

Florida Energy Systems Consortium (FESC)

www.floridaenergy.ufl.edu

FL Energy Summit Oct 14-16, 2015

UF UNIVERSITY of
FLORIDA



FAU
FLORIDA
ATLANTIC
UNIVERSITY



USF UNIVERSITY OF
SOUTH FLORIDA



FLORIDA
POLYTECHNIC
UNIVERSITY

Florida Energy Systems Consortium (FESC)

Created by Florida Statute in 2008

Purpose... Unite Florida energy experts - including Florida's 12 Universities - so that the State leads in energy research and develops innovative energy systems giving rise to...

*Improved energy efficiency and
Expanded economic development*

Strategic Activities

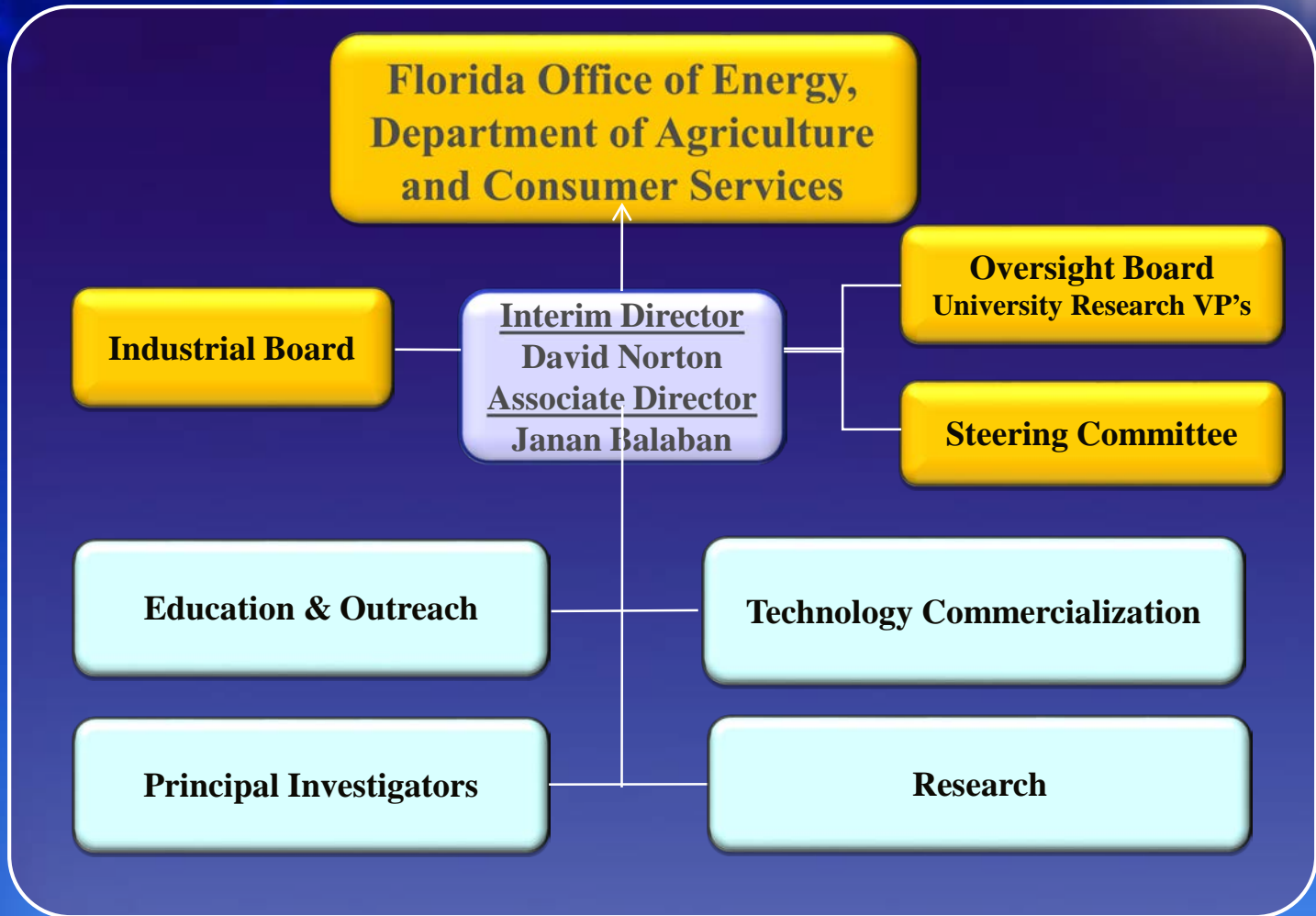
- Research
- Technology Commercialization
- Outreach
- Education

FESC involves more than

- 400 Faculty
- 100 Centers and Institutes
- 200 Companies within Florida



FESC Leadership Structure



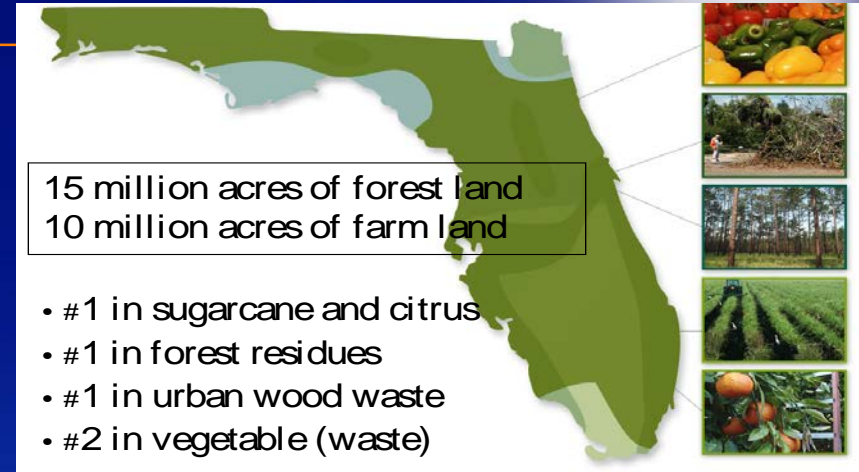
Strategic Research Thrusts

- Developing Florida's Biomass Advantage for Renewable Fuels
- Harnessing Florida's Solar Resources
- Enhancing Energy Efficiency and Conservation
- Securing Energy Delivery Infrastructure and Energy Storage
- Capturing Florida's Marine Energy Resources for Power Generation



Developing Florida Biomass Resources

- Florida has ~10% of US biomass resources
- 51% statewide tree coverage
- 80% of it is commercial



Climate allows year around energy crop growth, high crop yield and conversion efficiency

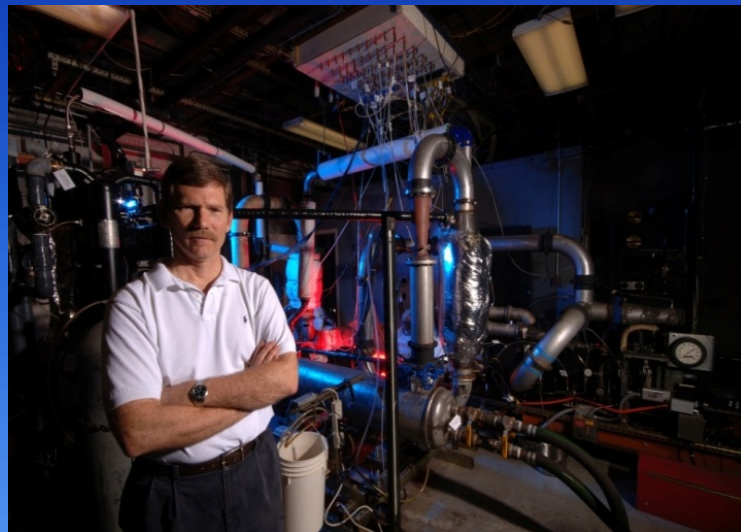
Biomass Plants in FL

- 100MW Biomass Power Plant - Gainesville Renewable Energy Center
- Biomass to ethanol plant – INEOS
- Algae to ethanol plant - Algenol

University of Florida cellulosic ethanol biorefinery

FESC Bio Energy Research Areas

- Energy Crops
- Algal Research
- Biomass Conversion Technologies
 - Biochemical
 - Thermochemical
- Catalyst Development
- Computational Studies



Alternative Energy Crops for the Citrus Industry

Drop in Fuels

500,000 acres of Fallow Citrus Fields

Lost Crop: 194 Million Boxes since 2003

State of Florida Annual Loss: \$1.6 Billion



Replacement crops: Sugar beets, sweet sorghum, cane, tuber.

The aim is to produce sugar/starch from energy crops and convert sugar/starch to fuels (known technology). **Attract bio fuel manufacturers to the State (in communication with industry).**

Potential Liquid Fuel Production: 550,000,000 gal. Ethanol as a bench mark

\$1.375 Billion Annual Sales

25,000 direct jobs + 75,000 indirect jobs (ref: TCERDA)

Florida spends \$42B for 290 million barrels of petroleum annually, 90% in transportation. Florida aviation consumes 1.5-2.5 million gallons/day.



Advanced BioFuel (ABF) Feedstock Certification Working Group

- Led by FESC and the Treasure Coast Education, Research, and Development Authority (TCERDA).
- 9 Member team including FL Office of Energy.

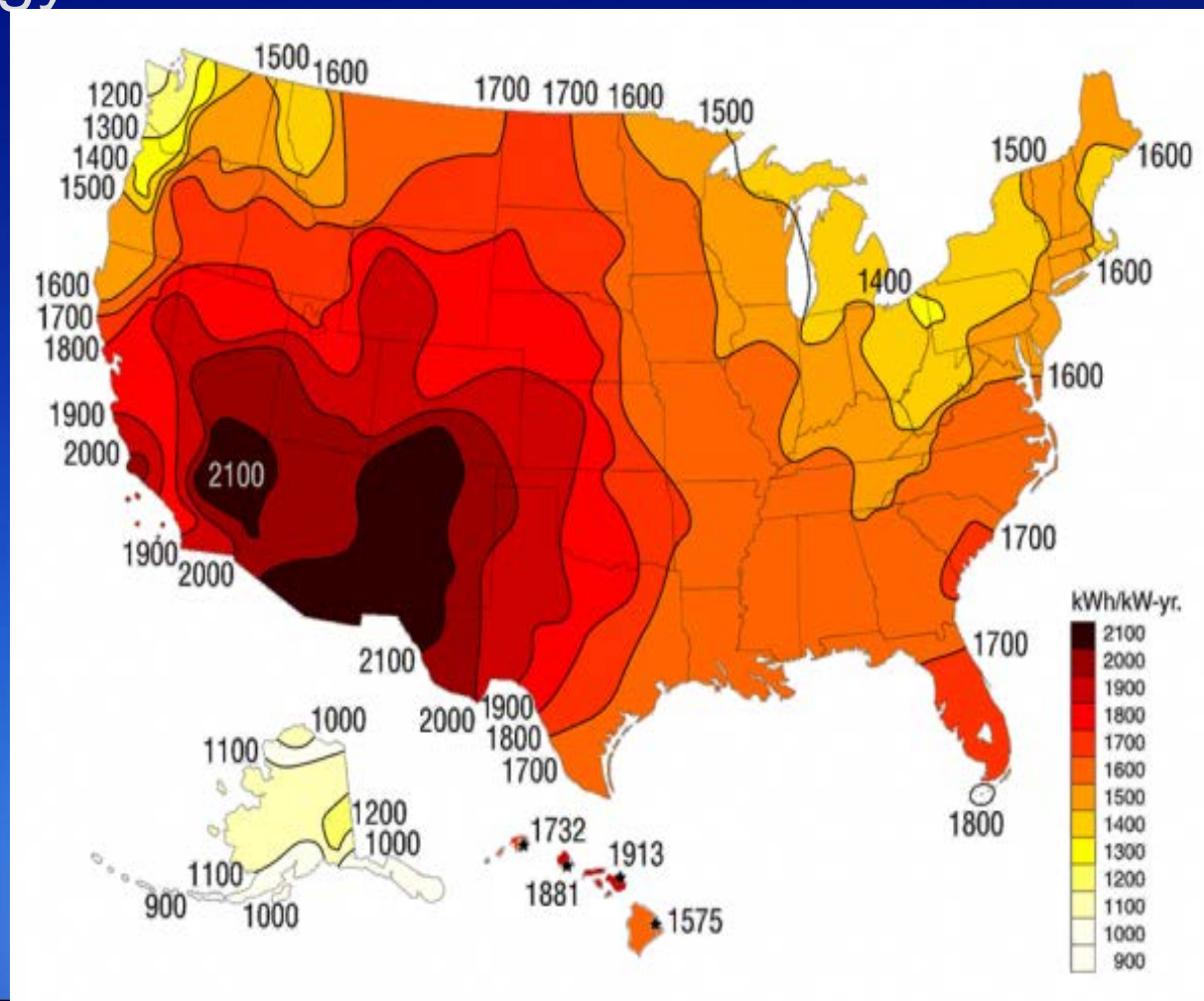
Needs: Replacement crops for former citrus farms; EPA certification required for new feedstocks/biofuels; Reduction of certification time

Goals

- Fully understand the EPA certification process and prepare a road map to reduce the certification time.
- Provide a statewide “Energy Crop Certification Program” implementation plan to FDACS.
- Convene industry leaders to expand the ABF supply chain of growers, processors and consumers in FL.

Harnessing Florida's Solar Resources

Solar energy is Florida's most abundant domestic energy resource



Solar Energy Research Focus Areas

- Low Cost CIGS Thin Film PV Process, PV panel Coatings, Materials
- Organic PV
- Non-Contact Energy Delivery for PV System
- Concentrated Solar Power (CSP)
- Solar Fuels



Solar Thermal Power Plant at USF

By Dr. Yogi Goswami



Solar Field for 50 kW_e Power Generation

Enhancing Energy Efficiency & Conservation

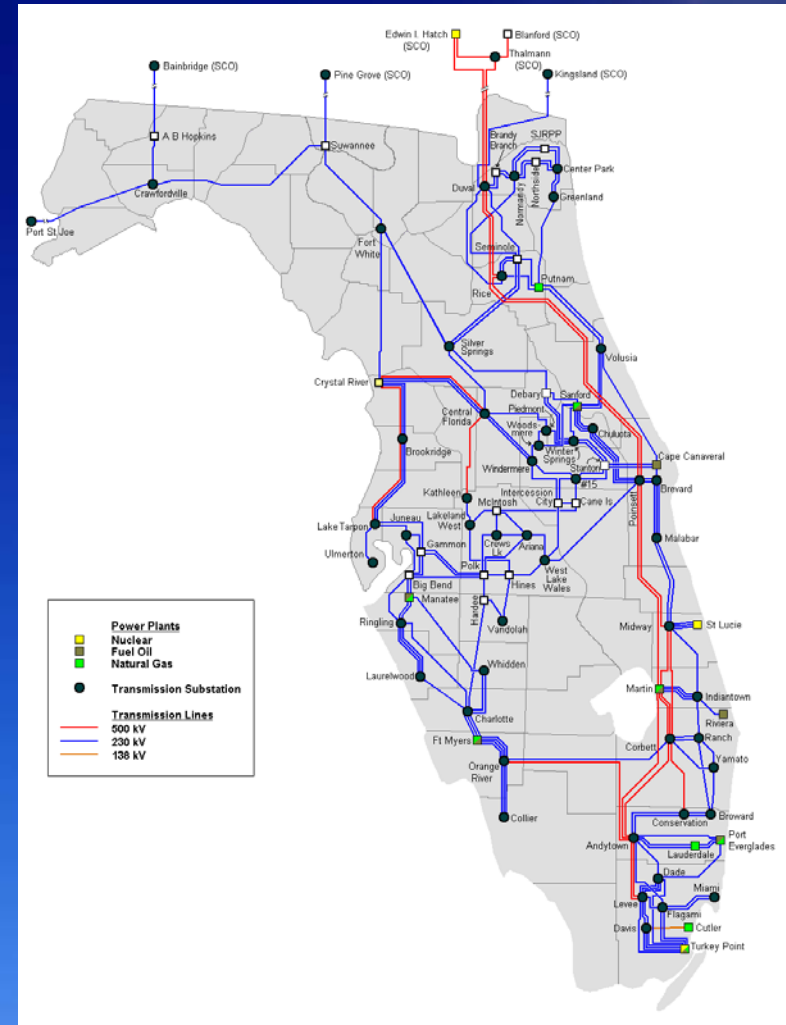
Residences consume more than 40% of Florida's electricity

- **Net –zero or energy efficient demonstration homes at multiple campuses** - UCF, FSU, USF, FIU, UWF: Used for research, training, outreach.
- Two side by side buildings at FSEC for Energy Efficiency research



Florida Grid

- Florida is surrounded by water on 3 sides
- Can receive power from north side only in case of natural disasters
- Distributed generation and micro-grids can be advantageous in hurricane prone areas

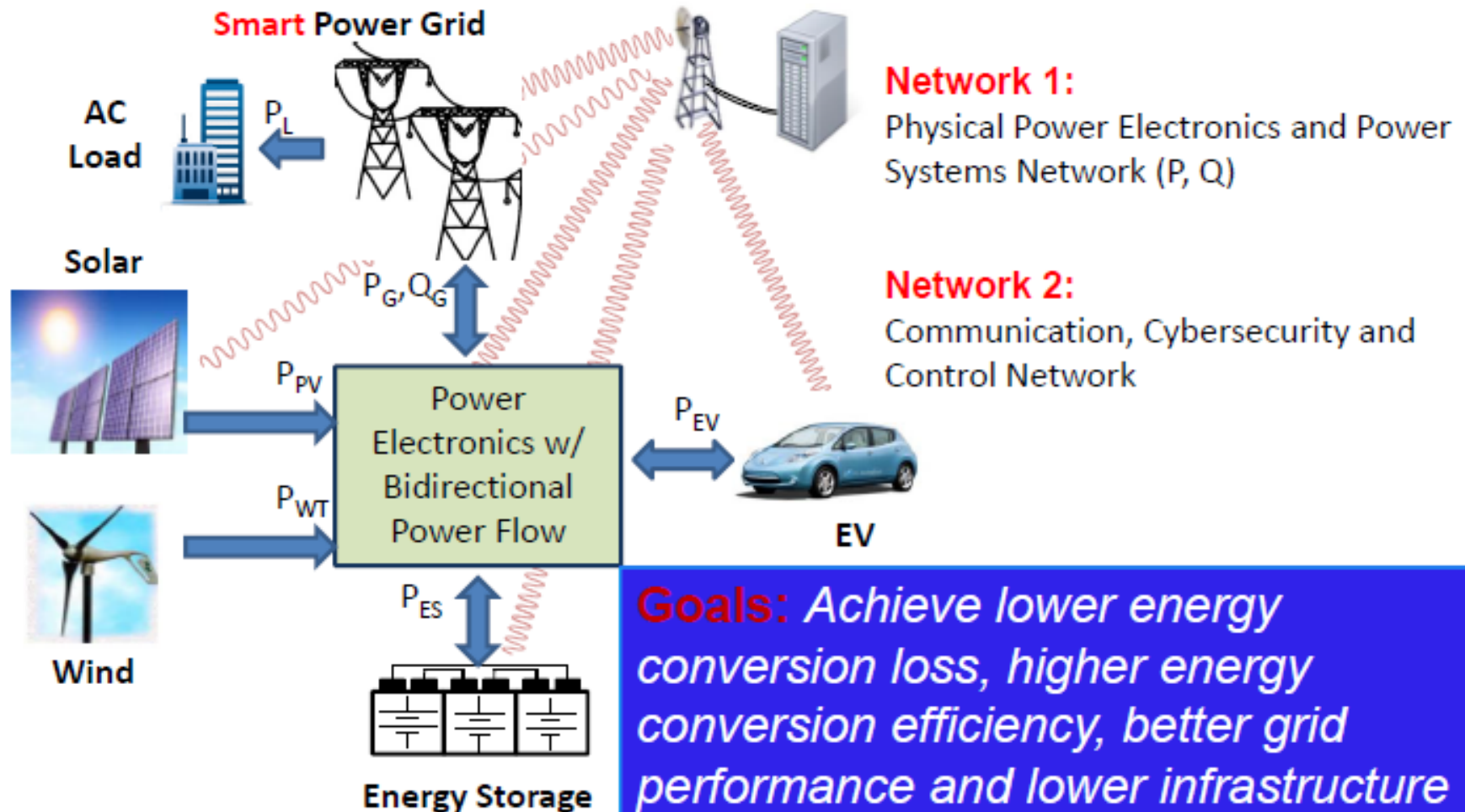


Securing Energy Delivery Infrastructure

- **Smart Grid Demonstration Project at USF in collaboration with Duke Energy:** Implementation of a “Smart Grid” with advanced sensors, communication and control technologies
- **Micro-grids:** PV and PHEV integration, micro-grid modeling and control, grid-tying inverters/converters, and energy storage (FIU, FSU, UCF, and UF)
- **Real Time Digital Simulation (RTDS):** By FSU Center for Advanced Power Systems
- **Grid Security**
- **Power Electronics, Micro Invertors**
- **Power Systems**
- **Energy Use Behavior**



Integration of Renewable Energy Sources into Grid with Energy Storage



Fuel Cell Research

- Membrane Electrode Assemblies (MEAs) by using carbon nanotube “bucky paper” for PEM Fuel Cells, By Dr. Jim Zheng, FSU; **Formed Bing Energy, Inc. with his technology.**
- Direct Methanol FC, By Dr. Jim Fletcher, UNF and Dr. Bill Lear, UF
- PEM FC, Membrane Degradation Mechanisms, by FSEC/UCF



Direct Methanol FC Prototype

Capturing Florida's Marine Energy Resources

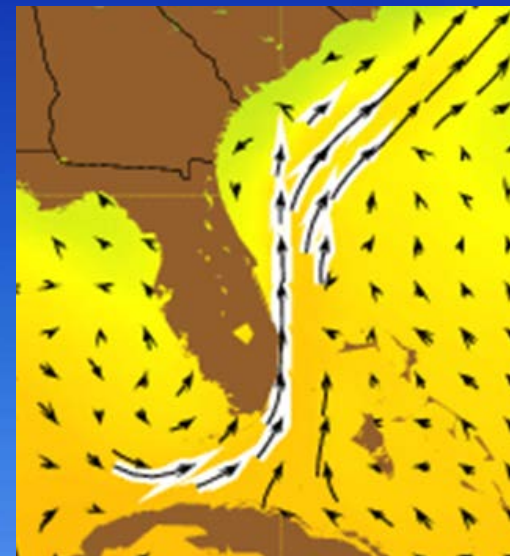
FAU Center was designated by US DOE as Southeast National Marine Renewable Energy Center (SNMREC)

Research Focus: Marine and Hydrokinetic (MHK)

Renewable Energy: Harnesses ocean current energy to generate electricity

Approach:

- Working with stakeholders, identifying barriers to market acceleration of MHK projects and solve through research, testing, and education.
- Focus areas include technological, environmental, and regulatory challenges.



Capturing Florida's Marine Energy Resources

Highlights

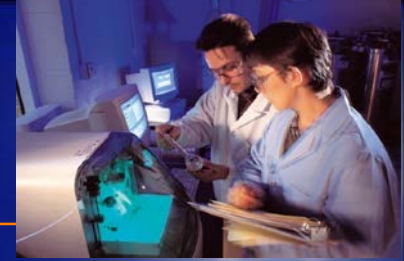
- Received **1st lease for conducting MHK activities on the U.S. outer continental shelf** in June 2014 to install small-scale ocean current turbine offshore testing infrastructure.
- Built a 20-kW 3m rotor diameter research turbine to investigate various technical and scientific gaps.
- Preliminary turbine tow tests complete



FESC USER FACILITIES

- 28 User Facilities within SUS
- Some Examples:
 - *Advanced Materials and Engineering Research Institute (AMERI) at FIU*
 - *Center for Advanced Power Systems (CAPS) at FSU*
 - *Photovoltaic Materials Laboratory at FSEC / UCF*
 - *Building Science Laboratory at FSEC / UCF*
 - *Materials Characterization Facility (MCF) at UCF*
 - *Major Analytical Instrumentation Center at UF*
 - *Particle Analysis Instrumentation Center (PAIC)*
- Posted at http://www.floridaenergy.ufl.edu/?page_id=14832

FESC Successes to Date - Research



Leveraged \$38 million in state appropriation to obtain \$425 million in energy research funding from third parties

Resulting dissemination of over 1000 publications and 1000 presentations – promotes Florida's energy capabilities and technical leadership helping to attract energy industry and energy funding to FL

Selected Award Examples

- US-India Joint DOE Clean Energy Research and Development Center in Biomass – UF Led
- US DOE funded FEEDER (Foundations for Engineering Education for Distributed Energy Resources) Consortium (UCF led with UF and FSU)
- Low Cost Thermal Energy Storage System Using Phase Change Materials funded by US DOE – USF Led
- FAU - designated by DOE as one of three National Marine Renewable Energy Centers
- Nation's only university-based Photovoltaic Regional Test Center at UCF, funded by NSF
- Electric Vehicle Transportation Center at UCF/FSEC funded by US DOE

FESC Successes to Date - Technology Commercialization

FESC Technology Commercialization Program

- Funding early stage market research/business plans – Phase I
- Matching funds for companies to leverage their R&D budgets – Phase II

Startup Companies – 32 companies formed based on university developed technologies

Technology Licensed – 101 licenses

Invention Disclosures – 459 submitted

Job Growth

- Across all diverse aspects of emerging energy technologies
- Over 100 new jobs

FESC Successes to Date – Education- Outreach

On-line Energy Certificate Program and 8 New Energy Courses

Over 100 specialized *Industry* Training and Education Events

Workforce Development - Program implementation with Florida Advanced Technological Education Center (FLATE).

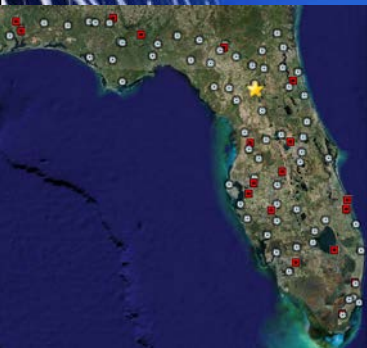
- Developed two energy degree programs

- Alternative Energy Technologies
- Industrial Energy Efficiency

Outreach to the Public

UF Program for Resource Efficient Communities

- Over 50 Fact Sheets prepared to help Florida citizens better conserve and increase energy efficiency
- Sustainable Floridians program (8 week training program preparing Florida citizens to be ambassadors for sustainability)



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