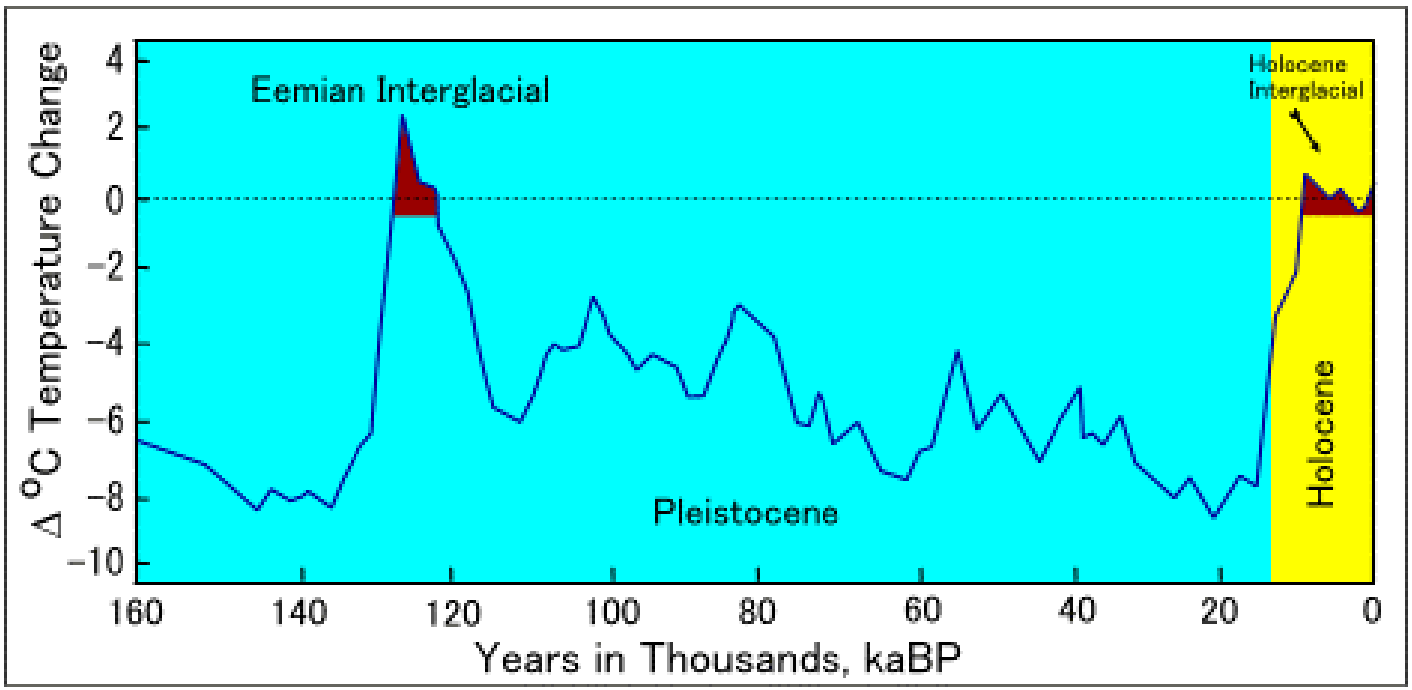
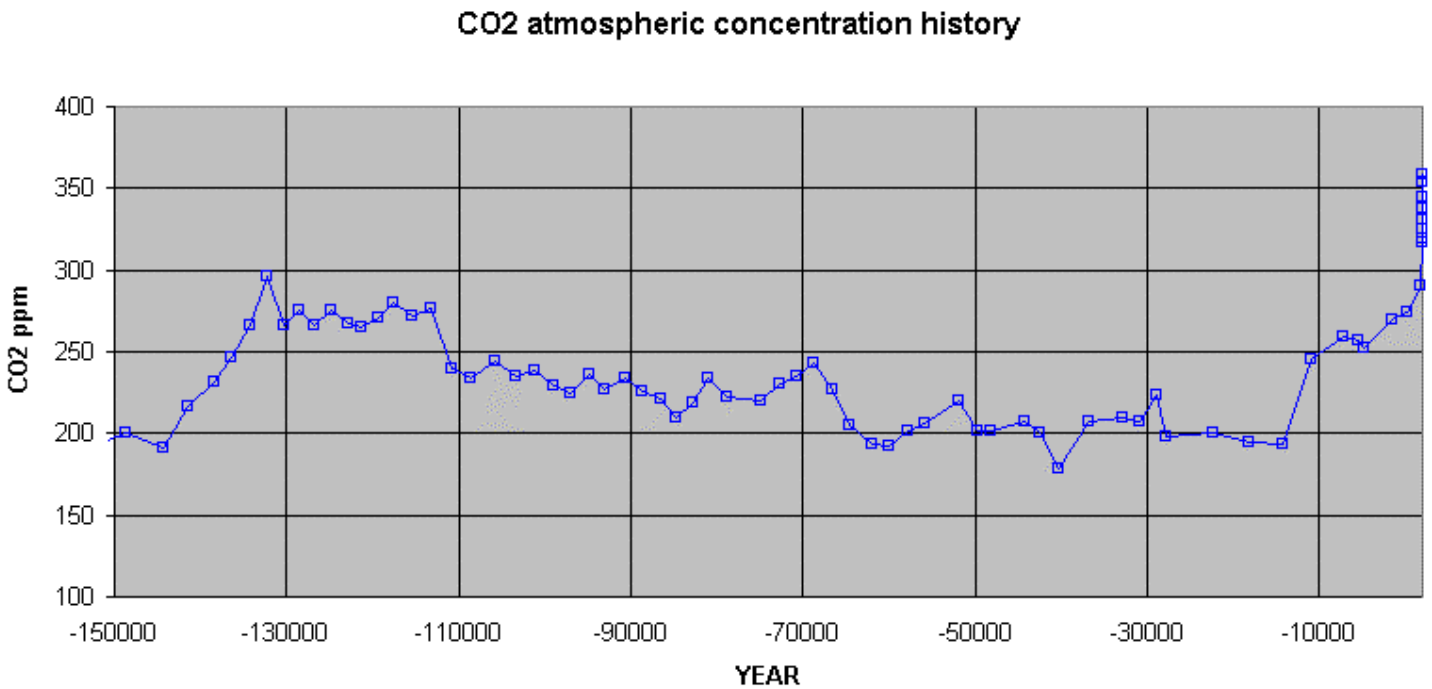
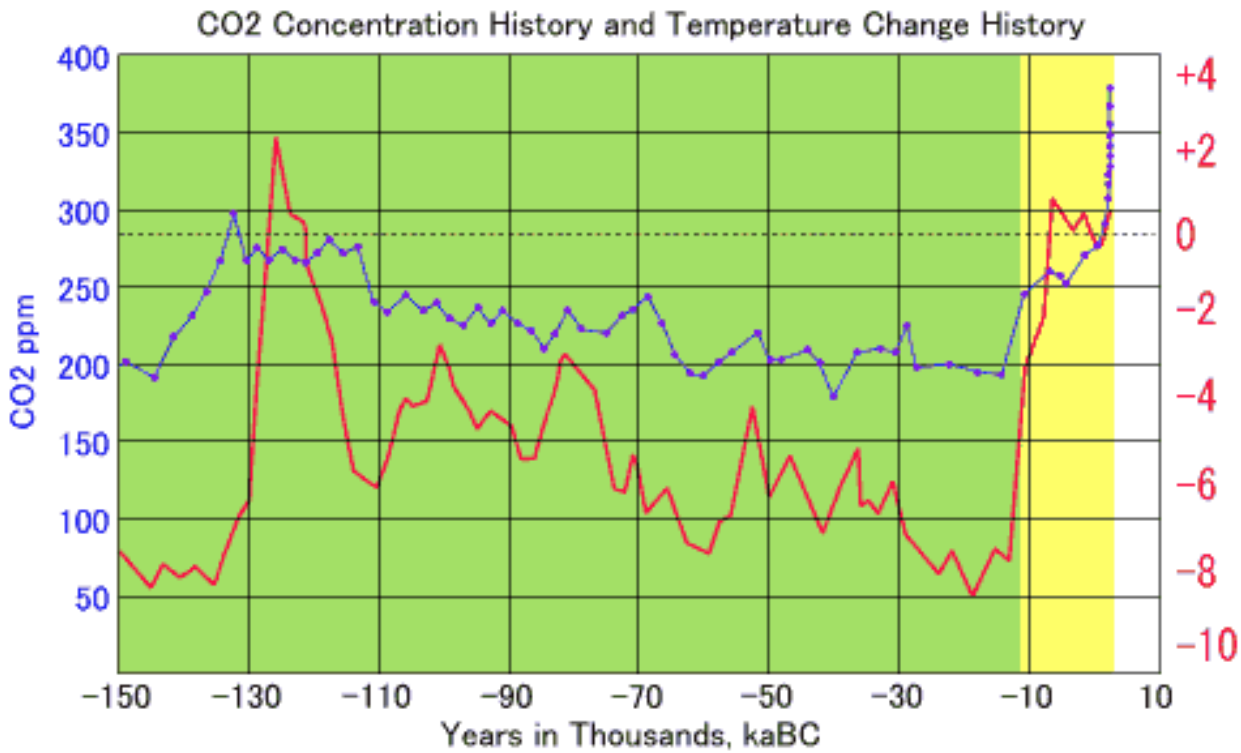
Temp data


Δ °C Temperature Change
4
2
0
−2
−4
−6
−8
−10
Eemian Interglacial
Holocene Interglacial
Pleistocene
Holocene
160
140
120
100
80
60
40
20
0
Years in Thousands, kaBP

Ice Core Data



CO2 and Temp


CO2 Concentration History and Temperature Change History
CO2 ppm
400
350
300
250
200
150
100
50
+4
+2
0
−2
−4
−6
−8
−10
−150
−130
−110
−90
−70
−50
−30
−10
10
Years in Thousands, kaBC

Significant Industrial Partnership in Energy: *Advanced Turbines and Energy Systems: Jay Kapat*

Siemens – UCF Research Collaboration:

"*This technical collaboration should establish UCF and Siemens as academia-industry partners in the betterment of Florida's economy*." Mr. Randy Zwirn, President and CEO, Siemens Westinghouse Power Corporation, August 24, 2005.

- **$370K (including state match) for laboratory construction.**
- **$0.5M in material processing and other equipment.**
- **8200 sq ft of new building: Siemens Center for Advanced Turbines and Energy Systems.**
- **More than $1M in research funding expected per year.**
- **Will build on currently ongoing activities in advanced cooling and coatings.**
- **UCF dominant in federal and industry research funding in turbines in FL ($4.6M since 2000)**

Significant Industrial Partnership in Energy: *Advanced Turbines and Energy Systems (continued)*

- **Immediate areas of focus:**

- **Advanced Cooling, Aerodynamics, CMC, Coatings,**
- **Combustion, Materials, Manufacturing, Rapid Prototyping,**
- **Mechanics of Materials, NDE, Secondary Flow,**
- **Sensors, Probabilistic Design, Wear.**

Activities will be expanded to cover other modes of power generation and energy systems

The above list includes faculty from multiple departments of CECS, AMPAC, and CREOL.

Significant Industrial Partnership in Energy: *Multiphase Transport Phenomenon: R. Kumar*

➢**Industry University Cooperative Research Center(IUCRC) – NSF:**

- **>$1M over 5 years**
- **New facility of 4000 sq ft to be built**

- **<u>Partners:</u> Petrobras, Conoco-Phillips, Chevron, Seepex, Two-Phase Flow Solutions**

➢**Direct research contracts:**

- **Petrobras: $650K**

- **Conoco-Phillips: $500K pending**

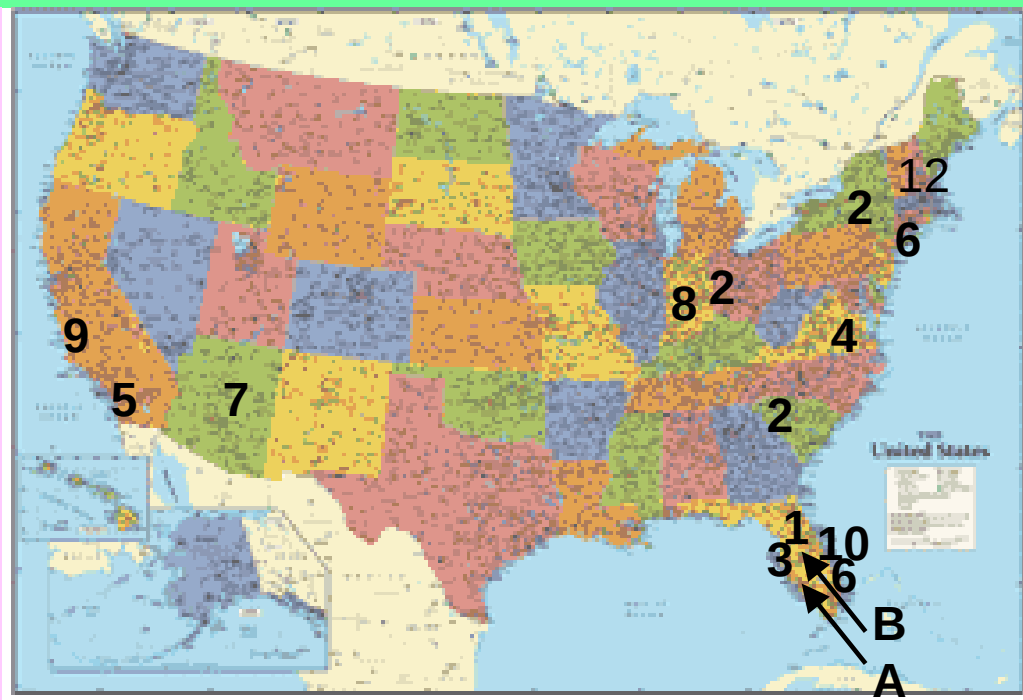
Florida's claim to the power generation industry

Vendors for large/medium machines:

1. **Siemens**
2. **General Electric**
3. **Mitsubishi Power Systems**
4. **Alstom**
5. **Solar Turbines**
6. **Pratt & Whitney** ->
   Agilis, Belcan, FTT (P&W spinoffs)
7. **Honeywell**
8. **RR Allison**

Vendors for microturbines

9. **Capstone**
10. **Elliott**
11. *Bowmen*
12. **NREC**
13. *Honda*



Integrated Gasification Combined Cycle (IGCC): most practical and immediate answer to environmentally friendly power generation solution based on clean coal (abundant in USA)technology.

Out of ~30 worldwide IGCC (integrated gasification combined cycle) power plants (12 in USA),

A. the first commercial plant is in Florida, AND

B. one of the latest is scheduled to be in Florida.

Pending Proposal for Federal Priorities: Advanced Turbines, Energy and Environment

SUS of Florida Turbines Research Initiative

SUS Lead: Dr. Jay Kapat, University of Central Florida

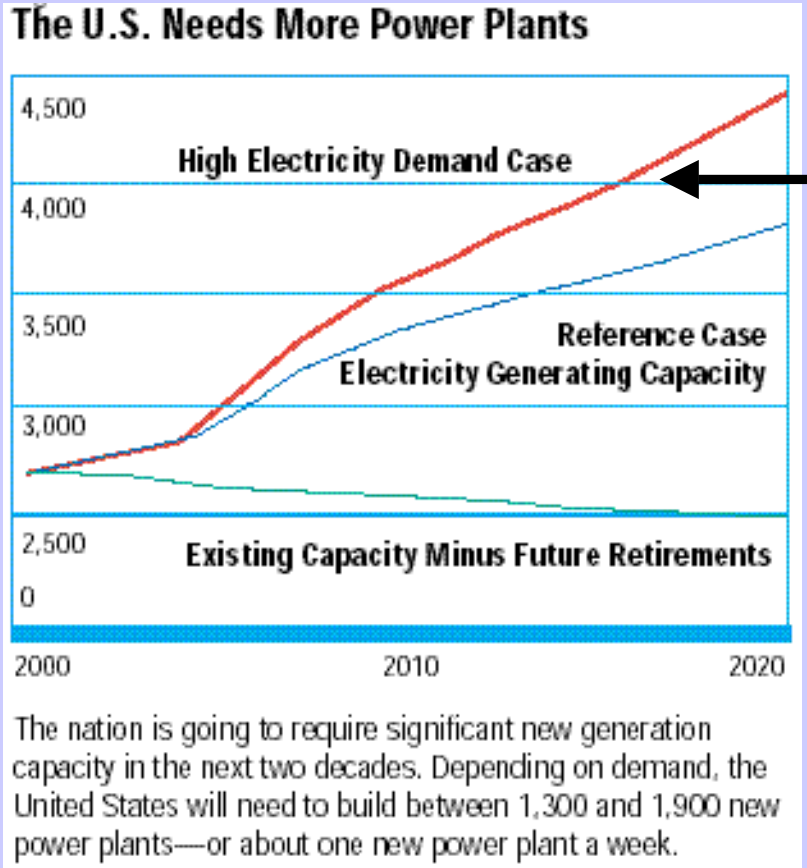
Current team involves 7 Florida Universities

Primary Components

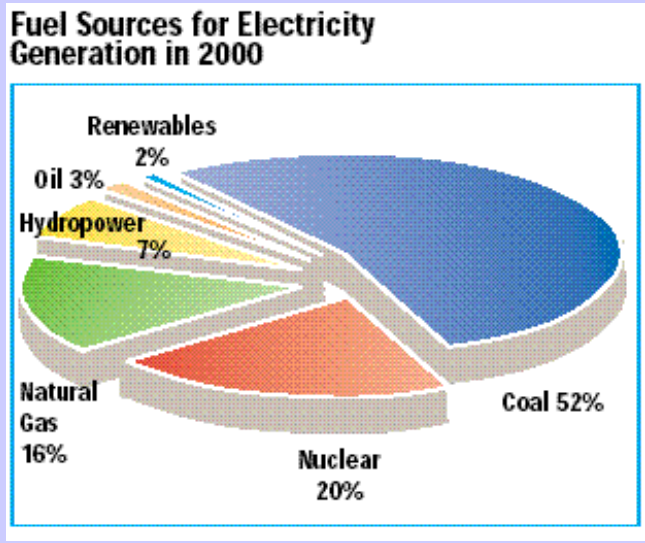
- **Higher efficiency and lower emissions in power generation**
- **Use of coal gas, synthetic gas & hydrogen for gas turbines**
- **Capture and sequestration of carbon from power plants and power conversion devices**
- **Distributed generation**
- **Multidisciplinary research & Design optimization through concurrent engineering**
- **Education and training to students, teachers and practicing engineers**
- **Outreach efforts in making public conscious about energy and environment**
- **Funding level: $5.5M per year**

Excerpt from National Energy Policy

Prepared by National Energy Policy Development Group (headed by the Vice President)



We need about one to two new power plants a week!!



Yet the new generation capacity must meet strict environmental regulations.

Business as usual WILL NOT work

⇒Challenge and Opportunity

DOE/UTSR Project – E. Petersen and F. Xu

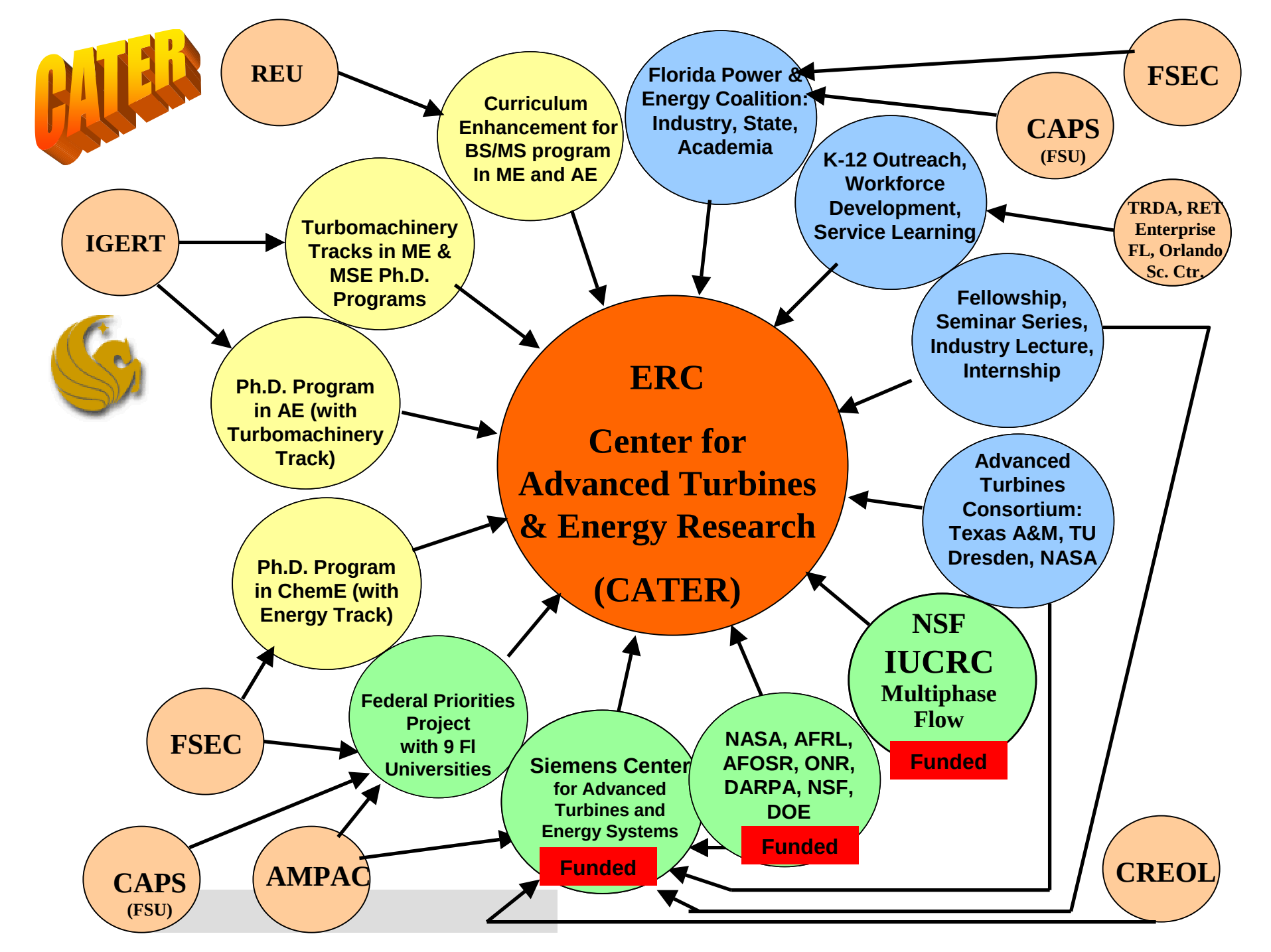
Combustion Characterization and Modeling of Fuel Blends for Power Generation Gas Turbines

- **Obtain Kinetic and Ignition Data** for Fuel Blends at Gas Turbine Conditions
- **Provide Practical Autoignition Data** for Immediate Usage
- **Generate Flame Speed Data** for Fuel Blends at Gas Turbine Conditions
- **Identify Improved Kinetics Models**
- Extend Study and Chemistry to Realistic Conditions Using **Numerical Modeling**

Energy Industry: An Industry with Multiple Facets

Primary Energy Sources	Energy Conversion	Energy Distribution	Energy Utilization
Coal	*Gas Turbines*	*Electricity*	Residential
Petroleum	*Steam Turbines*		
Natural Gas	*IGCC*		
Nuclear Fission	*Nuclear Power Plants*	*Gasoline/ natural gas*	Industrial
Biomass	*Wind Turbines*		
Wind	*Water Turbines*		
Solar	*Photovoltaics*	*Hydrogen*	Transportation
Hydroelectric	Photochemical		
	Fuel Cells		

Our current research / future plan address all of the highlighted items.


CATER
REU
Curriculum Enhancement for BS/MS program In ME and AE
Florida Power & Energy Coalition: Industry, State, Academia
FSEC
CAPS (FSU)
K-12 Outreach, Workforce Development, Service Learning
TRDA, RET Enterprise FL, Orlando Sc. Ctr.
IGERT
Turbomachinery Tracks in ME & MSE Ph.D. Programs
Fellowship, Seminar Series, Industry Lecture, Internship
Ph.D. Program in AE (with Turbomachinery Track)
ERC
Center for Advanced Turbines & Energy Research
(CATER)
Advanced Turbines Consortium: Texas A&M, TU Dresden, NASA
Ph.D. Program in ChemE (with Energy Track)
NSF IUCRC Multiphase Flow
Funded
Federal Priorities Project with 9 Fl Universities
FSEC
NASA, AFRL, AFOSR, ONR, DARPA, NSF, DOE
Funded
Siemens Center for Advanced Turbines and Energy Systems
Funded
CAPS (FSU)
AMPAC
CREOL