



The Florida Energy Systems Consortium

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The Florida Energy Systems Consortium (FESC) was created in 2008 by Florida statute to promote collaboration among the energy experts at Florida’s 11 public universities for the purposes of sharing energy-related expertise and assisting in the development and implementation of a comprehensive energy strategic plan for the state. The legislature provided approximately \$40M for energy research, education, outreach, and technology commercialization at five of the Florida universities. The Consortium was charged with performing research and development on innovative energy systems that lead to alternative energy strategies, improved energy efficiencies, and expanded economic development for the state.

Strategic Research Thrusts of FESC

The State University System (SUS) has considerable energy-related expertise and competitively funded research, but very little research is being directed at integration. The FESC research plan is thus based on the premise that the overarching energy-related research and innovation opportunities are at the systems level. The Consortium’s research focuses on the use of Florida’s two most abundant renewable energy resources (biomass and solar), carbon-free electric power generation (nuclear power, carbon sequestration), tapping the energy available from the ocean along our long and populated coastline, reducing consumption through energy conservation, and defining more efficient load management and energy storage systems.

Strategic Research Thrusts

The FESC research program is focused on seven strategic research thrusts, including the overarching Energy Systems thrust. These thrusts were defined on the basis of the perceived needs of the State of Florida. There are 68 projects under the consortium. The existing funding is being leveraged to obtain competitive funding to establish new programs.

A brief description of each thrust is given below.

1- Overarching Strategic Research Thrust: Understanding Florida's Energy Systems

An advantage of the consortium is that it collects the research expertise across the entire SUS and thus can conduct energy research more broadly. The key strategy of FESC is to inject a systems approach to energy research. This thrust will provide a platform for each of the other thrusts and allow direct connection to Florida's energy economy. This thrust unites existing strengths in energy science and engineering with recognized expertise in non-traditionally studied energy areas, including Law, Public Administration and Policy, Economics, Environmental Studies, Geography, Urban and Regional Planning, Information Systems, Social Sciences, and Media Arts. These experts will assist Florida's governing bodies in the development and implementation of a comprehensive, long-term, environmentally compatible, sustainable, and efficient energy strategic plan. It will do so by performing select and recurring analyses to provide objective and quantitative policy assessments. It will help evaluate and identify critical energy infrastructure, such as sighting, de-risking, capitalization, licensing, permitting, and governing.

2- Enhancing Energy Efficiency and Conservation

Energy efficient technologies and practices have the greatest potential to reduce Florida's energy consumption. The focus is improving existing and new residential and commercial design and construction building efficiency and energy system integration for sustainable community developments, industry energy auditing and efficiency, outreach, and education. Buildings use more energy than any other sector of the economy, including transportation and industry, thus making it a major efficiency target. The integration of innovative energy-efficient technologies and practices into our building operations and construction results in cleaner, healthier, and more sustainable and economically viable communities that are less susceptible to disaster.

3- Developing Florida's Biomass Resources

Biomass offers tremendous opportunity as a major, near-term, carbon-neutral energy resource. Florida has more biomass resources than any other state; ~7% of the U.S. total. Efficient biomass conversion is a complex system depending on locally available resources due to high shipping costs of low energy density biomass. The most efficient technologies to harness these resources are regionally specific and demand a systems approach. Cellulosic ethanol and gasification processes are just entering the early commercial phase and offer many opportunities for improvement. These improvements are urgently needed to reduce capital costs and facilitate commercial deployment, thus creating a new industry and new employment for Florida. The Florida State University System has internationally recognized contributors to biomass energy research.

4- Harnessing Florida's Solar Resources

The direct conversion of incident solar radiation to electric power is the ultimate sustainable energy source. It can be implemented in a distributed mode and fed to an existing distribution system (grid). Florida is one of the richest states in solar insolation, receiving ~6 kWhr/m²/day. Therefore, an appropriate strategy for the Sunshine State is to include a significant solar component in its renewables energy package to offset growth in energy demand. This will be implemented in part by encouraging broad deployment of solar technologies and developing a Florida industry to meet the demand. The SUS solar expertise is one of the largest and best in the country and serves as a research and education base to attract industry.

5- Ensuring Nuclear Energy & Carbon Constrained Technologies for Electric Power in Florida

Nuclear energy provides large-scale, carbon-free electric power generation today and will remain a major contributor to our power needs. Florida's existing nuclear energy workforce at the state's five existing facilities will soon witness significant personnel retirement in many critical disciplines. Additionally, an aggressive new plant strategy that is currently being pursued will require an expanded workforce. To meet these demands, an existing training reactor with the only digital control system within the nation will be used to provide training in critical areas such as design, construction, operation, fuel reprocessing, and waste remediation.

Development of clean coal and natural gas power generation with carbon sequestration is important for a carbon-constrained world since fossil fuels are the largest contributor to electric power generation. Advances in efficiency, demand response and management techniques, carbon capture and sequestration technologies and how these can be integrated into new fossil fuel generation plants are critical to meeting energy demand at an affordable cost. A particular focus of this thrust is exploring carbon sequestration technology relevant to Florida's geography.

6- Exploiting Florida's Ocean Energy Resources

Ocean energy is an emerging technology that uses the power of ocean currents, waves, tides, and salinity gradient to create renewable energy. Tapping ocean energy resources will reduce our reliance on fossil fuels. Research areas of focus include ocean current and thermal differential systems, cold, deep ocean water-based air-conditioning, underwater hydrogen generation and storage, and environmental impact and mitigation.

7- Securing our Energy Storage and Delivery Infrastructure

Increased electricity demand and severe weather adversely impact the reliability and resilience of Florida's electric power infrastructure. The next generation diversified portfolio of distributed renewable energy generation cannot become reality if electric infrastructure is not developed in conjunction with disparate supplies. Furthermore, the intermittent nature of some alternative power generation systems (e.g., solar and wind) will require advanced storage solutions. Research possibilities include investigation of grid topologies, equipment and systems (e.g., power electronics, transformers, and substations), revenue metering, monitoring and control aimed at improved reliability, power quality, availability and resiliency of the transmission and distribution system.

Industrial Collaboration and Technology Commercialization

FESC has an Industrial Partnership and Innovation Strategy that assures active collaboration with the private sector and other partners who support and guide FESC's vision, collaborate with FESC in our research, education, innovation, and outreach programs, and provide our students with an unparalleled educational experience to prepare them as R&D and innovation leaders of tomorrow. FESC's industrial collaboration program is designed to be an effective and efficient avenue for industry to guide FESC activities and benefit from the research, education and outreach activities of the Consortium. The program promotes a meaningful exchange between the partner universities and industrial partners from small, medium, and large companies, as well

as other organizations such as incubators, research parks, investors, entrepreneurs, and government laboratories.

Education and Outreach

The Education program has three focus areas, community college programming at the Associate of Science and certificate level, nuclear energy education, and a Masters degree in sustainable energy.

The Community Colleges offer an opportunity to develop a trained energy workforce through programming for both technician level 2 year students, as well as students planning on completing a Bachelors degree.

FESC works closely with the Florida Community College system as well as with the Florida Advanced Technological Education Center (FLATE), which coordinates the design of industry specific training programs for technicians at the community colleges in Florida. FESC disseminates energy curricula in cooperation with FLATE.

On the Collegiate Level, programming includes curriculum directed at the workforce for the nuclear industry, which now operates five nuclear power plants (FPL and PEF).

FESC outreach plans leverage the existing network of UF extension offices to reach out to each of our communities. The Florida Cooperative Extension Service has experience developing and delivering educational programs and products related to energy and resource-efficient community development with emphasis on housing. These programs and products include targeted continuing education courses for licensed builders, architects, engineers, landscape architects, interior designers, and others. Also, the UF Program for Resource Efficient Communities is an interdisciplinary group that promotes the adoption of best design, construction, and management practices in new residential master planned developments. FESC works with these existing networks to provide programming on efficient use of energy and alternative energy generation methods to the general public as well as targeted to specific audiences such builders, land planners, solar panel installers, and architects.

FESC Web Site: www.FloridaEnergy.ufl.edu