
- **Comparison of the 8th Edition Florida Building Energy Conservation Code with IECC 2024 & ASHRAE 90.1-2022 and IECC 2021 & ASHRAE 90.1-2019** | Florida Department of Business and Professional Regulation | 7/01/23 - 6/30/24 | $136,511 | B. Nigusse
- **8th Edition (2023) Florida Building Code, Energy Conservation** | Florida Department of Business and Professional Regulation | 7/17/23 - 6/30/24 | $25,000 | J. Sonne
- **Valencia College Energy Transition Plan** | Hanson Professional Services Inc. | 10/01/23 - 9/30/24 | $15,000 | C. Kettles
- **PV-GEMS: Photovoltaic Powered, Grid Enhanced Mechanical Solution.** A pre-packaged approach providing high efficiency and resilient space conditioning, and water heating | U.S. DOE | EOC: 1/31/2026 | $901,348 | E. Martin
- **Photonic Curing of Printed Copper Contacts for High Efficiency and Low-Cost Silicon Heterojunctions** | U.S. DOE SETO | 10/23 – 04/27 | Total $1,868,887 – Federal $1,494,911 | K. Davis
- **Materials Data Science for Stockpile Stewardship (MDS^3) Center of Excellence** | U.S. DOE National Nuclear Security Administration (NNSA) | 09/22 – 09/27 | $832,646 | K. Davis (PI), M. Li (Co-PI)

CURRENT PROGRAMS

Current DOE-Funded Collaborative Partnerships

- **Gaining Fundamental Understanding of Critical Failure Modes and Degradation Mechanisms in Fielded Photovoltaic Modules via Multiscale Characterization,** *K. Davis*
- **Clean, Affordable, and Resilient Energy Systems (CARES) for Socially Vulnerable and At-Risk Communities,** *K. Davis*
- **Photonic Curing of Copper Contacts***, 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. Matam*
- **Secure and Resilient Operations Using Open-Source Distributed Systems Platform (OpenDSP)**, *W. Sun*

New project

FSEC UCF

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*
- **Equitable Mobility Powering Opportunities for Workplace Electrification Readiness (EMPOWER)**
  C. Kettles
- **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

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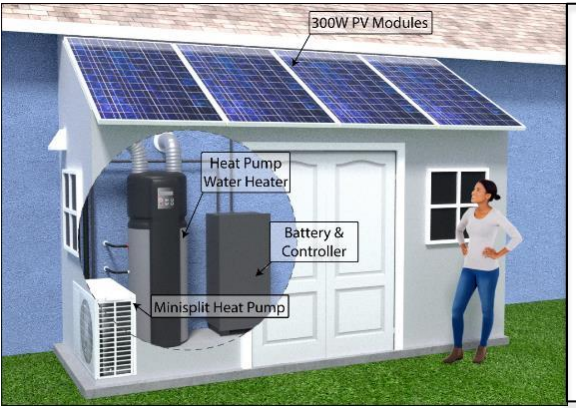
Current Contracts

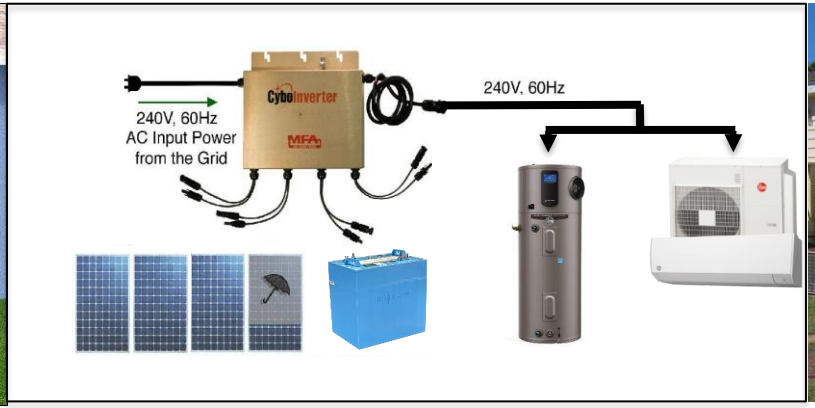
- **Updating AGDF Model Costs and Equipment for the Associated Gas Distributors of Florida** | Associated Gas Distributors of Florida | EOC: 12/31/2024 | R. Raustad
- **SunSmart Schools E-Shelter Maximization Project – Phase 1** | Florida Department of Agriculture and Consumer Services (FDACS) | EOC: 6/30/2024 | C. Kettles
- **Lab and Field Evaluation of Condensation Potential in Buried Ducts in Vented Attics Located in the Hot and Humid Climate Zones** | Owens Corning | EOC: 4/30/2024 | J. Sonne
- **Reimagining HVAC for New Manufactured Housing** | Slipstream | EOC: 6/30/2024 | D. Chasar
- **DRIVE (Developing Replicable, Innovative Variants for Engagement) for EVs in the USA** | Clean Fuels Ohio | EOC: 12/31/2024 | C. Kettles

Current Contracts

- **Long-term Outdoor PV Evaluations** | Sandia National Laboratories | EOC: 9/30/2024 | H. Seigneur
- **Development of RESNET Building Registry XSD Schema Version 3** | Residential Energy Service Network, Inc (RESNET) | EOC: 12/31/2023 | P. Fairey
- **Demonstration of Integrated Hydrogen Production and Consumption for Improved Utility Operations** | Orlando Utilities Commission | EOC: 12/31/2024 | J. Fenton
- **Benchscale Methanol Synthesis Process Development & Testing** | M2X Energy | EOC: 12/29/2024 | N. Muradov
- **Flexible Load Adaptation Training (FLAT) for Energy Services Professionals** | The Association of Energy Services Professionals (AESP) | EOC: 5/31/2024 | C. Kettles
- **Equitable Mobility Powering Opportunities for Workplace Electrification Readiness (EMPOWER)** | U.S. Department of Energy | EOC: 6/30/2025 | C. Kettles

Energy Systems Integration





- PV GEMS: PV-Powered, Grid-Enhanced Mechanical Solution
- $4.4M ($3.6M + $885k cost share)
- Focus is on manufactured housing application.
- Planning demonstrations in occupied homes in MA, CO, TX, OR, NC and GA.
- Currently constructing demonstration system prototype.

PI's: Eric Martin and Carlos Colon

Partners:

ROC usa® Resident Owned Communities BETTER TOGETHER

watsco COOLING THE AMERICAS

Rheem

NASEO National Association of State Energy Officials

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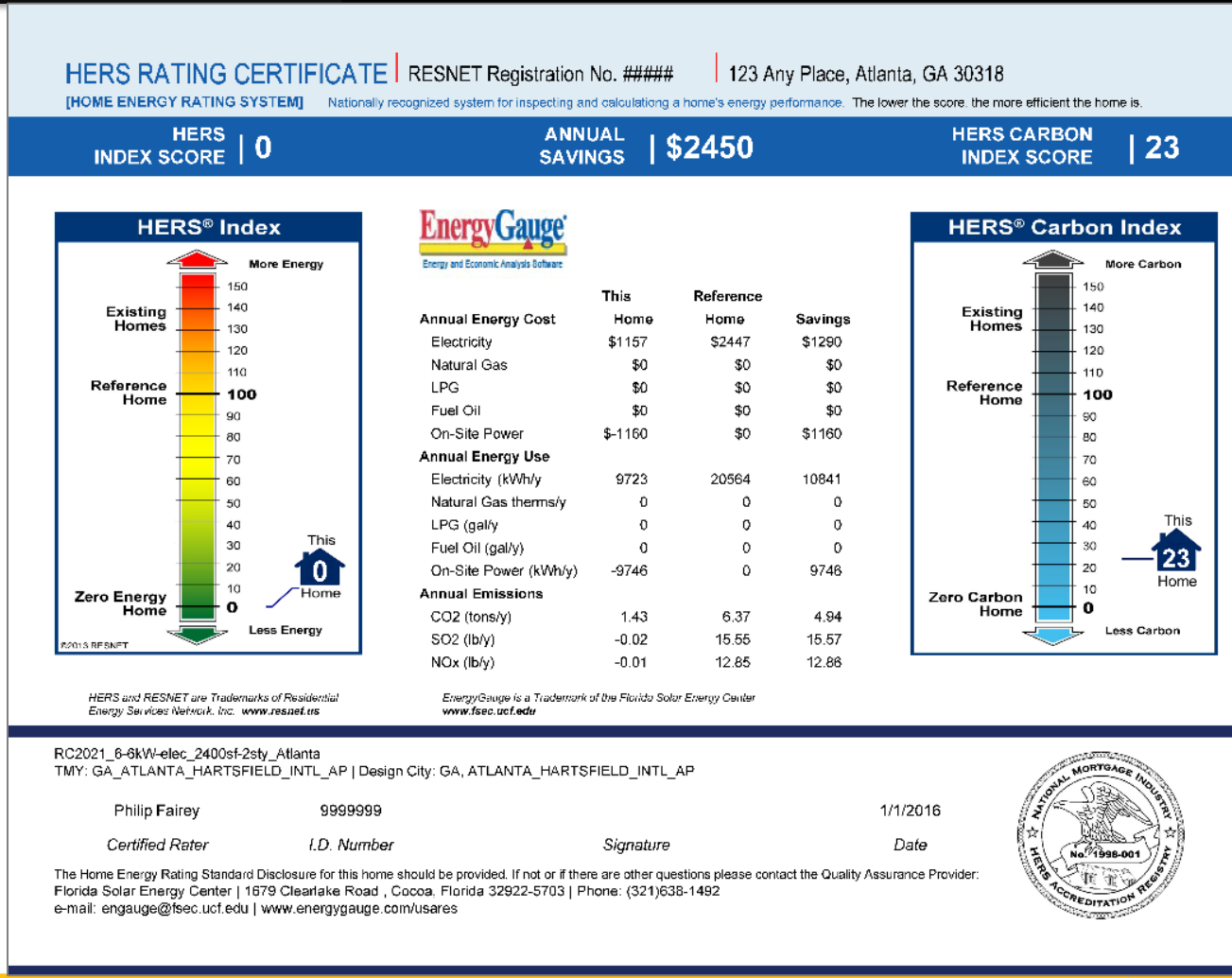
Getting to Zero

- 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 RATING CERTIFICATE | RESNET Registration No. ##### | 123 Any Place, Atlanta, GA 30318

[HOME ENERGY RATING SYSTEM] Nationally recognized system for inspecting and calculating a home's energy performance. The lower the score, the more efficient the home is.

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

EnergyGauge
Energy and Economic Analysis Software

Annual Energy Cost	This Home	Reference Home	Savings
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

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

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

Sponsored by DUKE ENERGY®

FREE Live Webinar Series (6)

UCF

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

Continuing Education: Online

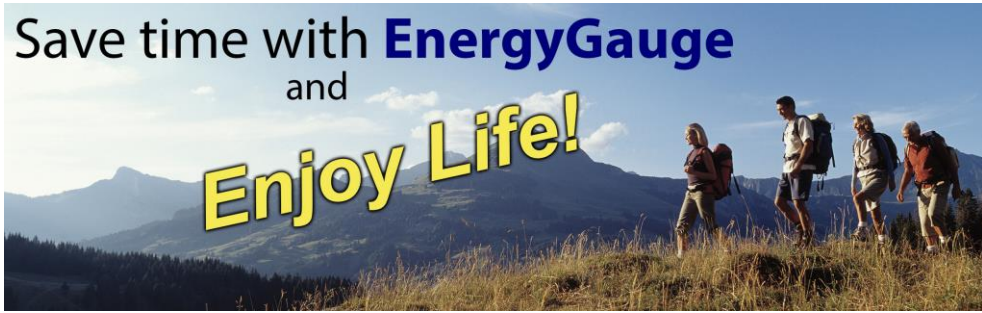
FSEC® Live Webinars:
8th Edition (2023) Florida Energy Conservation Code

Register now for November 29 & 30 classes! Last chance before 2023 energy code changes take effect.

Explore all of FSEC's continuing education courses at
https://energyresearch.ucf.edu/education/continuing-education/

- EnergyGauge software updated
- Accredited by FBC

EnergyGauge®
Energy and Economic Analysis Software



FLORIDA BUILDING COMMISSION

FSEC™ UCF

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

Pilot: Government Building Sustainability

- **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

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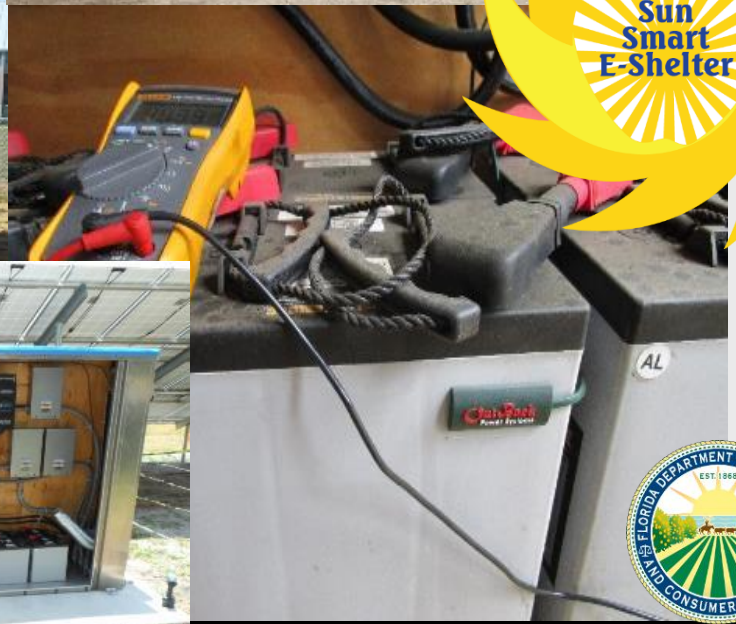

SunSmart Schools Emergency Shelter Program

2010-2014

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

2019-Present

- 118 schools inspected
- 107 schools received new batteries
- Over $2M from FDACS to make upgrades

Florida SOLAR ENERGY Apprenticeship Program

https://floridasolarapprentice.com/

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

STANDARDS OF APPRENTICESHIP
Florida Solar Energy Apprenticeship Program, GNJ 2022-FL-111515
REGISTERED BY
FLORIDA DEPARTMENT OF EDUCATION
DIVISION OF CAREER AND ADULT EDUCATION
APPRENTICESHIP SECTION

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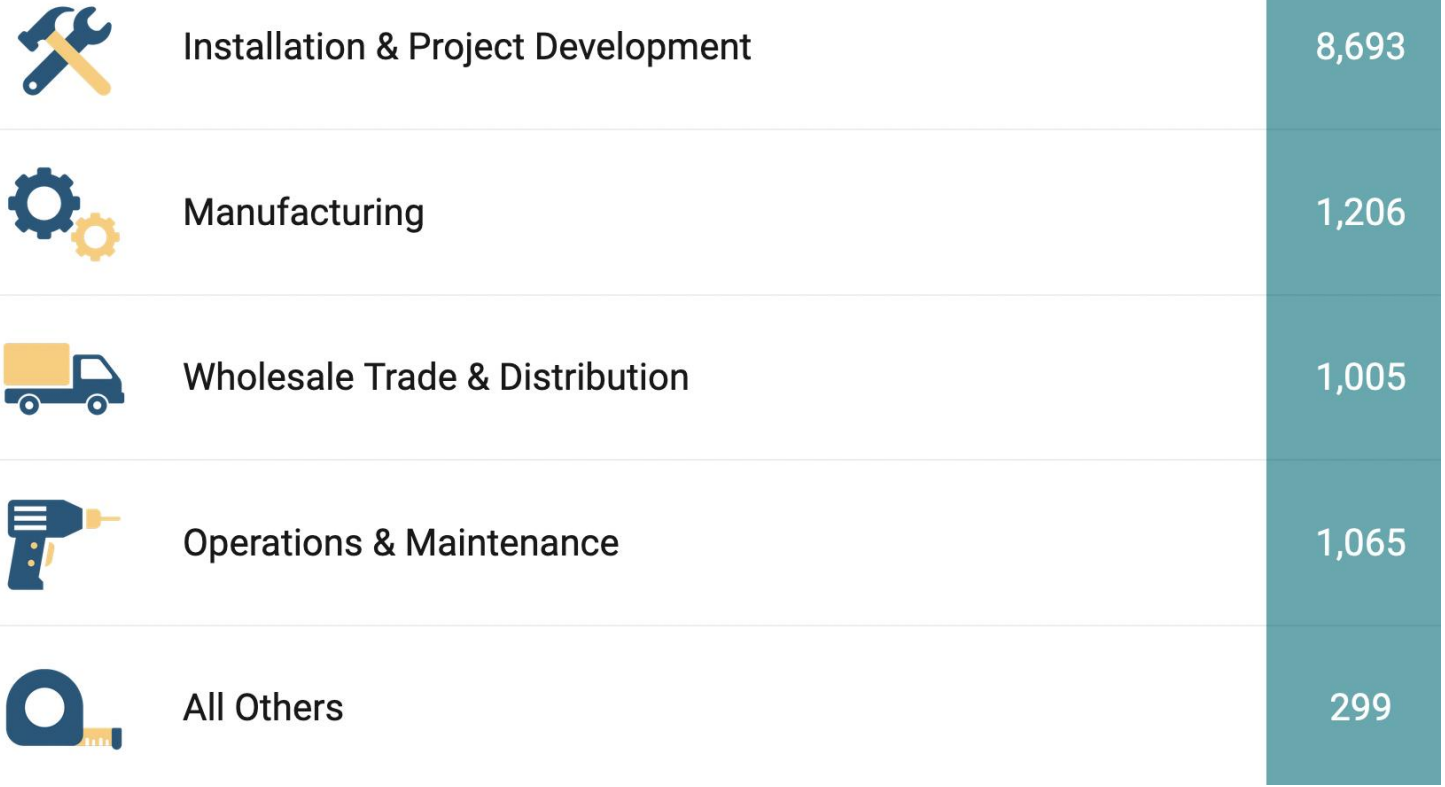
Florida Solar Job Trends

Solar Jobs, 2022	12,267
Jobs Added, 2022	506
% Growth, 2022	4.3%
State Ranking for Solar Jobs	2
State Ranking for Solar Jobs Per Capita	28
Projected Growth, 2023	8.2%
5-Year Growth, 2017-2022	42.8%

Source: https://irecusa.org/florida-solar-and-clean-energy-jobs/

Florida Solar Jobs by Sector



Source: https://irecusa.org/florida-solar-and-clean-energy-jobs/

Florida First in Solar Installations

SECTIONS CANARY MEDIA GET TH

Florida is now adding more solar power than any other state

Sorry, California and Texas! Florida zoomed to the No. 1 spot for solar installations in the first half of 2023, despite a decidedly mixed policy landscape.

15 September 2023

https://www.canarymedia.com/articles/solar/florida-is-now-adding-more-solar-power-than-any-other-state

- "The Sunshine State connected 2,499 megawatts of solar-generation capacity to the grid during the first half of 2023, blowing away the 1,648 megawatts added by California and the 1,292 megawatts added by Texas, according to the most recent U.S. Solar Market Insight report from the Solar Energy Industries Association and energy consultancy Wood Mackenzie."

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Research You Can Use

- **Extreme Heat Guides**:
  - Landscaping to Reduce Cooling Load
    - https://basc.pnnl.gov/resource-guides/landscaping-reduce-cooling-load
  - Emergency Air Conditioning and Food Refrigeration
    - https://basc.pnnl.gov/resource-guides/emergency-air-conditioning-and-food-refrigeration#edit-group-scope
  - Creating a Cool Room for Extreme Heat Events
    - https://basc.pnnl.gov/resource-guides/creating-cool-room-extreme-heat-events
  - Cool Roofs and Walls to Reduce Heat Gain
    - https://basc.pnnl.gov/resource-guides/cool-roofs-and-walls-reduce-heat-gain#edit-group-scope
  - Reducing Solar Heat Gain through Windows and Skylights
    - https://basc.pnnl.gov/resource-guides/shading-and-solar-control-windows-and-skylights
    - https://basc.pnnl.gov/resource-guides/window-attachments-solar-control-and-energy-efficiency

https://basc.pnnl.gov/information/extreme-heat-overview

Methane Removal

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

- Crude methanol characterizations

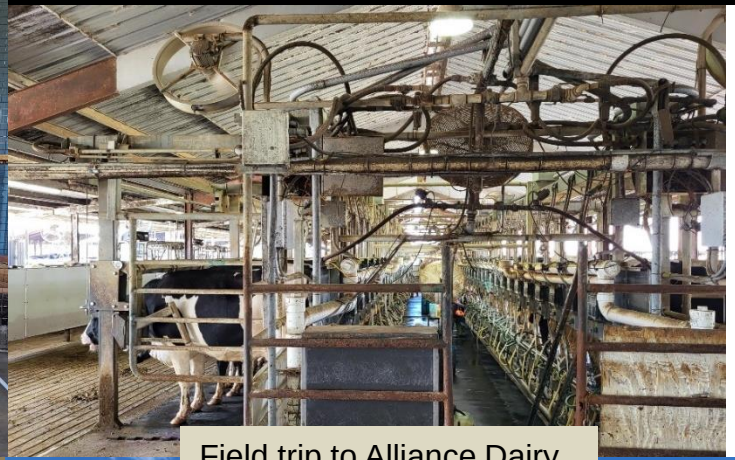
FOAK field test in ND

Sample shipped to FSEC for composition analysis and electrolysis study

M2X FSEC UCF

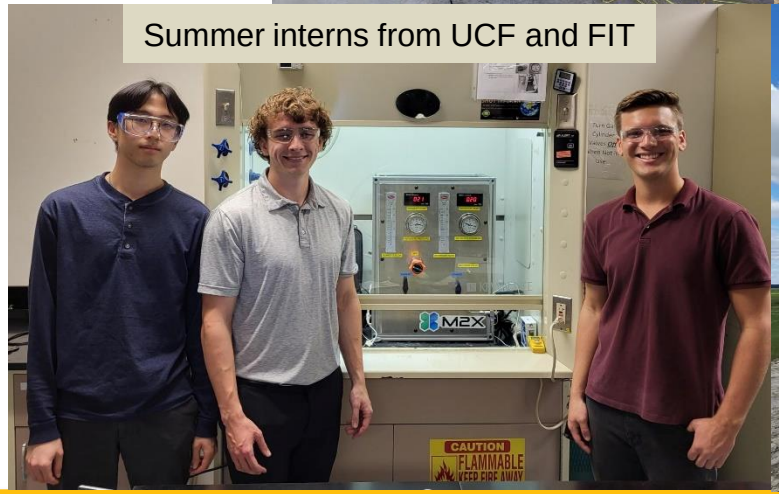
M2X Energy

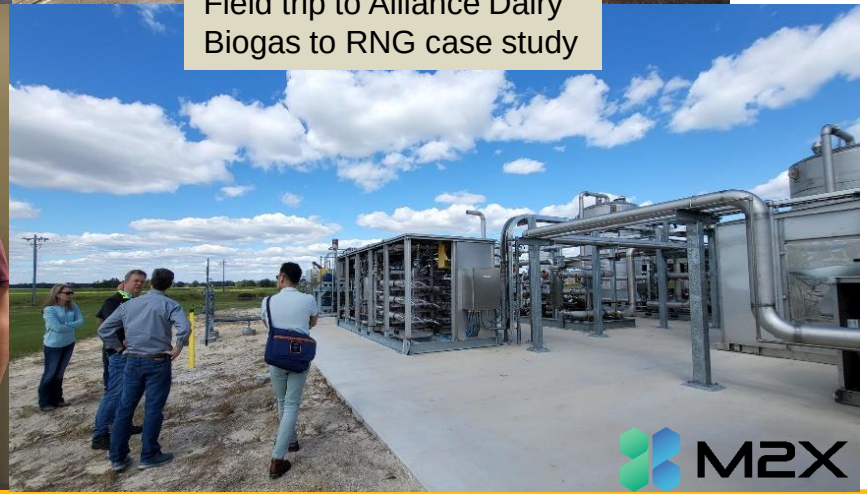
Catalytic oxidation for tailgas treatment



Field trip to Alliance Dairy Biogas to RNG case study

Summer interns from UCF and FIT





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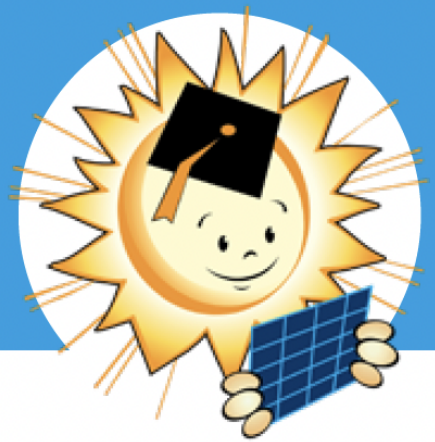
EVENTS & NEWS

FSEC's EnergyWhiz

Sponsored by



FSEC's EnergyWhiz

Empowering Student Innovation for a Clean Energy Future

EnergyWhiz is a celebration of student ingenuity, where K-12th graders showcase their renewable energy projects.

FSEC®
1679 Clearlake Rd
Cocoa, FL 32922

On-site @ FSEC: **April 20, 2024**

We Appreciate Our Volunteers!

U.S. DEPARTMENT OF ENERGY | Office of Science

Middle School Science Bowl

- Middle School Science Bowl @ FSEC: **February 24, 2024**
- Regional competition open to all Florida middle schools
- **In need of volunteers and sponsorships**
- $1000 sponsorship will cover all the costs for this event: Trophies, Medallions, Lunch for the students, teachers and volunteers
- Benefits:
  - Opportunity to speak to the students, parents and coaches at the event
  - Verbal and written acknowledgement as the key sponsor
  - Acknowledgement in the printed program distributed at the National event.
- Team from our regional event gets an all-expenses-paid trip to compete in the national event near Washington, D.C.
- Contact Susan Schleith for more info: susan@fsec.ucf.edu, 321-638-1017

SPACE COAST SCIENCE EDUCATION ALLIANCE SCSEA
Building the Foundation for STEM

Partnership with FSEC

NSB NATIONAL SCIENCE BOWL®
a competition like no other . . .

FSEC™ UCF

Congratulations!

- **Inaugural Class of Residential Energy Services Network (RESNET®) Recognition of Women Pioneers in HERS® Industry**
  - Tei Kucharski
  - One of 20 women recognized

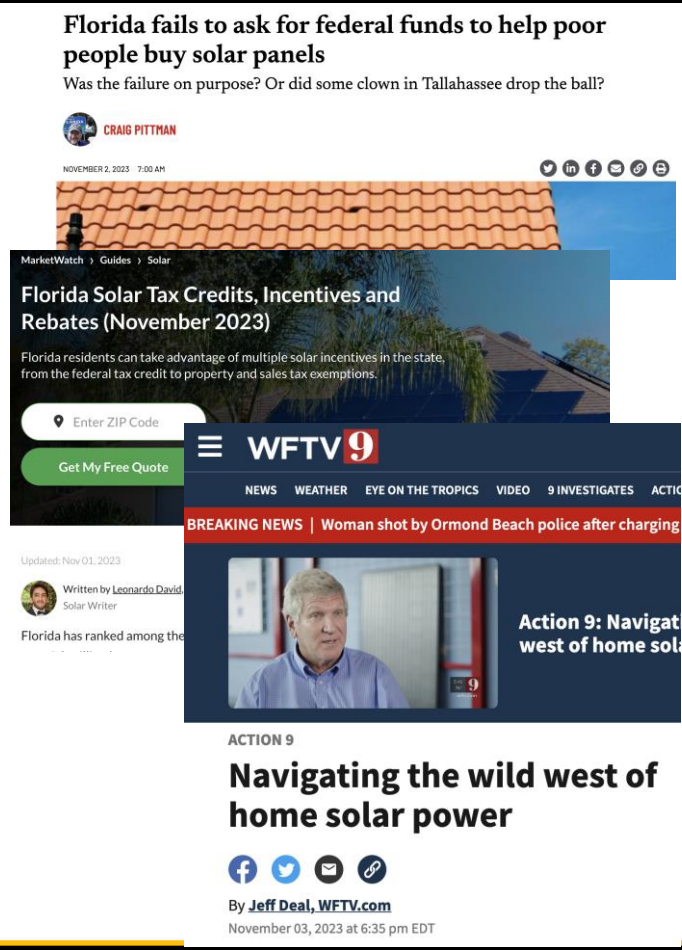
Tei Kucharski

Program Coordinator of RESNET® Rating Provider Energy Gauge and member of RESNET® Standards Development Committee 200

https://www.resnet.us/articles/inaugural-class-of-resnet-recognition-of-women-pioneers-in-hers-industry/

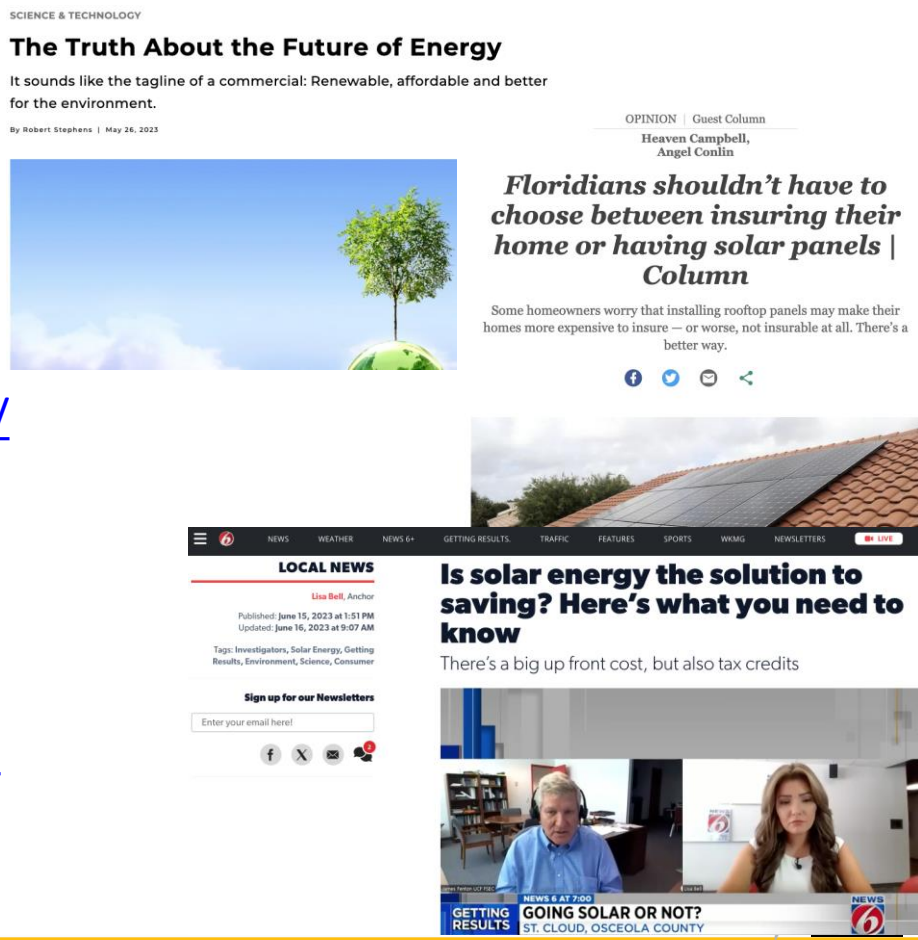
In the News

- **Florida Solar Tax Credits, Incentives and Rebates**
  https://www.marketwatch.com/guides/solar/florida-solar-incentives/
- **Florida fails to ask for federal funds to help poor people buy solar panels**
  https://floridaphoenix.com/2023/11/02/florida-fails-to-ask-for-federal-funds-to-help-poor-people-buy-solar-panels/
- **Navigating the wild west of home solar power**
  https://www.wftv.com/news/action9/navigating-wild-west-home-solar-power/HWYM23WNGNBAPHVLY37AGYEXAE/



In the News

- **The Truth About the Future of Energy** https://www.ucf.edu/news/the-truth-about-the-future-of-energy/
- **Floridians shouldn't have to choose between insuring their homes or having solar panels** https://www.tampabay.com/opinion/2023/06/10/floridians-shouldnt-have-choose-between-insuring-their-home-or-having-solar-panels-column/
- **Is solar energy the solution to saving? Here's what you need to know.** https://www.clickorlando.com/news/local/2023/06/15/is-solar-energy-the-solution-to-saving-heres-what-you-need-to-know/



FSEC New Hires

- **Emily Rawley**, Academic Support Coordinator II, Workforce & Business Development
- **Tabby Moye**, Contacts and Grants Specialist II, SET
- **Vanessa Aycart**, Maintenance Tech III, Facilities
- **Manjunath Matam**, Assistant Professor, Solar & Energy Systems Integration
- **Yifan Wang**, Assistant Professor, Special Projects
- **Andrew Ballen**, GRA (Mengjie Li), Solar & Energy Systems Integration
- **Shishir Singh**, GRA, Buildings Research
- **Luis Hernandez Babilonia**, Manager, Facilities
- **Angela Messer**, FSEC Training Specialist I, Buildings Research [starts Dec.]
- **Arnaldo Velez**, HVAC II, Facilities [starts end of Nov.]

UCF Undergrads

- **Nadia Khan**, Solar & Energy Systems Integration
- **Brent Thompson**, Solar & Energy Systems Integration
- **Alejandro Aparcedo**, Solar & Energy Systems Integration [starts 11/13]

FSEC Pending Searches

Buildings

- Post-Doc – Readvertising
- Assistant In, (simulation) – In contract stage
- Admin Asst III – Interviewing

Hydrogen

- Assistant Research Professor, (process analysis)

Solar & Energy Systems Integration

- Two Assistant Research Professors (floating solar, durability)

Communications

- Information Specialist

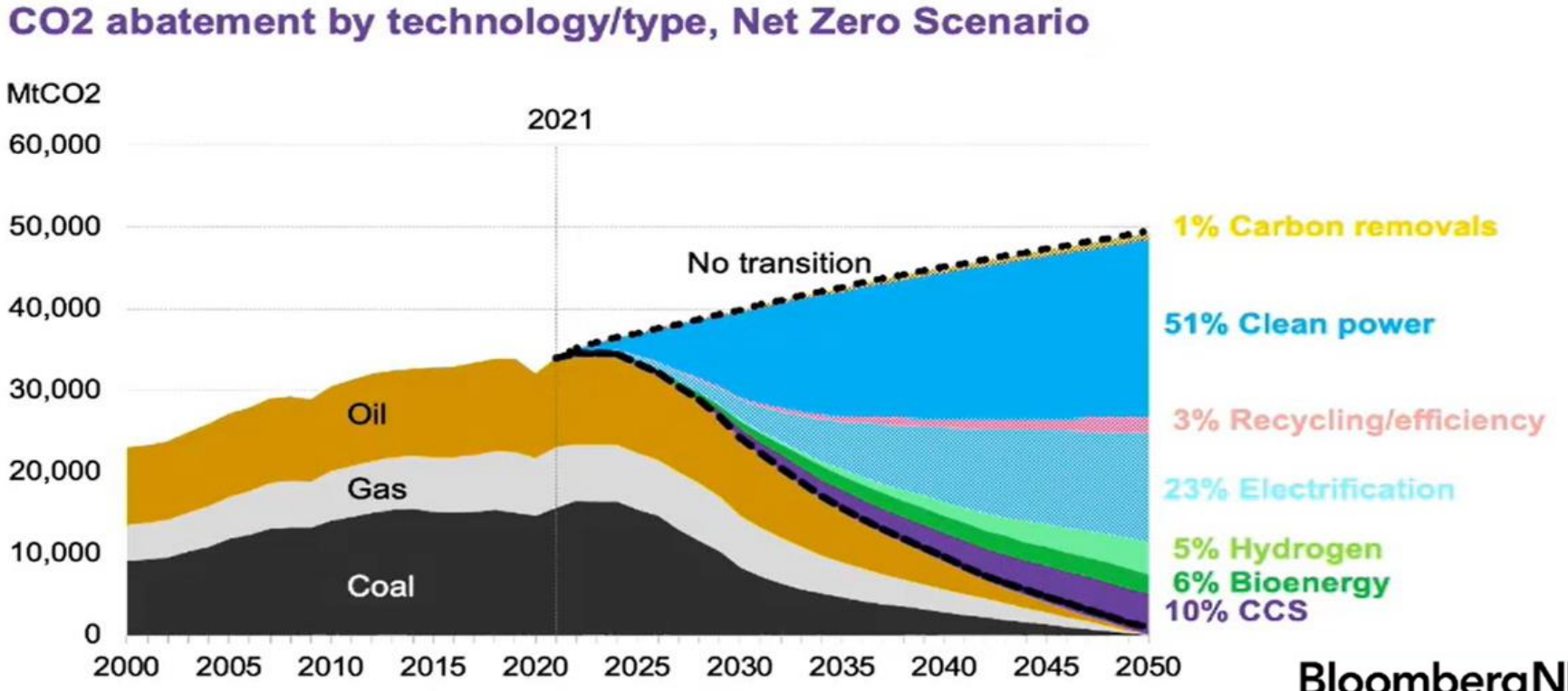
Facilities

- Maintenance Technician I

SUSTAINABILITY GOAL PARTNERSHIPS

Possible Paths to Net Zero Emissions by 2050

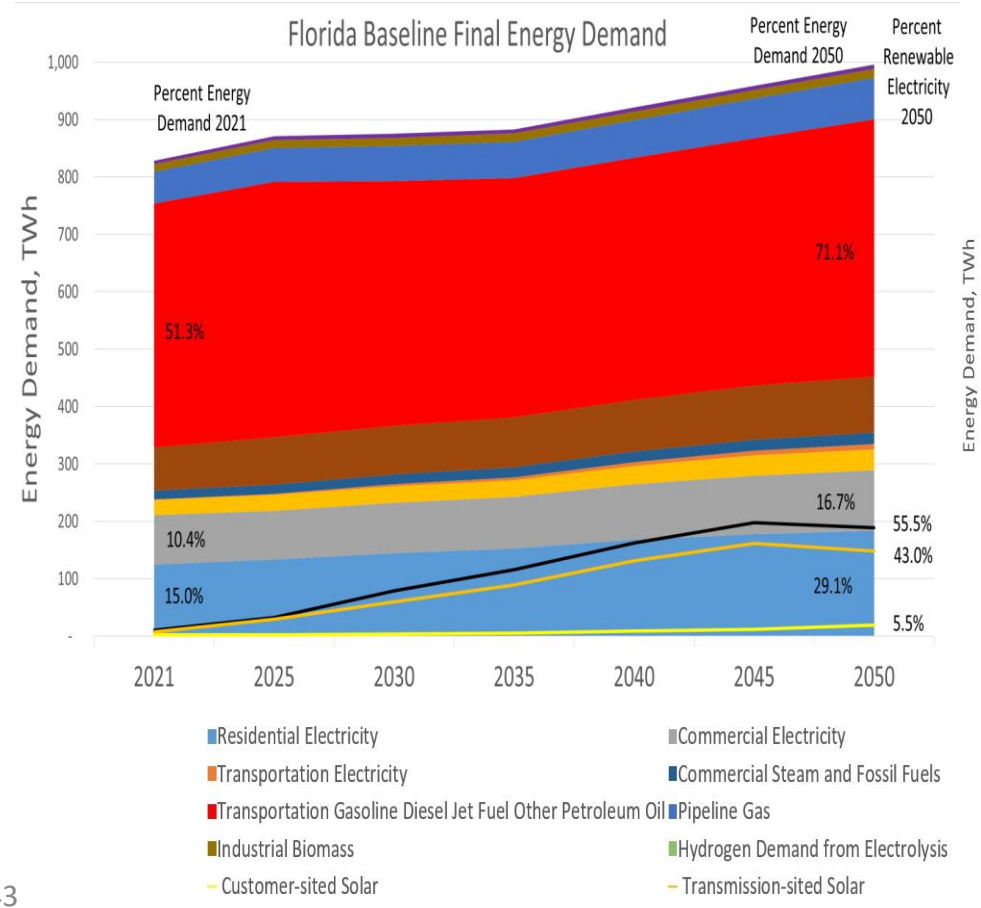
Clean power and electrification are the main drivers of emissions abatement

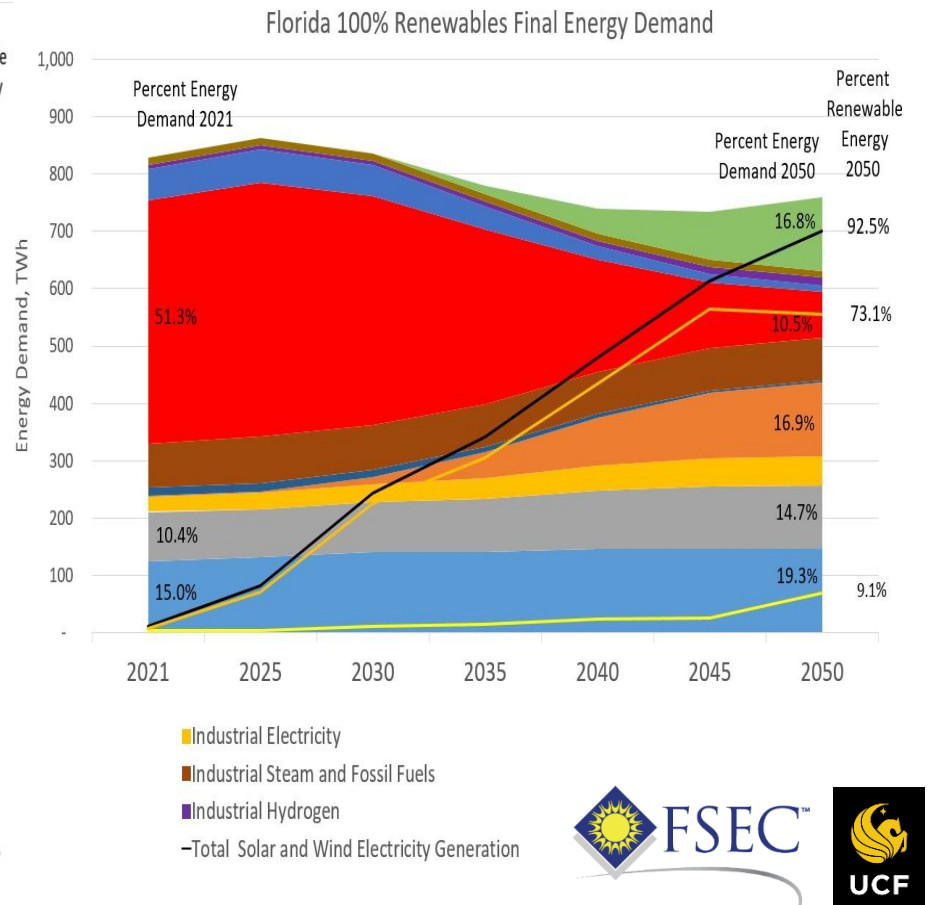


Source: BloombergNEF. Note: Abatement also includes fuel switching and other abatement technologies.

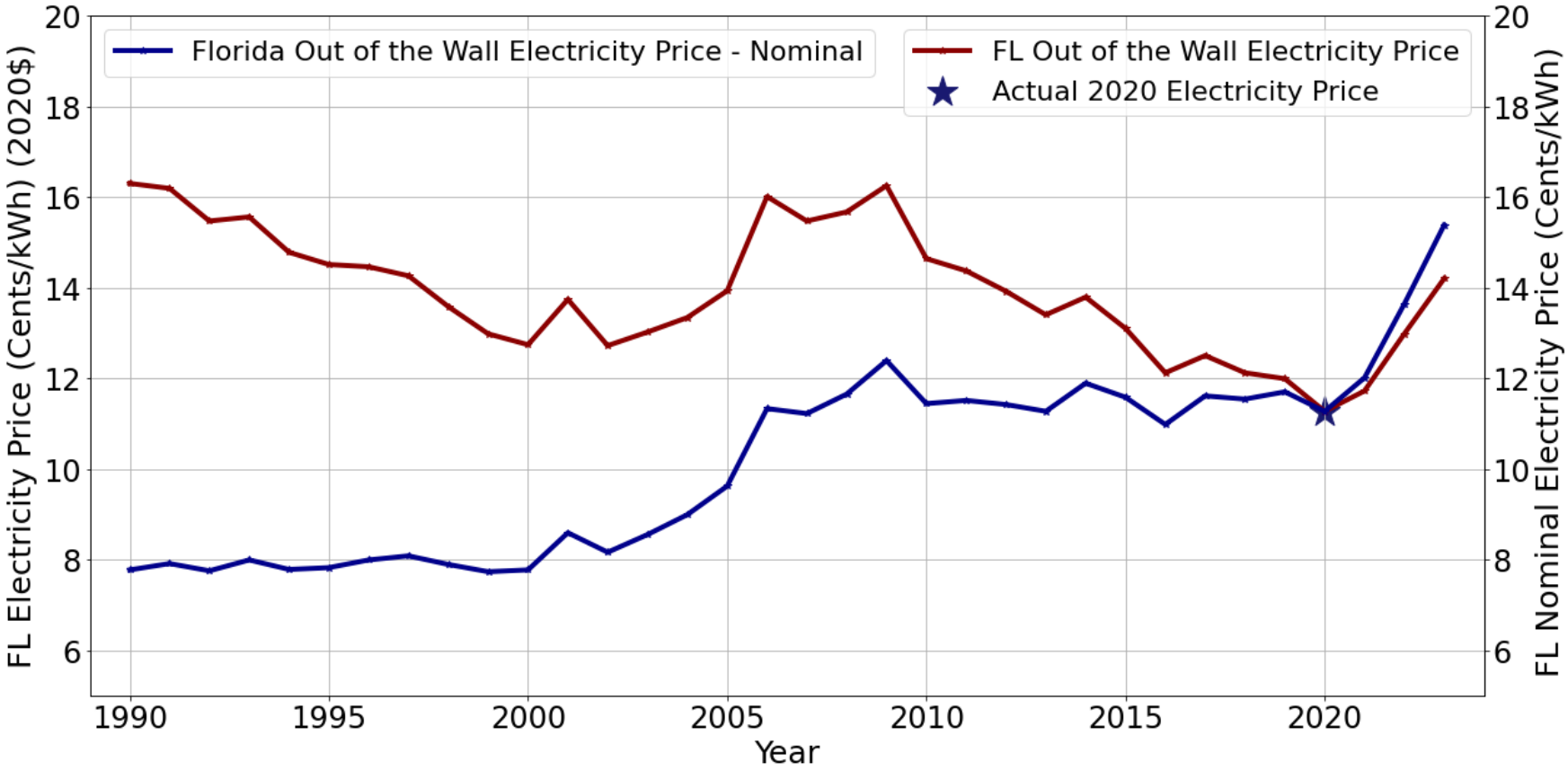
BloombergNEF

Florida Energy Demand





Florida Residential Electricity Prices



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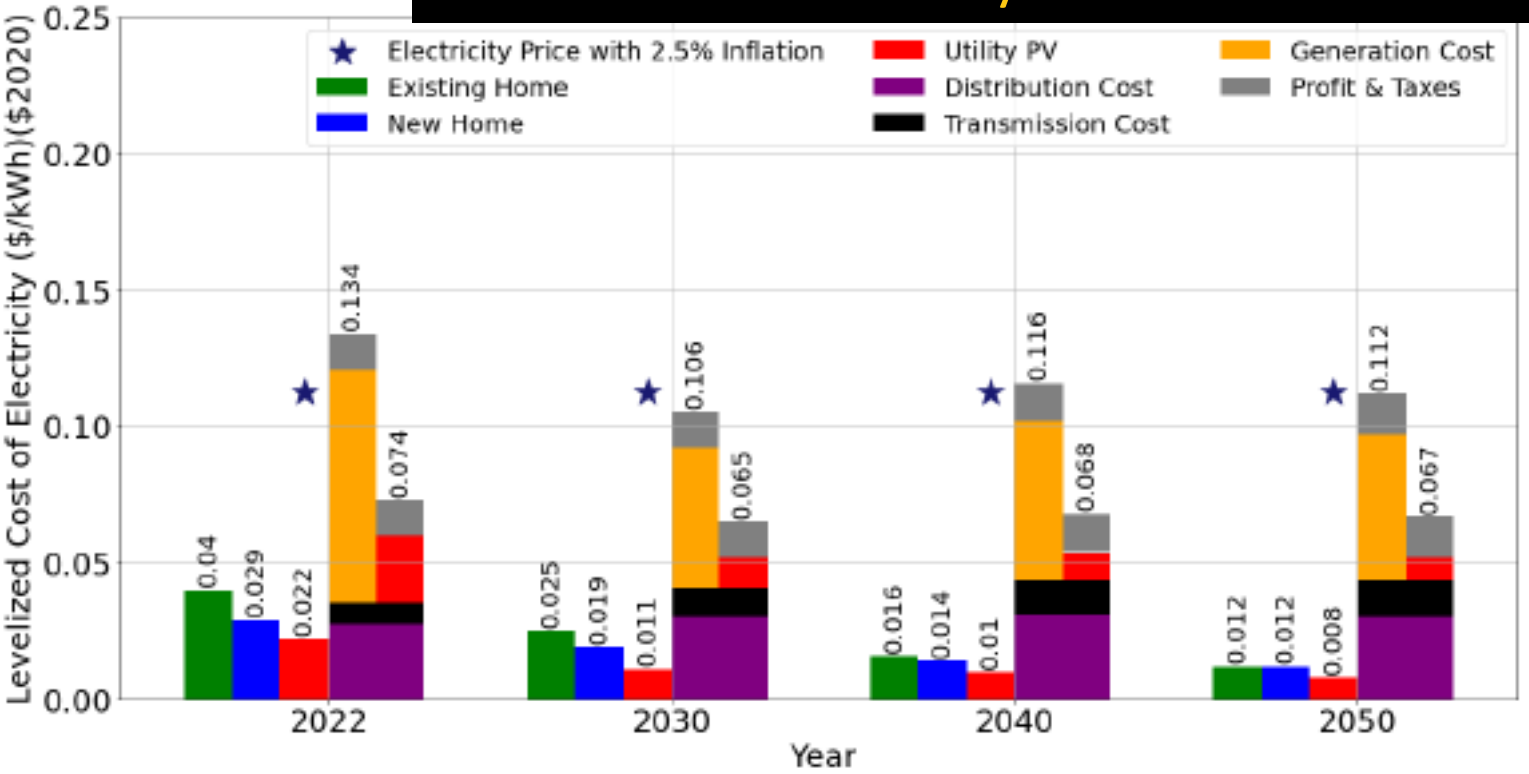
Residential and Utility Solar – **Florida Electricity**



Florida Levelized Cost of Electricity; Two Residential PV Homes, Utility PV, and Residential Electricity "out of the wall," with 30% Federal Income Tax Credit Applied to Residential and Utility PV.

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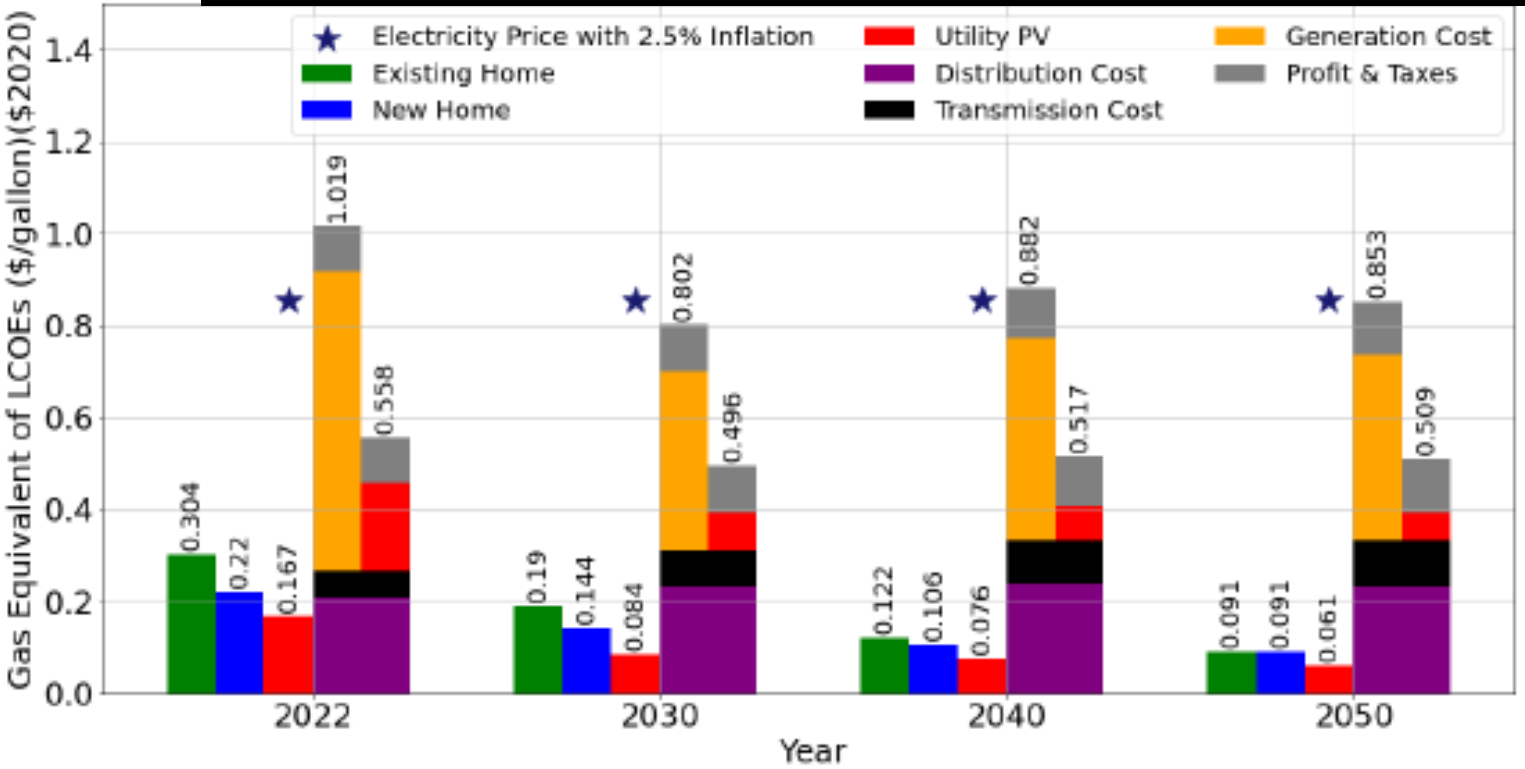
Residential and Utility Solar – **Florida Gasoline Equivalent**



Gas Equivalent of LCOEs ($/gallon) for PV Only Scenario with 30% PV ITC. EV range 220 miles, 68.7 kWh battery capacity (3.2 miles/kWh). Gasoline car 24.2 mpg.

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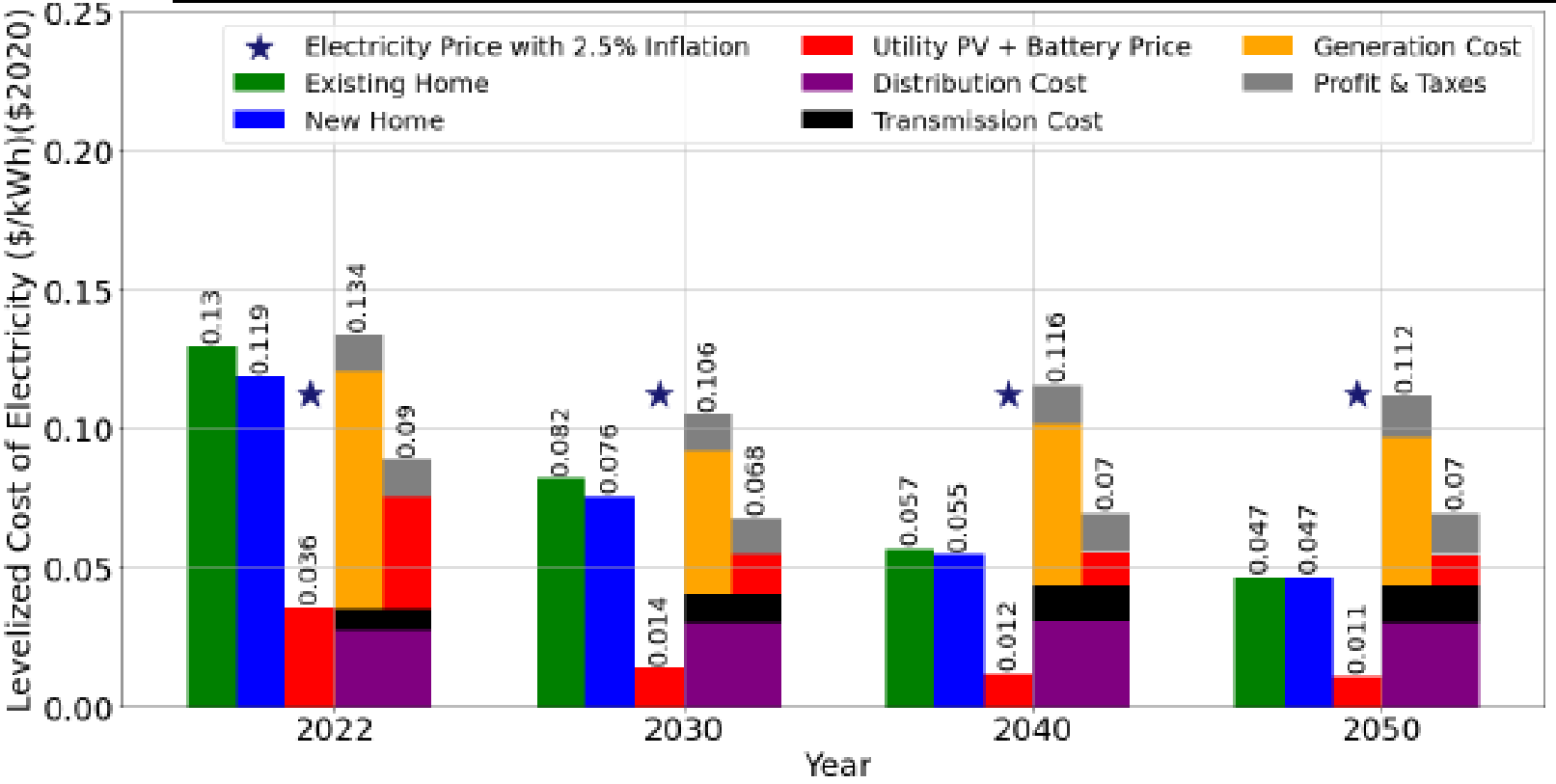
Residential and Utility, Solar + Battery – **Florida Electricity**



Utility PV + Battery (4-hour) ”out of the wall” Cost of Electricity, with the 30% Federal ITC for PV and Battery.

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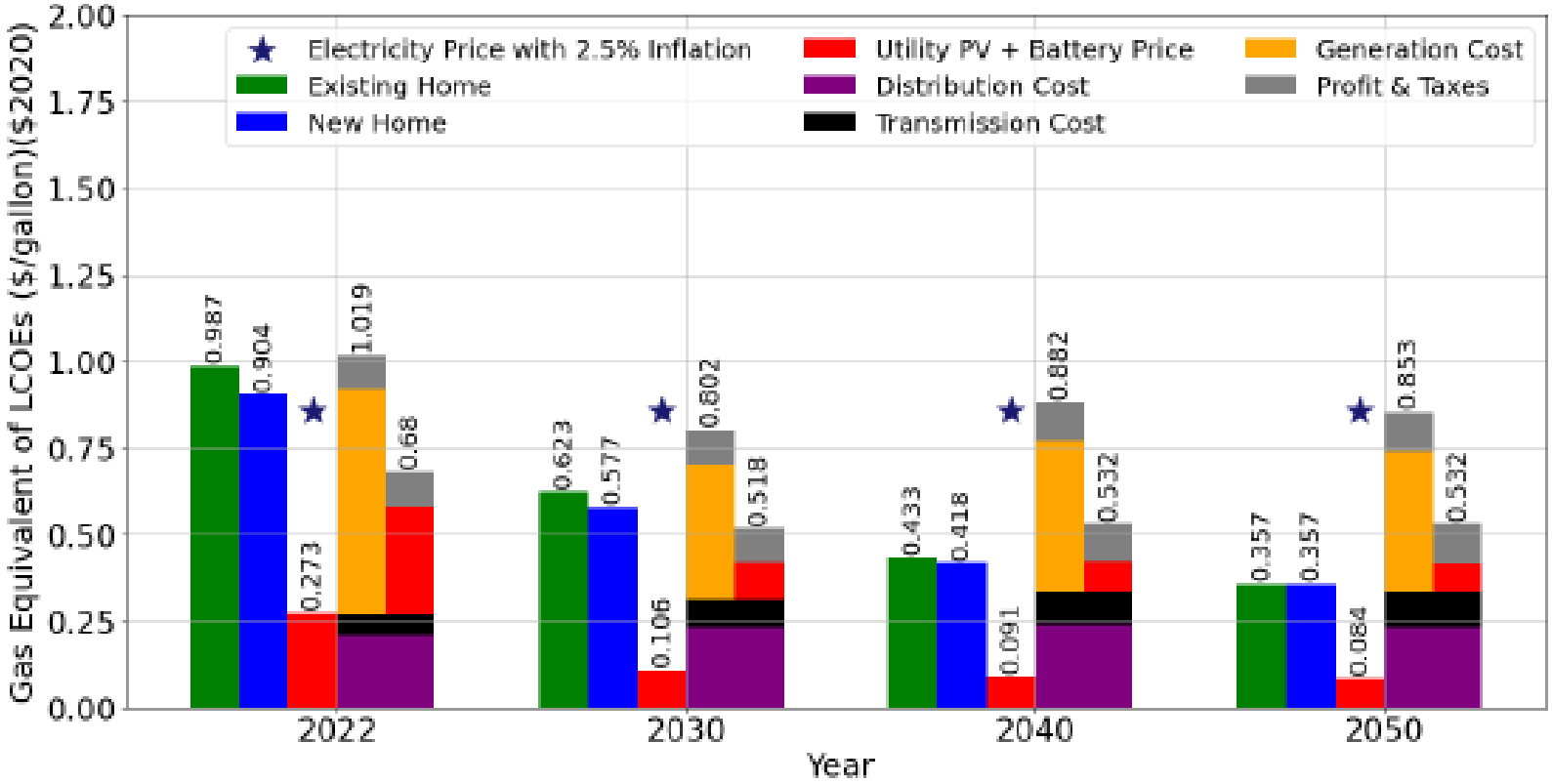
Residential and Utility, Solar + Battery – **Florida Gasoline Equivalent**



Gasoline Equivalent of LCOEs ($/gallon) for PV+Battery Scenario with 30% PV and Battery ITC.

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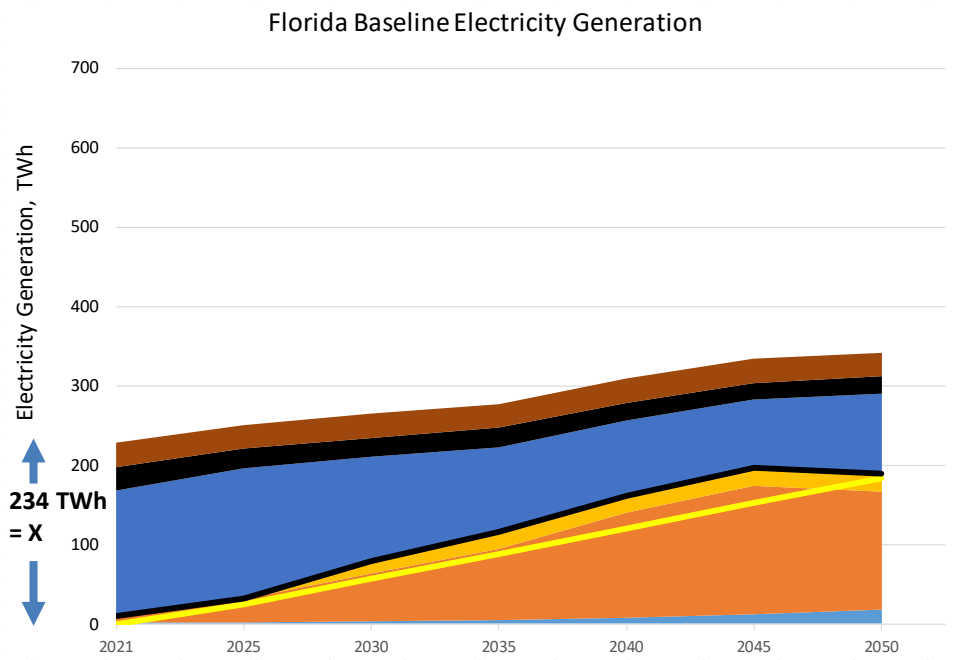
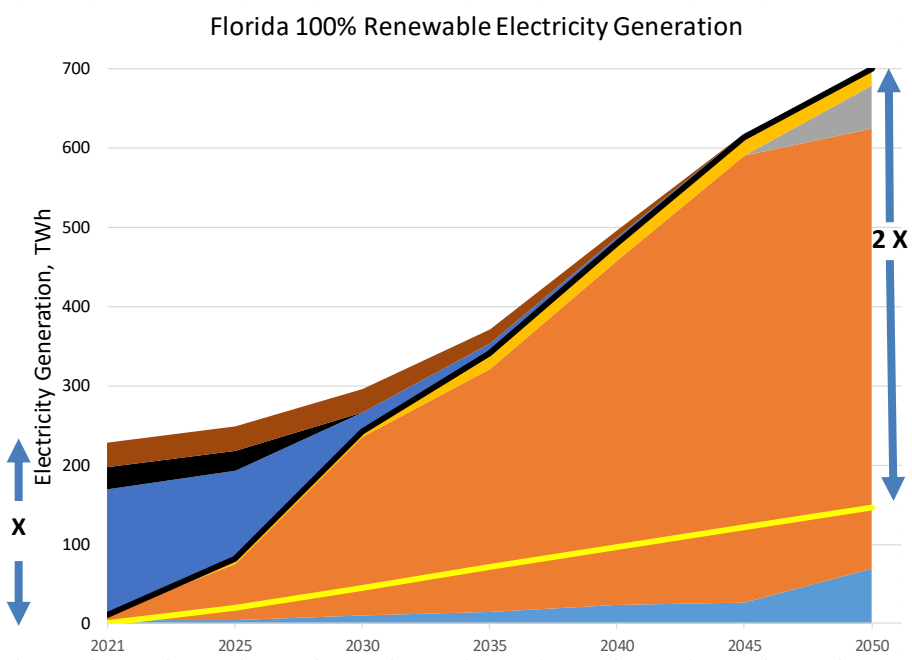
Florida Electricity Generation

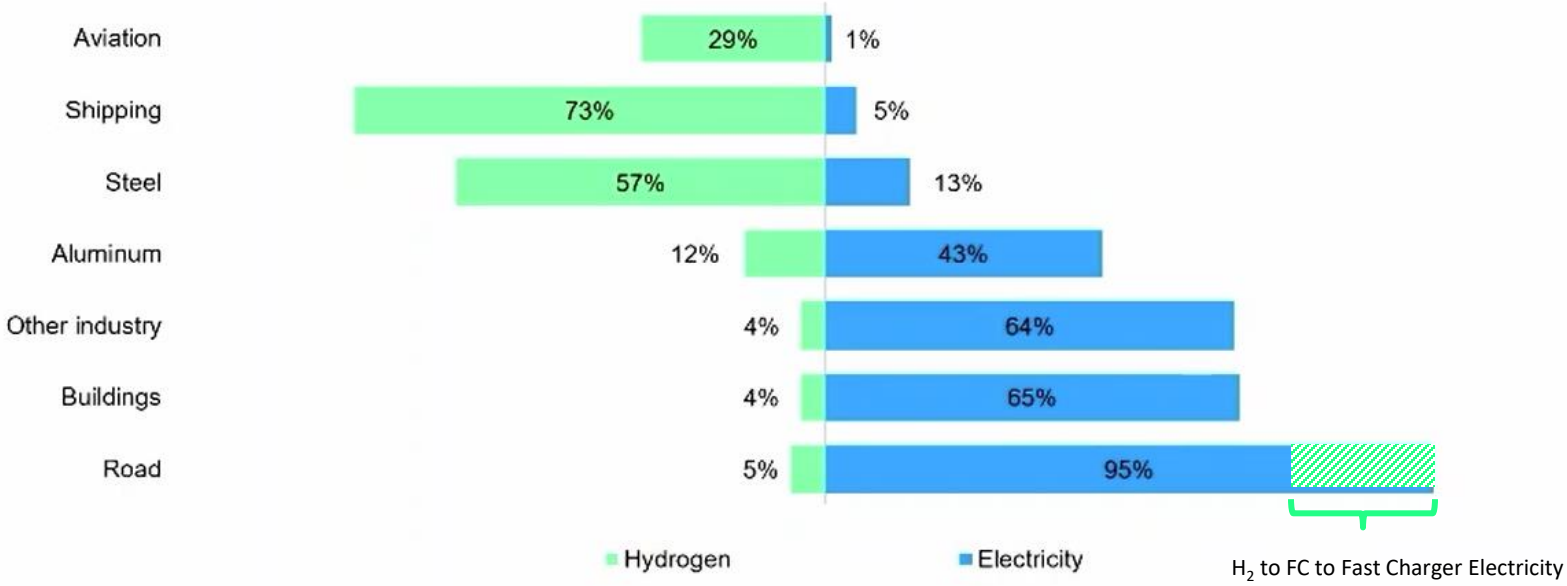




Customer-sited Solar
Transmission-sited Solar
Offshore WInd
Onshore WInd
Gas
Coal
Nuclear
Possible 100% solar residential electricity by 2050
Total Solar and Wind Electricity Generation

Renewable Hydrogen and Electricity will generally not compete

2050 final energy demand by sector, Net Zero Scenario



Source: BloombergNEF New Energy Outlook 2022

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