Florida Energy Systems Consortium (FESC)

A proposal submitted to the Florida Emerging Technology Commission

By the University of Florida, Central Florida, South Florida, and Florida State University

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Abstract:

A super Center of Excellence is proposed to address energy generation in Florida and its distribution and efficient use while growing the State's energy-related industry. A systems approach will be taken in partnership industry to demonstrate innovative technologies in addition to conducting programs in energy education and outreach.

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Executive Summary

Energy may be the defining issue of this century. Our quality of life, economy, standard of living, and security depend on clean, affordable, and reliable energy. The limited supply of fossil energy, its accelerated consumption, impact on global warming, and the dependence on its supply from unstable countries are major U.S. economic and security issues. Moreover, due to Florida's unique coastal geography and southern latitude, it is the state with both the most to gain by harnessing its abundant renewable energy resources and the most to lose if it doesn't. Fortunately, the state is rich in renewable energy resources, particularly biomass and solar, and has over 40 years experience operating nuclear power facilities. These facts were clearly communicated at the Summit on Global Climate Change sponsored by Governor Crist, and by his recent Executive Orders 07-126, -127 and -128.

To address these issues we propose to establish the Florida Energy Systems Consortium super Center of Excellence to bring the expertise of the State University System (SUS) to contribute to this complex problem. ***The premise of the Consortium is that the overarching energy-related research and innovation opportunities are at the systems level.*** The proposed Consortium will not only aggregate our energy research expertise to leverage its value, but also enable the broad systems approach necessary to provide a solution to the State's energy needs rather than merely advocating a particular energy resource or technology. The Consortium will focus on the use of its two most abundant renewable energy resources (biomass and solar), its best prospect for a large-scale, carbon-free new electric power generation (nuclear power), and reducing consumption through energy conservation, including more efficient load management.

Overarching these specific Florida-centric strategies is a systems approach to energy integration, which, at the highest level, will provide objective energy, economic, and policy analysis. Energy system performance will be evaluated from resource to consumer. Florida specific resource/technology areas will be targeted, barriers to deployment and commercialization identified, and research (ranging from fundamental through commercialization) performed to overcome these barriers. In addition, the Consortium will design programs to prepare a well-qualified energy workforce, assist in outreach to the consumer, develop systems analysis tools, provide analysis of proposed policies, and promote the location of the high-growth renewable energy industry within the state.

The research will be based on technologies such as more energy efficient homes and buildings, advanced photovoltaic/solar technologies, biofuels from cellulose and waste resources, fuel cells, batteries, and plug-in-hybrid vehicles to name just a few. These technologies and the associated energy industry are projected to be the greatest growth sector of the U.S. economy, and the proposed Consortium will provide the mechanism for that industry to take root and flourish in Florida. One of the key challenges for industry is the transition from laboratory-scale research to commercial production. Therefore, a major focus of the Consortium will be to expedite commercialization of innovative energy technologies, by taking advantage of SUS high tech incubators, industrial parks, and industry driven research centers to attract companies to establish manufacturing in the state. Not only will this new industry and resultant job creation have a major impact, but deployment of the resulting Florida energy resources and Consortium derived technologies will improve all sectors of the state's economy, especially with respect to from the cost of electricity and transportation-fuel to the tourism and agriculture industries, to the cost of home and business ownership. *There is no single issue that will have a greater impact on*

Florida's economy, and the proposed FESC is unique in its combined expertise and comprehensive systems approach.

Industrial Need and Outcome

A dramatic restructuring of the energy marketplace is taking place. Perhaps the most compelling evidence for this need is gleaned from the 42 support letters collected from industry. These letters commit $12.7 million in cash and $10.6 million in-kind to the Consortium, and indicate planned investments estimated at nearly $600 million in new plants and research and development in the State. It is being driven by the rapidly increasing cost of fossil fuels coupled with expanding world-wide demand for energy as well as increasing value placed on sustainability. This rapidly changing market place is an opportunity for industry to introduce innovations and capture new markets. It is also an opportunity for Florida to develop its own energy industry; exploit its rich bio- and solar-based generation capacity, expand its nuclear capacity, and rotate to more energy efficient living and working environments - all of which have the potential to create jobs, reduce our dependency on energy imported from other states, and make our energy infrastructure more resilient. Thus a need exists to help our existing industry (e.g., assisting the transportation sector with bio-based liquid fuels, construction industry with more energy efficient strategies and an informed public). Perhaps more urgent is the need to attract the emerging renewables energy industry, which will need access to university research, an educated workforce, and an attractive state climate.

There is clearly a compelling need to collect the energy expertise in our research universities to assist the development of the Florida energy industry. By design, the obvious near term outcomes of the Consortium's activities are the demonstration of the proposed initial thirteen systems goals. Each goal has strong industry commitment with specific deliverables that promise to demonstrate a technology that will lead to commercialization. Other potential outcomes include:

1. Increase Florida's Energy Independence

- Improving energy efficiency has not been fully exploited. This program will work with urban planners, builders, and architects to design more energy efficient communities (buildings account for ~84% of total electric power use in Florida). A zero-energy home will be demonstrated to learn more about its operation, to test innovative components, and educate the public.
- The base power generation is now largely fossil-based and this program will assist the utilities industry in evaluating carbon sequestration approaches, training of a nuclear workforce, and demonstrating advanced integrated demand-side energy management schemes with a potential 25% reduction in Florida's electric generation growth needs.
- Florida leads the nation in sustainable biomass production each year and the Consortium aims to genetically engineer energy intensive crops. With the refinement of cellulosic ethanol, gasification, pyrolysis, and anaerobic digestion technology, this biomass could serve as a feedstock to produce all of the automotive fuel and chemical feedstock needs of our State. The recent State investment ($20M) in a cellulosic ethanol plant at Florida Crystals Corp will produce ~2M gal/yr and serve as test bed alternative biomass feedstocks.
- Solar energy is Florida's most abundant domestic energy resource with twice the solar resource of the world's largest photovoltaic market. The team is very excited about the proposed collaboration with industry to assist in the design of a 300 MW solar thermal combined cooling/heating facility (FPL) and a 14 MW thin film photovoltaic power production facility (Dunnellon Solar1), making it one of the largest in the world. Additional

systems (e.g., balance of systems integration in PV modules, phosphate tailings to electronic grade Si to Si solar modules, an integrated PV/battery/solid state lighting system, and low-cost thin film PV process innovations) will be pursued to demonstrate PV power generation systems to grow a Florida-based PV industry.

- Industry also has a need for a skilled labor force. The Consortium is uniquely positioned to prepare this workforce and will develop a distance delivered MS degree program in Sustainable Energy and Power Engineering, work with the state's community colleges to prepare technicians, and use the agriculture extension service to introduce energy efficiency innovations into our communities.

2. Enhance Florida's Energy Security

- Local fuel production using available biomass makes Florida less susceptible to fuel shortages and disruption following catastrophes, both natural and intentional.
- Distributed power generation technology (e.g., solar PV, solar hot water, and fuel cells) allows those whose power is disrupted to have a source of power. Distributed generation also has the ability to reduce line losses and infrastructure utilization.
- Implementation of real-time transient analysis monitoring systems will improve security at the wide-area utility distribution level in Florida.

3. Produce Commercial Spin-Offs and Local Job Creation

- The commercialization of the proposed Consortium's research will be accelerated by the more than 40 existing energy-related incubators and centers within the SUS (see Economic Opportunity section) as well as the by the award winning and nationally ranked offices of technology and licensing. A focus on energy, however, is needed to capitalize on this rapidly growing industry segment.
- The Consortium's current energy research base of $81M annually, combined with a time-tested IP property policy that strongly encourages faculty innovation for commercial applications, produces approximately 65 inventions annually. The combined four universities have had an impressive 14 spin-off companies in the last three years alone, many of which were in the energy area. Selected examples include: two spin-offs based on UF microbial biocatalysis for biomass conversion into ethanol (Verenium) and biodegradable plastic monomers (BioEnergy LLC); Petra Solar is a PV inverter manufacturing firm that licensed UCF's *Grid-Tie* power conversion technology; and the *Gossamer Wind*® series ceiling fan, licensed from UCF by the King of Fans, is saving consumers $22M annually in energy costs. The CDQ cooling system licensed to Trane Company recently won a 2006 R&D 100 Award from R&D Magazine.
- The energy industry is characterized by high-skilled, high-wage jobs. Furthermore, the renewables industry generally creates a large workforce. For example, the Vote Solar Initiative estimates that 54,000 job-years would result from a 4 GW solar capacity by 2020. As another example the SRI concept upgrading phosphate tailings Silicon solar cell modules suggests a multi-billion dollar industry, which is similar in size to Florida's aerospace/defense industry.

4. Elevate Florida's Leadership

- The envisioned comprehensive systems approach to energy solutions fills a gap in the U.S. research landscape, thus distinguishing the SUS and the state. Furthermore, industry success will be based on providing effective energy systems, thereby ensuring relevancy of the Consortium's activities.

- Considerable energy-related federal funding has been and should be available for both research and demonstrations, and funding FESC will enhance the SUS competitiveness. Furthermore, researchers will be able to advance into larger scale systems that will make them more competitive for industry funding.
- The renewables industry is rapidly emerging, the nuclear industry will soon expand, and investment in energy efficiency is becoming more attractive. A strong university program is necessary for the state to participate economically in this growth.
- The proposed Consortium will be able to provide critical and objective systems analysis to assist industry and government in making prudent energy-related decisions.

University Capabilities

The SUS research capabilities are perhaps the state's most significant energy research resource. It makes good sense that these research capabilities be used to ensure the state has a secure energy future.

Energy Research The SUS has strong programs in basic and applied research related to the generation, distribution, and efficient use of energy (see for example *www.Energy.ufl.edu*). Over 250 faculty members are currently engaged in energy related research in areas ranging from renewables to nuclear to power distribution. In just the last 3 years the four collaborating research universities have been awarded in excess of $188M in competitive federal and state funding in power and energy research. The consortium members have led numerous federally funded programs in cellulosic ethanol, building energy efficiency, photovoltaics, Generation III and IV nuclear reactor designs, and hydrogen and fuel cells. Unfortunately, there is not a mechanism to bring together the university researchers with those in industry to address systems level problems. FESC will correct this situation.

Industrial Collaboration The Consortium will establish an office to coordinate the offices of technology and licensing at the four universities to coordinate industrial collaboration and provide commercialization assistance. To assure timely transfer of *FESC*'s technologies to the private sector, key industry partners will be engaged at every step of technology development from inception of the research program to commercialization. These partners will participate in our Advisory Board and be actively engaged in selecting the research systems goals, developing the research strategy, collaborating with *FESC* in undertaking the research, monitoring *FESC*'s progress and commercializing the energy technology deliverables from our activities. As an early indication of industry's support of the proposed Consortium, 42 letters of support have been received from senior executives of our industry partners. As evidenced by the breadth of support letters and the senior executive level of commitment, *FESC's* systems approach is strongly supported by both the private and public sectors. This will provide a base to build a vibrant and high paying energy industry sector in Florida.

Plan for Self-Sufficiency

The initial investment by the state in FESC will establish the research infrastructure, management system, and importantly, the credibility to serve as the focus for university-based energy research in Florida. It is anticipated that the Consortium will need recurring funding in the range $3M to $10M annually with ~$1M/yr for administration and the remainder for continued technology development, transfer, and commercialization opportunities (i.e., systems goals), as well as workforce development.

Support for new systems level goals will necessarily rely on collaboration with industry as well as success in winning external awards, most notably from the federal agencies. The industry collaboration fostered in part by our Advisory Board will ensure relevancy of the goals. Based on the added infrastructure produced by the infusion of state funding, it is estimated that the potential funding is at least $10M/yr above current levels. In particular, the electrical utilities in the state spend a combined ~$15 million annually on conservation and energy efficiency technologies, as allowed by the FPSC to be included in the rate basis. We are discussing with the utilities the possibility of pooling about half of these funds through FESC based on an agreement with the FPSC. The Consortium would also be in a position to apply for large federal center-level funding (e.g., NSF Engineering Research Center).

Recurring funding will be derived from several sources. The participating universities have agreed to return 7.5% of the overhead generated from proposals submitted through the Consortium (0.5 to $1M/yr). They have also committed continued funding for faculty positions, fellowships, and other expenses at a combined level of ~$12M/yr. Membership dues in the Consortium are anticipated to generate funding the range 0.25 to $0.4M/yr. In addition, user fees generated from incubator and testing facilities give an estimated potential funding of $0.02 to $0.1M/yr. Longer term, the Consortium members have agreed to return 5% of the licensing fees and royalties on the technologies developed to the Consortium. ***Based on the above plan, the Consortium will potentially generate over $7 million/year after the second year and as much as $15 million to $20 million/year after 5 years from the start.***

Organizational Plan

A relatively simple management plan is proposed that is designed to promote collaboration between researchers within the SUS and with industry and other external partners. It is designed to facilitate the demonstration of innovative energy systems with significant input from industry, leading to economic impact. A full time ***Director*** (Tim Anderson, (UF) interim) will provide focused leadership and will report to the ***Oversight Board***, consisting of the VPs for Research. The Director is steered by input from an industry-dominated, external ***Advisory Board*** and the ***University Council*** (a member from each university). Implementation of the FESC strategic plan is facilitated by two full time ***Assistant Directors*** for Technology Transfer, Commercialization, and Economic Development (P. Vaidyanathan) and Outreach and Education (A. Donnelly). Each systems goal (task) is led by a faculty expert (***PI***) and the technical thrusts for the Consortium as a whole are represented by a ***Thrust Leader*** (1. L. Ingram, UF; 2. J. Fenton, UCF and L. Stefanakos, USF; 3. D. Cartes, FSU; 4. Philip Fairey, UCF; 5. Alex Domijan, USF; 6. Rick Meeker, FSU).

Planned Budget

A detailed project budget break down, including assumptions and estimates, is included in the attached Cost Proposal. A summary of the project funding including funds provided from our industry partners and university cost sharing is presented in the Table below.

Table 1: Summary of Project Funding

Funding Summary ($)					
State Center of Excellence	Industry		Universities		Total Direct
	Cash	In-kind	Cash	In-kind	
40 M	12.7 M	10.6 M	25.2 M	3.0 M	91.5 M

Table 2: Crosswalk

2007 Centers of Excellence Criteria Crosswalk	Proposal Page #(s)
A. Vision, Leadership, and Research Focus (clear and integrated vision and plan to assure success for developing innovative technologies and transferring them to the commercial sector; technology-centric research focus)	1
Additional Considerations:	
A.1 *Evidence that the core team has a past track record of success in comparable endeavors.*	3, 8, 10, 17
A.2 *The scientific strength of the proposal (as supported by external review).*	3,5
A.3 *The relevance of the research and the extent to which it is either waxing or waning.*	1,2,3,5
A.4 *Whether or not the research is wholly new or has been attempted before.*	2,3,5
A.5 *An identification and analysis of the national/world competition and the extent to which it might be displaced by the proposal.*	3
A.6 *The extent to which the research addresses any Florida specific societal issues beyond the stated goals of the legislation.*	1,2,3,5
A.7 *The interpretation of "innovative technologies to include technological processes or applications as well as products.*	2,5
A.8 *Is the investment level appropriate and sufficient to make a difference in the identified technology area, and to result in a sustainable Center?*	17,18
B. Economic Opportunity (potential for positive national and state impact, including a high-skilled, high-wage Florida workforce)	13
Required Criteria:	
B.1 The regional economic structure and climate.	13,17
B.2 The degree to which the applicant transfers advanced and emerging sciences and technologies from its laboratories to the commercial sector.	13,2,8,9, 10
B.3 The degree to which the applicant stimulates and supports the creation of new ventures.	14
B.4 The existence of a plan to increase the likelihood of faculty and graduate students pursuing private-sector careers in the state.	15
Additional Considerations	

Technical Proposal

1. Vision, Leadership, and Research Focus

Rationale and Societal Need

Availability of a sustainable energy supply will play an increasingly important role in our future and will likely be the defining societal issue of this century. The limited supply of fossil fuel, accelerating consumption, impact on global warming, and dependence on supply from unstable countries are major U.S. economic and security issues. The development of environmentally friendly, renewable, cost-effective energy options to power automobiles, homes, and businesses are critical to our nation's future. Moreover, the dire forecast by the Intergovernmental Panel on Climate Change of unabated anthropogenic greenhouse gases (GHG) on our environment indicates this issue is critical to global survival.

At present, fossil fuels dominate world energy markets because they are readily available, have high specific energy content, and most importantly, are currently low cost. Fossil fuels, however, are a finite resource and we are approaching the point where available resources of oil and gas cannot meet the worlds demand. Since Hubbert's prediction in l956 that the U.S. oil production would reach a peak in l973 and then decline (Hubbert, 1974) [1] , scientists and engineers have known that world-wide oil production would follow a similar trend. Today, the only question is when the world peak will occur. Based on the Hubert's predictive model and the 2200 to 3900 billion barrels of ultimate recoverable resources (U.S. DOE 2006), [2] we may be at the peak oil production now or arrive there within the next few years.

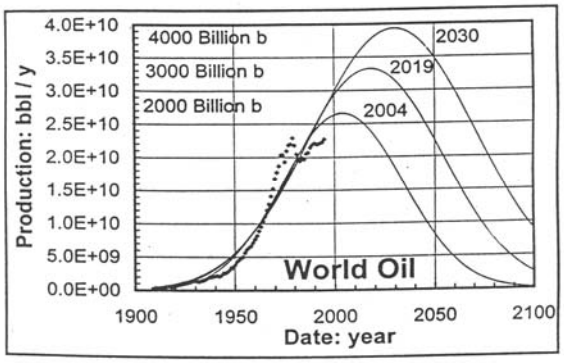

Figure 1: World Oil production for various amounts of recoverable resources (Source: A. Bartlett, mathematical Geology,32,2002) there within the next few years.

Although considerable effort has been directed towards the transition to a "hydrogen economy", perhaps the most promising near term solution for transportation is biofuels. As oil production decreases and the cost of gasoline increases, the fraction of alternative transportation fuels increases. There is urgency for the search for alternative energy sources, and that for the foreseeable future transportation will rely on a mixture of fuels. What is important to take away from the above is that the energy industry is changing rapidly with potential negative consequences for Florida, but also economic opportunities for its people. This means that a higher order system-wide approach to energy is critical. The same can be said for stationary electric power generation, which is currently a mix of natural gas, coal, and nuclear power. Due to the concern for carbon emissions, electric power generation will transition to a solar, biomass, clean coal with carbon sequestration, and nuclear mix. *The proposed Consortium is unique in its capability to address this imminent broad-energy-resource scenario.*

The value of the proposed *Consortium* is that we not only advance the development of the most promising sustainable energy technologies by bringing together recognized leaders in energy technologies, but we focus on the overall system from energy resource to consumer. In so doing we can address the primary performance and economic issues that currently limit the

[1] Hubbert, M.K. 1974. U.S. energy resources: Review as of 1972. In *National Fuels and Energy Policy Study*,93-40 (92-75).

[2] US Energy Information Agency 2006. *International Energy Outlook 2006*, EIA, Washington, D.C.

deployment of these crucial technologies. Moreover, through the 2006 Center of Excellence, the *FISE Energy Technology Incubator* and incubators at the other universities, we have the ability to translate this world class research into commercial products and innovative companies that could revolutionize the most basic societal need – energy.

Energy Systems Vision

The utilization of energy involves a very complex system including conversion, storage, distribution, and utilization. For new, efficient technologies and renewable energy resources to be utilized, the entire system needs to meet consumer expectations. Most research, however, has focused on addressing current limitations of one technology or another, rather than addressing the system as a whole. It is the premise of this Consortium that a systems approach to energy is the opportunity for innovation, economic impact, and relevancy to industry.

Our vision is to take a multidisciplinary systems approach to developing sustainable energy technologies and resources. The system performance will be evaluated from resource to consumer, based not just on technology but also on economics, environmental impact, and consumer acceptance factors. To reach this objective, fundamental research is required in specific technology/resource areas that need improvement. Research results from these science and technology thrusts will then be integrated into systems analysis and compared with current and alternative technology/resource systems.

The goal is to address this urgent need through collaborative research and development across the SUS and industry, so that Florida is recognized as a world leader in energy research, education, technology, and policy development. Achievement of this goal is critical to attracting high tech energy companies to Florida. Furthermore, the Consortium will increase our competitiveness in external funding to the SUS and extent of industry collaboration. Additional specific goals are:

1. *Coordinate and initiate greater collaborative interdisciplinary energy research:* By coordinating the extensive SUS energy expertise an opportunity exists to become the recognized leader in an energy systems approach. The vision is that new breakthroughs will occur through systems integration and intensification (e.g., electricity/hydrogen cogeneration) and a national need exists in systems analysis (e.g., catastrophic event response and objective energy system cost analyses). Therefore, an integrated energy systems approach is necessary to determine the best options for a sustainable future, taking into consideration environmental, economic, and manufacturability impacts. The proposed Consortium will integrate expertise, provide leadership in external collaborative research opportunities, promote recognition, and communicate value to state and Federal governments.
2. *Create a Florida Energy Technology Industry:* Provide the necessary research and technology development capability, through augmentation of our research infrastructure and use of our existing centers and incubators, to attract high tech companies in the energy field to Florida and continue to support them during their development, and in so doing, provide the conduit for technology commercialization and job creation.
3. *Provide a State Resource for Objective Energy Analysis*: Assess energy technologies, environmental impacts, economics, policy, and law. Develop the systems evaluation and integration approach necessary for implementation of the energy technologies for both the electric power and transportation sectors.
4. *Develop education and outreach programs to prepare a qualified energy workforce and informed public:* An evolving energy industry requires a prepared workforce of engineers, scientists, economists, public policy experts, and others. Successful research requires Ph.D.s

educated in the energy field. Further, the public needs to become energy aware if they are to make sensible choices. The Consortium would develop a M.S. degree program as well as courses and modules, technician training programs for both on-campus and distance delivery. A more detailed description is given in the Management and Infrastructure section.

Leadership

The SUS energy expertise has both the breadth to develop system wide answers to our energy problems and the depth to successfully compete for awards from the most fundamental NSF or DOE solicitations. In fact the faculty identified below with the research thrusts, are already leaders in their respective fields (*see resumes*). For example, they preside on the Governor's Climate Change Action Committee, provide testimony to the U.S. Congress and the Florida PSC, and serve in various advisory roles to NSF, DOE, and other federal and state agencies. Since energy solutions are often region dependent, the SUS understands as well as any the region. Quantitative metrics of leadership are provided in the Accountability table below. Probably the most notable metric is the rapid increase in VC and investment income.

The proposed Consortium is dedicated to commercializing "leading-edge" energy technologies. Within the 3 year time frame of the Center of Excellence award we propose to focus initially on the development and commercialization of the systems goals described below, with others coming on board as the research results and commercialization opportunities warrant.

Research Focus

Table 3: Accountability Measures for UF, UCF,USF, & FSU

Accountability Measures for UF, UCF, USF, & FSU			
Research Effectiveness	**2005**	**2006**	**2007**
Competitive Energy Grants Applied For: Received:	177/$28.8M 279/$67.7M	214/$130.0M 193/$58.4M	247/$102.0M 236/$140.2M
Total Research Expenditures-Energy only	$92.9M	$69.9M	$86.8M
Refereed Journal Publications in Energy	382	455	390
Professional Presentations on Energy	389	428	463
Invention Disclosures Filed and Issued	51	70	66
Technologies licensed/revenues received	7/$337K	9/$203K	21/$730K
Collaboration Effectiveness			
Collaborations with postsecond. institutions	56	58	76
Collaborations with K-12 Schools	2009	2940	2677
Collaborations with Private Industry	101	120	165
Students Supported in Energy	84	92	211
Students Graduated	40	45	47
Job placement of Graduates in Energy	31	39	47
Economic Development Effectiveness			
Business Start-Ups in Florida	5	3	9
Jobs created and saved in Florida	215	245	346
Specialized industry training & education	75	80	90
Dollars from VCs and other investments	$900K	$2.0M	$19.2M

Note: Table reflects only a portion of actual UF, UCF, USF & FSU energy research due to difficulty of separating prior-history, multi-university, energy-only data.

FESC is self-organized into six *Energy Thrusts* to better utilize our expertise. Each of the first five thrusts is based on a relevant resource and technology expertise in a specific energy research area. The 6th thrust crosses multiple energy research areas, promotes inter-university collaboration, and addresses system level goals based on potential economic impact.

Thrust 1. 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 state, ~10% of U.S. total. As such, harnessing these resources should be a key component of Florida's energy strategy. Efficient biomass conversion, however, is a complex

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J. Fenton	*Dir., FL Solar Energy Center*	*UCF*
B. Joseph	*Chair, Chemical Engineering*	*USF*

system depending on locally available resources (due to high shipping costs of low energy density biomass). For example, South Florida is a major sugar cane and citrus producing region; whereas, North Florida has abundant woody biomass resources. Therefore, 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 cost and facilitate commercial deployment, thus creating new industry and new employment for Florida. The SUS is an internationally recognized contributor to biomass energy research and harnessing Florida's biomass energy resources is an essential mission of the Consortium.

Thrust 2. Harnessing Florida's Solar Resources

The direct conversion of incident solar radiation to electric power is the ultimate sustainable energy source. Not only does it bypass photosynthesis and thus carbon, but it can be implemented also in a distributed mode and fed to an existing distribution system (grid). Florida is one of the richest states in solar radiation, receiving ~6 kWhr/m^2/day. Therefore, the appropriate strategy for the Sunshine State is to include a significant solar component in its renewables 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. Fortunately, the solar expertise resident in the SUS is one of the largest in the country and would serve as a research and education base to attract industry. The implementation of this strategy will require continued cost reductions, and systems integration will be central. Collecting this broad research expertise through a consortium approach would facilitate the translation of the solar innovations into more cost efficient systems.

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Y. Goswami	*Co-Dir., Clean Energy Research Ctr*	*USF*
Tim Anderson	*Associate Dean of Engineering*	*UF*
I. Batarseh	*Dir., Florida Power Electronics Ctr*	*UCF*
A. Krothapalli	*Dir., Sustainable Energy Science*	*FSU*
E. Stefanakos	*Dir., Clean Energy Research Center*	*USF*

Thrust 3. Ensuring Nuclear Energy & Carbon Constrained Technologies for Electric Power

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G. Sjoden	*Nuclear Engineering*	*UF*
A. Domijan	*Dir., Res. & Planning*	*USF*
D. Cartes	*Assoc. Dir, CAPS*	*FSU*

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 five existing facilities will soon witness significant retirement. Additionally, an aggressive new plant strategy will require an expanded workforce. To meet these demands, an existing training reactor would 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 development of *carbon sequestration technology relevant to Florida's geography*.

Thrust 4. Enhancing Energy Efficiency and Conservation

Energy efficient technologies have the greatest potential to reduce Florida's energy consumption.

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Y. Goswami	*Co-Dir., Clean Energy Res. Ctr*	*USF*

The focus is improving existing and new 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 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 into our building operations and construction will result in cleaner, healthier, and more sustainable and economically viable communities that are less susceptible to disaster. As part of the Consortium, well-instrumented testing structures will be established to evaluate the effectiveness of integrated emerging technologies as well as hurricane-level wind resilience.

Thrust 5. Securing our Energy Delivery Infrastructure

Increased electricity demand and severe weather adversely impact the reliability and resilience of Florida's electric infrastructure. Resulting power interruptions are an economic hardship of several $B/yr and a threat to public safety. This will escalate as Florida's population increases. The proposed diversified portfolio of distributed renewable generation will not become reality if electric infrastructure is not developed in conjunction with supply. Research includes 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.

A. Domijan	*Dir., Research & Planning*	*USF*
S.J. Dale	*Dir., CAPS*	*FSU*
I. Batarseh	*Dir., FL Power Elect. Ctr*	*UCF*

Thrust 6. Energy Systems and their Environmental and Economic Impacts – overarching

P. Sotkiewicz	*Public Utility Research Ctr*	*UF*
E. Wachsman	*Dir. FISE*	*UF*
P. Fairey	*Deputy Dir., FSEC*	*UCF*
R. Meeker	*Prog. Mgr., CAPS*	*FSU*
All Thrust 1-5 Participants	*UF, UCF, USF, FSU*	

Florida's industry, utilities, and government need sound advice and research on energy technologies and strategies to set a prudent course for the future. The implementation of effective economic policies is important to any energy system. The SUS should provide the State with expertise in energy and environmental economics and policy with insight into the economic and regulatory environment of the energy industry. Coupling the expertise in technologies for generating power, distributed resources, and reducing emissions with an understanding of cost-benefit/effectiveness analysis and policy are crucial to a systems approach and to the State. The expertise in this thrust will be used to evaluate the potential of our systems level goals to make a significant impact in the State. Moreover, significant changes are anticipated in our energy system and we need to fully understand the system's response to policy change by developing analysis tools and Florida-specific databases. Therefore, the overarching goals of this thrust are to:

- *Develop the systems evaluation and integration approach necessary for implementation of the energy technologies developed in the other thrusts.*

- *Provide a State resource for objective analysis of energy technology, environmental impact, economics, policy and law.*

To have the greatest positive impact, a key strategy of the Consortium is to define systems level goals that not only drive the research agenda but also integrate innovation into validated energy systems that can be transferred to the commercial market. Use of these systems level drivers will allow the research to have shorter term (~3 yrs) and tangible focus, meld SUS-wide teams with common purpose, and allow progress to be better assessed. Vertically integrated *Systems Goals* (also referred to as Tasks for budgeting purposes) will also better convey the Consortium's value and attract resources to sustain it.

The organization of FESC is thus a matrix of SUS expertise in specific thrust areas with multiple thrust areas focused on system level goals. To illustrate our system-level approach, consider the overall system to address Florida's transportation and electric power needs utilizing its natural energy resources (Fig. 2). Inputs to the overall system are biomass and solar energy. Within that system are interrelated subsystems providing necessary functions to different sectors of the economy. Numerous other proposed systems that could not be included due to page limitations.

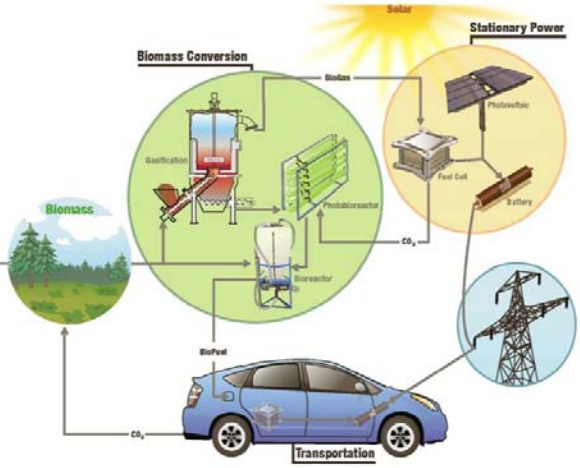

Figure 2: Integrated renewable energy systems

Task 1. Integrated Florida Bio-Energy Industry

Florida is biomass rich, which provides an alternative to conventional energy sources, environmental, rural economic growth, and energy security benefits. The growth of a bioenergy industry will generate needed sustainable energy for Florida, revitalize its agriculture, and create employment in the state. To maximize its impact on Florida's future, however, the bioenergy industry needs to emulate mature industries such as oil, where the feedstocks are fractionated based on value and density and processed to maximize the yield of a diverse set of products (e.g., natural gas, gasoline, and diesel). Similarly Florida needs to fractionate its biomass resources based on value to produce a range of products from food to biofuels, chemical feedstocks and electricity (Fig. 3). Integration of these technologies and processes provides the potential for a Florida bioenergy industry that can then compete with conventional fossil fuel based industries without displacing our critical food supply.

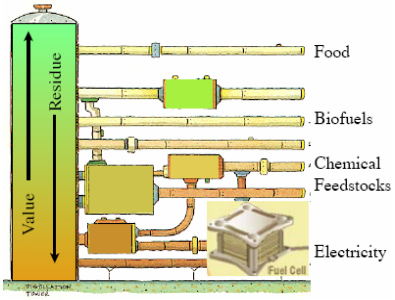

Figure 3: Integrated bio-energy industry

<u>*Energy Intensive Crop Development*</u> - The first step in an integrated Bio-Energy industry is development of energy intensive crops. The proposed research will provide breakthroughs in identification of Florida energy crops and cultivars, development of best agricultural practices for production, and focused improvements using traditional and molecular genetic approaches. Energy crop research will focus on two groups, C-4 plants (e.g., cane and switch grass) and short rotation trees (e.g., pine and poplar). Natural cultivars will be screened for yield, and compositions that enhance digestion into ethanol. Deliberate gene changes will also be investigated to alter plant wall structure for efficient extraction and depolymerization of carbohydrates. The proposed research will: advance our knowledge of how plants partition

carbon; identify genes to breed plants that are more readily extractable/digestible to increase conversion efficiency; establish best agricultural practices for production of Florida energy crops; and develop economic models to estimate costs and identify improvement opportunities.

Biochemical Conversion of Florida's Cellulosic Biomass to Liquid Fuels and Chemicals - Biofuels and chemical feedstocks are the greatest value added products of this industry. Our focus is the biochemical production of alcohols to serve as a bridge-fuel to reduce dependence on imported petroleum and decrease net carbon emissions using a non-food, biomass feedstock. Florida has the potential to produce ~93 MT/yr of cellulosic materials, over 7% total U.S. production. Florida also has a leadership position in cellulosic ethanol development. Unlike corn ethanol processes, cellulosic ethanol is in the earliest stages of commercialization. Florida has provided $20M in construction funds to build a ~2M gal/yr cellulosic ethanol plant at Florida Crystals Corp. Once fully operational this facility will generate revenue to support research and design improvements and provide validation for diverse Florida feedstocks. FESC funds will support initial start-up operation and research opportunities that can rapidly advance bio-fuel technology.

This project will develop and demonstrate an integrated, multi-product biorefinery at pre-commercial scale to support a full economic and technical feasibility analysis for the use of Florida-grown feedstocks. The goal of this facility is to evaluate, validate, and improve processes, improve efficiency and decrease complexity, and accelerate full commercialization of cellulosic biorefineries in Florida. This facility will represent a complete test bed for new trial crops as well as existing municipal, forestry, and agricultural residues. This facility will complete the renewable cycle by converting solar energy stored in biomass from Florida fields into automotive fuels and chemicals to replace petroleum. Together with energy crop production, this project will provide a comprehensive demonstration of a "Farm to Fuel"/"Fields to Wheels" biorefinery to facilitate commercial development of renewable fuels in Florida.

Integrated Biofuel, Hydrogen and Electricity Cogeneration from Biomass and Solid Waste - Finally low value agricultural residues, as well as solid waste, are used to produce additional fuels, hydrogen, and electricity. The integrated system will incorporate technologies for conversion of biomass to biogas and subsequently H_2, electric power and liquid bio-fuels. The task addresses the incorporation of a biorefinery into existing agricultural, municipal and industrial activities that produce organic wastes or byproduct streams. Anaerobic digestion (ADG) and thermal gasification will be developed for wet and dry, respectively, biomass resources. ADG will be developed to produce CH_4-rich streams that will be tested directly in a Siemens 3kW solid oxide fuel (SOFC) for electric power generation as well as for a feedstock in subsequent bio-fuel synthesis. Thermal gasification processes will produce H_2 enriched synthesis gas. The resulting biogases will be analyzed for composition and utilized in a membrane reactor to produce pure H_2 and in subsequent catalysis to create clean burning liquid hydrocarbon fuels (from ethanol and gasoline to diesel and JP8 jet fuel). The membrane reactor produces pure H_2 from hydrocarbon feed stocks by internal steam reforming and water-gas shift reactions and the *in-situ* product removal drives H_2 production to higher yields than are otherwise thermodynamically achievable. This will demonstrate the efficacy, cost advantages of H_2 production from biomass, and advance the technology to the proof of concept scale for industry investment.

The fuels produced will be tested for combustion properties and electric power generation. SOFC operation on biogas would be the most efficient means of producing electricity from Florida's abundant renewable biomass resources. Siemens Power Generation (Orlando, FL) has identified biomass as a major part of its future growth and is teaming with UF on the proposed task. Optimization of the integrated system will be performed to help adjust gasification design

parameters based on projected overall economics of H_2, biofuel and electric power production. A system economic and GHG reduction analysis, including mass and energy balances to determine overall efficiencies, will be carried out using data obtained from the operation of the individual components and the integrated system. Economic feasibility of a full-scale system will be performed, including effect of increased capital investment and feedstock transportation costs.

Task 2. An Integrated Sustainable Transportation System

A potential integrated sustainable transportation system is a plug-in hybrid electric vehicle (PHEV) charged by PV generated electricity while "plugged-in" and fuel cells operating on biofuel while in transit. Electric vehicles charged from solar PV are the ideal carbon free transportation. However, batteries do not currently give the desired driving range, so plug-in hybrids are the closest technology to achieving this dream of carbon-free transportation. A further dramatic improvement in efficiency and reduction in emissions would be achieved if the hybrid's IC-engine was replaced with a fuel cell. SOFCs are the most efficient technology for directly converting the chemical energy of hydrocarbon fuels to electricity on a "well to wheels" system-basis, thus, producing the least CO_2/kWh from conventional fuels and if designed to operate on biofuel would both be carbon-neutral and operating on a renewable resource. For a PHEV-SOFC/biofuel vehicle to be commercially viable its operation must be transparent (within existing transportation fueling infrastructure) and cost competitive with current technology. To achieve this we will integrate Li-Battery and SOFC developments. *If successfully developed this system would be a transformational change in transportation technology, potentially creating a new transportation industry in the state.*

Figure 4: Integrated fuel cell-battery hybrid

Energy storage is key to efficient use where demand and supply vary, ranging from HEVs to solar PV systems. Li-batteries are attractive due to high energy/power density. For HEV/PHEV further improvements in specific energy, energy density, and lifetime are necessary. To achieve these goals we will investigate higher voltage positive (olivine and spinel oxides) and negative (carbon nano-tube) electrodes that have potential for increased energy density and power. Research will focus on fundamentals of ionic transport, phase stability at high charged state and the electrode/electrolyte interface, combining relevant experimental techniques with first principles computational methods to identify factors that control Li mobility. We will also determine degradation mechanisms and design batteries with improved cycle life. State of the art SOFCs operate at >700°C; however, a *UF team has developed the world record conductivity (100X conventional) electrolyte and achieved record cathode performance that operates as low as ~300°C*. Therefore, our focus is anode and cell/stack development. We will develop direct-bioethanol anodes using catalytic conducting materials with controlled microstructures, integrate results, and fabricate and demonstrate complete low temperature biofuel SOFCs using the *FISE Energy Technology Incubator*.

We will also develop and optimize operating control systems and evaluate life-cycle costs of the PHEV-SOFC/biofuel vehicle, including total engineering systems analysis and economic accounting of GHG emissions from increased fuel efficiency in combination with the plug-in feature using PV for charging. The analysis will examine outcomes under different state and federal energy policy scenarios including potential efficiency rebates and carbon taxes.

Task 3. Solar Thermal Power for Bulk Power and Distributed Generation

Solar thermal power is the most advanced and economic technology for bulk (MW scale) power production. At present about 5000MW of solar thermal power is in design or construction,

including 300MW by FPL. The biggest advantage of solar thermal power over PV is that they provide power for longer time by combining solar power during peak irradiance times and bio-fuel energy storage for off peak times. The present cost of power from these plants is ~11 *c*/kWh which can be reduced to <6 *c*/kWh with experience, larger capacities and mass production.

The proposed project will develop design methodologies, set up demonstration and test facilities, optimize for Florida conditions, develop and commercialize innovative thermodynamic cycle technologies, and develop control technologies for grid integration. Our approach will be to advance proven technologies for utility adoption while simultaneously developing new low cost and efficient technologies. We will develop test facilities and pilot demonstration systems at UCF, USF and UF and conduct technology evaluation and optimize plant operation strategies for Florida conditions. In addition, we will advance the novel USF thermodynamic cycle technology for combined power and cooling in cooperation with industry for commercialization. Successful effort on this project will result in increased renewable resource based power, reduction of GHG emissions, and establishment of a new power industry in Florida while helping the electrical utilities meet pending renewable portfolio standards. The project will be closely coordinated with FPL to support its planned 300MW solar thermal power plant. The project participants include recognized experts in Solar Thermal Power who have already developed the first generation design software for FPL.

Task 4. Si Photovolatics from Low-cost, Florida-derived Si Feedstock

The PV industry is the fastest growing industry in the world. The rapid expansion has produced a demand for Si feedstock than now exceeds the demand of the IC industry resulting in the need for nearly $10B in added capacity. This Si feedstock shortage has caused the contract price of PV grade Si to exceed $50/kg and recent spot market prices in the ~$300/kg range. SRI has developed a technology to take a Florida phosphate industry by-product to electronic grade Si at a cost well below PV industry targets. The goal of this Task is to establish a Florida-based PV industry using this Si feedstock. This *raw material to finished product PV industry* would be a major boon to the State economy, estimated to be a multi-billion dollar industry, similar in size to Florida's aerospace/defense industry. In addition, the number of indirect jobs created for a given investment in the PV industry (e.g., installation) is much greater than most industries. Further these jobs are high-value and there is tremendous export potential.

The largest US phosphate resources are in Polk County, FL, generating 32M tons of waste/year, and the resulting silicoflouride complexes (e.g., Na_2SiF_6) have little value. The SRI process converts Na_2SiF_6 to Si (product) and NaF (by-product used for toothpaste). Their process has been optimized to the extent that high purity, PV-grade silicon is produced and the estimated scaled production cost is ~$14/kg, well below the industry's target price. The process has been demonstrated to 2 MT/yr and is now ready for scale-up. The next step is vertical integration of the process to PV module production. Although SRI has promising preliminary results on the electrical properties of Si ingots as well as fabricated cells, the influence of specific impurities on cell performance is not clear. This Task will direct research aimed at translation of this Si feedstock to high efficiency PV produced by this innovative process. We will generate performance data to guide SRI process improvement and assist qualification by potential PV producers. SRI will produce Si feedstock, cast ingots and characterize impurity content to verify initial quality. Wafers sliced from the ingots will be characterized for electronic properties (resistivity, carrier type, lifetime, and diffusion length). We will fabricate PV cells from these wafers, characterize performance (open circuit voltage, short circuit current, fill factor, and

efficiency) and compare with results from conventional cells. Similar comparisons will be made for interested cell manufactures using their specific process.

Additionally, the Consortium team will develop novel approaches to thin-film-Si PV using the phosphate-based industry feedstock. Thin-film-Si is motivated by cost reduction by substituting the Si substrate with a less expensive material so that only a thin ~25 μm Si layer is needed. Cell performance will be evaluated and material properties characterized. The Consortia will serve as the interface between the feedstock provider (SRI) and the PV manufacturer by determining the relationship between feedstock quality and device performance.

Task 5. Florida Based Low Cost Manufacture of Photovoltaic (PV) Systems

PV has entered into a period of record growth. While the US led early on, it lost the lead to Europe and Asia whose governments are aggressively pursuing solar and providing the economic climate for its growth and success. Over 27,000 new jobs were generated in Germany alone as a result of PV solar energy. Most of the current production is based on crystalline Si technology. However, there are fundamental limits to the ultimate Si costs that may inhibit it from achieving the desired level of contribution to worldwide energy production. In contrast, thin-film PV technology can reach the desired outcome due to fast deposition rates and lower cost. USF, UCF and UF play a lead role in developing these technologies. *The world record 16% efficiency for CdTe was set by USF and held for 10 yrs*. The time has come to coordinate the leading-edge resources within the SUS and establish a Florida PV industry.

To achieve the desired level of energy generation, efficiency has to be >13%, which has been achieved in the laboratory; however, there is an inability to transfer laboratory success into manufacturing success (Table 3). The transfer process has been the purview of industry, with limited success. What is needed is a fundamental understanding of this process, which can best be done in a university environment with industry cooperation. It is proposed to combine SUS expertise with local industry to develop this foundation. We will build and operate a pilot line that includes all aspects of module fabrication and characterization for the SUS/industry partners to develop manufacturing processes.

Table 4: Thin film PV efficiency

Thin Film Technology	Highest Lab Efficiency	Production Module Efficiency
CdTe	16%	8%
CIGS	20%	11%
a-Si	13%	8%

Task 6. Advanced PV Device Program

The US DOE Solar America Initiative (SAI) has an ambitious 50% efficiency goal. UCF, UF and USF are already participating in the SAI program: UCF is conducting research with BP Solar on reliability and durability, UF just won a solicitation for research on hybrid cells and USF just won a solicitation for research on next generation CdTe cells. However, this research represents only a small fraction of available support and the SUS should position itself to be more competitive in this federal R&D effort. Thus, the goal is to expand the SUS capabilities and infrastructure to conduct R&D toward the 50% efficiency goal, leveraging federal research dollars, creating valuable intellectual property and attracting major PV industries to the state. R&D will focus on hybrid organic PV, nano-architectures, multiple excitation generation, plasmonics, and tandem/multijunction cells.

Task 7. PV Energy Conversion and System Integration

This Task is an innovative system-driven approach for the design and commercialization of PV modules, representing a paradigm shift in the way solar energy is deployed and commercialized. The main target is to dramatically reduce PV cost through innovation and system integration to foster a new solar energy based industry, creating new R&D and manufacturing jobs in Florida.

The proposed *PlugN'Gen* system architecture allows PV modules to be produced and marketed just like other "plug and play" consumer products (e.g., TVs), overcoming the installation cost barrier. Today's grid-tied PV systems use PV panels in series to produce high-voltage DC. Centralized inverters convert this to grid-compatible AC. High-voltage DC is hazardous requiring expensive installation (installed cost is 2X that of the PV panels). In contrast, *PlugN'Gen* modules have inverters on the back of each panel. Installation of these modules is far less costly, requiring no special training. The modularity of AC module systems allows optimized harvesting of available power and systems to be incrementally installed (thus more budget-friendly). Advanced inverter topologies will be investigated in order to achieve efficiency, reliability, and cost objectives. Inverter lifetime will be increased to match the PV panels they service. Digital control techniques will allow integration of control functions, implementation of complex algorithms in low-cost controller chips, and better response to temperature and solar insolation changes.

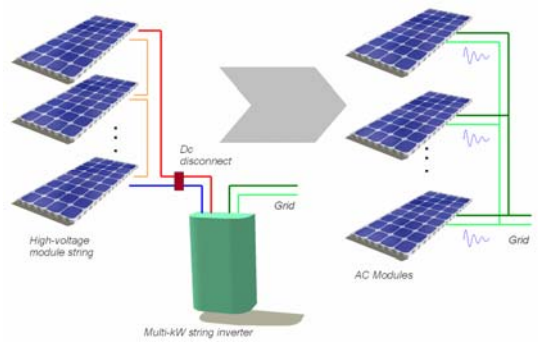

Figure 5: From today's centralized PV inverter to *PlugN'Gen* AC modules: a paradigm change.

Task 8. Integrated PV/Storage and PV/Storage/Lighting Systems

To the consumer and utility it's not the cost of PV, it is the availability (timing) and amortized cost of generated electricity that is critical. Unfortunately, the timing for peak solar power does not coincide with peak power demand and energy storage (battery) is necessary, thus the need for an integrated/optimized PV/battery system. Another aspect of this is to consider a primary end use of electric power, lighting. Light emitting diodes (LED), operating on low voltage DC, have 4X the efficiency of incandescent bulbs. Each PV panel generates low voltage DC; however, PV power must be converted to 110VAC for grid-distribution and then stepped down to low voltage DC for LED lighting. Major system efficiencies can be attained by the PV/battery/LED system since each is a low-voltage DC device.

The goal is to increase the efficiency and reduce the cost of solar power through the integration of PV, Li-battery, and LED lighting technologies. Since all components are in the form of thin films, the PV/battery/LED system can be integrated as a single module. Since half of the materials cost of each device is the substrate, integrated module will also reduce materials costs and processing steps. Importantly, their integration further eliminates the need for inverters since they are all low-voltage devices. Such an integrated device can be used to store energy during the day and power the LED panel for lighting in the evening. In addition, we will explore the possibility of fabricating a semi-transparent module. The success of this Task will lead to a novel solar-power lighting panel that can be used as a sky light during the day and a lighting panel during the night without using grid-power. We not only will develop the technologies, but also integrate devices and perform technology-economic evaluation, including life-cycle costs.

Task 9. Solar and Biomass Fuels to Fuel Cell Emergency Power Backup

The goal is to design, integrate, verify, and demonstrate both photovoltaic power, hydrogen generation through electrolysis to stored hydrogen fuel cell systems and stored liquid biomass fuel to fuel cell systems that will vastly improve the reliability and durability of backup power for extended outages. The uninterrupted power supply (UPS) for telecom applications represents

a unique market entry opportunity for Florida. Current UPS systems are not satisfactory because of capacity loss in hot environments, and with 1000s of communications towers throughout Florida there is high commercial potential. Moreover, 20% of Florida telephone customers rely on UPS for emergency and personnel communications after hurricane outages. Research will focus on the various components and systems demonstrations to prototype development.

Task 10. Energy Efficient Building Technologies and Zero Energy Homes

Buildings account for ~84% of total electric power use in the state. A ~35% reduction in building energy use can be achieved by improved efficiency, saving Florida millions of kWhr/yr. The US DOE goal is to create efficient "zero energy homes" using only on-site PV power. Energy storage can be provided by PHEVs (Task 2). Using a systems approach to couple zero energy home technology with PHEVs offers the opportunity to develop marketable products that meet Florida's energy and environmental goals. New and emerging building energy efficiency systems require study with respect to Florida's unique hot/humid climate. Cost/benefit analysis of efficient buildings, building energy efficiency expertise in our education system and our marketplace along with creative financial instruments and business models are needed. To address this need we will: conduct field evaluations to document the cost/benefits of "beyond code" building energy efficiency programs; conduct testing of building efficiency options; create building energy course work; recruit advanced Florida builders and early adopter homeowners to collaborate on a zero energy home – PHEV design project; construct and monitor zero energy homes; develop optimization models, including benefit/cost analysis and grid interactions.

Task 11. Establishing an Efficient and Reliable Energy Delivery Infrastructure

All of the above systems interact with the grid and by optimization can be integrated to reduce our overall energy demand and increase grid resilience. In this Task we will use existing and planned communities as *in-situ* test beds to demonstrate integrated systems of revolutionary distributed green generation, improved grid and home efficiency, and automated energy conservation technologies for residential, substation, and distribution scale energy systems. Projected outcomes include: a 25% reduction in Florida's electric generation growth needs; reduced power system outages and restoration times for Florida; a market for green building construction, with distributed grid connected renewable generation; reduce GHG emissions; a new green energy value dimension to Florida's housing market, and ultimately Florida becoming a world leader in green community construction. We purpose to demonstrate advanced integrated energy generation, management, and utilization for substations, distribution, and modern residential and commercial developments, produce green distributed energy, reduce energy demand and improve security at the wide-area utility distribution level in Florida, and subsequently drastically reduce Florida's GHG emissions. We will integrate three sub-systems: distribution level Renewable Energy Strategic Load Pockets; Intelligent Residential Energy Management Systems; and real-time transient analysis monitoring system.

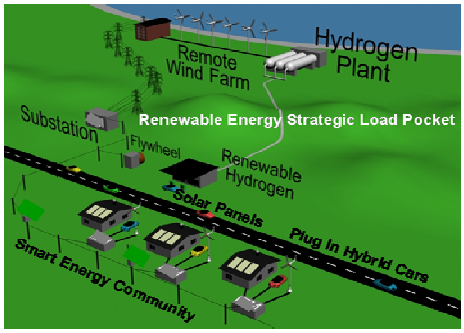

Figure 6: Community-based energy system

Task 12. Carbon Capture and Sequestration

Current dependence on fossil fuels for US electric power and transportation fuels continues to increase GHG emissions resulting in global warming and climatic change. Cost-effective CO_2 removal is required to accommodate growth and bridge our transition to greater energy diversity

and efficiency. Several carbon sequestration approaches are under development by our team utilizing abundant Florida resources. Geological sequestration by CO_2 injection into saline carbonate aquifers is being developed and tested by USF, representing a new sequestration technology. Biomass-based sequestration is being developed at UF using Florida crops and has widespread support of its agricultural industry. This will focus on a by-product of renewable fuel production as a carbon sink. Chemical sequestration to useful products is being developed by UCF via a novel catalytic process that includes solar-derived H_2. The resulting elemental carbon and lignin-based polymers can be stored and transported at ambient temperatures and pressures, and stored in geologic formations or used as possible commercial products. Each approach offers unique advantages to offset our transition to more carbon neutral power and transportation. Cost-effective carbon capture and sequestration is of primary interest to the major Florida power companies. They have proposed formation of a state-wide consortium to address this issue and the proposed Consortium can serve this role. Florida agricultural industries are also very interested in developing carbon sequestration as a supplemental land use.

Task 13. Clean Drinking Water using Advanced Solar Energy Technologies

Availability of fresh water is one of the biggest problems facing the world and Florida is one of the most vulnerable to fresh water shortages. Moreover, Florida ground water is contaminated in many locations from leaky underground tanks, agricultural pesticides, and other chemicals. Although possible to desalinate abundant sea water, conventional systems are too energy intensive. Solar energy can provide the needed energy, and innovative new solar vacuum (USF) and humidification/dehumidification (UF) desalination systems can provide adequate fresh water for the state's needs. Systems will be developed for both bulk water desalination and small community needs/disaster response. We will also develop photocatalytic disinfection to remove contaminants and integrate these technologies with solar PV for complete water supply systems.

2. Economic Opportunity

Florida imports 99% of the energy it uses.[3] Vehicles on Florida's roads consume 8.1 billion gallons of gasoline each year, and the residential electricity price increased 45% in 2006.[4] Furthermore, the state is expected to see a 32% increase in energy demand over the decade, most of which is expected to be provided by natural gas.[5] The energy business will be marked by change and growth.

Florida has the ability to hedge energy price risks by diversifying its portfolio by using our renewable energy resources (solar, biomass), improving energy efficiency, and expanding nuclear production. Moreover, these resources are environmentally friendlier than traditional fossil fuels. These Florida resources can be used to generate both electricity and renewable fuels and chemical feedstocks. *The local production of indigenous fuels not only helps the state's economy through lower prices and diversification of fuel price risk and more stable prices, but also it will create a new energy industry within the state that will create new, higher-skilled and higher-technology jobs within Florida.* These new Florida energy industries will hire newly graduated scientists and engineers skilled in renewable energy generation and energy efficiency. Many of these new industries will be created by the faculty and these students through incubator and university-industrial partnerships.

Technology Innovation and Transfer The Consortium's current energy research base of

[3] Florida Department of Environmental Protection, *Florida's Energy Plan*, January 2006.
[4] Data source is the United States Energy Information Administration.
[5] Data source is the United States Energy Information Administration.

$81M, combined with a time-tested IP property policy that strongly encourages faculty innovation for commercial applications, produces approximately 65 inventions annually. The combined four universities have had an impressive 14 spin-off companies in the last three years alone, many of which were in the energy area. UF was the top-performing public institution at transferring its research to the marketplace in 2006, earning nearly $43M in licensing income and launching ten new companies (46 in last 5 years). As another example, USF generated $2.1M in IP revenue and 23 licenses in 2007 – 13 to Florida start-up companies. FSU signed 92 deals over the last 10 years, has produced 15 start-up company licenses.

A few specific examples are mentioned below to illustrate their breadth and significance. The *Gossamer Wind*® ceiling fan, developed by UCF, has sold more than 1.1 million units, saving consumers more than $22M in energy costs annually. UF licensed technology has enabled BioEnergy International, LLC to develop a pipeline of novel biocatalysts and two 108MG/yr ethanol plants. The CDQ cooling system (UCF), licensed to Trane Company, recently won two prestigious national. A $14 million start-up company (Petra Solar) is using UCF patents on grid-tie PV inverter technology. FSU's Center for Advanced Power Systems has patented technologies to integrate renewable energy sources to grid and a number of off-grid zero emissions residential and commercial buildings.

There are also many excellent examples of University-assisted venture capital start-up companies. USF's Clean Energy Research Center has enabled a small start-up company, NanoCVD, to obtain a Phase II SBIR grant with the potential for a multimillion dollar business and associated jobs in Tampa Bay.

The four universities will work closely with their respective Technology Parks and Incubators. UF's Sid Martin Incubator has successfully 'graduated' 11 start-up companies. All have been successful at obtaining venture capital, with about half moving to corporate facilities in Florida, including Verenium's construction of a 1.4MG/yr. ethanol plant. Progress Corporate Park located in Alachua, Florida is home to more than 30 companies. UCF's Technology Incubator won the 2004 national technology incubator award and has helped more than 80 emerging technology companies that have generated nearly 700 jobs at average annual salaries of $60,000. FSU's Center for Advanced Power Systems acts as an incubator for a small company developing superconducting connector technologies for power systems application and plans to collaborate with Tallahassee CC on new area incubator capabilities for manufacturing start-ups. Other on-campus offices such as the UCF Venture Lab, Centers for Entrepreneurship and Innovation and Small Business Development Centers will provide assistance in creating high-technology jobs for the renewable energy and energy-efficiency industries that will be created by the work of the Consortium.

Impact on Workforce The Consortium will foster creation of new industries and associated jobs in renewable and energy efficiency technologies where Florida now has little to no presence. It is the goal of the Consortium that the 32% increase in energy use projected by Florida's utilities be significantly offset by increases in energy efficiency and the use of renewable energy generation. Much of the conventional generation of electricity by combustion of coal and natural gas will be improved through the use of carbon sequestration, fuel processing, and increase in nuclear power generation. As outlined in the Management and Infrastructure section, the proposed Consortium will provide educational opportunities for both the conventional power generation industries and newly created industries. New curricula in energy and coordinated programs across multiple universities will be developed to greatly expand the availability of energy education supporting existing and emerging energy industries in Florida.

New investments in energy related activities are increasing. According to DowJones, in the last quarter alone, there were 48 venture backed investments in energy, with 17 of those in the Southeast. Increased investments in energy efficiency, solar and biomass would result in significant reductions in consumer fossil energy expenditures over the next 15 years with certainty and could reduce overall energy expenditures versus staying on the present course, while promoting robust job growth in the state. According to a recent ACEEE study, these technologies, facilitated by Consortium research, would reduce consumer energy costs by over $28 billion relative to constructing new power plants. This would result in the creation of more than 14,000 new jobs. Energy efficiency and renewable energy has the added benefit of balancing the fuel supply and therefore stabilizing energy prices. The state's environment would benefit as well, with reductions in conventional power plant operations reducing SO_2 by more than 16 thousand tons and NO_x by almost 11,000 tons and CO_2 by over 37 million metric tons in 2023.[6] This would aid utilities in meeting Clean Air Interstate Rule (CAIR) compliance, and would help in meeting the CO_2 emissions targets delineated in the Governor's Executive Order on Climate Change (EO 07-127).

The U.S. PV industry has been growing at a rate of 40% per year (increasing from 108 MW in 2005 to 141 MW in 2006 and to 259 in 2007). Industry surveys and U. S. Department of Energy data indicate that this double-digit growth is expected to continue. The present U.S. PV industry is comprised of eight companies, none of which are located in Florida. However, there are several PV companies with regional sales and distribution offices in Florida and the Florida marketplace will certainly grow in our state as more incentives become available.

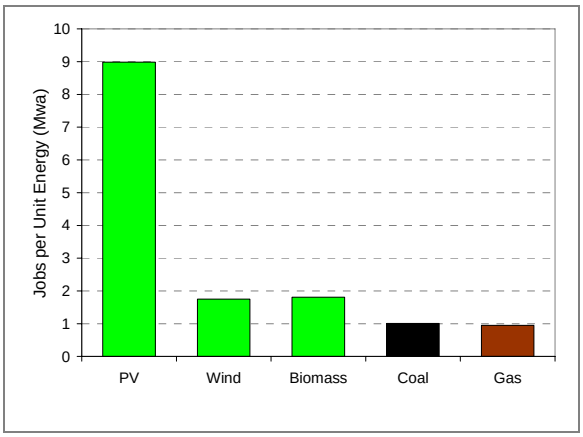

Figure 7: Jobs per unit of energy capacity for various power production technologies.

Recent projections indicate that even relatively small penetrations of PV capacity in Florida could have significant impacts on high-wage, high-technology jobs in the state. The Vote Solar Initiative estimates that 54,000 job-years would result from a 4 GW solar capacity by 2020.[7] A similar study conducted by the University of Texas projects that Texas could create 123,000 new high-wage manufacturing and electrical service jobs by 2020 through actively moving toward solar.[8]

These job creation numbers imply an economic gain of $3.9 to $6.9 billion in payroll for the state by 2020. The total industry potential would be five times the payroll or $20 to $35 billion plus international trade at $2 billion giving a total economic impact of $22 to $37 billion.

A recent University of California – Berkeley study finds the solar industry produces seven to eleven times as many jobs (on a megawatt capacity basis) as coal-fired power plants and has a larger positive trickle-down effect than wind energy (see Fig. 9).[9]

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[6] Elliot, N., et.al., June 2007. "Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demands." ACEEE Report E072, American Council for an Energy Efficient Economy, Washington, DC.
[7] Rose, G., July 12, 2007. "Plan for a Florida Solar Initiative: 2% Solar by 2020." Proposal to Governor Crist's Executive Office, The Vote Solar Initiative.
[8] University of Texas, July 2007. "Solar Power Could Create 123,000 New Jobs in Texas by 2020"
[9] Kammen, D. K. Kapadia, and M. Fripp, April 2004. "Putting Renewables to Work: How many Jobs Can the Clean Energy Industry Create." University of California, Berkeley, CA.

The four Universities have committed to hire 11 new "match" faculty positions in the energy technology fields and to provide equipment start-up packages for each of these faculty members who will have joint appointments. The Consortium, with strong guidance from the Industry Board, will attract these eminent scholars to the SUS to educate students of the future. The Consortium will bring in outstanding graduate students to work with the faculty through recruitment at the national level.

3. Management and Infrastructure

The management structure of the Florida Sustainable Energy Consortium was designed to promote collaboration between the experts in the SUS with a focus on producing innovative energy systems with significant input from industry, leading to economic impact. The organizational structure of FESC is shown in the chart below. A full time ***Director*** will provide focused leadership for the full function of the consortium. The Director will report to the ***Oversight Board***, which consists of the Vice-Presidents for Research of each of the four founding universities. This board will have ultimate responsibility for both the technical performance and financial management of FESC.

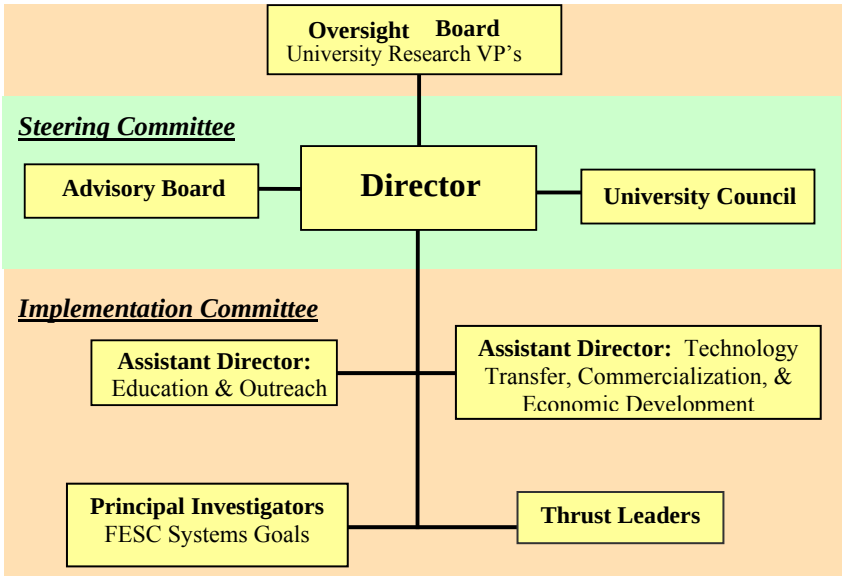

Figure 8: Organizational chart

An ***Associate Director*** will represent each founding university and collectively form the ***University Council***. This group will provide guidance on vision and direction to the Director, facilitate communication with each member university, and recommend future efforts of FESC and importantly conduct *comprehensive performance evaluation and accountability measurement and assessment.* To ensure input from the external stakeholders, an ***Advisory Board*** will be established by invitation with both *Affiliated* (significant financial contributor) and *Associated Members* (significant technical contributor) from government, industry, National Laboratories and education. The ***Steering Committee*** is constituted by both the Board and Council, and chaired by the Director, and is responsible for establishing and assuring the success of FESC's strategic plan.

The ***Principal Investigator*** of each Systems Goal is central to implementing the vision of FSEC as this person is responsible for the technical success of the goals. As outlined in the Vision, FSEC's energy expertise is gathered in six Thrust Areas, each with a ***Thrust Leader*** who understands the consortium's capabilities in the area. The ***Assistant Director for Technology Transfer, Commercialization, and Economic Development*** oversees external partnerships and works to maximize impact on the Florida energy market. The ***Assistant Director for Outreach and Education*** coordinates activities in energy education, the preparation of an educated workforce, and outreach to both the public and private sectors. This group forms the ***Implementation Committee*** and is charged with carrying out the objectives of the strategic plan.

Education & Outreach Plan Workforce losses in the energy and power sectors are expected to approach 40% by 2010. Coupled with the predicted increase in energy demand as well as the desire to expand energy-related industry in the State, it is critical that Florida have a well-trained workforce. Competitiveness requires scientists and engineers who can design marketable products and operate our power infrastructure. This consortium of State universities is well suited to coordinating a state-wide workforce development initiative that focuses on college level degrees, technician training, and public and commercial sectors awareness.

College Level: In addition to ongoing programs across a broad range of disciplines within the SUS, the consortium will develop specific programs targeted at preparing graduates with a background in energy. A significant program will be directed at the workforce for the nuclear industry, which now operates five nuclear power plants (FPL and PEF). To meet the demand anticipated from retirement and expansion, a significant investment will be made to the UF training reactor. In addition, the Consortium will implement a new M.S. degree program in Sustainable Energy and Power Engineering that will also be distance delivered. FESC will offer internship exchanges for industry to team at a university partner's research site on a specific systems goal. Additionally, each university will develop continuing education courses for technical and non-technical professionals, run REUs, and develop modules, laboratories, and courses to be shared amongst the university partners.

Technician Level: FESC will work with the Florida community college campus programs using FLATE (Florida Advanced Technological Education Center), which coordinates the design and operation of industry specific training programs for technicians at the community colleges in Florida.

Public and Commercial Sectors Outreach: A major focus of the program will be using the existing extension offices to reach out to each of our communities. Specifically, a variety of programs on efficient use of energy and alternative energy generation methods will be offered to the general public as well as targeted to specific audiences such builders, land planners, solar panel installers, and architects. As another approach to educate the general public, FESC will produce a weekly public radio segment through WFSU and National Public Radio to update listeners on advances in sustainable energy practices. A newspaper column and an electronic newsletter will be used as additional means to educate the public and the stakeholders.

Maturity of Existing Programs and Available Capital Facilities

Comprehensive Performance and Accountability Measurement System: The University Council will maintain and update the Accountability Table shown in the Vision, Leadership, and Research Focus section. They will also develop specific metrics appropriate for the Consortium. The Council will routinely assess the program of research, submit their findings in writing to the Director for the Steering Committee to evaluate and adjust the FESC strategic plan.

Available to Support FESC R&D: The more than 40 world class centers research and teaching at the four founding universities represent the best minds and research infrastructure in Florida and collectively they are internationally recognized for their contributions to sustainable energy and energy delivery. Uniting them under the FESC umbrella and building their infrastructure will only enhance their effectiveness. The Accountability Table evidences their historical success.

FESC Site Plan: FSU will provide 900 ft^2 of dedicated office space to FESC. In addition, 30,000 ft^2 of state of the art power and energy laboratory space and equipment is available to FESC at no charge. USF will provide 3500 ft^2 of additional space and the funds to develop a prototyping and pilot line facility for PV, solar thermal power and biomass manufacturing

programs in collaboration with industry. This space will be adjacent to the 7500 ft^2 energy laboratory and office space that has been just finished. All of the existing CERC and PCUE facilities in four buildings will also be dedicated to FESC. UCF will upgrade 3,000 ft^2 of space into wet chemical laboratory space at the Florida Solar Energy Center and create 4,800 ft^2 of new buildings research test facilities for energy efficiency systems and subsystems. Over 72,000 ft^2 of space at the Florida Solar Energy Center and over 10,000 ft^2 of space in the College of Engineering will be made available to FESC. UF has the 2006 Center of Excellence, FISE Energy Technology Incubator, an 8000 ft^2 facility dedicated to energy technology prototype development and biofuel processing research. The latter is augmented by a $20M biofuel pilot plant. In addition, UF has an 11 acre energy park on campus dedicated to energy-related research and will provide 700 ft^2 of dedicated office space to administer FESC.

Resources Dedicated to FESC: The four universities are committed to the success of FESC and have collectively pledged in excess $28M as summarized in Table at the right. Additionally the four Research VPs will be actively engaged in ensuring success in their role as a member on the Oversight Board. It is noted that this table reflects direct university investments, and thus does not include academic salaries of faculty.

Table 5: University Resources Dedicated to FESC

Fund Source	FY 08	FY 09	FY 10	TOTAL
Cash				
New Faculty Sal. & Release	$1.7M	$1.6M	$1.5M	$4.8M
Faculty Rsrch Startup Supp.	$3.1M	$1.5M	$1.5M	$6.1M
Endowments	$1.2M	$1.2M	$1.2M	$3.6M
Staff Supp. & Expenses	$3.1M	$3.1M	$3.1M	$9.3M
Graduate Students	$0.1M	$0.1M	$0.1M	$0.2M
New Buildings & Renovation	$0.5M	$0.1M	$0	$0.6M
Prototype Facility Rent	$0.2M	$0.2M	$0.2M	$0.6M
In Kind				
Staff Supp. & Expenses	$1.2M	$1M	$0.8M	$3M
TOTAL Resources				$28M

Evidence That the Investment Level Is Appropriate and Sufficient: A detailed cost proposal is attached in Volume II of this proposal. The cost proposal and the Executive Summary present a concise description of requested funding levels and their scope. It is noted that proposed Consortium is a partnership between industry, the State of Florida, and the SUS, with nearly equal levels of contributions to the vision.

4. Leveraging Resources and Other Collaboration

To meet Florida's energy needs large collaborative and innovative efforts are required that unifies and focuses energy research programs at various universities and institutions. These energy efforts must be in close cooperation with industry and government. The proposed Consortium of four state research universities, together with industry partners, propose an unprecedented state-wide collaboration to coordinate and unify energy-related research, development, technology commercialization, education, outreach, and technology transfer to fulfill Florida's rapidly growing energy needs while protecting the environment.

The proposed Consortium brings together diverse energy expertise from more than 40 energy related centers, laboratories and institutes, ranging from the state-wide Florida Solar Energy Center at UCF, to rare and unique facilities such as the Teaching and Research Nuclear Reactor at UF. The Consortium's diverse energy expertise is impressive, not only in the state but across the US and the world. The Consortium has the capability to combine strong research and education programs in energy technology and policy. This combination of technology and policy is critical to assist the government, the energy industry, and utilities in their decision process and in setting priorities for energy resource investment. The broad energy technology expertise is

also critical to the energy industry and utilities in comparing technologies and determining the most appropriate one for each site and application based on the available resources.

Partnership with Industries, National Labs, and Other Institutions: The research centers and the faculty involved in the Consortium have an impressive track record of partnerships with the energy industry including electrical utilities, biofuel companies, large and small solar energy companies, and the building industry. In addition, there are commitments from start-up companies such as NovaRay Solar, Turbogenix, Answer Biofuels, Petra Solar, Solarsa, Meyer Solar and others to invest as much as $100M in the state for manufacturing based on collaborations with the Consortium's associated researchers and research centers. In addition to private companies, there will be strong collaborations with SRI, National Renewable Energy Lab, Sandia National Lab, Oak Ridge National Lab and others based on existing strong partnerships with researchers in the Consortium. Although only the four largest Florida universities are formally associated with the Consortium, researchers from other universities, such as, FAU, FIU, UM, and UNF are already involved in the research tasks proposed in this proposal. Collaborations with researchers from other Florida universities will be actively encouraged in the Consortium.

Advisory Council: As outlined in the Management and Infrastructure section, the Consortium's Advisory Council will bring together diverse expertise from leaders of the broad energy industry, Florida Public Service Commission, State Government, USDOE, and national labs. The Advisory Council will provide their input for strategic planning of the Consortium and will foster further collaborations with other industry partners and institutions.

Cost Share and Investments from Industry: Energy industries in and out of the State of Florida have expressed very strong support for the proposed Consortium, including general and specific tasks that are of great interest to them. They include:

- Major electrical utilities in Florida, including, Florida Power and Light Company, Progress Energy Florida, TECO Energy, Gulf Power, JEA, Seminole Electric, Orlando Utilities Corp. and FMPA.
- Bioenergy companies, including, Verenium Corporation and Bioenergy International, Florida Crystals Corporation, Plum Creek Timber Company, Answer Biofuels, Prado and Associates and Hydrogen Technologies.
- Solar Energy companies, including, FPL Energy, Sharp Solar, BP Solar, GE Solar, Verizon, Petra Solar, Solarsa, Solyndra, Turbogenix, Dunnellon Solar1, BrightWatts and NovaRay Solar, and CENICOM.
- Other energy industries, including, Siemens Corp., BG & E and ConocoPhillips, Lynntech, Nextech, Electro Energy, and APECOR.

Cost share and investments from these companies have been offered in many forms. They include: direct cash cost share, in-kind cost share, and investment in manufacturing in the State based on the participation of the consortium members. The total value of all of cost shares and investments is well over $300 million, not counting the $1.2B planned investment by FPL for a solar power plant in which the Consortium members will provide assistance by way of design methodology, technology evaluation and test facilities at the universities.

Plan for Self Sustainability The proposed Consortium will need about $3M to $10M each year on a continuing basis from year 4 onwards. Of this, about $1M/year would be needed for administration and the rest would be for technology development, technology transfer and commercialization, and workforce development. In other words, we will need $1M/year

unrestricted for administration with the remainder directed for specific goals and projects. The following have been identified as the sources of funds for the Consortium on a continuing basis:

- **Electrical Utilities**: The most significant potential source of continuing funding is the annual contributions from the electrical utilities for programs of specific interest to the utilities. At present, the electrical utilities in the state spend about $15 million combined annually on conservation and energy efficiency technologies. These expenditures are allowed by the FPSC to be included in the rate basis. We are discussing with the utilities pooling about 50% of these funds through FESC based on an agreement with the FPSC, which will allow them to leverage their funds. We estimate a potential funding of **$7M/year**.
- **Large Research Programs:** With an initial state investment, it is believed that Consortium faculty will be extremely competitive in funding requests from federal agencies, national and global foundations, and industries. Based on the history of energy research funding of the individual universities participating in this Consortium and the present combined funding of over $50M, we estimate potential funding to be at least $10M/year above the current levels. The participating universities have agreed to return 7.5% of the overhead generated from proposals submitted through the Consortium for its operations and investments in infrastructure, which is expected to generate funds in the range of **$0.5M to $1M per year** from year 4 onwards.
- **Membership Dues from Industrial Members:** Companies will be invited to join the Consortium as Affiliate or Associate members by paying an annual fee of $2000 to $50,000 per year based on varying levels of benefits regarding the research and technology transfer from the Consortium. Based on an informal survey of the electrical utilities and other companies, we estimate a potential funding of **$0.25M - $0.4M/yr.**
- **User Fees from Incubator & Testing facilities:** The proposed facilities, especially in tasks 1, 2, 3, and 5 are unique not only in Florida but in the nation. Therefore, we anticipate charging $40 to $150/hr (depending on cost, complexity, and required scheduled maintenance) for use of each piece of equipment. We estimate potential funding of **$0.02- $0.1M/yr.**
- **Licensing and Technology Transfer**: The universities have agreed to return 5% of the licensing fees and royalties on the technologies developed at the incubators and laboratories to the Consortium. The University of Florida has consistently ranked among the top 10 in the country in annual licensing income earning over **$40M in FY 2005**. The four universities execute more than 100 combined license agreements a year. Recognizing the long time lags, we estimate the returned licensing fees to be about **$0.5M/yr,** based on the track record of the universities and the researchers involved.
- **Recurring Funds Commitment by the Universities:** The universities have committed a combined total of about **$28M** in recurring support for this consortium (see table 4). Although most of these funds are for salaries and facilities, they help maintain the Consortium indirectly by supporting the research that will help develop and commercialize the energy technologies.
  Based on the above estimates, **FESC will potentially generate over $7M/yr after the second year and as much as $15 to $20M/yr after 5 years from the start.**

Resumes
BIOGRAPHICAL SKETCH

Timothy J. Anderson: **300 Weil Hall, University of Florida, PO Box 116005, Gainesville, FL 32611, Phone (352) 392-0946, email: tim@ufl.edu**

Fields of Interest: Thin film photovoltaics; deposition of thin films; MOCVD and MBE of compound semiconductors, oxides, carbides & nitrides; thermochemistry and phase equilibria of inorganic materials; flow visualization; gas phase spectroscopy; wide bandgap materials.

Education:
Iowa State University, 1973, B.S. in Chemical Engineering
University of California, Berkeley, 1975, M.S. in Chemical Engineering
University of California, Berkeley, 1980, Ph.D. in Chemical Engineering

Research and Professional Experience:
Associate Dean for Research and Graduate Programs, University of Florida (2003-present)
Chairman, Chemical Engineering Department, University of Florida (1991-2003)
Professor, Chemical Engineering Department, University of Florida (1988-present)
Associate Professor, Chemical Eng. Department, University of Florida (1983-1988)
Visiting Professor, Laboratoire de Thermodynamique et Physico-Chimie Metallurgiques, Centre National de la Recherche Scientifique, Grenoble, France (1985-1986)
Assistant Professor, Chemical Engineering Department, University of Florida (1978-1983)

Awards Last 5 Years:
2007 Warren K. Lewis Award for Chemical Engineering Education (AIChE)
2007 Professional Achievement Citation in Engineering (PACE) Award, Iowa State University
2006 Elected Fellow of the American Society for Engineering Education (ASEE)
2005 Elected Fellow of the American Institute of Chemical Engineers (AIChE)
2005 ConocoPhillips Lectureship (39th): Oklahoma State University
2004 Benjamin J. Dasher Award FIE Conf. (with M. Ohland, G. Zhang, and B. Thorndyke)
2003 Recipient Vanderbilt University Tis Lihiri Lectureship
2003 George Lappin National Program Committee Service Award, AIChE
2002 Univ. of Michigan and Michigan State Univ. Joint Lectureship
2001 Union Carbide Lectureship Award, ASEE
2001 Research Partnership Award, U.S. Dept. of Energy, Office of Power Technologies

Synergistic Activities:

Journal Editorial Activities:

- Associate Editor of Journal of Phase Equilibria
- Consulting Editor, AIChE Journal
- Editor, *Chemical Engineering Education Journal*
- Editorial Adv. Board, *J. SMET Ed.*

Selected Recent Society Activities:

Institute of Electrical and Electronics Engineers (IEEE)

- Photovoltaics Specialist Conference: Publications Chair (2002), Program Committee (2003), Treasurer (2005), International Organizing Committee and Secretary (2006), Program Chair (2008), Conference Chair (2009)

Council for Chemical Research
- Governing Board (1996-1999)
- Graduate Education Action Network Leader (2000-present)

10 Relevant Publications:

1. *"In situ* Investigation of the Selenization Kinetics of Cu–Ga Precursors Using Time-resolved High-temperature X-ray Diffraction," W.K. Kim, E.A. Payzant, T.J. Anderson, and O.D. Crisalle, *Thin Solid Films*, 515 (15), 5837-5842 (2007).
2. "Investigation of Rapid Thermal Annealing on Cu(In,Ga)Se_2 Films and Solar Cells," X. Wang, S.S. Li, W. K. Kim, S. Yoon, V. Craciun, J. M. Howard, S. Easwaran, O. Manasreh, O. D. Crisalle and T. J. Anderson. *Solar Energy Mat. & Solar Cells*, 90, 2855-2866 (2006).
3. "Thermodynamic Description of the Ternary Compounds in the Cu-In-Se System," J. Shen, W. K. Kim, S. Shang, M. Chu, C. Song, and T. J. Anderson. *Rare Metals*, 25(5), 481-488 (2006).
4. "*In situ* Investigation on Selenization Kinetics of Cu-In Precursor Using Time-resolved, High Temperature X-ray Diffraction," W. K. Kim, E. A. Payzant, S. Yoon, and T. J. Anderson. *J. Crystal Growth*, 294(2), 231-235 (2006).
5. Morphological Study of InN Films and Nanorods Grown by H-MOVPE," H. J. Park, S. W. Kang, O. Kryliouk, and T.J. Anderson. *MRS Symp. Proc.*, 892, 231-238 (2006).
6. "Investigation of Rapid Thermal Annealing on Cu(In,Ga)Se_2 Films and Solar Cells," X. Wang, S.S. Li, W. K. Kim, S. Yoon, V. Craciun, J. M. Howard, S. Easwaran, O. Manasreh, O. D. Crisalle and T. J. Anderson. *Solar Energy Mat. & Solar Cells*, 90, 2855-2866 (2006).
7. "Comparison of Device Performance and Measured Transport Parameters in Widely-varying Cu(In, Ga) (Se, S) Solar Cells," I.L. Repins, B.J. Stanbery, D.L. Young, S.S. Li, W.K. Metzger, C.L. Perkins, W.N. Shafarman, M.E. Beck, L. Chen, V.K. Kapur, D. Tarrant, M.D. Gonzalez, D.G. Jensen, T.J. Anderson, X. Wang, L.L. Kerr, B. Keyes, S. Asher, A. Delahoy, and B. Von Roedern. *Prog. Photovoltaics*, 14(1): 25-43 (2006).
8. "Reaction Kinetics of α-$CuInSe_2$ Formation from an In_2Se_3/CuSe Bilayer Precursor Film," W.K. Kim, S. Kim, E.A. Payzant, S.A. Speakman, S. Yoon, R.M. Kaczynski, R.D. Acher, T.J. Anderson, O.D. Crisalle, S.S. Li and V. Craciun, *J. Phys. Chem. Solids.* 66(11), 1915-1919 (2005).
9. "Effect of a Cu-Se Secondary Phase on the Epitaxial Growth of $CuInSe_2$ on (100) GaAs," S. Yoon, S. Kim, V. Craciun, W. K. Kim, R. Kaczynski, R. Acher, T. J. Anderson, O. D. Crisalle, and S. S. Li, *J. Crystal. Growth,* 281, 209–219 (2005).
10. "Reaction Kinetics of $CuInSe_2$ Thin Films Grown from Bilayer InSe/CuSe Precursors", S. Kim, W.K. Kim, E.A. Payzant, R.M. Kaczynski, R.D. Acher, S. Yoon, T.J. Anderson, O.D. Crisalle, and S.S. Li, *J. Vac. Sci. Technol. A*, 23(2), 310-315 (2005).

Refereed Journal Publications: 190 ***Conference Presentations:*** 297 (30 invited)

Graduate Students/Postdoctoral Fellows Last 5 Years:

Current Ph.D.: D. Wood, V. Chaudhari, J. Lee, M. Monroe, J. Revelli, M. June, D. Kim, O. Kim, R. Krishnan, B. Serrano

Ph.D. in last 5 years: H. Ajmera (Intel), O. Bchir (Intel), A. Chang (Oregon St. U.), D. Crunkleton (U. Tulsa), M. Huang (Beijing, China), J. Hwang (LG), M. Ider (Gebze Yuksek Tech. Inst.), S. Johnston (Intel), S. Kang (Samsung), K. Kim (Lam Research), S. Kim (Intel), T. Kim (LG), W.K. Kim (U. Florida), L. Kerr (Miami U.), R. Lowrey (Florida Inst Tech), J. Mangum (CREE), M. Mastro (Naval Research Lab), J. Park (Samsung Corning), K. Probst (Dominion Semiconductor), M. Reed (II-VI Inc.), B.J. Stanbery (Heliovolt), V. Varanasi (U. San Francisco), Y.S. Won (NIST)

BIOGRAPHICAL SKETCH

Canan Balaban, cbalaban@ufl.edu
Manager, NASA Hydrogen Research Program
University of Florida
309 Weil Hall
PO Box 116550
Gainesville FL 32611-6300

Education

B.Sc., Chemical Engineering, Middle East Technical University, Ankara Turkiye
M.Sc., Chemical Engineering, University of Washington, 1980, Seattle WA

Professional Experience

- Manager, NASA Hydrogen Research Program, University of Florida. 2004 to present.
- Engineering & Cyber Solutions, Gainesville FL. Vice-President. 2001-2004.
- Energizer Power Systems, Alachua, FL. Technology Staff Engineer. Designed and managed the installation of two test-bed facilities, $3M in total, performed computer simulations, developed new products, and improved existing products and processes. Transferred two technologies from research to manufacturing. 1991-2001
- Geltech, Inc., in Alachua, FL. Senior Research Engineer, Manager of Manufacturing and Engineering, Director of Quality Assurance and Engineering. Installed a $1.7-million test-bed facility. Transferred three technologies from research to manufacturing. 1986-1991.
- Reichhold Chemicals Inc., Mt Bethel, NJ. Senior Staff Engineer at the Phenolic Resin Division. Provided direction, guidance and support for all engineering functions at each plant site for seven division locations. 1985-1986
- Reichhold Chemicals Inc., Tacoma, WA. Process Engineer, Computer System Manager. Automated the manufacturing process of pentachlorophenol. 1980-1985.
- Turkish Coal Enterprises, Ankara Turkiye. Project Eng. for smokeless fuel. 1976-1977.

Patents, Trade Secrets

1. *Pasted positive electrode and process for its production*, 8/20/02, US Patent #6,436,575
2. *Improved nickel slurry*, 8/24/99, Trade Secret # 32701
3. *Method of making sol-gel monoliths*, 12/31/91, US Patent #5,076,980

Canan Balaban is a member of the Tau Beta Pi Engineering Honor Society. While a team leader at Energizer Power Systems, Balaban received the firm's Excellence Award for Employee Involvement. She is listed in *Who's Who in Polymers and Plastics*.

BIOGRAPHICAL SKETCH

Issa Batarseh - batarseh@mail.ucf.edu

Research Specialty Areas:
Solar energy conversion, grid-tied PV systems, advanced power electronics control systems.

Education:

University of Illinois, Chicago	Electrical Engineering	Ph.D.	1990
University of Illinois, Chicago	Electrical Engineering	M.S.	1985
University of Illinois, Chicago	Electrical and Computer System Engineering	B.S.	1983

Position and Employment:

2002 – Present	Professor and Director, School of Electrical Engineering and Computer Science, University of Central Florida, Orlando, FL
1996 – 2002	**Associate Professor**, Electrical Engineering and Computer Science, University of Central Florida, Orlando FL
1991 – 1996	**Assistant Professor,** Electrical Engineering and Computer Science, University of Central Florida
1990 – 1991	**Postdoctoral Researcher,** University of Illinois, Chicago, IL
1989 – 1990	**Visiting Assistant Professor**, Purdue University, Hammond, IN
1987 – 1988	**Research Engineer**, Zenith Electronics Co., Glenview, IL
1903 – 1989	**Research and Teaching Assistant,** Electrical Engineering and Computer Science Department, University of Illinois, Chicago IL

Research Focus:

Dr. Batarseh's research interest focuses on the development of high frequency power electronic energy conversion systems to improve power efficiency, reduce cost and improve performance. The research includes solar energy conversion (inverters), monitoring systems, design of high frequency dc-to-ac and dc-dc resonant converter topologies; power electronic circuits for distributed power systems applications. His has published more than 350 journal, conference papers, book and book chapters.

Through an NSF Research Equipment Grant in 1994, Dr. Batarseh established the Florida Power Electronics Center (FloridaPEC) in the Department of Electrical and Computer Engineering, which is now the School of Electrical Engineering and Computer Science at University of Central Florida. The objective of the FPEC work is to carry out research and development of power electronic circuits and systems. Current research projects are funded by NASA, NSF, Florida Power, DoE, DoD and local industry.

Summary of Funded Research:
Total research funds for Dr. Batarseh in *Florida*PEC has reached more than $10 million from funding agencies including: NSF, DoD, DoE, NASA, U.S. Air Force, U.S. Army, U.S. Navy, and many private sector partners such as Emerson, Intel, Texas Instruments, APECOR, Inc., Lockheed Martin and Allied Signals Co. Obtained ten NSF Grants including research equipment grant, unsolicited grants and workshops.

Graduate Students Supervised:
20 Ph.D., 27 MS Theses, 8 Honor Undergraduate Theses. Three M.S. thesis and five Ph.D. dissertations are currently in progress.

Patents:
Dr. Batarseh has fourteen U.S. Patents issued and four are pending in the area of energy conversion and power electronics.

Summary of Publications:

Over the last fifteen years, Dr. Batarseh published more than fifty journals and more than 200 conference papers in areas of power conversion, efficiency improvement, power factor correction, maximum power tracking, high power density dc-dc and dc-ac conversion circuits. Please see web site at <*FloridaPEE.engr.ucf.edu*> for more details.

Honors & Awards:

- Elected Fellow of IEEE for contribution in power electronics, November 2005.
- Elected Fellow of IEE, 2004.
- Received the IEEE Best Paper award by IEEE Power Electronics Society, 2006.
- Future Energy Challenge Award, 3rd Place. Given by Department of Energy. 1st Place: Texas A&M, 2nd Place Virginia Tech, 4th place Wisconsin-Madison.
- College Distinguished Researcher Award, College of Engineering, 2001.
- Distinguished Researcher Award, School of EECS, 2000.
- Outstanding Engineering Educator of the Year, IEEE-1998.
- Fulbright Scholar, 1997.
- Outstanding Engineering Educator of the Year, IEEE-1998.
- Teaching Incentive Program Award, 1994, 1998, 2000.
- Outstanding Faculty Advisor Award, College of Engineering, 1998.
- Outstanding IEEE Power Engineering Orlando Chapter, 1997.
- IEEE Outstanding Chapter Award, IEEE Orlando Section, 1995.
- Excellence in Undergraduate Teaching Award, College of Engineering, 1996.

Professional Service:

- Serving as Associate Editor for IEEE Trans. On Aerospace and electronic Systems, and IEEE Trans. On Circuits and Systems.
- NSF –*Panel Reviewer for* CAREER, IGERT, REU, SBIR, STTR, International Programs.

Book Author:

Power Electronic Circuits, John Wiley Publisher, *2003 (546 pages).*

Recent Related Significant Publications:

1. H. Al-Atrash, F. Tian, and I. Batarseh, "Tri-Modal Half-Bridge Converter Topology for Three-Port Interface," IEEE Trans. Power Electron., vol. 22, no. 1, pp. 341-345, January 2007.
2. Chris Iannello and Issa Batarseh, "Small Signal and Transient Analysis of a Full-bridge, ZCS-PWM Using Averaging," IEEE Transactions on Power Electronics, August 2003.
3. C. Iannello, S. Luo, I. Batarseh.," Dynamic Modeling of the Full bridge ZCS PWM Converter" Aerospace and Electronic Systems, IEEE Transactions, Volume: 38 Issue: 2 , pp. 515-526, April 2002.
4. J. Abu-Qahouq and Issa Batarseh, "Unified Steady-state Analysis of Soft-switching DC-DC Converters," IEEE Transactions on Power Electronics, Vol. 17, No. 5, pp. 684-692, September 2002.
5. J. Abu-Qahouq and Issa Batarseh, "Unified Steady-state Analysis of soft-switching DC-DC Converters," IEEE Transactions on Power Electronics, Vol. 17, No. 5, pp. 684-692, September 2002.
6. H. Al-Atrash, and I. Batarseh, "Boost-Integrated Phase-Shift Full-Bridge Converters for Three-Port Interface," Power Electronics Specialists Conference (PESC) 2007, June 2007
7. F. Tian, K. Mansfield, J. Elmes, I. Batarseh and K. Siri,"A Single-Staged High-Frequency Link Inverter Design with Reactive Energy Storage Network," PESC 2007, June 2007.
8. W. Al-Hoor, H. Al-Atrash, J. Abu-Qahouq, and I. Batarseh, "DSP-Based Stable Control Loops Design for a Single Stage Inverter," APEC 2006, March 2006.
9. F. Tian, H. Al-Atrash, R. Kersten, C. Scholl, K. Siri, and I. Batarseh, "A Single-Staged PV Array-Based High-Frequency Link Inverter Design with Grid Connection," IEEE Applied Power Electronics Conf. and Expo., 2006, pp.1451-1454.
10. H. Al-Atrash, M. Pepper, and I. Batarseh, "A Zero-Voltage Switching Three-Port Isolated Full-Bridge Converter," IEEE Intl. Telecommunications Energy Conf., 2006, pp. 411-418.

Funded Research Contracts – Current:

1. Phase II SBIR – Integrated Three-Port Converters for Compact and Efficient Power Management (PI)
   Sponsor: NASA (UCF Share: $220,000)
2. Split-Phase DC-AC Converter for Hybrid Vehicles (PI), Sponsor: John Deere Corporation, $30,000
3. Phase I SBIR – Low-Cost, High-Efficiency, High-Density, DC-DC Converter (PI)
   Sponsor: US Navy, $70,000 (UCF Share: $30,000)
4. Phase I SBIR – Integrated Three-Port Converters for Compact and Efficient Power Management (PI)
   Sponsor: NASA, $100,000 (UCF Share: $35,000)
5. Bidirectional DC-DC Converter for Hybrid Vehicles (PI)
   Sponsor: John Deere Corporation, $30,000
6. Compact, High-Power, High-Power, High-Voltage, Bidirectional DC-DC Converter (ID: 1044633) (PI)
   Sponsor: APECOR (Applied Power Electronics Corp.), $375,000
7. Dynamic Digital Power Techniques to Improve Efficiency and performance (ID: 1045325) (PI)
   Sponsor: Intel Corporation, $100,000.00
8. FHTC match to Petra Solar: Research and Development Activities on Grid-Tie Inverter (ID: 1046578) (CO-PI)
   Sponsor: UCF/I-4, $450,000.00
9. Hybrid Architecture for Efficient Distributed Generation (ID: 1045083) (PI)
   Sponsor: California Energy Commission, $89,935.00
10. International Research Experience for Students in Photovoltaic Based Power Electronics Conversion Systems (ID: 1044854) (PI), Sponsor: National Science Foundation, $138,355.00
11. Prototype of T8 Quick-Disconnect Ballast (ID: 1046804) (CO-PI), Sponsor: AUI Management, $20,000.00
12. Radiation-Hard Power System-on-Chip (SoC) for Space Applications (ID: 1044393) (CO-PI)
    Sponsor: UCF/Space Research Initiative, $160,000.00
13. Research and Development Activities on Grid-Tie Inverter (ID: 1046579) (CO-PI), Sponsor: Petra Solar, $900,000
14. RF: Batarseh Research Support (ID: 1046506) (PI), Sponsor: Various, $5,000
15. STTR Phase I: POWER GENERATING BACKPACK (ID: 1044719) (CO-PI), Sponsor: APECOR, $30,030
16. The 21st Century World Class Scholars Program (ID: 1045059) (PI), Sponsor: FL Board of Governors, $2,000,000

BIOGRAPHICAL SKETCH

David L. Block
Director Emeritus, Florida Solar Energy Center, University of Central Florida
Phone: (321) 638-1001, Fax: (321) 504-3438 E-mail: block@fsec.ucf.edu

Research Specialty Areas:
Contract management, PV systems and economics, hydrogen technologies, energy policy

Education:

Virginia Polytechnic Institute	Engineering Mechanics	Ph.D.	1966
Virginia Polytechnic Institute	Engineering Mechanics	M.S.	1964
University of Iowa	Civil Engineering	B.S.	1962

Position and Employment:

Jan., 07 – Present	Special Projects, Florida Solar Energy Center (FSEC), University of Central Florida, Orlando, FL
May 06 – Jan., 07	Acting PV Division Director, Florida Solar Energy Center, University of Central Florida, Orlando, FL
Nov., 02 – May, 06	Hydrogen Program Director, Florida Solar Energy Center, University of Central Florida, Orlando, FL
June, 77 – Nov., 02	Director, Florida Solar Energy Center, University of Central Florida, Orlando, FL
Sept., 68 – June, 77	Acting Dean, Associate Dean and Professor, College of Engineering, University of Central Florida, Orlando, FL
Oct., 66 – Sept., 68	Staff Engineer, Dynamics and Loads Section, Martin Marietta Corporation, Orlando, FL
Feb., 62 – Oct., 66	Aerospace Engineer, Structures Division, Natural Aeronautics and Space Administration (NASA), Hampton, Virginia

Research Focus:
Dr. Block has the distinction of serving as FSEC's Director for 25 years which was the longest of any individual in a similar position in the United States. In the 25 years under his leadership, FSEC earned national and international recognition as the largest and most active state-supported solar energy institute in the nation. As FSEC's Director, he was responsible for leading the State of Florida's research efforts in solar energy and energy efficiency and FSEC's programs and activities. These activities included being responsible for administrative, budgets, and program development and for pursuit of new research programs.

Dr. Block has also been very active in the national photovoltaic and hydrogen program. These activities cover all aspects of both technologies and he is a frequent visitor to the U. S. Department of Energy. His leading of the NASA hydrogen research program has given him experience with hydrogen for space applications and with individuals at NASA Glenn Research Center and at NASA Kennedy Space Center. He has also served on the Board of Directors of the National Hydrogen Association and has numerous industry contacts.

Honors and Awards:
- Presidential Award for Special Merit, University of Central Florida (2001).
- Public Education Award, National Hydrogen Association (2001).
- Fellow of the American Solar Energy Society (2000).
- Charles Greeley Abbot Award, American Solar Energy Society (1999).

- Cornerstone Society, University of Central Florida College of Engineering (1997).
- Engineer of the Year, Florida Engineering Society and Canaveral Council of Technical Societies, Florida Engineering Society/Indian River Chapter (1991).
- Who's Who in Science and Technology (1985).
- Fellow of the Florida Engineering Society (1983).
- Young Engineer of the Year (1973).

Professional Affiliation:
- Florida Engineering Society (Fellow)
- American Solar Energy Society (Fellow)
- National Society of Professional Engineers
- National Hydrogen Association
- Solar Energy Industries Association
- Florida Solar Energy Industries Association (Charter Member, Hall of Fame)
- American Renewable Hydrogen Energy Alliance (Founder and Chairman)
- Interstate Renewable Energy Council (formerly Interstate Solar Coordination Council, Founder and Chairman)

Representative Related Publications:
- **Block, D. L.,** "Photovoltaic Performance and Cost for Florida Applications, "FSEC Research Report No. FSEC-RR-78-06.
- **Block, D. L., Raissi, A,** "NASA Hydrogen Research at Florida Universities," WHEC 16, Lyon, France, June **2006**
- **Block, D. L.,** "Energy: Business as Usual is Not an Option," Florida Engineering Society Journal Article, July **2006**.
- **Block, D. L., Szaro J.,** "Redefining Market Strategies for Promoting Solar to Commercial Customers," Final report for DOE contract (DE-FG44-03R410913) March **2006**.
- **Block, D. L., Szaro J.,** "Integrating Solar Efficient, Affordable House and Rural Utility Applications," Final report for DOE contract (DE-FG44-03R410918) March **2006**.
- **Block, D. L.**, "30 Years Under the Sun, History of the Florida Solar Energy Center," book, 278 pages, October **2005**
- **Block, D. L**., "Hydrogen Research at Florida Universities", Annual report for the third year on NASA Grant NO. NAG3-2751, November **2005**
- **Block, D. L**. and Raissi, A., "Hydrogen Technologies Fact and Myths," Proceedings of the World Renewable Energy Congress, Aberdeen, Scotland, May **2005**
- **Block, D. L.**, and Raissi, A., "Hydrogen: Automotive Fuel of the Future," IEEE Power and Energy Magazine, November/December **2004**
- **Block, D. L.**, "Hydrogen Technologies – Relay: Florida's Energy and Electric/Utility Magazine," Public Power Association, Volume 39, November/December **2004**
- **Block, D. L**., "Hydrogen Research at Florida Universities," Annual Report on NASA NO. NAG#-2751, November **2004**
- **Block, D. L**., "Comparative Costs of Hydrogen Produced from Photovoltaic Electrolysis and from Photoelectrochemical Processes,@ Proceedings of 12th World Hydrogen Energy Conference, Buenos Aires, Argentina, June **1998**
- **Block, D. L**., "Photovoltaic Electricity Costs,@ FSEC Research Report, February **1998**
- **Block, D. L**.,"Hydrogen from PV Electrolysis," Final Contract Report, U.S. Department of Energy, NASA/KSC, Florida Energy Office, January **1996**
- **Block, D. L**., "Proceedings of 10th World Hydrogen Energy Conference,@ Editor of three volumes, June **1994**

BIOGRAPHICAL SKETCH

Gijs Bosman: **565 New Engineering Building, University of Florida, PO Box 116130, Gainesville, FL 32611, Phone (352) 392-0910, email: bosman@ece.ufl.edu**

Fields of Interest: Semiconductor devices characterization and modeling.

Education:

University of Utrecht, The Netherlands	Physics	B.S.	1971
University of Utrecht, The Netherlands	Physics	M.S.	1976
University of Utrecht, The Netherlands	Physics	Ph.D.	1981

Research and Professional Experience:

Professor, Department of Electrical and Computer Engineering, University of Florida, 1990 present.

Associate Professor, Department of Electrical and Computer Engineering, University of Florida, 1986-1990.

Assistant Professor, Department of Electrical and Computer Engineering, University of Florida, 1981-1986.

Research Fellow, University of Utrecht, The Netherlands, 1976-1981.

Awards:

2006, Eta Kappa Nu, Teacher of the Year Award, ECE Student Chapter at UF

1999, College of Engineering Teacher of the Year Award for 1998-1999

1998, University of Florida TIP Award for Outstanding Teaching

1994, University of Florida TIP Award for Outstanding Teaching

1994, Departmental Award for Outstanding Teacher of an EE Core Course

1989, Departmental Award for Supervising the Outstanding Ph.D. Dissertation of 1988

1987, Departmental Award for Supervising the Outstanding Ph.D. Dissertation of 1986

1986, Departmental Award for Outstanding Teacher of an EE Core Course

1985, Departmental Award for Supervising the Outstanding Ph.D. Dissertation of 1985 (with C. M. Van Vliet)

1984, Tau Beta Pi Award for Excellence in Undergraduate Teaching

Selected Recent Professional Activities:

Member of the Scientific Organizing Committee of the 19th International Conference on Noise and Fluctuations held in Tokyo, Japan, September 2007.

General Chair and Host of the 16th International Conference on Noise in Physical Systems and 1/f Fluctuations held in Gainesville FL October 22-25, 2001.

Member and past-chair of the International Advisory Committee on Noise in Physical Systems and 1/f Fluctuations (1998-present).

10 Relevant Publications:

1. L. Kore and G. Bosman, “Feasibility of Porous Silicon as a Primary Material in Solar Cells,” Solar Energy Materials and Solar Cells, vol. 57, pp. 31-48, 1999.
2. Shahed Reza, Quyen T. Huynh, Gijs Bosman, Jennifer Sippel, and Andrew G. Rinzler, “ 1/f Noise in Metallic and Semiconducting Carbon Nanotubes,” J. Appl. Physics, vol. 100, 094318 (2006).
3. Shahed Reza, Gijs Bosman, M. Saif Islam, Theodore I. Kamins, Shashank Sharma, and R. Stanley Williams, “Noise in Silicon Nanowires,” IEEE Trans. on Nanotechnology , vol. 5 (5), pp. 523-529, 2006.
4. Shahed Reza, Quyen T. Huynh, Gijs Bosman, Jennifer Sippel, and Andrew G. Rinzler, “ Thermally Activated Low Frequency Noise in Carbon Nanotubes,” Journal of Applied Physics, vol. 99, 11, 2006. Art. No. 114309. Also published in the Virtual J. of Nanoscale Science and Tech., vol. 13 (24), 2006.
5. Jing Guo, Sayed Hasan, Ali Javey, Gijs Bosman, and Mark Lundstrom, “”Assessment of High-Frequency Performance Potential of Carbon Nanotube Transistor,” IEEE Trans. on Nanotechnology, vol. 4, pp. 715-721, 2005.
6. Robert Dieme, Gijs Bosman, Toshikazu Nishida, and Mark Sheplak, “ Sources of excess noise in silicon piezoresistive microphones,” J. Acoustic Soc. Am., vol. 119, pp. 2710-2720, 2006
7. Jonghwan Lee, Gijs Bosman, “Comprehensive noise performance of ultrathin oxide MOSFETs at low frequencies,” Solid-State Electronics, vol 48, pp. 61-71, 2004.
8. J. E. Sanchez, G. Bosman, and M. E. Law, "Two-dimensional semiconductor device simulation of trap assisted generation-recombination noise under periodic large-signal conditions and its use for developing cyclostationary circuit simulation models," IEEE Trans. Electron Devices, vol. 50, pp.1353-1352, May 2003.
9. Martin von Haartman, Martin Sanden, Mikael Ostling, and Gijs Bosman, "Random telegraph noise in SiGe heterojunction bipolar transistors," J. Appl. Phys., 92, pp. 4414-4421, 2002.
10. F.-C. Hou, G. Bosman, and M. E. Law, “Simulation of oxide trapping noise in sub-micron n-MOSFETs,” IEEE Trans. Electron Devices, vol. 50, pp. 846-852, March 2003.

Refereed Journal Publications: 80 ***Conference Presentations:*** 48 (24 invited)

Graduate Students/Collaborators Last 5 Years:

- Ph.D. Thesis Advisor (last 5 years) for: Derek Martin (Agilent), Shahed Reza (HP), Juan Sanchez (AMD), Frank Hou (Texas Instruments), Jongwan Lee (Goldstar), Lisa Kore (Consultant). Total number of Ph.D. students supervised since 1981 is 20.
- Other collaborators or co-authors: Dr. George R. Duensing (Invivo), Dr. Keith R. Green (Texas Instruments), Mr. Martin von Haartman (KTH, Sweden), Mr. Don Ladwig (Texas Instruments), Prof. M. E. Law (University of Florida), Prof. Mikael Ostling (KTH, Sweden), Dr. Martin Sanden(KTH, Sweden), Dr. Charles Saylor (Invivo), Prof. M. Sheplak (University of Florida), Prof. T. Nishida (University of Florida), Prof. Andrew Rinzler (University of Florida).

BIOGRAPHICAL SKETCH

David A. Cartes
Department of Mechanical Engineering
FAMU – FSU College of Engineering
Florida State University
Tallahassee, Florida 32316-2175

Residence: (850) 575-5893
Office: (850) 645-1184
Facsimile: (850)410-6337
Email: dave@caps.fsu.edu

Fields of Interest – Adaptive algorithms***,*** artificial Intelligence, and multi-agent systems with application to power and energy systems for distributed control, nonlinear systems, secure control architectures, condition based monitoring, automated power system fault analysis, knowledge based systems, advanced power electronics and machine control, power quality management, and modeling and simulation.

Education and Training
Excelsior College, Business and Economics, B.S., 1986
Troy State University, Management Science, M.S., 1992
Dartmouth College, Engineering Science, B.E., 2000
Dartmouth College, Engineering Science, Ph.D., 2001

Research and Professional Experience
Associate Director, Center for Advanced Power Systems, Florida State University, 2007-present
Associate Professor of Mechanical Engineering, Florida State University, 2007-present
Assistant Professor of Mechanical Engineering, Florida State University, 2001– 2007
Office of Naval Research Summer Faculty Fellow – July-August 2004
Graduate Research Assistant, Dartmouth College 1995-2001
Commissioned Officer, Nuclear Power Engineer, United States Navy, 1975-1994

Awards
2007 Senior Member of the IEEE.
2005 President's Award, American Society of Naval Engineers.
2005 Certificate of Appreciation, American Society of Mechanical Engineers (ASME)
2004 Certificate of Appreciation, American Society of Mechanical Engineers (ASME)

Synergistic Activities
- Member Working Group IEEEE Standard 1547.3&4 - *Standard for Interconnecting Distributed Resources with Electric Power Systems*
- Control Sub-Committee Chair IEEE Standard 45- *Recommended Practice for Electric Installations on Shipboard*
- Executive Committee IEEE PES Working Group "Multi Agent Systems"
- Member IEEE PES Task Force on 'Intelligent Control Systems'
- Chaired the 2005 American Society of Naval Engineers - All Electric Ship Reconfigurable and Survivable Systems Symposium.
- Program Director 2003 ASME-Tallahassee Town Hall Meeting, *Florida's Energy Needs and the Role of Technology in Satisfying Those Needs*.
- Program Director 2002 ASME-Tallahassee Town Hall Meeting, *The Important Engineering and Technology-Related Issues Facing the State of Florida in the Next 5 to 10 years*.

10 Relevant Publications

1. P. Kolavennu, S. Palanki, **D. Cartes**, J. Telotte, "Adaptive Controller for Tracking Power Profile in a Fuel Cell Powered Automobile," J. Process Control, *in print*
2. L. Liu, W. Liu, **D. Cartes**, "Permanent Magnet Synchronous Motor Parameter Identification using Particle Swarm Optimization," J. Computational Intelligence Research (IJCIR), Vol. 4, No. 2 March 2008, *in print*
3. K. Huang, **D. Cartes**, S. Srivastava, "A Multi-agent Based Algorithm for Ring-structured Shipboard Power System Reconfiguration," IEEE Trans. Systems, Man, and Cybernetics-Part C. Vol. 37, No. 5, Sept. 2007, pp. 1016 – 1021
4. L. Liu, **D. Cartes**, "Synchronisation Based Adaptive Parameter Identification for Permanent Magnet Synchronous Motors," IET Trans. Control Theory & Applications, Vol. 1, No. 4, July 2007, pp. 1015 – 1022.
5. L. Liu; K. Logan, **D. Cartes**, S. Srivastava, "Fault Detection, Diagnostics, and Prognostics: Software Agent Solutions," IEEE Trans. Vehicular Technology, Vol. 56, No. 4, Part 1, July 2007, pp. 1613 - 1622
6. K. Huang, S. K. Srivastava, **D. Cartes**, "Solving Information Accumulation Problem in Mesh Structured Agent System," IEEE Trans. Power Systems, Vol. 20, Issue 1, February 2007, pp. 493-495.
7. W. Liu, L. Liu, **D. Cartes**, G. Venayagamoorthy. "Binary Particle Swarm Optimization Based Defensive Islanding Of Large Scale Power Systems," J. Computer Science & Applications, Vol. 4, No. 3, 2007, pp. 69-83.
8. H. Li, **D. Cartes**, M. Steurer, H. Tang, "Control Design of STATCOM with Superconductive Magnetic Energy Storage," IEEE Trans. Applied Superconductivity, Vol. 15, No. 2, June 2005, pp. 1883-1886.
9. **D. Cartes**, L. Wu, "Experimental Evaluation of Adaptive Three-Tank Level Control," ISA Trans., Vol. 44, No. 2, April 2005, pp. 283-293
10. **D. Cartes**, L. Ray, R. Collier, "Lyapunov Tuning of the Leaky LMS Algorithm for Single-Source, Single-Pont Noise Cancellation," Mechanical Systems and Signal Processing (MSSP), Vol. 17, No. 5, September, 2003, pp. 925-944.

Refereed Journal Publications: 29 Conference Presentations: 64 (12 invited)

Patents

Method for tuning an adaptive leaky LMS filter, United States Patent 6,741,707, Cartes, et al. May 25, 2004

Thesis and Post Doctoral Advisor in Last Five Years

Present – Dr. Sanjeev Srivastava (Texas A&M), Dr. Wenxin Liu (Univ. Missouri – Rolla), Dr. Lily Liu (Florida St. Univ.), Dr. Karl Schoder (West Va. Univ.), Dr. David Chung (Va. Tech.), Mr. Siyu Leng (Ph.D. Candidate), Mr. Jabid Mendez (M.S. Candidate)

Past – Dr. Lewei Qian, (Siemens), Dr. Kai Huang (Slumberger), Dr. Jie Tang (S&C Electric Company), Dr. Li Liu (FSU), Dr. Li-Hsiung Sun (LG Electronics), Mr. Liqun Xing (Siemens), Ms. Zhiping Ding (Caterpillar), Mr. Lei Wu (BP).

Research Awards in Past 5 Years

$6.8M, from ONR, DOE, State of Florida, for an average of $1.36M per year

BIOGRAPHICAL SKETCH

SUBRATO CHANDRA, Ph.D.
Florida Solar Energy Center

EDUCATION:

Ph.D., Engineering (1975), M.S., Aerospace Engineering (1973), West Virginia University, Morgantown, WV.

B. Tech. (Honors), Aeronautical Engineering (1971), Indian Institute of Technology, Kharagpur, India.

PROFESSIONAL EXPERIENCE:

1983- 2001, Division Director, Buildings Research Division, FSEC.

Directed the Buildings Research division at FSEC during 1983 - 2001. Mr. Philip Fairey and I co-led a nationally recognized team of over 20 professionals and had oversight responsibilities for an annual budget exceeding $3,000,000.

- Advanced the state of the art in energy-efficient and healthy houses. Performed systems engineering in high-visibility demonstration houses featured in *Better Homes and Gardens* (12-page article, October 1994) and *Professional Builder* (cover story, March 1996).
- Discovered new way to prevent dust mite infestation (leading cause of asthma in humid climates) in new homes though simultaneous use of central dehumidification and superior vacuum cleaning practices. Results were reported in the *J. Allergy and Clinical Immunology,* January 2000.

2001 - Present, Program Director, Buildings Research Division, FSEC.

Serving as project director of the U.S. DOE sponsored Building America Industrialized Housing Partnership project, www.baihp.org which is currently funded by U.S. DOE at a level of ~$1,900,000/yr. Put together an industry / academia partnership and wrote proposal that won this nationally competed solicitation twice – the first time in 1999 and then again in 2006. Primary project goals are to cost effectively reduce the energy cost of factory and site built housing by up to 50% and assist the project partners in constructing thousands of energy efficient homes while enhancing indoor air quality, durability and productivity. Over 120,000 such homes have been constructed by BAIHP partners to date.

SELECTED PUBLICATIONS:

Fonorow, K., Chandra, S., Martin, E., McIlvaine, J., "*Energy and Resources Efficient Communities through Systems Engineering: Building America Case Studies in Gainesville, FL.",* Proceedings of the 2006 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Asilomar, CA., August 2006.

Thomas-Rees, S., Chandra, S., Barkaszi, S., Chasar, D., Colon C., *Improved Specifications for Federally Procured Ruggedized Manufactured Homes for Disaster Relief in Hot/Humid Climates* Fifteenth Symposium on Improving Building Systems in Hot and Humid Climates, July 24-26, 2006 Orlando, FL.

Chasar, D., Chandra, S., Parker, D., Sherwin, J., Beal, D., Hoak, D., Moyer, N., McIlvaine, J., *Cooling Performance Assessment of Building America Homes*, Fifteenth Symposium on Improving Building Systems in Hot and Humid Climates, July 24-26, 2006 Orlando, FL.

McGinley, W.M., Jones, A., Turner C., Chandra S., Beal D., Parker D., Moyer N., McIlvaine, J. *Optimizing Manufacturerd Housing energy Use* Proc.- Symposium on Improving Building Systems in Hot, Humid Climates , Richardson , Tx , May 17-19, 2004

McIlvaine, J., Beal D., Moyer N., Chasar D., Chandra S. *Achieving Airtight Ducts in Manufactured Housing* Proc.- Symposium on Improving Building Systems in Hot, Humid Climates , Richardson , Tx , May 17-19, 2004

Chandra, S., Parker D., Beal, D., et al *Alleviating Moisture Problems in Hot, Humid Climate Housing*

Position Paper for NSF Housing research agenda workshop, UCF, Orlando, FL Feb 12-14, 2004 (Invited)

Chandra S., Beal, D. *Allergy Relief in Humid Climates* Home Energy, March/April 2002, pp.30- 33

Chandra, S., Beal, D. *Preventing House Dust Mite Allergens in New Housing* Proc, ASHRAE IAQ 2001 conference San Francisco, Nov 5-7, 2001

SYNERGISTIC ACTIVITIES:

Presentations and Media Recognitions:

Presenter at the South East Builder Conference -2003,2004,2005. International Builders Show, 2006. Media recognitions in central Florida press and TV since 2001.

Reviewer:

Served as a peer reviewer for DOE and paper and proposal reviewer for ASHRAE, DOE-SBIR, California Energy Programs, NIST and others

Teaching and Advising:

Teach the Mechanical part of CCE4813, Mechanical and Electrical Systems for Buildings, required 4 hr course for UCF Civil Engineering senior students enrolled in the construction option every fall since 2004. Serve as Joint Faculty, Department of Civil Engineering as well as Department of Industrial Engineering and Management Systems, University of Central Florida (UCF), Orlando, FL. During 1990 - 1999 taught course on Engineering Economy. Served on thesis committees of graduate students. Chair, Brian Fuehrlein honors undergraduate thesis, awarded first place for 1999 theses among all UCF undergraduates. Chair, Matthew McCloud undergraduate thesis committee, 2001-2002.

Memberships:

Member ASHRAE, FSEC representative to Metro Orlando Home Builders Association and the National Institute of Building Science

Service:

Member of the Board, American Lung Association of Central Florida 1999-2006.

BIOGRAPHICAL SKETCH

Jacob N. Chung: **332 MAE-B, University of Florida, PO Box 116300, Gainesville, FL 32611, Phone (352) 392-9607, email: jnchung@ufl.edu**

Fields of Interest: Experimental, numerical and analytical fluid mechanics and heat transfer associated with droplets and bubbles, boiling and condensation, heat and mass transfer in dehydration and porous media, two-phase flow and heat transfer, packed bed thermal storage system, particle and droplet dispersion in turbulent free shear flows, fluid mechanics and heat transfer in micro-gravity boiling and two-phase flow, large-scale direct numerical simulation of transition to turbulence for mixed convection flows by spectral methods, nuclear reactor thermal-hydraulic analysis, transport processes in manufacturing and materials processing for nano-cluster material, nano- and micro-scale transport phenomena, liquefaction, storage and transport of cryogenic fluids.

Education:

Ph.D.	Mechanical Engineering,	University of Pennsylvania,	1979
MS	Nuclear Engineering,	University of Missouri,Columbia,	1973
BS	Nuclear Engineering,	National Tsing Hua University, Taiwan,	1970

Research and Professional Experience:

1998-present : Professor and Andrew H. Hines, Jr./Progress Energy Corporation Eminent Scholar Chair, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL 32611-6300, Phone: 352-392-9607, Fax: 352-392-1071, e-mail : jnchung@ufl.edu,
Web site : www.grove.ufl.edu/~jnchung.

1989-1998 : Professor, School of Mechanical and Materials Engineering, Washington State University, Pullman, WA. 99164-2920.

1984-1989 : Associate Professor, Department of Mechanical and Materials Engineering, Washington State University.

1979-1984 : Assistant Professor, Department of Mechanical Engineering, Washington State University

Awards and Recognition :

Washington State University College of Engineering 1988 Faculty Research Excellence Award
1989 WSU College of Engineering faculty elected to the Honor Society of Phi Kappa Phi.
Washington State University School of Mechanical and Materials Engineering research excellence award, 1994 and 1995
IBM Physical Sciences and Mathematics Faculty Achievement Award, 1989.
AIAA Distinguished Leadership and Service Award, 1995.
Elected to the Fellow grade by ASME, 1996.
ASME Heat Transfer Division Journal of Heat Transfer Associate Editor Achievement Award, 2006

Synergistic Activities:

Dr. Chung's research activities for the past twenty eight years have been in the general areas of heat and mass transfer with applications to energy conversion and power production such as bubble dynamics, phase change heat transfer, multiphase flows, and laminar-turbulent transition and turbulence in heated flows. He has six years of engineering experiences with Nuclear power industry. Recently he has focused on pyrolytic gasification and micro-scale transport phenomena,

in addition to and atomistic and molecular dynamics simulations. He is the author and co-author for more than 150 refereed technical papers on the above areas in archival journals.

10 Relevant Publications:

1. Ji, Y., Yuan, K., Chung, J. N., "Numerical simulation of wall roughness on gaseous flow and heat transfer in a microchannel", **49**, *Journal of International Heat and Mass Transfer*, 1329-1339, 2006

2. Ji, Y., Yuan, K., Chung, J. N. and Chen, Y.C., "Effects of transport scale on heat/mass transfer and performance optimization for solid oxide fuel cells ", *Journal of Power Source*, **161**, 380-391, 2006.

3. Chen, Y.C. and Chung, J.N. "The Linear Stability of Mixed Convection in a Vertical Channel Flow," *J. Fluid Mech*., **325**, 29-51, 1996.

4. Su, Yi-Chung and Chung, J. N. "Linear Stability Analysis of Mixed-Convection Flow in a Vertical Pipe," *J. Fluid Mech*., **422**, 141-166, 2000.

5. Chen, Y.C. and Chung, J.N. "A Direct Numerical Simulation of K- and H-Type Flow Transition in a Heated Vertical Channel,"*Physics of Fluids*, **14**, 3327-3346, 2002.

6. Chen, T. and Chung, J. N., "An experimental study of miniature-scale pool boiling," ASME *J. Heat Transfer,* **125**, 1074-1086, 2003.

7. Chen, T. and Chung, J.N. "Heat Transfer Effects of Coalescence of Bubbles from Various Site Distributions on Microheaters," *Proceedings of the Royal Society, London, A : Mathematical, Physical and Engineering Sciences*, **459**, 2497-2527, 2003.

8. Nguyen, H.D. and Chung, J.N. "A Chebyshev-Legendre Spectral Method for the Transient Solution of Flow Past a Solid Sphere," *J. Comp. Phys.*, **104,** 303-312 (1993).

9. Chung, J.N. and Troutt, T.R., "Simulation of Particle Dispersion in a Jet," *J. Fluid Mech*., **186**, 199-223 (1988).

10. Snyder, T.J. and Chung, J.N. and Schneider, J.B., "Bubble Dielectrophoresis with Application to Thermal Management in Terrestrial Gravity and Microgravity Environments : Part II- Experimental Analysis," *J. of Applied Physics*, **89**, 4084-4090, 2001.

Refereed Journal Publications: 122 ***Conference Presentations:*** 70

Graduate Students/Postdoctoral Fellows Last 5 Years:

Current: A. Agaral, C.F. Tai, S. Maroo, T.S. Lee, Y.W. Na, M. Bai

Ph.D. supervised in last 7 years:

Tao Ye (industry)
Tailian Chen (industry)
K. Yuan (industry)
R. Xiong (Georgia Institute of Technology)
Ji Yan (Business School, Stanford)

BIOGRAPHICAL SKETCH

Neelkanth G. Dhere

Research Faculty and Professor, Florida Solar Energy Center, University of Central Florida
Phone: (321) 638-1442, Fax: (321) 638-1010 E-mail: dhere@fsec.ucf.edu

Research Specialty Areas:
Thin-film solar cells, Solar hydrogen, and Reliability of PV modules and systems

Education:

University of Poona	Physics	Ph.D.	1966
University of Poona	Physics, Electronics	M.S.	1962
University of Poona	Physics, Mathematics, Chemistry	B.S.	1960

Position and Employment:

1990 – Present	Program Director, Florida Solar Energy Center (FSEC), University of Central Florida
1993 – Present	Professor, Department of Mechanical, Materials and Aerospace Engineering, University of Central Florida
1986 – 1990	Senior Research Scientist, Solar Research Institute, Golden CO.
1971 – 1986	Professor Materials Science and Engineering and Chief, Solar Cells and Microelectronics Laboratory , Rio de Janeiro, Brazil
1970 – 1971	Research Fellow, Comissão National de Atividades Espaciais, Sao Jose dos Campos, SP Brazil
1966 – 1970	Head Techniques Laboratory, Physical Research Laboratory, Ahmedad, India

Research Focus:
Dr. Dhere has installed at FSEC the World's largest University facility for preparation of complete photoelectrochemical (PEC) and photovoltaic (PV) cells over 10cm x10cm area by selenization/sulfurization and has achieved the record conversion efficiency of 13.73% as measured at NREL for small (0.44 cm^2) $CuIn_{1-x}Ga_xSe_{2-y}S_y$ (CIGSeS) solar cells. He has designed from first principle, built and installed vacuum deposition systems and has prepared PEC and PV cells based on p-type CIGSeS and CdTe thin-films and a RuS_2 photoanode for generation of hydrogen by splitting water. He developed special techniques to extract samples from photovoltaic modules. 35 MS and PhD students have completed graduate research under his guidance. He was instructor of two tutorials on tutorials on Thin Film Solar Cells and Design and Reliability of PV Modules at the 30th and 31st IEEE PV Specialists' Conference at New Orleans, LA and at Orlando, FL and 4th World PV Solar Energy Conference at Hawaii. He has 188 publications including two book-chapters on high Tc thin films in Physics of Thin Films, Vol. 16, (M. H. Francombe and J. L. Vossen, eds), Academic Press, 1992 and on Hydrogen Production from Solar Energy Chapter in "Hydrogen Fuel: Production, Transport and Storage" (R. Gupta, ed.), CRC Press (submitted).

Honors and Awards:
- 2003 UCF Research Incentive Award
- Outstanding Engineer Award 2002 – Inst of Electrical and electronic Eng Region 3
- UCF Distinguished Researcher of the Year for Institutes and Centers, 2002
- Research Partnership Award for Outstanding Collaboration DOE EERE 2001

Professional Affiliation:

- Fellow, American Vacuum Society (2003)
- Emeritus Member and Founder-President (1979-80) Brazilian Vacuum Society,
- Chairperson, AVS Florida Chapter 2005
- Program Chairperson, Joint Symposium of the Florida Society for Microscopy, Florida Chapter of the American Vacuum Society (AVS), March 2005
- Co-Chair, National Thin Film Module Reliability Team during 2002-2005
- Life senior member IEEE
- Life member Indian Vacuum Society
- Senior member International Solar Energy Soc. and American Solar Energy Society

Representative Related Publications:

- N. G. Dhere, "Present status and future prospects of CIGSS thin film solar cells", Solar Cells & Solar Energy Materials, 91 (2007) 1376–1382.
- N. G. Dhere, S. M. Bet and V. V. Hadagali, "Leakage Currents Pathways, Magnitudes and Their Correlation to Humidity and Temperature in High Voltage Biased Thin Film PV Modules", Proc. 19th European PV Solar Energy Conference, Paris, France, June 7-11, 2004, pp. 2170-2173.
- G. Braunstein, A. Muraviev, H. Saxena, N. Dhere, V. Richter, and R. Kalish, "P-Type Doping of Zinc Oxide by Arsenic Ion Implantation", Applied Physics Letters, Vol. 87, p. 192103, (2005).
- N. G. Dhere, A. A. Kadam, S. S. Kulkarni, S. M. Bet and A. H. Jahagirdar, "Large Area CIGS2 Thin Film Solar Cells on Foils: Nucleus of a Pilot Plant", Solar Energy Journal, 77, (2004), pp. 697-703.
- N. G. Dhere, S. M. Bet and H. P. Patil, "High-Voltage Bias Testing Of Thin-Film PV Modules", Proc. 3rd World Photovoltaic Solar Energy Conf. Osaka, Japan, CD, presentation 6P-A9-42, (2003).
- N. G. Dhere and R. G. Dhere, "Thin-Film Photovoltaics" J. Vac. Sci. & Technol, (A) 23 (2003) pp. 1208-1214.
- N. G. Dhere, S. R. Ghongadi, M. B. Pandit, and A. H. Jahagirdar, "CIGS2 Thin-Film Solar Cells On Flexible Foils For Space Power" Prog. Photovolt: Res. Appl. Vol. 10, (2002), pp. 407-416.
- N. G. Dhere and N. R. Raravikar, "Adhesional Strength and Surface Analysis of a PV Module Deployed in Harsh Coastal Climate" Solar Energy Materials and Solar Cells, vol. 67, (2001), pp 363-367.
- L. Weinhardt, O. Fuchs, D. Groß, G. Storch, E. Umbach, N. G. Dhere, A. A. Kadam, S. S. Kulkarni and C. Heske, "Band alignment at the CdS/Cu(In,Ga)S2 interface in thin film solar cells", Applied Physics Letters, 86, 062109 (2005).

BIOGRAPHICAL SKETCH

Alexander Domijan, Jr.
College of Engineering, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL 33620, Office: 813-974-6854, Fax: 813-974-5250, Email: alexd@eng.usf.edu

Fields of Interest:
Electric power engineering: electric power quality (electrical transients, harmonics, signal processing and conditioning, standards development, and power quality impacts on a wide variety of end-use and utility systems), distributed power systems, micro-grids, power system reliability performance, power electronic systems (FACTS and custom power) and machine drives, electrical measurements and instrumentation (power definitions and fundamental concepts, instrument design/specification, standards, wavelet analysis and data acquisition), power system unbundling and competitive issues, biomass and solar power generation, and Flexible-Reliable-Intelligent-Electrical-eNergy-Delivery-Systems.

Education:
B.S., University of Miami, FL, 1981 in Electrical Engineering
M.Engr., Rensselaer Polytechnic Institute, NY, 1982 in Electric Power Engineering
Ph.D., University of Texas at Arlington, TX, 1986 in Electrical Engineering (Energy Systems)

Research and Professional Experience:

Executive Director, Office of Research and Planning, College of Engineering, University of South Florida, 2006-present
Professor and Director, Power Center for Utility Explorations, University of South Florida, Dept. of Electrical Engineering, 2005-present
Associate Professor, University of Florida, Dept. of Electrical and Computer Engr., 1992-2005
Director, Florida Power Affiliates and the Power Quality and Power Electronics Laboratory, University of Florida, 1987-2005
Assistant Professor, University of Florida, 1987-1992
Postdoctoral Fellow, Univ. of Texas at Arlington, Energy Systems Research Center, 1986-1987
Research Assistant, University of Texas at Arlington, 1982-1986
Research Fellow (with RPI), General Electric Company, Advanced Development Engineering, 1981-1982

Representative Publications:
1. A.Domijan, A. Montenegro, A.J. Keri, and K. Mattern, "Simulation Study of the World's First Distributed Premium Power Quality Park," IEEE Transactions on Power Delivery, April 2005, pp.1483-1492.
2. T. Lin and A. Domijan, "On Power Quality Indices and Real Time Measurement," IEEE Transactions on Power Delivery, Vol. 20, No. 4, October 2005, pp. 2552-2562.
3. A. Domijan, R. Slavickas, and M. El-Kady, "A Novel Decision-Making Methodology for Addressing Electrical Utility Total Cost," Int. J. of Power and Energy Systems, Vol. 26, No.2, 2006.
4. T. Lin and A. Domijan, "Real Time Measurement of Power Disturbances Part 1: Survey and a Novel Complex Filter Approach, Electric Power Systems Research, Elsevier, 76 (2006) pp. 1027-1032.
5. T. Lin and A. Domijan, "Real Time Measurement of Power Disturbances Part 2: Implementation and Evaluation of Novel Complex Filter/Recursive Algorithm, Electric Power Systems Research, Elsevier, 76 (2006) pp. 1033-1039
6. Q. Ai and A. Domijan, "New Load Models for Fast Transient Stability," Int. J. of Power and Energy Systems, Vol. 26, No. 1, 2006, pp. 49-57.
7. T. Lin, and A. Domijan, "Recursive Algorithm for Real-Time Measurement of Electrical Variables in Power Systems," IEEE Transactions on Power Delivery, Vol. 21, No. 1, January 2006, pp. 15-22.

8. T. Lin, A.Domijan, "Estimation of the Instantaneous Frequency in Power Systems Using a Novel Complex Filter," In Press, IEEE Transactions on Power Delivery.

9. A. Domijan, R.K. Matavalam, A. Montenegro, W.S. Wilcox, Y.S. Joo, L. Delforn, J.R. Diaz, L. Davis, and J. D'Agostini, Effects of Normal Weather Conditions on Interruption in Distribution Systems, Int. J. of PES, Paper 203-3453, Vol 25, No. 1, 2005, pp. 54-62.

10. A. Domijan, A. Montenegro, A. Keri, and K. Mattern, "Custom Power Devices: An Interaction Study," In Press, IEEE Transactions on Power Systems, Paper TPWRS-00076.

Publications: Refereed Journal: 85, Standards: 4, Book Chapters: 3, Proceedings (Ed): 8

Presentations: Scientific Meetings: 125, Universities and Institutes: 30

Funding: +4M

Synergistic Activities:

Honors and Awards:

International Cooperation Award, Peak Load Management Alliance, 2003; Editor-in-Chief, International Journal of Power and Energy Systems, Published by the International Association of Science and Technology for Development, 1997-present; 1995 IEEE Power Engineering Education Committee Outstanding Subcommittee Award; 1996 IEEE Power Engineering Society Working Group Award (for work on the IEEE Guide for Service to Equipment Sensitive to Momentary Voltage Disturbances); AEA Fellow; GE Fellow.

Professional Services:

President, International Association of Science and Technology for Development.
IASTED International Conference on High Technology in the Power Industry (Chair)
NSF Conference on Unbundled Power Quality Services (Co-Chair)
IEEE International Conference on Harmonics and Quality of Power (Chair, 2000)
Flexible, Reliable, Intelligent Electric eNergy Delivery Systems Conference (Chair – USA group)
IEEE Gainesville Section (Chair)
Southeastern Electricity Metering Association (Chair for 20+ years)
IASTED International Conferences on Power and Energy Systems (Chair, 1999, 2000, 2001, 2002, 2006)
Caribbean Colloquium on Power Quality, 2003, (Executive Committee).
International Power Con 2003: Blackout, NYC, 2003 (Chair).
IEEE International Conference on Harmonics and Quality of Power, 2004 (Executive Committee)
IASTED International Power Con 2004: Distributed Generation and Demand Response (Chair)

Committee Memberships:

IEEE Working Group on distribution voltage quality; IEEE Power Engineering Education Committee; IEEE working Group on Monitoring Electric Power Quality; IEEE Working Group on Electricity Metering; ASHRAE Technical Committee 8.11: Electric Motors and Controls; ASHRAE Technical Committee 1.9: Electrical Systems; IEEE PES – various committees; American Society for Engineering Education; The Association for Energy Engineers; IEEE Industry Applications Society; IEEE Education Society; IEEE Computer Society; IEEE Power Electronics Society; IEEE Neural Networks Council; IEEE Industrial Electronics Society; IEEE Society on Social Implications of Technology; IEEE Instrumentation and Measurement Society; International Association of Science and Technology for Development.

Collaborators and Other Affiliations:

Recent Collaborators:

Prof. J. Hasagawa, Prof. K. Nara, Prof. K. Tsuji, Prof. C. Alvarez, Prof. M. Langston, Prof. D. Kafura, Prof. A. Krings, Dr. F. Sheldon, Prof. A. Easterline, Prof. B. Johnson, Prof. P. Oman.
Graduate Advisors: Dr. R. R. Shoults, University of Texas at Arlington, Dr. S. Salon, Rensselaer Polytechnic Institute

Selected Graduate Advisees:

A Abu-Aisheh (M.S.), T. Buchh (Ph.D.), R. Chang (Ph.D.), R. Fehr (Ph.D), J. Chen (Ph.D.), E. Cheng (M.S.), G. Chung (Ph.D.), D. Czarkowski (Ph.D.), E. Embriz (M.E., and Eng.), R. Gatechompol (M.S.), A. Gilani (M.E.), J. Goetten (M.S.), B.H. Park (M.S.), C. Hsu (Ph.D.), X. Huang (Ph.D.), K. Komoto (M.E.), R. Lai (Ph.D), C. Mata (M.S.), A. Montenegro (Ph.D.), L. Montoya (M.S.), J. Oseguda (M.E.), Q. Qun (Ph.D.), S. Ramakrishnan (M.E.), M. Syed (M.S.), M. Tartibi (M.S.), G. Thoman (M.S.), R. Thottappillil (Ph.D.), D. Walker (M.S.), Y. Yin (M.E.), A. Islam (M.S.), and G. Yount (M.E.).

Total Advised: 15 Ph.D., 31 M.S., 8 M.E., 1 Eng

BIOGRAPHICAL SKETCH

ANNE E. DONNELLY

Director, South East Alliance for Graduate Education and the Professoriate Program
Particle Engineering Research Center
206 Particle Science & Technology, University of Florida, Gainesville, FL, 32611
Phone: (352) 846-0153 Fax: (352) 846 –1196 Email: adonnelly@erc.ufl.edu

Professional Preparation

Ohio Wesleyan University	Zoology	BA	1975
Georgia State University	Finance	M.B.A.	1982
University of Florida	Instruction & Curriculum	Ph.D.	1996

Appointments

2005-present	Director, South East Alliance for Graduate Education and the Professoriate Program, University of Florida, Gainesville, Florida
1997-Present	Associate Director for Education and Outreach, PERC, UF
1996-1997:	Education Coordinator, PERC, University of Florida, Gainesville, FL
1995-1996:	Undergraduate Pre-intern Field Advisor, University of Florida, Gainesville, FL
1994-1995:	Graduate Teaching Assistant, University of Florida, Gainesville, FL
1983-1987:	Marine Science Educator, University of Georgia Marine Extension Center, Skidaway Island, GA
1982-1983:	Science Teacher, Dekalb County School District, Atlanta, GA
1981-1982:	Program Manager, The Georgia Conservancy, Atlanta, GA
1978-1981:	Environmental Specialist, Department of Natural Resources, The State of Georgia, Atlanta, GA
1975-1978:	Education Specialist, University of Georgia Marine Extension Center, Sapelo Island, GA

Selected Publications/Presentations
5 most relevant publications

Donnelly, Anne E., "The South East Alliance for Graduate Education and the Professoriate-LACCEI Connection," *The Third Latin American and Caribbean Conference for Engineering and Technology,* Cartagena, Columbia, June 8-10, 2005.

Donnelly, Anne E., Invited Lecture. 'How to Develop a Comprehensive Center Education Program," Science Foundation of Ireland, First Center Director's Meeting, Dublin, Ireland, March 26, 2004.

Donnelly, A.E. and E. Hodge, "How to Develop an Education Program Evaluation Plan", a workshop presented at the *NSF Research Centers Educators Network Meeting,* Gainesville, Florida, March 4-6, 2004.

Donnelly, A.E., K. Johanson, "Solids Handling Education – Part of a Comprehensive Program at the NSF Particle Engineering Research Center, University of Florida" *4th International Conference for Conveying and Handling of Particulate Solids*, Budapest, Hungary, May 27-30, 2003.

Hodge, E. and A.E. Donnelly, "Identification of Strategies of the ERC for Particle Science & Technology at The University of Florida to Attract Female Undergraduate Students in Engineering Research," Proceedings *of the WEPAN 2002 Annual Conference*, San Juan, Puerto Rico, June 8-11, 2002.

5 additional relevant publications

Donnelly, Anne E., E. Hodge, C.Y.Wu, and P. Biswas. "The Importance of Assessing Educational Materials Development Projects," *2006 International Aerosols Conference*, St. Paul, Minnesota, Sept. 10-15, 2006.

Donnelly, Anne E, E. Hodge, M. Budak, H. Wintz, R. Switt, C.Y.Wu , P. Kumar, P. Biswas, P. Chapman, and A. L. Allen. "A Model for Teaching Materials Evaluation: Development and Testing of Interactive Computer Simulations Modules for Undergraduate Education", *Proceedings of the American Society of Engineering Education Annual Conference*, Salt Lake City, Utah, June, 2004.

Davies, R., A.E. Donnelly, B.M. Moudgil, B. Scarlett, M. Ghadiri, S. Lawson, K.J. Roberts, and R.A. Williams, "Developments in Particle Science and Technology Research and Training: UK and USA Perspective" *World Congress on Particle Technology 4,* Sydney, Australia, July 21-25, 2002.

Hargis, J. and A.E. Donnelly, "Engineering Education and the Internet: A Study of the Effectiveness of Web Formats on Student Learning," *Proceedings of the American Society of Engineering Education Annual Conferen*ce, Albuquerque, New Mexico, June 24-27, 2001.

Donnelly, A.E, D. Gamble, and J. Glover, "Leveraging Institutional and Governmental Resources to Benefit Minority and Women Engineering and Science Students," *Proceedings of the NAMEPA/WEPAN 2001 Joint Conference*, Alexandria, Virginia, April 21-24, 2001.

SynergisticActivities

Co-PI for the NSF SEAGEP program designed to increase the number of minority faculty in Science and Engineering disciplines. To date, 60 minority students in STEM PhD programs in nineteen Science and Engineering departments have been supported at UF.

Program Director - The Advanced Training in Technology: Particle Science Summer School in Winter at the PERC. This International graduate training program has included over 200 graduate students in an intensive program of modules taught by global experts.

Developed and manage the PERC Undergraduate Research Program that has provided research experience to over 700 undergraduate students over the past 10 years. This program has consistently had high representation of women and minority participants.

PI - PERC NSF Research Experience for Undergraduates Program that over the past 11 years has provided 110 non-UF students with the opportunity to conduct summer research at the center.

Program Director - PERC NSF International Research Experience for Undergraduates program Conduct education program evaluation, on the PERC education programs as well as other NSF funded CCLI grants.

Founding Member of the NSF Research Centers Educators Network (NRCEN)

Collaborators

Pratim Biswas (U. Washington, St Louis), Joe Glover (UF), Brij Moudgil (UF), Kevin Powers (UF), C.Y. Wu (UF)

Graduate Advisor : John J Koran (deceased)

Graduate Student Committees in the Past 5 years: none

BIOGRAPHICAL SKETCH

Chris S. Edrington
Department of Electrical and Computer Engineering
FAMU – FSU College of Engineering
Center for Advanced Power Systems
Florida State University
Tallahassee, Florida 32310-2870

Residence: (850) 656 -7266
Office: (850) 410 - 6410
Office: (850) 645 -7213
Facsimile: (850) 645 -1534
Email: dave@caps.fsu.edu

Fields of Interest –Modeling, simulation, design, and control of electrical drive systems; applied power electronics; distributed energy systems; grid integration of renewable energy sources; prognostics and diagnostics for electrical machinery.

Education and Training
Arkansas State University, Engineering, B.S., Magna Cum Laude, 1999
University of Missouri-Rolla, Electrical Engineering, M.S., 2001
University of Missouri-Rolla, Electrical Engineering, Ph.D. 2004

Research and Professional Experience
Assistant Professor of Electrical Engineering, Florida State University, 2007-present
Assistant Professor of Electrical Engineering, Arkansas State University, 2004– 2007
Graduate Research Assistant, University of Missouri-Rolla, 1999-2004
Undergraduate Research Assistant, Arkansas State University, 1996-1999
Licensed Professional Engineer-#12952, Arkansas, 2007

Awards
2006 2nd Prize Paper Award, IEEE Transactions on Industry Applications.
2005 Outstanding Power Engineering Award-Grainger Fellow, Grainger Foundation
2001 IGERT Fellow, National Science Foundation
1999 GAANN Fellow, Department of Education

Synergistic Activities
- Chair of Invited Speakers and Tutorials, IEEE Vehicular Power and Propulsion Conference, 2007.
- Secretary Elect, IEEE Tallahassee Chapter.
- Publicity Chair, IEEE Vehicular Power and Propulsion Conference, 2010 and 2011.

Relevant Publications
C. S. Edrington, B. Fahimi, and M. Krishnamurthy, "An Auto-Calibrating Inductance Model for Switched Reluctance Motor Drives," IEEE Transactions on Industrial Electronics, Volume 54, Issue 4, August 2007.

M. Krishnamurthy, C. S. Edrington, A. Emadi, A. Asadi, M. Ehsani, and B. Fahimi, "Making the Case for Applications of Switched Reluctance Motor Technology in Automotive Products," IEEE Transactions on Power Electronics, Volume 21, Issue 3, May 2006.

M. Krishnamurthy, C. S. Edrington, B. Fahimi, "Prediction of Rotor Position at Standstill and Flying Shaft Conditions in Switched Reluctance Machines," IEEE Transactions on Power Electronics, Volume: 21, Issue 1, January 2006.

C. S. Edrington, D. C. Kaluvagunta, J. Joddar, B. Fahimi, “Investigation of electromagnetic force components in SRM under single and multi-phase excitation”, IEEE Transactions on Industry Applications, Volume: 41, No. 4, July/Aug. 2005.

C. S. Edrington, M. Krishnamurthy, B. Fahimi, "Bipolar Switched Reluctance Machines: A Novel Solution for Automotive Applications", IEEE Transactions on Vehicular Technology, Volume 54, Issue 3, May 2005.

Refereed Journal Publications: 5 Conference Presentations: 17 Books: 1 chapter

Patents

C. S. Edrington and B. Fahimi, “Method and Apparatus for Control of Switched Reluctance Machines” Patent Disclosure 04UMR037, December 2003.

Thesis Advising

Present – Jabid Mendez (MS co-advisor), Dorca Lee (PhD committee member).

Research Awards in Past 5 Years

Scholarly Undergraduate Research Fellowship Grant/ACPA, 2005

“Reduced Parts Converter for Realization of Bipolar Excitation of a 4-phase 8/6 Switched Reluctance Machine”

Arkansas State University Scholarly Initiative Grant, 2005

“Improvement in Magnetic Modeling for the 2-phase Induction Machine: Application to Variable Speed Control”

NASA: Arkansas Space Grant Consortium Award, 2006

“Development of a Switched Reluctance Wheel Motor for Vehicle Propulsion”

NASA: Arkansas Space Grant Consortium Award, 2007

“Development of Inverter Topologies for Driving an In-wheel Reluctance machine”

NASA: Arkansas Space Grant Consortium Award, 2007

“Development of a High-thrust Linear Switched Reluctance Machine: Application to Vehicle Launch Systems”

Arkansas State University Faculty Development Grant, 2007

“Exploration of Ultracapacitor-assisted Fuel Cell-based Power Systems: Application to Driving Highly Inductive Electrical Loads”

BIOGRAPHICAL SKETCH

Philip Fairey

Florida Solar Energy Center (FSEC)
1679 Clearlake Road
Cocoa, FL 32922-5703

e-mail: pfairey@fsec.ucf.edu
phone: (321) 638-1005
fax: (321) 638-1010

EDUCATION & TRAINING

Master, City and Regional Planning, Clemson University, 1975
B.A., Architecture, Clemson University, 1969

PROFESSIONAL EXPERIENCE

Principal responsibility for more than 30 building energy research contracts totaling more than $11 million. Experimental and analytical expertise in fields of moisture transport and control, advanced cooling and dehumidification systems, uncontrolled air flows and pressures, indoor air quality (IAQ), building energy-efficiency and energy conservation systems, natural ventilation systems, building diagnostics and instrumentation and monitoring system, engineered building design, renewable energy systems, industrialized housing systems, building codes & standards, building energy rating systems, and building energy analysis software tool development.

1990-present: *Deputy Director*, FSEC. Assist the Director in matters of policy, planning, budget and personnel. Represent FSEC at public and institutional engagements and on committees on which it is asked to serve. Act on behalf of the Director in his absence. Perform contracted research.
1986-1990: *Program Director* for Buildings Research, FSEC. Research and development of advanced building energy-efficiency and cooling and dehumidification concepts and systems. Responsibilities include overall program development, supervision of fifteen to twenty research professionals, research contract management and administration, and experimental and analytical buildings and energy research.
1980-1986: *Research Scientist*, FSEC. Responsibilities included development of research plans, preparation of major research proposals, supervision of three to five professionals, administration and management of research contracts, design and management of the FSEC Passive Cooling Laboratory, lectures at workshops and seminars, administration of building design competitions, responses to public inquiries and analytical and experimental research.
1979-1980: *General Manager*, Building Systems, Inc. Responsible for design and construction of factory-built modular homes in the Carolinas.
1975-1979: *Owner*, Piedmont Shelters, Inc. Responsible for design and construction of custom solar homes in the Carolinas.
1969-1973: *1st Lieutenant*, U.S. Army. Administrative officer for U.S. Army Depot, Federal Republic of Germany.

PUBLICATIONS

More than 100 technical publications, including 4 books or book chapters, 2 U.S. Patents, 38 peer-reviewed articles, 58 major research reports and magazine articles, public information documents and video productions, including

Elliot, N., M. Eldridge, A. Shipley, J. Laitner, S. Nadel, P. Fairey, R. Vieira, J. Sonne, A. Silverstein, B. Hedman and K. Darrow, "Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demand." ACEEE Report: E072, American Council for an Energy Efficient Economy, Washington, DC, June 2007.

Fairey, P., J. Sonne, "Effectiveness of Florida's Residential Energy Code: 1979-2007." Final Report: FSEC-CR-1717-07, Florida Solar Energy Center, Cocoa, FL, May 2007.

Fairey, P., C. Colon, E. Martin, S. Chandra, "Comparing Apples, Oranges and Grapefruits: An Analysis of Current Building Energy Analysis Standards for Building America, Home Energy Ratings and the 2006 International Energy Conservation Code." Final Report: FSEC-CR-1650-06, Florida Solar Energy Center, Cocoa, FL, August 2006.

Fairey, P. and D. Goldstein, "Getting it Right Matters: Why Efficiency Incentives Should be Based on Performance and Not Cost." Proceedings of ACEEE 2004 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, DC, August 2006.

Baden, S., P. Fairey, P. Waide, P. de T'serclaes and J. Laustsen, "Hurdling Financial Barriers to Low Energy Buildings: Experiences from the USA and Europe on Financial Incentives and Monetizing Building Energy Savings in Private Investment Decisions." Proceedings of ACEEE 2004 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, DC, August 2006.

Fairey, P., D. Parker, B. Wilcox and M. Lombardi, "Climate Impacts on Heating Seasonal Performance Factor (HSPF) and Seasonal Energy Efficiency Ratio (SEER) for Air Source Heat Pumps." *ASHRAE Transactions*, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta GA, June 2004.

Fairey, P., R. Vieira, M. Elder, C. Kettles, J. Tait, et.al., "Florida's Energy Future: Opportunities for Our Economy, Environment and Security." Final Report: FSEC-CR-1676-04, Florida Solar Energy Center, Cocoa, FL, January 2004.

Fairey, P., J. Tait, D. Goldstein, D. Tracey, M. Holtz and R. Judkoff, "The HERS Rating Method and the Derivation of the Normalized Modified Loads Method." Research Report: FSEC-RR-54-00, Florida Solar Energy Center, Cocoa, FL, October 11, 2000.

Fairey, P., and M. Swami, "Attic Radiant Barrier Systems: A Sensitivity Analysis of Performance Parameters," *International Journal of Energy Research*, Vol. 16, pp. 1-12, John Wiley & Sons, Ltd., New York, NY, January 1992.

Fairey, P., and A. Keresteciogl u, "Dynamic Modeling of Combined Thermal and Moisture Transport in Buildings: Effect on Cooling Loads and Space Conditions," *ASHRAE Transactions*, Vol. 91, Pt. 2, 1985.

SYNERGISTIC ACTIVITIES

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Member, Standing Standards Project Committee 140 member, *Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs,* 2001-present; Member, Standing Standards Project Committee 62.2, *Ventilation and IAQ in Low-Rise Residential Buildings,* 2007-present.

Florida Building Commission, Energy Technical Advisory Group Member. Advise Commission on maters related to Florida Building Energy Codes and Standards, 1998-present.

Florida Energy Commission, Efficiency and Conservation Advisory Group Member. Advise Commission on energy efficiency and energy conservation potentials, 2006-present

Florida Green Building Coalition: Founding Member; Chairman, Standards Committee, 1999-2005.

RESNET Member: Board of Directors, 1998-present; Chairman, *Training and Certification Task Force*, 2000-2005; Chairman, *Software Evaluation Task Force*, 2000-2005; President, 2004-2006.

BIOGRAPHICAL SKETCH

James M. Fenton
Professor and Director, Florida Solar Energy Center, University of Central Florida
Phone: (321) 638-1002, Fax: (321) 638-1010 E-mail: jfenton@fsec.ucf.edu

Research Specialty Areas:
Fuel Cells, hydrogen technologies, energy efficiency, renewable energy, energy policy

Education:

University of Illinois	Chemical Engineering	Ph.D.	1984
University of Illinois	Chemical Engineering	M.S.	1982
University of California	Chemical Engineering	B.S.	1979

Position and Employment:

2005 – Present	Director, Florida Solar Energy Center, of Univ. Central Florida
2005 – Present	Professor, MMAE Univ. Central Florida
1999 – 2004	Associate Director, UConn's Environmental Research Institute
1998 – 2004	Professor, University of Connecticut
1998 – 1999	Acting Head Chem. Engr. Dept., University of Connecticut
1993 – 1999	Director, Pollution Prevention Research & Dev. Center, UCONN
1991 – 1998	Associate Professor, University of Connecticut
9/91 – 1995	Consultant to IBM, T. J. Watson Res. Center
1/91 – 9/91	Visiting Scientist, IBM, T. J. Watson Res. Center
1984 – 1991	Assistant Professor, University of Connecticut

Research Focus:

Dr. Fenton, as Director of FSEC, leads a staff of 140 in the research and development of energy technologies that enhance Florida's and the nation's economy and environment and educate the public, students and practitioners on the results of the research. FSEC, created in 1975 by the Florida Legislature to serve as the state's energy research institute, is the nation's largest and most active state-supported renewable energy and energy efficiency research institute. In addition to his duties as FSEC Director, he leads a 12-member university and industry research team in a $19 million U.S. Department of Energy research program to develop the next generation proton exchange membrane (PEM) fuel cell automobile engine. Dr. Fenton's research activities in fuel cells, pollution prevention and sustainable energy are helping FSEC expand its nationally acclaimed research and education programs in hydrogen, alternative fuels, solar energy and buildings energy efficiency. He is the author of more than 120 scientific publications, a book on Experimental Methods for PEM fuel cells, a number of book chapters and holds three patents. His students have presented more than 100 seminars at national/international meetings and he has given over 250 seminars He was recently elected as Fellow of The Electrochemical Society and he serves on Governor Crist's Action Team on Energy and Climate Change.

His ongoing fuel cell research and education topics include: methanol oxidation electrocatalysts, CO tolerance electrocatalysts, hydrogen purification processes, low- methanol crossover membranes, high temperature membranes, membranes needing no external humidification, selective oxidation catalysts, gas diffusion layer design, reversible PEM fuel cells, biomass and landfill gas fuel processing, undergraduate laboratory fuel cell experiments, K-12 fuel cell demonstrations and experiments and design of PEM FC-powered toys.

Key Recent Fuel Cell Research Publications:

1. Bonville, L. J., H.R. Kunz , Y. Song, A. Mientek, M. Williams, A. Ching, and J.M. Fenton. 2005. "Development and demonstration of a higher temperature PEM fuel cell stack." Journal of Power Sources, 144, 107 (2005).
2. Xu, H., Y. Song, H. R. Kunz and J. M. Fenton. 2005. "Effect of Elevated Temperature and Relative Humidity on Oxygen Reduction Reaction Kinetics for Proton Exchange Membrane Fuel Cells." J. Electrochem. Soc. 152, A1828 (2005).
3. Song, Y., J.M. Fenton, H.R. Kunz, L. J. Bonville, and M.V. Williams. 2005. "High Performance PEM Fuel Cells at Elevated Temperatures Using Nafion® 112 Membranes." Journal of the Electrochemical Society, **152**, A539 (2005).
4. Ramani, V., H. R. Kunz, J. M. Fenton. 2005. "Effect of particle size reduction on the conductivity of Nafion®/phosphotungstic acid composite membranes." Journal of Membrane Science 266:1-2, 110-114 (2005).
5. Mittal, V., H. R. Kunz and J. M. Fenton. 2006. "Is H_2O_2 Involved in the Membrane Degradation Mechanism in PEMFC?" Electrochemical and Solid-State Letters, 9, A299 (2006).
6. Xu, H., Y. Song, H. R. Kunz and J. M. Fenton. 2006. "Operation of PEM fuel cells at 120–150 °C to improve CO tolerance." Journal of Power Sources, 159:2, 979-986(2006).
7. Ramani, V., H. R. Kunz, J. M. Fenton. 2005. "Effect of particle size reduction on the conductivity of Nafion®/phosphotungstic acid composite membranes." Journal of Membrane Science 266:1-2, 110-114 (2005).
8. V. Mittal, H. R. Kunz, J. M. Fenton. 2007. "Membrane Degradation Mechanisms in PEMFCs." J. Electrochem. Soc., 154, B652 (2007).

Recent Externally Supported Research Contracts

"Development of High-Temperature Membranes and Membrane Electrode Assemblies" which is in support of UTC Fuel Cells Cooperative Agreement #DE-FC04-02A-67608, between UTC Fuel Cells and DOE For the Development of High-Temperature Membranes, UTC Fuel Cells, 04/01/04 – 01/10/06, $700,000 in DOE funds, $176,843 match for a total project cost of $876,843.

"Reformed Methanol Fuel Cell System for High-End Portable Electronics: Improved High Temperature Fuel Cell Stack Assembly/Cell Stack Optimization and Endurance." Connecticut Innovations, Yankee Ingenuity Technology Competition, 11/1/2004 to 10/31/2006, $329,757.

"Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program (Topic 2 of DE-PS36-05GO95020)." 4/1/2006 to 3/31/2011, DOE funds $2,500,000 and $625,000 in matching UCF funds for a total program of $3,125,000.

"Development of Test Methodology for Evaluation for Fuel Cell Membrane Durability," 3/1/2007 to 12/31/2007, UTC Power a Division of United Technologies, $133,551.

Partial List of Collaborators within last 48 months

D. Kountz, K. Raiford, M. Roelofs, D. Mah of DuPont, H. Gasteiger, M. Mathias of General Motors, A. Haug, N. Cipoline, J. Meyers, T. Skiba, T. Jarvi, L. Protsailo of UTC Fuel Cells, T. Fuller of Georgia Tech. University, H. R. Kunz, L. Bonville of UConn, V. Ramani Illinois Inst. Technology, Louie Scribner of Scribner Associates, Simon Yeung of DOW Chemical, Allen Barnett and Christine Honsberg University of Delaware.

Advisor: Ph.D. supervised by Professor R. C. Alkire at the University of Illinois, 1980
1984.

Thesis Advisor and Postgraduate-Scholar Sponsor:

Fifteen students have received Ph.D.'s, twenty have received M.S. degrees and ten students have served as post-doctoral associates under Dr. Fenton.

BIOGRAPHICAL SKETCH

CHRIS S FEREKIDES

RANK: Professor of Electrical Engineering; since 08/2005

EDUCATION: BS, Electrical Engineering, University of South Florida, 1987.
MS, Electrical Engineering, University of South Florida, 1989.
PhD, Electrical Engineering, University of South Florida, 1991.

EXPERIENCE: Since 1991 Dr. Ferekides has been carrying out research sponsored by the Department of Energy, on thin film CdTe solar cells. Primary objectives of this research are: the development of manufacturable technologies for CdTe solar cells; the development of device operation models for thin film solar cells; the development of II-VI materials/processes for thin film solar cell applications. Research funded by private industry has focused on the development of thin film x-ray detectors, and transparent conducting electrodes. He has over the last 15 years served as a major professor to over 25 Ms and PhD students. He is currently supervising 4 graduate research assistants. He has served as the CdTe High Efficiency Team Leader for several years (1993-2000).

AFFILIATIONS/HONORS/AWARDS

Institute of Electrical and Electronics Engineers (IEEE), American Vacuum Society (AVS), American Society for Engineering Education (ASEE), Tau Beta Pi (Engineering Honor Society), Phi Kappa Phi (Scholastic & Service Achievement), Outstanding Young Investigator Award 1995, College of Engineering, University of South Florida, First place in the area of Analysis, Characterization, and Device Fabrication of Thin Film Cadmium Telluride during a DOE review, 1994. Office of Energy Efficiency and Renewable Energy Office of Power Technologies 2001 Research Partnership Award Thin Film Photovoltaic Partnership Program.

SELECTED RELEVANT JOURNAL PUBLICATIONS (last 5 Years)

1. "Surface science studies of Cu containing back contacts for CdTe solar cells", b. Spath, K. Lakus-Wollny, J. Fritsche, C. S. Ferekides, A. Klein, W. Jaegermann, *Thin Solid Films,* 515, 15, (2007), pp. 9172-6174
2. "Photoluminescence studies of CdTe films and Junctions", S. Vatavu, H. Zhao, V. Padma, R. Rudaraju, D. L. Morel, P. Gaşin*, Iu. Caraman and C. S. Ferekides*, Thin Solid Films,* 515, 15, (2007), pp. 6107-6111
3. "An Effective Method of Cu Incorporation in CdTe Solar Cells for Improved Stability", S. Erra, C. Shivakumar, H. Zhao, K. Barri, D. L. Morel and C. S. Ferekides, *Thin Solid Films,* 515, 15, (2007), pp. 5933-5836
4. "The Structural and Electrical Properties of Zn-Sn-O Buffer Layers and their Effect on CdTe Solar Cell Performance", S. Gayam, S. Bapanapalli, H. Zhao, L. Nemani, D. L. Morel and C. S. Ferekides, *Thin Solid Films,* 515, 15, (2007), pp. 6060-6063
5. "Development of $ZnSe_xTe_{1-x}$ p-type contacts for high efficiency tandem structures", S. Vakkalanka, C. S. Ferekides, and D. L. Morel, *Thin Solid Films,* 515, 15, (2006), 6132-6135
6. "Transparent Conducting Oxide Thin Films of Cd_2SnO_4 by RF Magnetron Co-sputtering of the Constituent Binary Oxides", R. Mamazza, D. L. Morel, and C. S. Ferekides, Journal of *Thin Solid Films*, 484, 1-2, (2005), pp. 26-33
7. "Transparent Conductors and Buffer Layers for CdTe Solar Cells", C. S. Ferekides, R. Mamazza, U. Balasubramanian, and D. L. Morel, Journal of *Thin Solid Films*, 480-481, (2005) pp. 224-229
8. "Transparent High Perfomance CdSe Thin Film Solar Cells", P. Mahawela, S. Jeedigunta, S. Vakkalanka, C. S. Ferekides, and D. L. Morel, Journal of *Thin Solid Films*, 480-481, (2005), pp. 466-

470
9. "$Cd_{1-x}Zn_xTe$ Thin Films and Junctions", C. S. Ferekides, R. Mamazza, U. Balasubramanian, and D. L. Morel, Journal of *Thin Solid Films*, 480-481, (2005), pp. 471-476
10. "II-VI Compounds as the top Absorbers in Tandem Solar Cell Structures", P. Mahawela, G. Sivaraman, S. Jeedigunta, J. Gadaputi, M. Ramalingam, S. Subramanian, S. Vakkalanka, C. S. Ferekides, and D. L. Morel, Journal of *Materials Science and Engineering B*, 116, 3, (2005), pp. 283-291
11. "CdTe Thin Film Solar Cells: Device and Technology Issues", C. S. Ferekides, U. Balasubramanian, R. Mamazza, V. Viswanathan, H. Zhao, and D. L. Morel, Journal of *Solar Energy*, 77, 6, (2004), pp. 823-830
12. "Electronically Active Layers and Interfaces in Polycrystalline Devices: Cross-section Mapping of CdS.CdTe Solar Cells", Iris Vicoly-Fisher, S. R. Cohen, D. Cahen, and C. S. Ferekides, *Applied Physics Letters*, **83**, 24, (2003), p 4924.
13. "Analysis of Carrier Transport Phenomena in High Band Gap II-VI-Based MIS Photovoltaic Devices", P. Mahawela, S. Jeedigunta, C. S. Ferekides, and D. L. Morel, Journal of *Thin Solid Films*, 431-432, (2003), pp. 461-465
14. "Characterization of Carrier Generation and Transport Mechanisms in Single Crystal and Thin Film HgI_2", U. Khadilkar, R. Mamazza, C. S. Ferekides, and D. L. Morel, Journal of *Thin Solid Films*, 427 (2003) pp. 381-385.
15. "The Effect of the $CdCl_2$ Treatment on CdTe/CdS Thin Film Solar Cells Studied Using Deep Level Transient Spectroscopy", V. Komin, B, Tetali, V. Viswanathan, D.L. Morel and C. S. Ferekides, Journal of *Thin Solid Films,* 431-432, (2003), pp. 143-147
16. "Electrical and Optical Properties of tin-doped CdO Films Deposited by Atmospheric Metalorganic Chemical Vapor Deposition", Zhiyong Zhao, D. L. Morel, and C. S. Ferekides, Journal of *Thin Solid Films*, 413 (2002) pp. 203-211.

SYNERGISTIC ACTIVITIES:

Chris Ferekides has been very active in the area of thin film photovoltaics. In 1992 he was elected a team leader of the High Efficiency Group under the Thin Film Partnership Program (NREL/DOE). He has had extensive collaborations within the thin film community as well as with local industry in areas other than PV. Over the last few years he has he has supervised several REU students and two teachers who participated in an RET program. He has served on the review committee for the IEEE PVSC on several occasions including the last two meetings. Most recently he joined the H_2research group at USF to develop cost effective and efficient methods for generating H_2.

COLLABORATORS:

1. Birkmire, Robert, Institute of Energy Conversion, University of Delaware
2. Cahen, David, Weizmann Institute, Israel
3. Compaan, Alvin; Department of Physics and Astronomy, University of Toledo
4. Dhere, Neelkanth, University of Central Florida, Florida Solar Energy Center
5. Fahrenbruch, Alan, ALF Inc. (formerly of Stanford University)
6. Gessert, Tim, National Renewable Energy Laboratory
7. Hepp, Aloysius F., NASA Glenn Research Center at Lewis Field
8. Kaydanov, Victor, Colorado School of Mines
9. Sites, Jim, Department of Physics, Colorado State University
10. Sudharsanan, R., Spectrolab, CA

BIOGRAPHICAL SKETCH

D. Yogi Goswami, Ph.D., P.E.
John and Naida Ramil Professor
Co-Director, Clean Energy Research Center, University of South Florida, Tampa FL

EDUCATION

Ph.D.	Mechanical Engineering, Auburn University, Auburn, Alabama, USA	1975
M.S.	Mechanical Engineering, Auburn University, Auburn, Alabama, USA	1971
B.S.	Mechanical Engineering, University of Delhi, Delhi, India	1969

EMPLOYMENT

9/05 - Present	John and Naida Ramil Professor, College of Engineering University of South Florida, Tampa, Florida
6/90 – 9/05	UF Research Foundation Professor and Director, Solar Energy & Energy Conversion Laboratory, Department of Mechanical Engineering, University of Florida, Gainesville, Florida
8/77 - 5/90	Mechanical Engineering Department, North Carolina A&T State University, Greensboro, North Carolina

EDITORIAL ACTIVITIES

- Editor in Chief, *Solar Energy Journal*, International Solar Energy Society, 2002 - Present
- Editor in Chief, *Advances in Solar Energy,* American Solar Energy Society, 1998-Present
- Editorial Board, *Advances in Solar Energy*, American Solar Energy Society, 1994-1997.
- Associate Editor, *Journal of Solar Energy Engineering*, 1989-1994
- Editorial Advisory Board, *CRC Mechanical Engineering Handbook*, 1995-Present; Hong Kong Institution of Engineers Journal; Journal of Energy & Environment, Bangladesh.

AWARDS AND CERTIFICATES (Total: 53)

- Farrington Daniels Award, International Solar Energy Society, 2007 (**Highest award of ISES**)
- Frank Kreith Energy Award, ASME, 2007 (**Highest energy award of ASME**)
- Charles Greely Abbott Award for Outstanding Scientific, Technical and Human Contributions to the Development and Implementation of Solar Energy (**Highest Award of the American Solar Energy Society**).
- John Yellott Award for Outstanding Contributions to the Field of Solar Energy, ASME Solar Energy Division, 1995 (**Highest Solar Energy Award from ASME**).
- Distinguished Lecturer, ASME, 2000-2003
- Fellow, ASME, ASES

PUBLICATIONS: Books (Total: 14 Books, 13 Book Chapters, 6 Conference Proceedings)

Goswami, D.Y. and Kreith, F., *Energy Conversion,* CRC Press, August 2007.
Kreith, F. and **Goswami, D.Y.,** *Handbook of Energy Efficiency and Renewable Energy,* CRC Press, May 2007.
Kreith, F. and **Goswami, D.Y.,** *Handbook of Energy Management and End Use efficiency***,** CRC Press, July 2007.
Kreith, F. and **Goswami, D.Y.,** *Mechanical Engineering Handbook,* CRC Press, 2004.
Goswami, D.Y., (Editor-in-Chief), *Advances in Solar Energy: An Annual Review of Research and Development*. Volume 16, American Solar Energy Society, Inc., August 2005.
Goswami, D.Y., Kreith, F. and Kreider, J., *Principles of Solar Engineering* (2nd Edition*)*, Taylor and Francis Pub., January 2000. (*NOTE:* This is a textbook for Senior Undergraduate and Graduate Students, 694 pages.)

Goswami, D.Y., *Progress in Solar Engineering,* Hemisphere Pub., 1987.
Goswami, D.Y., *Alternative Energy in Agriculture,* Vols. I and II. CRC Press, October 1986. (*NOTE*: This is a reference book in two volumes, about 200 pp. each.)

PATENTS (Total: 7 issued, 5 pending, 4 licenses, over $100 million sales)
Goswami, D.Y., "Electrostatic Photocatalytic Air Disinfection," U.S. Pat. No. 5,993,738, Nov. 30, 1999 (22 Claims).
Goswami, D.Y., "Photocatalytic System for Indoor Air Quality," U.S. Pat. No. 5,933,702 Aug. 3, 1999 (92 Claims).
Goswami, D.Y., "Photocatalytic Air Disinfection," US Patent No. 5,835,840, November 10, 1998. (27 Claims).
Goswami, D.Y., C.K. Hsieh, C.K. Jotshi and J.F. Klausner, "Contact Resistance Regulated Storage Heater," US Patent No. 5,694,515, December 2, 1997 (18 Claims).
Goswami, D.Y., C.K. Hsieh, C.K. Jotshi and J.F. Klausner, "Phase Change Material Storage Heater," US Patent Serial No. 5,687,706, Nov. 18, 1997 (17 Claims).

REFEREED PUBLICATIONS: (More than 200)

Mahishi, M.R., **Goswami, D.Y.** 2007 "An experimental study of hydrogen production by gasification of biomass in the presence of a CO_2 sorbent", International Journal of Hydrogen Energy, 32: 2803-2808.

Sadramelli, S.M., and **Goswami, D.Y.**, 2007, "Optimum operating conditions for a combined power and cooling thermodynamic cycle" *Applied Energy,* Elsevier Pub., 84, 254-265.

Mahishi, M.R., Sadrameli. S.M., Vijayaraghavan, S., **Goswami, D.Y.** (Accepted for publication) "A novel approach to enhance the hydrogen yield of biomass gasification using CO_2 sorbent", ASME Journal of Engineering for Gas Turbines and Power.

Vijayaraghavan, S.**,** and **Goswami, D. Y.,** 2006, "A Combined Power and Cooling Cycle Modified to Improve Resource Utilization Efficiency Using a Distillation Stage." *Energy: The International Journal*, Volume 31, Issues 8-9, Pages 1177-1196.

Martin, C., and **Goswami, D.Y.** 2006, "Effectiveness of Cooling Production with a Combined Power and Cooling Thermodynamic Cycle," *Journal of Applied Thermal Engineering*, Vol. 26, 5-6, 576-582.

Vohra, A., **Goswami, D.Y.,** Deshpande, D.A., Block, S.S., 2006, "Enhanced Photocatalytic Disinfection of Indoor Air," *Applied Catalysis B: Environmental*, Vol. 65, 57-65.

Vohra, A., **Goswami, D.Y**., Deshpande, D.A., Block, S.S., 2005, "Enhanced Photocatalytic Inactivation of Bacterial Spores on Surfaces in Air," *Journal of Industrial Microbiology and Biotechnology,* Vol. 32, 364-370.

Goel, N., and **Goswami, D. Y.,** 2005, "A Compact Falling Absorber," ASME *Journal of Heat Transfer*, vol. 127, pp. 957-965.

Vijayaraghavan, S., and **Goswami, D.Y**., 2005, "Organic Working Fluids for a Combined Power and Cooling Cycle," ASME *Journal of Energy Resources Technology*, 127(2), pp. 125-130.

Goel, N., and **Goswami, D. Y**., 2005, "Analysis of a Counter-Current Vapor Flow Absorber," *International Journal of Heat and Mass Transfer*, Vol. 48, No. 7, pp. 1283-1292.

Mirabel, S.T., Goel, N., and Ingley, H.A., **Goswami, D.Y.,** 2004, "Utilization of Domestic Fuels for Hydrogen Production" *International Journal of Power and Energy Systems*, Vol. 24, No. 3, pp. 239-245.

Al-Kharabsheh, S., and **Goswami, D.Y.**, 2004, "Theoretical analysis of water desalination system using low grade solar heat," *Journal of Solar Energy Engineering*, vol. 126, No. 2, pp.774-780, 2004.

Goswami, D.Y., Vijayaraghavan, S., Lu, S., and Tamm, G., 2004, "New and Emerging Developments in Solar Energy," *Solar Energy Journal,* vol. 76:1-3, pp. 33-43.

Tamm, G., **Goswami, D.Y.,** Lu, S., and Hasan, A.A., 2004, "Theoretical and Experimental Investigation of an Ammonia-Water Power and Refrigeration Thermodynamic Cycle," 2004, *Solar Energy Journal,* vol. 76:1-3, pp. 217-228.

Al-Kharabsheh, S. and **Goswami, D.Y.,** 2003, "Analysis of an innovative water desalination system using low-grade solar heat," *Desalination*, pp. 323-332, Sept.

Vijayaraghavan, S., and **Goswami, D. Y.**, 2003, "On Evaluating Efficiency of a Combined Power and Cooling Cycle," *ASME Journal of Energy Resources Technology*, Vol. 125, No.3, pp. 221-227.

FUNDED RESEARCH

Managed over 70 externally funded research projects in the fields of solar energy, energy conservation, heat transfer, fluid mechanics and environmental control, from state and federal agencies, and private corporations.

LEADERSHIP AT THE HIGHEST LEVELS OF PROFESSIONAL SOCIETIES

- *President,* International Solar Energy Society (ISES), 2004- 2005
- *Governor,* ASME International, 2003-2006
- *Senior Vice President*, ASME International, 2000-2003.
- *Vice-President,* International Solar Energy Society (ISES), 2001- 2003.
- *President*, International Association Solar Energy Education (IASEE), 2000-2002
- *Member*, *Board of Directors,* American Solar Energy Society (ASES), 1995-1997, 1998-2000.

BIOGRAPHICAL SKETCH

Brenton Greska

Florida State University

Department of Mechanical Engineering

2525 Pottsdamer Street

Tallahassee, FL 32310

Phone (850) 644-5720

email: bgreska@sesec.fsu.edu

Fields of Interest:

- Advanced catalysis, advanced PEM fuel cells, very high efficiency water electrolysis for hydrogen production, hydrogen combustion, and concentrating solar thermal cogeneration systems

Education:

- Florida State University, 1998, B.S. in Mechanical Engineering
- Florida State University, 1999, M.S. in Mechanical Engineering
- Florida State University, 2005, Ph.D. in Mechanical Engineering

Research and Professional Experience:

- Assistant Director, Sustainable Energy Science & Engineering Center
  Florida State University (2005 - present)
- Assistant Research Scientist, Department of Mechanical Engineering
  Florida State University (2005 - present)
- Aerospace Engineer, Cryogenics and Fluids Branch
  NASA Goddard Space Flight Center (1999 – 2000)

Awards:

- **2000 - NASA Special Act Award for modernizing the way that the branch data acquisition system.**

Selected Professional and Entrepreneurial Activities:

- 2006 – present; Vice President, Sustainable Technology LLC. Tallahassee, FL

Memberships:

- Member, American Society of Mechanical Engineers
- Member, American Institute of Aeronautics & Astronautics

Selected Publications within the Last Five Years:

1. Krothapalli, A., and Greska, B., "Multi-generation Concentrating Solar-Hydrogen Power System for Sustainable Rural Electrification", Proceedings of 20th World Energy Congress, Rome, Italy, November 2007.
2. Kramer, J., Krothapalli, A. and Greska, B., "The Off-Grid Zero Emission Building", Proceedings of Energy Sustainability 2007, Long Beach, CA, June 2007.
3. Krothapalli, A., Venkatakrishnan, L., Lourenco, L., Greska, B., and Elavarasan, R., "Turbulence and Noise Suppression of a Supersonic Jet by Water Injection", *J. Fluid Mechanics,* **491**, 2003, 131-159.

Conference Presentations: 10

BIOGRAPHICAL SKETCH

David W. Hahn – dwhahn@ufl.edu
Knox T. Millsaps Professor
Department of Mechanical and Aerospace Engineering
PO Box 116300
University of Florida, Gainesville, FL 32611-6300

EDUCATION

Institution	Degree	Date
Louisiana State University	B.S.M.E.	1986
Louisiana State University	Ph.D.	1992
U.S. FDA CDRH Electro-Optics Branch	Post-doctoral	1993-94

PROFESSIONAL EXPERIENCE

2007-present Knox T. Millsaps Professor, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, Florida.

2003 - 2007 Associate Professor, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, Florida.

1998 - 2003 Assistant Professor, Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, Florida.

1994 - 1998 Senior Member of Technical Staff, Sandia National Laboratories.

1993 - 1994 National Research Council Post-Doctoral Associate, F.D.A. Center for Devices and Radiological Health.

HONORS AND AWARDS

Award for Technical Excellence, Sandia National Laboratories 1998
Editorial Advisory Board, *Applied Spectroscopy* 2005-present

PUBLICATIONS AND PATENTS

Patents

U.S. Patent # 7,207,983. System And Method For Real-Time Feedback During Laser Refractive Surgery. D.W. Hahn and B.T. Fisher (2007).

US Patent # 6,998,980. Microfield Interface Device For Monitoring Animal Cage Environments. H.A. Ingley, D.W. Hahn and A.H. Battles (2006).

U.S. Patent # 6,061,641. Method for improving instrument response. D.W. Hahn, K.R. Hencken, H.A. Johnsen, and W.L. Flower (2000).

U.S. Patent #5,951,768. Flame stabilizer for stagnation flow reactor. D.W. Hahn and C.F. Edwards (1999).

U.S. Patent # 5,827,904. Medical implant composition. D.W. Hahn (1998).

U.S. Patent # 5,840,373. Method of growing films by flame synthesis using a stagnation-flow reactor. D.W. Hahn and C.F. Edwards (1998).

Selected Publications (from 55+ total)

1. B.C. Windom, P.K. Diwakar, D.W. Hahn. Dual-Pulse LIBS for Analysis of Gaseous and Aerosol Systems: Plasma-Analyte Interactions, *Spectrochimica Acta Part B*, 61:788-796 (2006).

2. B.T. Fisher and D.W. Hahn. Development and Numerical Solution of a Mechanistic Model for Corneal Tissue Ablation with the 193-nm Argon Fluoride Excimer Laser,

   J. Optical Society of America B: Optics, Image Science & Vision, 24:265-277 (2007).

3. V. Hohreiter and D.W. Hahn. Plasma-Particle Interactions in a Laser-Induced Plasma: Implications for Laser-induced Breakdown Spectroscopy, *Analytical Chemistry*, 78:1509-1514 (2006).

4. B. Hettinger, V. Hohreiter, M. Swingle, and D.W. Hahn. Laser-Induced Breakdown Spectroscopy for Ambient Air Particulate Monitoring: Correlation of Total and Speciated Aerosol Counts, *Applied Spectroscopy*, 60:237-245 (2006).
5. V. Hohreiter and D.W. Hahn, Dual-Pulse LIBS: Time-Resolved Transmission and Spectral Measurements, *Spectrochimica Acta Part B*, 60:968-974 (2005).
6. K.B. Kim, L. Shanyfelt, and D.W. Hahn. Analysis of Dense Medium Light Scattering With Applications to Corneal Tissue: Experiments and Monte Carlo Simulations, *Journal of the Optical Society of America A: Optics, Image Science & Vision*, 23:9-21 (2006).
7. G.D. Yoder, P.K. Diwakar, D.W. Hahn. Assessment of soot particle vaporization effects during laser-induced incandescence using time-resolved light scattering, Applied Optics*, 44:4211-4219 (2005).*
8. V. Hohreiter and D.W. Hahn. Calibration effects for laser-induced breakdown spectroscopy of gaseous sample streams: Analyte response of gaseous phase species vs. solid phase species, *Analytical Chemistry*, 77:1118-1124 (2005).

9. A. J. Ball, V. Hohreiter, D. W. Hahn. Hydrogen Leak Detection Using Laser-Induced Breakdown Spectroscopy, *Applied Spectroscopy*, 59:348-353 (2005).
10. P.B. Dixon and D.W. Hahn. On the Feasibility of Detection and Identification of Individual Bioaerosols Using Laser-Induced Breakdown Spectroscopy, *Analytical Chemistry*, 77:631-638 (2005).

11. B.T. Fisher and D.W. Hahn. Measurement of Small-Signal Absorption Coefficient and Absorption Cross-Section of Collagen for 193-nm Excimer Laser Light and the Role of Collagen in Tissue Ablation, *Applied Optics*, 43:5443-5451 (2004).

12. V. Hohreiter, A. Ball, D.W. Hahn. Effects of Aerosols and Laser Cavity Seeding on Spectral and Temporal Stability of Laser-Induced Plasmas: Applications to LIBS, *J. Analytical Atomic Spectroscopy*, 19:1289-1294 (2004).
13. V. Hohreiter, J.E. Carranza, and D.W. Hahn. Temporal Analysis of Laser-Induced Plasma Properties as Related to Laser-Induced Breakdown Spectroscopy, *Spectrochimica Acta Part B*, 59:327-333 (2004).
14. H.M. Solo-Gabriele, T.G. Townsend, D.W. Hahn, T.M. Moskal, N. Hosein, J. Jambeck, G. Jacobi. Evaluation of XRF and LIBS technologies for on-line sorting of CCA-treated wood waste, *Waste Management*, 24:413-424 (2004).
15. K. Iida, C.Y. Wu and D.W. Hahn. *In Situ* Analysis of the Interaction of Manganese Vapor and Silica Microspheres in a Laboratory-scale Combustor, *Combustion Science and Technology*, 176:453-480 (2004).

BIOGRAPHICAL SKETCH

James P. Heaney- heaney@ufl.edu
Professor and Chair
Department of Environmental Engineering Sciences
University of Florida 32611-6450

EDUCATION

Institution	Degree	Date
Northwestern University, Evanston, Illinois	PhD in C.E.	1968
Northwestern University, Evanston, Illinois	MSCE	1965
Illinois Institute of Technology, Chicago, Illinois	BSCE	1962

PROFESSIONAL EXPERIENCE

2003- Professor and Chair, Department of Environmental Engineering Sciences, University of Florida, Gainesville
1994-2003 Professor, Dept. of Civil, Environmental, and Architectural Engineering, University of Colorado, Boulder
1968-1991 Professor, Dept. of Environmental Engineering Sciences, University of Florida, Gainesville
1967-1968 Senior Research Engineer, Battelle-Northwest, Richland, Washington
1962-1964 Sanitary Engineer, US Public Health Service, Colorado River Basin Project

CURRENT PROFESSIONAL SOCIETIES AND SELECTED RELATED ACTIVITIES

1) American Academy of Environmental Engineers, Diplomate
2) American Academy of Water Resources Engineers, Diplomate and Member of the Board of Directors
3) Alliance for Water Efficiency, Inaugural Board Member
4) ASCE/EWRI Urban Water Resources Research Council (Chair, 2001-02)

REGISTRATION

Registered Professional Engineer, State of Florida #17365

RECENT UNIVERSITY RESEARCH ACTIVITIES

Urban Water Conservation Clearinghouse, Florida DEP, 2007-2010 PI
Infiltration Stormwater BMP Evaluation, Florida DEP, 2006-2008 Co-PI
Airport Stormwater Management, FAA and Florida DEP, 2006-2007 Co-PI
Methods for Evaluating Water Reuse Options, Florida DEP, 2006-2007 PI
Wastewater Reuse Options for Southeast Florida, Florida DEP, 2005 Co-PI
LID Options for Control of Combined Sewer Overflows, Water Environment Research Foundation, 2004-05 PI
Effectiveness of Urban Wet-weather BMPs, Water Environment Research Foundation, 2003-05 PI

SELECTED PUBLICATIONS

Heaney, J.P. 2007. Centralized and decentralized urban water, wastewater and storm water systems. Chapter in Novotny, V., Breckenridge, L. and P. Brown, Eds. *Cities of the Future: Towards Integrated Sustainable Water and Landscape Management*. IWA Publishing, London.
Lee, J.G., Heaney, J.P., Rapp, D.N., and C.A. Pack. 2006. Life cycle optimization for highway BMPs. *Water Science and Technology,* Vol. 54, No. 6-7, p. 477-484
Heaney, J.P. and J. Lee. 2006. *Methods for optimizing urban wet-weather control systems.* EPA/600/R-06/034, US EPA, Edison, NJ

Wright. L, Heaney, J. and S. Dent. 2006. Risk Optimization of a Wet-Weather Sanitary Sewer Overflow Control Plan. *Journal of Infrastructure Systems*. (12), 3, p. 174-183.
Koopman, B., Heaney, J.P., et al. 2006. Ocean Outfall Study. Final Report to Florida Dept. of Environmental Protection, Tallahassee, FL http://www.dep.state.fl.us/water/reuse/techdocs.htm
Sample, D.J. and J.P. Heaney. 2005. Integrated management of irrigation and urban stormwater infiltration. *J. of Water Resources Planning and Management*, Vol. 131, No. 4, p. 307-315..
Lee, J.G., Heaney, J.P., and D. Lai. 2005. Optimization of integrated urban wet-weather control strategies. *Jour. of Water Resources Planning and Management*, Vol. 131, No. 4.
Lee, J., and J.P. Heaney. 2003. Urban imperviousness and its impacts on stormwater systems. *Jour. Of Water Resources Planning and Management,* Vol. 129, No. 5, p. 419-426.

Sample, D., Heaney, J.P., Wright, L., Fan, C-Y., Lai, F-H., and R. Field. 2003. Costs of best management practices (BMPs) and associated land for urban stormwater control. *Jour. of Water Resources Planning and Management,* Vol. 129, No. 1, p. 59-68.

Sample, D., Heaney, J.P., Wright, L. and R. Koustas (2001) Geographical Information Systems, Decision Support Systems, and Urban Stormwater Management. *Jour. of Water Resources Planning and Management*. Vol. 127, No. 3.

Lippai, I. and J.P. Heaney (2000) Efficient and equitable impact fees for urban water systems. *Jour. of Water Resources Planning and Management,.* Vol. 126, No.2, p. 75-84.

Also reprinted in *Water Resources Journal, United Nations*,.June, p. 26-41.

Heaney, J.P., Pitt, R. and R. Field, Eds. 2000. *Innovative Urban Wet-Weather Flow Management Systems.* EPA-600-R-99-029, Cincinnati, OH.
http://www.epa.gov/ORD/NRMRL/pubs/600r99029/600R99029prelim.pdf
Lippai, I., Heaney, J.P., and M. Laguna. 1999. Robust Pipe Network Design Optimization Using Genetic Algorithms. *Jour. of Computing in Civil Engineering*, Vol. 13, No.3, p. 135-143.
Heaney, J.P. 1997. Cost Allocation. Chapter 13 in *Civil and Environmental Engineering Systems: An Advanced Applications Text*. C.ReVelle and A.E. McGarity, Eds, J. Wiley and Sons, New York.
DeOreo, W.B., Heaney, J.P., and P. Mayer. 1996. Flow trace analysis to assess water use. *Jour. AWWA*, Vol. 88, No. 1, p. 79-90.
Heaney, J.P. 1995. Risk Analysis in Water Resources Engineering. in Herricks, E. Ed. *Stormwater Runoff and Receiving Systems*. Lewis Publ., Boca Raton, FL, p. 211-231.

BIOGRAPHICAL SKETCH

Lonnie O'Neal Ingram - ingram@ufl.edu
Distinguished Professor and Director
Department of Microbiology and Cell Science,
Florida Center for Renewable Chemicals and Fuels
Bldg. 981 Museum Road, PO Box 110700
University of Florida, Gainesville, FL 32611-0700

EDUCATION

Institution	Degree	Date
University of South Carolina at Columbia, Biology	B.S.	1969
University of Texas at Austin, Botany	Ph.D.	1971
Oak Ridge National Laboratory, Biology Division	Post-doctoral	1971-1972

PROFESSIONAL EXPERIENCE

1972-1998	Assistant Professor to Professor, Department of Microbiology and Cell Science, Department of Immunology and Medical Microbiology, UF, Gainesville
1998-present	Director, Florida Center for Renewable Chemicals and Fuels
2001-present	Distinguished Professor in Research
1984	Faculty Appointment and Mini-sabbatical in molecular genetics at Washington University with Dr. Roy Curtiss, III.

HONORS AND AWARDS (Selected)

U.S. Department of Commerce, Landmark Patent No. 5,000,000	1991
Distinguished Service Award, (highest award presented for research by USDA)	1993
Fellow, American Academy of Microbiology	1998-present
Fellow, Society of Industrial Microbiology and Biotechnology	2001-present
Member, National Academy of Sciences	2001-present
Elected, American Academy of Microbiology Board of Governors	2006-09
Invited Advisor to President George W. Bush on cellulosic ethanol	2007
Member, Advisory Group of the FL Energy Commission on Renewable Energy	2007
C.D. Scott Award on Biotechnology for Fuels and Chemicals	2007
Member, Florida Governor's Action Team on Energy and Climate Change	2007

PUBLICATIONS AND PATENTS

Patents (from 15 issued)

U.S. Patent No. 5,000,000 Ethanol Production by *Escherichia coli* Strains Co-expressing *Zymomonas pdc* and *adh* Genes, L.O. Ingram, F. Alterthum, T. Conway (1991)

U.S. Patent No. 5,424,202 Ethanol Production by Recombinant Hosts, L. O. Ingram, D. S. Beall, G. F. H. Burchhardt, W.V. Guimaraes, K. Ohta, B. E. Wood, K. T. Shanmugam, D.E. Fowler, A. Ben-Bassat (1995)

U.S. Patent No. 6,102,690. L.O. Ingram, X. Lai, M. Moniruzzaman and S.W. York. Recombinant organisms capable of fermenting cellobiose (2000).

U.S. Patent No. 6,333,181. Ethanol production from lignocellulose. B.E. Wood and L.O. Ingram (2001).

U.S. Patent No. 7,098,009. Production of chemicals from lignocellulose, biomass or sugars. K.T. Shanmugam, L.O. Ingram M.A. Patel, M.S. Ou and R. Harbucker. (2006)

Selected Publications (from 201 total)

1. Ingram, L.O. 1992. Genetic engineering of novel bacteria for the conversion of plant polysaccharides into ethanol. In M.R. Ladisch and A. Bose (ed), Harnessing Biotechnology for the 21st Century, p. 507-509. American Chemical Society Press, Washington, D.C.

2. Ingram, L.O., X. Lai, M. Moniruzzaman, B.E. Wood, and S.E. York. 1997. Fuel ethanol production from lignocellulose using genetically engineered bacteria. In B.C. Saha and J. Woodward (eds.), Fuels and Chemicals from Biomass. ACS Symposium Series 666, p. 57-73. American Chemical Society Press, Washington, D.C.
3. Aldrich, A.C.C. Borges, T.B. Causey, A. Martinez, F. Morales, A. Saleh, S.B. Underwood, L.P. Yomano, S.W. York, J. Zaldivar, and S. Zou. 1999. Enteric bacterial catalysts for fuel ethanol production. Biotechnol. Prog. 15: 855-866.
4. Tao, Han, Adnan Hasona, Phi Min Do, L.O. Ingram and K.T. Shanmugam. 2005. Global gene expression analysis revealed an unsuspected *deo* operon under the control of molybdate sensor, ModE protein, in *Escherichia coli*. Arch Microbiol: 184:225-233.
5. Patel MA, MS Ou , LO Ingram, and KT Shanmugam. 2005. Simultaneous saccharification and co-fermentation of crystalloine cellulose and sugar cane bagasse hemicellulose hydrolysate to lactate by a thermotolerant acidophilic *Bacillus sp*. Biotechnology Progress 21(5): 1453-1460.
6. Zhou, S., L.P. Yomano, K.T. Shanmugam, and L.O. Ingram. 2005. Fermentation of 10% (w/v) sugar to D(-)-lactate by engineered *Escherichia coli B*. Biotechnology Letters. 27: 1891-1896
7. Miller, E.N. and L.O. Ingram. 2006. Combined effect of betaine and trehalose on osmotic tolerance of *Escherichia coli* in mineral salts medium. Biotechnol. Lett. 29: 213-217.
8. Gutierrez, T., L.O. Ingram, J.F. Preston. 2006. Purification and characterization of a furfural reductase (FFR) form Escherichia coli stain LYO1 - An enzyme important in the detoxification of furfural during ethanol production. J. Of Biotechnology. 121(2): 154-164.
9. Martinez, A., T.B. Grabar, K.T. Shanmugam, L.P. Yomano, S.W. York, and L.O. Ingram. 2007. Low salt medium for lactate and ethanol production by recombinant *Esherichia coli* B. Biotechnol. Letters. 29: 397-404.
10. Jarboe, L.R., T.B. Grabar, L.P. Yomano, K.T. Shanmugam, L.O. Ingram. 2007. Development of ethanologenic bacteria. Book Chapter. Adv. Biochem Engin/Biotechnol 108: 237-261.

BIOGRAPHICAL SKETCH

Pierce Jones
Professor, Agricultural and Biological Engineering
Director, Program for Resource Efficient Communities
University of Florida
E-mail: pjones10@ufl.edu
Phones: 352-392-8074

Education:

University of Florida	Agricultural Economics	BS	1968
University of South Florida	Astronomy	MA	1976
University of Florida	Mechanical Engineering	PhD	1981

Employment (University of Florida):

Extension Administration Assistant Director (Energy Program Leader)	1997
Agricultural Engineering Professor	1996
Agricultural Engineering Associate Professor	1990
Agricultural Engineering Assistant Professor	1986
Agronomy Department Assistant Research Scientist	1982

Publications (Selected):

- Jones, P.H. and Jack Haldeman. 1986. Management of a crop research facility with a micro-computer based expert system. Transactions of the ASAE 29:235-242.
- Jones, P.H., J.S. Nelson*, and H. Pirozzoli*. 1995. The National Ag Safety Disc: A database of agricultural health, safety and injury prevention Educational materials. Journal of Agricultural Safety and Health 1(1) 7-15.
- Jones, P.H. 1996 Computer-based Hazard Communication Program Delivery for the Construction Industry. In Implementation of Safety and Health on Construction Sites. Ed. A. Dias & R. Coble. Balkema, Rotterdam. 157-166.
- Smith, M. T. and Pierce Jones. 2003. The Impact of Energy Efficient House Construction on Homeownership Costs: A Case Study in Gainesville, Florida. Family and Consumer Sciences Research Journal. 32(1) 76-98.
- Jones, Pierce. 2004. Promoting Best Design and Product Selection Practices in Florida's Residential Construction Industry. In Housing Research Agenda Workshop: Proceedings and Recommendations – Volume II. 259-265.
- Gregory, J.H., M.D. Dukes, G.L. Miller, and P.H. Jones. (2005). *Analysis of double ring infiltration techniques and development of a simple automatic water delivery system.* Applied Turfgrass Science. Available at, http://www.plantmanagementnetwork.org/pub/ats/guide/2005/ring/
- Gregory, J.H., M.D. Dukes, P.H. Jones and G.L. Miller. (2006). *Effect of urban soil compaction of infiltration rate for low impact development.* Journal of Soil and Water Conservation. Accepted.

Grants/Contracts (Selected):

2007:

- Energy Outreach Programming for the Hot, Humid Climate Zone – National Association of State Universities and Land Grant Colleges (USDOE) - $190,000
- Promoting Windstorm Resistant Homebuilding - Florida Office of Insurance Regulation - $146,000

2006:

- Katrina Energy Project - Mississippi State University (DOE) - $20,000
- Promoting Energy Conservation Programs - Florida Energy Office - $75,000
- Effectiveness of Low Income Customer Energy Use Reduction Program - Gainesville Regional Utilities - $50,000
- Florida Building Code Continuing Education Courses - Florida DCA - $208,000

2005:

- Florida Building Code Continuing Education Courses - Florida DCA - $160000
- Energy Efficient Residential Construction in Florida: Application of Building Science Principles in Practical Training Programs - United States DOE - $50,000

Creative Activities:

Florida Energy Extension Service (1995-2004): From 1995 to 2004 I directed the Florida Energy Extension Service (FEES) as it was transitioned from a grant funded program into a self-funded entrepreneurial group within the Cooperative Extension Service at the University of Florida. FEES developed and delivered targeted training programs and educational publications primarily concerned with the construction of resource efficient homes with emphasis on energy, water, windstorm, termite and indoor air quality issues. FEES also conducted housing related applied research. Its research and educational programs were all designed to promote understanding of the connection between building designs, construction processes, and materials as they relate to durability, resource efficiency and profitability. Key products include:

•Build Green & Profit, a 14-hour continuing education course for licensed building contractors. Since 1996 the course has been presented more than 250 times to more than 5,000 participants.

•Energy Efficient Building Construction in Florida, a required reference text for individuals taking the exam to become licensed building contractors. Since 1999 more than 30,000 copies have been sold, generating revenues in excess of $800,000 to support its publication.

Program for Resource Efficient Communities (2004-present): In 2004 I joined with an inter-disciplinary faculty group to establish the Program for Resource Efficient Communities (PREC), which promotes adoption of best design and management practices that measurably reduce energy and water consumption and environmental degradation in new master planned residential community developments. PREC's focus extends from the lot level through site development to surrounding lands and ecological systems. PREC conducts workshops, continuing education programs, applied research projects and academic training programs. PREC also consults directly on selected development projects identifying and evaluating implementation of innovative resource efficient design, construction and operational practices. It concentrates especially on projects with the potential to serve as case studies and that demonstrate successfully applied low impact development practices.

Madera: In 2001 the Florida Energy Extension Service partnered with a developer to design and build a resource-efficient community, *Madera*, on a 44-acre site adjacent to the University of Florida in Gainesville, Florida. FEES built three homes in the 88-home community, including the model center. All houses built by the University were exemplars of resource efficient construction practices. They were designed in close coordination with each of the builders to meet basic efficiency and green performance criteria intended to be standard in all of *Madera*'s homes as well as incorporating appropriate upgrade packages intended to be available as options. *Madera* is a for-profit 88-home subdivision <u>not</u> a demonstration project.

BIOGRAPHICAL SKETCH

James F. Klausner: **Department of Mechanical and Aerospace Engineering, University of Florida, PO Box 116300, Gainesville, FL 32611, Phone (352) 392-3506, email: klaus@ufl.edu**

Fields of Interest: Energy Systems, Thermal and Chemical Transport, Hydrogen, Powder Mechanics, Multiphase Flow, Waste Heat Utilization, Desalination, and Cryogenics.

Education:
United States Merchant Marine Academy, 1984, B.S. in Marine Engineering
University of Illinois, Champaign-Urbana, 1986, M.S. in Mechanical Engineering

University of Illinois, Champaign-Urbana, 1989, Ph.D. in Mechanical Engineering

Research and Professional Experience:
Professor Klausner has extensive project management experience, and he will bring those management skills to successfully lead the University of Florida energy research. Past experience includes serving as Group Leader for the Powder Transport and Handling thrust of the UF Particle Science and Technology Research Center from 1996-2000 (approximate budget $1.5 million). He also served as Group Leader for the Hydrogen Production, Transport, and Storage thrust for the NASA Hydrogen Grant to the University of Florida from 2003-2007 (approximate budget $1.2 million). He currently serves as the Group Leader for the Hydrogen Economy branch of the Florida Institute for Sustainable Energy. He has also had substantial educational management experience and was the Interim Director for the Electronic Delivery of Graduate Education from 2006-2007 (approximate budget $700 K). Prof. Klausner currently serves as a member of the ASME Heat Transfer Division Executive Committee.

A major research initiative Dr. Klausner launched over the past several years is the development of a waste heat driven, low temperature desalination process for which a patent has been issued. He is currently working with local Florida electric utilities and water management districts to commercialize the desalination process. In addition, a large multinational corporation is supporting pilot testing of the process for implementation in its processing facilities world-wide. A large focus of Dr. Klausner's research has focused on understanding the role of gravity in multiphase convection heat transfer. The progress he has made has allowed his research group to develop high heat flux two-phase thermal management processes for variable gravity environments. This work has been supported by NASA, as these processes provide for compact and lightweight heat transfer equipment to be deployed in spacecraft. NASA continues to support this work as Space Exploration becomes a growing initiative within NASA. Dr. Klausner also has an active research program studying cryogenic transport. The development of hydrogen as a fuel to support the transportation sector of the economy will require cryogenic transport systems. The two-phase flow and energy transfer associated with cryogenics is unique and requires, a sound fundamental understanding for efficient and safe transport.

Synergistic Activities:

Editorial board, *Int. J. Heat and Fluid Flow*

Fellow, American Society of Mechanical Engineers (ASME)

ASME Heat Transfer Division Executive Committee

Patents and Copyrights: 8 total.

Awards: American Society of Mechanical Engineering Fellow, 1992 NASA Technology Transfer Award, University of Florida Teaching Award (TIP), SAE Ralph R. Teetor Educational Award

Selected Publications (from 100+)

1. Klausner, J,F., Mittan, N., Ingram, B., "Quenching Our Growing Thirst," *Georgetown Journal of Interantional Affairs* (Invited Paper), Summer/Fall, pp. 133-140, 2007.
2. Garrity, P., Klausner, J.F., and Mei, R., "A Flow Boiling Microchannel Evaporator Plate for Fuel Cell Thermal Management," in press *Heat Transfer Engineering*, 2006.
3. Klausner, J.F., Li, Y., Mei, R., "Performance Characteristics of the Diffusion Driven Desalination Process," *Desalination*, (196), pp. 188-209, 2006.
4. Klausner, J.F., Li, Y., Mei, R., "Evaporative Heat and Mass Transfer for the Diffusion Driven Desalination Process," *Heat and Mass Transfer*, Vol. 42/6, pp. 528-536, 2006.
5. Bower, J.S. Bower, and Klausner, J.F., "Gravity Independent Subcooled Flow Boiling Heat Transfer Regime," in press *Experimental Thermal and Fluid Science*, 2006.
6. Liao, J., Mei, R., Klausner, J.F., "A Film Boiling Model for Cryogenic Chilldown at Low Mass Flux inside a Horizontal Pipeline," *Heat and Mass Transfer*, (42), pp. 891-900, 2006.
7. Chen, T., Klausner, J.F., Garimella, S.V., Chung, J.N., "Subcooled Boiling Incipience on a Highly Smooth Microheater," *Int. J. Heat and Mass Transfer*, Vol. 49, pp. 4399-4406, 2006.
8. Klausner, J.F., Li, Y., Darwish, M., and Mei, R., "Innovative Diffusion Driven Desalination Process," *J. Energy Resources Technology*, Vol. 126, pp. 219-225, 2004.
9. Chen, D.M., Klausner, J.F., and Mei, R., "A Fluid Mechanics Approach to Describing the Behavior of Pneumatically Conveyed Powder Plugs," *Powder Technology*, Vol. 124, pp. 127-137, 2002.
10. Jotshi, C.K., Hsieh, C.K., Goswami, D.Y., Klausner, J.F., Srinivasan, N., "Thermal Storage in Ammonium Alum/Ammonium Nitrate Eutectic for Solar Space Heating Applications," *Journal of Solar Energy Engineering*, Vol. 120, pp. 20-24, 1998.
11. Klausner, J.F., Martin, A.R., Goswami, D.Y., and Schanze, K.S., "On the Accurate Determination of Reaction Rate Constants in Batch Type Solar Photocatalytic Oxidation Facilities." *Journal of Solar Energy Engineering*, Vol. 116, pp. 19-24, 1994.
12. Wyness, P., Klausner, J.F., Goswami, D.Y., and Schanze, K.S., "Performance of Nonconcentrating Solar Photocatalytic Oxidation Reactors Part I: Flate Plate Configuration." *Journal of Solar Energy Engineering*, Vol. 116, pp. 2-7, 1994.
13. Bedford, J., Klausner, J.F., Goswami, D.Y., and Schanze, K.S., "Performance of Nonconcentrating Solar Photocatalytic Oxidation Reactors Part II: Shallow Pond Configuration." *Journal of Solar Energy Engineering*, Vol. 116, pp. 8-13, 1994.

Graduate Students and Post Docs

Current Post Docs: Jameel Kahn, Abdullah Kendoush
Current Graduate Students: Pat Garrity, Mukta Limaye, Richard Parker, Bradley Bon, Wenxing Ye

BIOGRAPHICAL SKETCH

William E. Lear – lear@ufl.edu
Assoc. Professor
Mechanical & Aerospace Engineering Department
P.O. Box 116300
University of Florida, Gainesville, FL 32611-6300

EDUCATION

Institution	Degree	Date
University of Alabama, M.E.	B.S.	1974
Stanford University, M.E.	M.S..	1979
Stanford University, M.E.	Ph.D.	1984

PROFESSIONAL EXPERIENCE

1999-present	Associate Professor, Department of Mechanical & Aerospace Engineering, UF, Gainesville
1984-1999	Assistant Professor, Department of Mechanical Engineering, UF, Gainesville
1995	Visiting Associate Professor, Department of Mechanical and Aerospace Engineering, Cornell University
1991-1992	Visiting Associate Professor, Department of Mechanical and Aerospace Engineering, Cornell University
1991	Faculty Fellow, NASA/ASEE Summer Faculty Fellowship, NASA Glenn Research Center, Cleveland, OH
1990	Senior Engineer, Pratt & Whitney Aircraft, Government Engine Business, West Palm Beach, FL
1989	Senior Engineer, Pratt & Whitney Aircraft, Government Engine Business, West Palm Beach, FL
1988	Senior Engineer, Pratt & Whitney Aircraft, Government Engine Business, West Palm Beach, FL

HONORS AND AWARDS (Selected)

Best Paper award, ASME IMECE, Advanced Energy Systems Division	2005
Best Student Paper award, ASME IMECE, Advanced Energy Systems Division	2005
Best Paper award, AIAA Terrestrial Systems Technical Committee	2005
Associate Fellow, AIAA	2004
Pi Tau Sigma award "Outstanding Professor in Mechanical Engineering,"	1995
Sustained Excellence in Teaching, University of Florida	1994
Certificate of Appreciation, ASEE	1993
ASEE New Engineering Educator Excellence Award	1987
Tau Beta Pi award "Outstanding Undergraduate Teaching," University of Florida	1986

PUBLICATIONS AND PATENTS

Patents

U.S. Patent Application Serial No. 11/151,951 Combined Cooling and Power Plant with Water Extraction.

Selected Publications

1. Khan, J.R., Lear, W.E., Sherif, S.A., Howell, E.B., and Crittenden, J.F., "Water Extraction and Performance of a Novel Pressurized CHP System." AIAA *Journal of Propulsion and Power*, under review.

2. Khan, J., Lear, W.E., and Sherif, S.A., "Performance of a Novel Combined Cooling and Power Gas Turbine with Water Harvesting." ASME *Journal of Engineering for Gas Turbines and Power*, under review.
3. Boza, J.J., Lear, W.E., and Sherif, S.A., "Performance of a Novel Semi-Closed Gas Turbine Refrigeration Combined Cycle." ASME *Journal of Energy Resources Technology*, under review.
4. Kandil, S.M., Lear, W.E., and Sherif, S.A., "Performance of a Jet-Pumped Cryogenic Refrigeration System." AIAA *Journal of Propulsion and Power*, Vol. 20, No. 6, November/December 2004, pp. 1018-1025.
5. Kandil, S.M., Lear, W.E., and Sherif, S.A., "Mass Advantages in a Jet-Pumped Active Thermal Management System." *SAE Transactions-Journal of Aerospace*, Vol. 111, No. 1, 2002, ISBN 0-7680-1285-6, pp. 765-773.
6. Freudenberg, K., Lear, W.E., Sherif, S.A., and Golliher, E.L., "Mass-Based Optimization of Thermal Management and Power Systems for Space Applications." AIAA Journal of Propulsion and Power, Vol. 18, No. 6, November-December 2002, pp. 1161-1169.
7. Lear, W.E., Parker, G.M., and Sherif, S.A., "Analysis of Two-Phase Ejectors with Fabri Choking." IMechE Journal of Mechanical Engineering Science, Vol. 216, Part C, No. C5, 2002, pp. 607-621.
8. Nord, J.W., Lear, W.E., and Sherif, S.A., "Analysis of a Heat-Driven Jet-Pumped Cooling System for Space Thermal Management." AIAA *Journal of Propulsion and Power*, Vol. 17, No. 3, May-June 2001, pp. 566-570.

INSTITUTIONAL AND PROFESSIONAL SERVICE (Last Five Years):

Chair-elect, AIAA AIAA Terrestrial Energy Systems Technical Committee, 2007
Vice-chair, AIAA Terrestrial Energy Systems Technical Committee, 2005-2007
Technical Program Chair, 5th IECEC, 2007
Student Section Advisor, ASME, University of Florida, January 2001-present
Member, MAE Dept. Graduate Committee, Thermal Science Design Committee
Member, College of Engineering Curriculum Committee, 2001-2002
Member, Steering Committee, AIAA IECEC, 2003 – present
Topical Area Coordinator, AIAA IECEC, 2003, 2004, 2005, 2006
Topical Area Coordinator, AIAA Aerospace Sciences Meeting, 2002, 2003, 2004, 2005
Session Organizer/Chair, AIAA Aerospace Sciences Meeting (9 sessions in last 5 years)
Session Organizer/Chair, AIAA IECEC (6 sessions in last 3 years)
Reviewer, AIAA J Propulsion & Power (18), NSF SBIR panel (3)
Member, AIAA Terrestrial Energy Systems Technical Committee, 1997-2005
Member, ASME IGTI Education Technical Committee, 2001-present

BIOGRAPHICAL SKETCH

Hui Li
ECE Department, FAMU-FSU College of Engineering
2525 Pottsdamer Street, Tallahassee, Florida 32310
Email: li@eng.fsu.edu Tel: (850) 410-6590

Education

Ph.D., The University of Tennessee**,** Knoxville, TN, Electrical Engineering (2000)
M.S., Huazhong University of Science & Technology, China, Electrical Engineering (1995)
B.S., Huazhong University of Science & Technology, China (1992)

Appointments

Assistant Professor, August 2002 – present
College of Engineering, Florida A&M University-Florida State University, Tallahassee, FL, Department of Electrical and Computer Engineering

Assistant Scholar/Scientist, June 2002- August 2002
Center for Advanced Power Systems, Florida State University, Tallahassee, FL

Member of Technical Staff, Jan 2001- May 2002

Tyco Electronics, Power Systems(formally Lucent Technologies, Bell Labs, Power Systems), Mesquite, Texas

Research Engineer, May 1999- December 2000Engineering Technology Division
Power Electronics & Electric Machinery Research Center
Oak Ridge National Laboratory, Oak Ridge, Tennessee

Professional Activities and Awards

- NSF Career Award, 2007
- Engineering Research Award, FAMU-FSU College of Engineering, 2007
- First Year Assistant Professor Award, Florida State University, 2003
- Planning Grant Award, Florida State University, 2004
- Best Paper Presentation Award, IEEE 29TH Industrial Electronics Conference, Virginia, USA, 2003
- Best Paper Award, The 8th World Multi-Conference on Systemics, Cybernetics, and Informatics, Florida, 2004
- Senior Member, IEEE, 2001 - present; Member, IEEE, 2000 - 2001; Student Member, 1997 - 2001
- Associate Editor, *IEEE Transactions on Industry Applications*, 2006
- Chair, Special Activities, Industrial Power Converter Committee, IEEE Industry Applications Society, 07
- *Chair, Education Activities Committee, IEEE Power Electronics Society, 2007 - present*
- *Session Chair, Alternative and Renewable Energy, 38th annual Power Electronics Specialists Conference, Orlando, FL, June 18, 2007*
- *Session Chair, Cryogenic Power Electronics, Applied Superconductivity Conference, Jacksonville, FL, 2004*

10 Recent Publications

- Danwei Liu, Hui Li, "Design and Implementation of A DSP Based Digital Control System for A Dual Bridge Isolated Bi-directional dc-dc Converter," in Record, IEEE Applied Power Electronics Conf., 2006, pp.19-23.
- Danwei Liu, Hui Li, "A Novel Multiple-Input ZVS Bidirectional dc-dc Converter," in Record, IEEE Industrial Electronics Conf., 2005, pp.579-584.
- Hui Li, Danwei Liu, "Small Signal Analysis of A Dual Half Bridge Isolated ZVS Bi-directional dc-dc converter for Electrical Vehicle Applications," in Record, IEEE Power Electronics Specialist Conf., 2005, pp. 2777-2782.
- Fang Z. Peng, Hui Li, G. Su, J. Lawler, "A New ZVS Bi-directional dc-dc Converter for Fuel Cell and Battery Applications," IEEE Transaction on Power Electronics, vol. 19, no.1, pp.54-65, Jan. 2004.
- Hui Li, Fang Z. Peng, J. Lawler, " Modeling of a New ZVS Bi-directional dc-dc Converter," IEEE Transactions on Aerospace and Electronic Systems, vol. 40, no.1, pp.272 – 283, Jan. 2004.
- Hui Li, Fang Z. Peng, J. Lawler, "A Natural ZVS Medium-power Bi-directional dc - dc Converter with Minimum Number of Devices," IEEE Transaction on Industrial Applications, vol.39, no.2, pp.525-635, March/April 2003.
- Hui Li, Keli Shi, Peter McLaren, "Neural Network Based Sensorless Maximum Wind Energy Capture with Compensated Power Coefficient," IEEE Transaction on Industrial Applications, vol. 41, no.6, pp. 1548 – 1556, Dec. 2005.
- Keli Shi, Hui Li, "Optimized PWM Strategy Based on Genetic Algorithms," IEEE Transaction on Industrial Electronics, vol. 52, no.5, pp. 1458 – 1461, Oct. 2005.
- Hui Li, David Cartes, Mischa Steurer, Haibin Tang, "Control Design of STATCOM with Superconductive Magnetic Energy Storage Elements," IEEE Transaction on Applied Superconductivity, vol. 15, no.2, pp.1883 – 1886, June 2005.
- Hui Li, Thomas Baldwin, Cesar A. Luongo, Da Zhang, "A Multilevel Power Conditioning System for Superconductive Magnetic Energy Storage," IEEE Transaction on Applied Superconductivity, vol.15, No. 2, pp.1943-1946, June 2005.

Synergistic Research Projects:

- Design, Modeling and Control of High Efficiency and High Power Density Multi-port Power Electronics Module for Hybrid Energy Systems, NSF project, PI, 2007-2012
- Integration of microturbines and fuel cells for the development of low emission APU, NASA, co-PI, Feb. 2007- Feb. 2008
- Advanced Technology Conversion, US Navy/ ONR project, PI, July 2002 – present
- Power System and New Technology Insertion, DOE project, PI, 2005 –2007

Thesis and Post Doctoral Advisor in Last Five Years:

Master: Andrew Otete (2004), Kijam Woodley (2004)

Ph.D. students: Da Zhang (2006), Danwei Liu (2006), Lewei Qian (2007, co-supervisor)

Current Ph.D. students: Sardis Azongha, Yuhang Deng, Lei Wang, Zhichao Wu, Zhan Wang

Supervised post doc: Keli Shi (2004), Du Zhong (2006), Kaiyu Wang (2007)

Current post doc: Liming Liu

BIOGRAPHICAL SKETCH

Jenshan Lin – jenshan@ufl.edu
Professor
Department of Electrical and Computer Engineering
559 Engineering Building, PO Box 116130
University of Florida, Gainesville, FL 32611-6130

EDUCATION

Institution	Degree	Date
National Chiao Tung University, Taiwan, Electrophysics	B.S.	1987
University of California at Los Angeles, Electrical Engineering	M.S.	1991
University of California at Los Angeles, Electrical Engineering	Ph.D.	1994
University of California at Los Angeles, Electrical Engineering	Post-doctoral	1994

PROFESSIONAL EXPERIENCE

2007-present	Professor, University of Florida
2003-2007	Associate Professor, University of Florida
2001-2003	Technical Manager, Agere Systems
2000-2001	Technical Manager, Bell Laboratories, Lucent Technologies
1994-2000	Member of Technical Staff, Bell Laboratories, AT&T/Lucent Technologies

HONORS AND AWARDS (Selected)

N. Walter Cox Award of IEEE Microwave Theory and Techniques Society	2007
Elected Member, IEEE Microwave Theory and Techniques Society Administrative Committee	2006-present
ETA KAPPA NU Outstanding Young Electrical Engineer Award, Honorable Mention	1997
UCLA School of Engineering and Applied Science Outstanding Ph.D. Award	1994

PUBLICATIONS AND PATENTS

Patents (6 issued)

United States Patent 6,922,108: Active balun circuit for single-ended to differential RF signal conversion with enhanced common-mode rejection, July 26, 2005.

United States Patent 6,208,846: Method and apparatus for enhancing transmitter circuit efficiency of mobile radio units by selectable switching of power amplifier, March 27, 2001

United States Patent 5,940,291: Low-complexity adaptive controller, August 17, 1999.

United States Patent 5,832,365: Communication system comprising an active-antenna repeater, November 3, 1998.

United States Patent 5,724,005: Linear power amplifier with automatic gate/base bias control for optimum efficiency, March 3, 1998.

United States Patent 5,620,909: Method of depositing thin passivating film on microminiature semiconductor devices, April 15, 1997.

Selected Publications (from 151 total)

1. T. Anderson, H.T. Wang, C. Li, Z. N. Low, B. S. Kang, J. Lin, S. J. Pearton, A. Osinsky, Amir Dabiran, P. Chow, J. Painter, F. Ren, "A New Advance in Hydrogen Sensors," (Invited) Hydrogen and Fuel Cell Safety, July 2007.
2. J. Jun, B. Chou, J. Lin, A. Phipps, S. Xu, K. Ngo, D. Johnson, A. Kasyap, T. Nishida, H. T. Wang, B. S. Kang, T. Anderson, F. Ren, L. C. Tien, P. W. Sadik, D. P. Norton, L. F. Voss, and S. J. Pearton, "A Hydrogen Leakage Detection System Using Self-Powered Wireless Hydrogen Sensor Nodes," Solid State Electronics, Vol. 51, Issue 7, pp. 1018-1022, July 2007.
3. C. Li, J. Lin, O. Boric-Lubecke, V. M. Lubecke, A. Host-Madsen, B.-K. Park, "Development of Non-

contact Physiological Motion Sensor on CMOS Chip and Its Potential Applications," Proceedings of the 7th IEEE International Conference on Application-Specific Integrated Circuits (ASICON), Vol. 2, p. 1022-1027, Oct. 26-29, 2007. (Invited)
4. Y. Xiao, C, Li, J. Lin, "A Portable Non-Contact Heartbeat and Respiration Monitoring System Using 5-GHz Radar," IEEE Sensors Journal, Vol. 7, No. 7, pp. 1042-1043, July 2007.
5. C. Li, Y. Xiao, J. Lin, "Experiment and Spectral Analysis of a Low-Power Ka-Band Heartbeat Detector Measuring from Four Sides of a Human Body," IEEE Transactions on Microwave Theory and Techniques, Vol. 54, No. 12, pp. 4464-4471, December 2006.
6. Y. Xiao, J. Lin, O. Boric-Lubecke, V. Lubecke, "Frequency tuning technique for remote detection of heartbeat and respiration using low-power double-sideband transmission in Ka-band," IEEE Transactions on Microwave Theory and Techniques, Vol. 54, No. 5, pp. 2023-2032, May 2006.
7. L. C. Tien, P. W. Sadik, D. P. Norton, L. F. Voss, S. J. Pearton, H. T. Wang, B. S. Kang, F. Ren, J. Jun, and J. Lin, "Hydrogen sensing at room temperature with Pt-coated ZnO thin films and nanorods," Applied Physics Letters, 87, 222106, November 2005.
8. S.N.G. Chu, F. Ren, S.J. Pearton, B.S. Kang, S. Kim, B.P. Gila, C.R. Abernathy, J.-I. Chyi, W.J. Johnson and J. Lin, "Piezoelectric polarization-induced two dimensional electron gases in AlGaN/GaN heteroepitaxial structures: Application for micro-pressure sensors," Materials Science and Engineering: A, Vol. 409/1-2, pp. 340-347, November 2005.
9. H. T. Wang, B. S. Kang, F. Ren, L. C. Tien, P. W. Sadik, D. P. Norton, S. J. Pearton, and J. Lin, "Detection of hydrogen at room temperature with catalyst-coated multiple ZnO nanorods," Applied Physics A, Vol. 81, No. 6, pp. 1117-1119, November 2005.
10. A. EL. Kouche, J. Lin, M. E. Law, S. Kim, B. S. Kim, F. Ren, S. J. Pearton, "Remote Sensing System for Hydrogen Using GaN Schottky Diodes," Journal of Sensors and Actuators B: Chemical, Vol. 105/2, pp. 329-333, 2005.

BIOGRAPHICAL SKETCH

Richard H. Meeker, Jr., P.E. Florida State University, Center for Advanced Power Systems, 2000 Levy Ave., Tallahassee, FL 32310, Phone (850) 645-1711, email: meeker@caps.fsu.edu

Fields of Interest (Energy-related): Boiler, generation, and power delivery control systems, system visualization, decision support, and enterprise business intelligence, power and control systems modeling and simulation, integration and control of distributed and renewable energy resources (biomass, solar, fuel cells, CGT's and micro-turbines, plug-in HEV's, etc), system-wide interdependencies and optimization, co-generation and combined heat and power (CHP), low-level waste heat recovery, energy policy.

Education/Training

University of South Florida (USF), B.S., 1986, Mech. Engineering
University of Florida (UF), M.B.A., 2002, Business

Experience

Program Dev. Mgr.-Industry Partnerships, Florida State Univ., Ctr. for Adv. Pwr. Sys. (2004 – present)
Adjunct Instructor, FAMU-FSU College of Engineering., Chem. & Biomed. Engr. Dept. (2006 – present)
Vice President, Principal Engineer, Process Control Solutions, Inc. (2004 – present)
President, Principal Engineer, Process Control Solutions, Inc. (1994 – 2004)
Process Control Manager (Fiberline), Buckeye Florida, LP. (1992 – 1994)
Process Control Manager (Major Capitol Projects), Procter & Gamble (1989 – 1992)
Process Control Engr. (Paper Machines; Major Capital Proj's), Procter & Gamble (1986 – 1989)
Co-op Engineer (Power Plant Const., Envir. Planning), Tampa Electric Co. (1983 – 1986)

Professional Licensure and Affiliations

Licensed professional engineer (PE) in Florida and Georgia
Senior member of Institute of Electrical and Electronics Engineers (IEEE);
    Member of IEEE Power Engineering Society (PES)
    Member of IEEE Industrial Applications Society (IAS)
Senior member of Instrumentation, Systems and Automation Society (ISA);
    Member of ISA Power Industry Division; Process Measurement and Control Division; and Pulp and Paper Division.
    Member of ISA SP-99, Manufacturing and Control Systems Security Standards Committee
Member, American Society of Mechanical Engineers (ASME);
    Executive Officer of ASME Tallahassee Section (currently Vice Chair, Govt. Relations Chair, and Town Hall Meeting Committee Chair)
Member, American Society of Naval Engineers (ASNE)
Member of NIST Process Control Security Requirements Forum (PCSRF)

Synergistic Activities

Project management, proposal development, research involvement on major U.S. Dept. of Energy-funded projects at FSU Center for Advanced Power Systems (awards up to $5 million, covering electric power infrastructure reliability and security).
Involved in FSU campus energy strategy and project development.
Liaison and facilitator for FSU CAPS staff on technology transfer and intellectual property development.
Periodic control systems engineering and consulting engagements in pulp and paper mill energy facilities.

Selected Publications and Presentations

Cartes, D., Ordonez, O., Harrington, J., Cox, D., Meeker, R., "Novel Integrated Energy Systems and Control Methods with Economic Analysis for Integrated Community Based Energy Systems", IEEE, *Power Engineering Society General Meeting*, 2007.

M. Steurer, J. Langston, S. Suryanarayanan, P. F. Ribeiro, R. Meeker "Model Validation and Voltage Deviation Analysis of an Existing Wind Farm using High Fidelity Real Time Digital Simulation", in *proceedings of 2007 CIRED Conference*, Vienna, Austria, May 21-24 2007

Meeker, R., Suryanarayanan, S., "Technology Risk Mitigation Approaches for an Evolving Power Grid", Florida Municipal Electric Association, *Energy Connections Conference and Trade Show*, October 2006 (presentation).

Tang, J., Hovsapian, R., Sloderbeck, M., Langston, J., Meeker, R., McLaren, P., Becker, D., Richardson, B., Baca, M., Trent, J., Hartley, Z., Parks, R., Smith, S., "The CAPS-SNL Power System Security Testbed", Proceedings, CRIS, *Third International Conference on Critical Infrastructures*, Alexandria, VA, September 2006.

Meeker, R., "Florida R&D Contributes to the Future Electric Power Grid", *Relay Magazine*, Florida Municipal Electric Power Association, Nov./Dec. 2005.

Meeker, R., Cheng, X., "Instrument Engineers Handbook, Vol. 2 - Process Control" – "Boiler Control and Optimization" section (update), 4th Edition, 2004.

Meeker, R., "Instrument Engineers Handbook, Vol. 2 - Process Control" – "ORP Control" section (update), 4th Edition, 2004.

Meeker, R., Singer, B., "Security and Process Control Systems – An Overview of ISA SP-99 and Other Standards and Practice Initiatives", *TAPPI Fall Technical Conference*, Chicago, October 2003 (presentation).

Meeker, R., Selekwa, M., "Improved Process Control of Industrial Wood-Waste Boilers", Proceedings, *ASME International Joint Power Generation Conference (IJPGC),* Atlanta, July 2003.

Meeker, R., "Unleashing Your Data Without Getting Bit – A Practical Guide to Process Data Historians and Process Information Systems", Proceedings, *TAPPI Paper Summit*, Atlanta, 1999.

Meeker, R., "Paper Quality Measurement Standards and Issues", *Neles Paper Automation Users Group Symposium*, 1999 (presentation).

Meeker, R., "pH Treatment of Coal Pile Runoff", *ISA District 3 Student Paper Award*, 1985.

Meeker, R., "Level Sensors - Operation and Selection*", ISA District 3 Student Paper Award*, 1984.

BIOGRAPHICAL SKETCH

Don L. Morel
Professor of Electrical Engineering
Chair of the Electrical Engineering Department

Degrees:

B.S., Physics, Tulane University, 1966
Ph.D., Physics, Tulane University, 1971
MBA, Rutgers University, 1979

Employment History

2003 – present:	Chair of Electrical Engineering, University of South Florida
1989 – present	Professor of Electrical Engineering, University of South Florida.
1987 - 1989:	Vice President of Research, Atlantic Richfield Solar Division(ARCO Solar).
1985 - 1987:	Director of Research, ARCO Solar.
1981 - 1985:	Director of Advanced Research, ARCO Solar.
1977 - 1981:	Group Head, Exxon Research and Engineering.
1971 - 1977:	Senior Research Scientist, Exxon Research and Engineering.

USF service:

Total number of years: 16
Original appointment date: Professor, 11/89
Major Committees: College of Engineering Faculty Governance, and Research Committees, Chair of EE Department Faculty Governance, member of Dean of College of Engineering Search Committee, Chair of Electrical Engineering Chair Search Committee
Courtesy Professor Department of Physics

Related Experience:

Subsequent to receiving my Ph.D. I spent eighteen years working in the energy industry. The first ten years were in the Corporate Research Laboratories of Exxon as a senior scientist and group leader. Over the next eight years in the Solar Energy Division of Atlantic Richfield Corp.(now Shell Solar). I progressed to the level of Vice President of R&D. In that capacity I was General Manager of a major operation consisting of a staff of about one hundred. Since this responsibility included fundamental R&D through pilot line manufacturing, the staff consisted of technicians through Ph.D. engineers and scientists representing all areas of the physical sciences. At ARCO(Shell) Solar I was responsible for development of the first commercial amorphous silicon power modules and subsequently for the scale-up of $CuInSe_2$ technology to pre-commercial production.

My experience also extends to the general fields of semiconductor materials and device physics. Materials classes have included organic semiconductors, polymers, compound semiconductors, amorphous materials, crystalline silicon, and transparent conductors. Although primary emphasis has been with photovoltaic devices; additional experience includes photodetectors, thin film transistors and memory devices, x-ray and gamma ray detectors. This real world experience influences my approach to research in academia in a major way.

Consulting: EPRI, Solarex/AMOCO, Lockheed Martin, Constellation Technology Corporation, Solar Power Technologies, BP Solar

Contracts and Grants: Over $5,000,000 over the past 10 years

Publications/Patents: 120 publications, 8 U.S. patents

Recent Relevant Publications

Analysis of carrier transport phenomena in high band gap II–VI-based MIS photovoltaic devices • ARTICLE
Thin Solid Films, Volumes 431-432, 1 May 2003, Pages 461-465
P. Mahawela, S. Jeedigunta, C. S. Ferekides and D. L. Morel

The effect of the $CdCl_2$ treatment on CdTe/CdS thin film solar cells studied using deep level transient spectroscopy • ARTICLE
Thin Solid Films, Volumes 431-432, 1 May 2003, Pages 143-147
V. Komin, B. Tetali, V. Viswanathan, S. Yu, D. L. Morel and C. S. Ferekides

P. Mahawala, G. Silvaraman, S. Jeedigunta, J. Gadupiti, M. Ramalingam, S. Submaranian, S. Vakkalanka, C. S. Ferekides and D. L. Morel, "II-VI Compounds as the top Absorbers in Tandem Solar Cell Structures*", Materials Science and Engineering B,* 116 (2005) 283 – 291.

$Cd_{1-X}Zn_XTe$ thin films and junctions • ARTICLE
Thin Solid Films, Volumes 480-481, 1 June 2005, Pages 471-476
C.S. Ferekides, R. Mamazza, U. Balasubramanian and D.L. Morel

Transparent high-performance CDSE thin-film solar cells • ARTICLE
Thin Solid Films, Volumes 480-481, 1 June 2005, Pages 466-470
P. Mahawela, S. Jeedigunta, S. Vakkalanka, C.S. Ferekides and D.L. Morel

Transparent conductors and buffer layers for CdTe solar cells • ARTICLE
Thin Solid Films, Volumes 480-481, 1 June 2005, Pages 224-229
C.S. Ferekides, R. Mamazza, U. Balasubramanian and D.L. Morel

BIOGRAPHICAL SKETCH

Nazim Muradov

Principal Research Scientist, Florida Solar Energy Center, University of Central Florida
Phone: (321) 638-1448, Fax: (321) 638-1010 E-mail: muradov@fsec.ucf.edu

Research Specialty Areas:
Hydrogen production and utilization, fossil fuel decarbonization, solar energy conversion.

Education:

Institute of Chemical Physics, Moscow, Russia	Physical Chemistry	D.Sc.	1990
Institute of Chemical Physics, Moscow, Russia	Kinetics and Catalysis	Ph.D.	1975
Institute of Oil and Chemistry, Baku, Azerbaijan	Petroleum Engineering	B.S./M.S.	1970

Position and Employment:

1990 – Present	Principal Research Scientist, Florida Solar Energy Center
1970 – 1990	Principal Research Scientist, Institute of Petrochemical Processes, Baku, Azerbaijan

Research Focus:
Dr. Muradov has been involved in hydrogen energy research for the past 25 years. The main areas of his research activities include: thermocatalytic and photocatalytic hydrogen production, fuel reformers and hydrogen generators for fuel cells, catalytic solar energy conversion, integrated renewable energy-based utility systems, carbon nanostructures, fossil fuel decarbonization and hydrocarbon processing. Dr. Muradov has spearheaded research efforts on the development and patenting of a novel process for CO_2-free production of hydrogen by catalytic pyrolysis of natural gas. He developed a novel method for production of nanostructured carbon materials (including conical carbon structures not previously described in the literature) as byproducts of hydrogen production from methane and other hydrocarbons. Dr. Muradov devised and patented a portable emission-free hydrogen generator/reformer for fuel cell applications. Under NASA contract he is leading the program of research and development on the local production of hydrogen from renewable resources such as landfill gas and citrus waste with minimal environmental impact. Since 1992, Dr. Muradov has been a PI and co-PI of more than $4 million in externally funded research (U.S. DOE, NASA, U.S. DOD/Navy, U.S. DOD/ONR, EPA and several industrial funding sources).

Honors and Awards:
- UCF Research Incentive Award, 2003
- University of Central Florida (Institutes and Centers) Distinguished Researcher of the Year Award, 1996.

Professional Affiliation:
- Board of Directors of the International Association for Hydrogen Energy,
- Editorial Board of the "International Journal of Hydrogen Energy",
- International Editorial Council of the "Processes of Petrochemistry and Oil Refining",
- American Chemical Society,
- Scientific Council of Madrid's Institute for Advanced Studies (IMDEA) "Energia", Spain

Representative Related Publications:

- Muradov, N., T-Raissi, A. "Solar Production of Hydrogen Using Self-Assembled Polyoxometalate Photocatalysts", J. Solar Energy Engineering, 128, 326, 2006
- Muradov, N., Smith, F., T-Raissi, A. "Autothermal catalytic pyrolysis of methane as a new route to hydrogen production with reduced CO_2 emissions", Catalysis Today, 116, 281-288, 2006
- Muradov, N., Veziroglu, N., "From Hydrocarbon to Hydrogen-Carbon to Hydrogen Economy", International Journal of Hydrogen Energy, v.30 (3), pp. 225-237, 2005
- Muradov, N., Smith, F., T-Raissi, A. "Catalytic Activity of Carbons for Methane Decomposition Reaction, Catalysis Today, v. 102-103, 225, 2005.
- Muradov, N., Chen Z., Smith F., "Hydrogen from Fossils with Reduced CO_2 Emissions: Modeling Fluidized Bed of Carbon Particles", International Journal of Hydrogen Energy, 30, 1149-1158, 2005.
- Muradov, N., "Emission-free Reformers for Mobile and Portable Fuel Cell Applications", Journal of Power Sources, 118, pp.320-324 (2003)
- Muradov, N., U.S. Patent No. 6,670,058 (2003) "Thermocatalytic Process for CO_2-free Production of Hydrogen and Carbon from Hydrocarbons"
- Muradov, N., U.S. Patent No. 6,653,005 (2003) "Portable Hydrogen Generator-Fuel Cell Apparatus"
- Muradov, N. "Hydrogen via Methane Decomposition: an Application for Decarbonization of Fossil Fuels", International Journal of Hydrogen Energy, v.26, 1165, 2001
- Muradov, N. "Catalysis of Methane Decomposition over Elemental Carbon", Catalysis Communications, No.2, 89, 2001
- Linkous, C., Muradov, N., U.S. Patent No. 6,572,829 (2003) "Closed Cycle Photocatalytic Process for Decomposition of Hydrogen Sulfide to its Constituent Elements"
- T-Raissi, A., Muradov, N. and Martin, E. U.S. Patent No. 6,582,666 (2003) "Apparatus for High-flux Photocatalytic Pollution Control",
- Linkous, C., Muradov, N., Mingo, T. "Aspects of Solar Hydrogen Production from Hydrogen Sulfide Using Semiconductor Particulates", Intern. J. Hydrogen Energy, v.19, No.3, 203, 1994
- Muradov, N. "Solar Detoxification of Nitroglycerine Contaminated Water Using Immobilized Titania", Solar Energy, v. 52, No. 3, pp. 283-288, 1994.

BIOGRAPHICAL SKETCH

Juan C. Ordonez
Department of Mechanical Engineering
FAMU – FSU College of Engineering
Florida State University
Tallahassee, Florida 32310

Office: (850) 644-8405
Facsimile: (850) 410-6337
Email: ordonez@caps.fsu.edu

Fields of Interest –thermodynamic optimization, constructal theory, and thermal modeling of advanced power systems

Education and Training

Pontificia Bolivariana Univ.	Mechanical Engineering	Ing., 1996
Pontificia Bolivariana Univ.	Energy Systems	M.S., 1998
Duke University	Mechanical Engineering	Ph.D., 2003

Research and Professional Experience

Assistant Professor	FAMU/FSU College of Engineering (ME)	8/03 – present
Researcher	Center for Advanced Power Systems, FSU	8/03 – present
Research Assistant	Duke University	8/98 – 5/03.
Aux/assit. Professor	Pontificia Bolivariana University (ME, Col)	1/96 – 8/98.

Awards

2007 Dean Excellence in Research Award.
2005 Nominated for the Ilya Prigogine Prize of Thermodynamics (Nancy, France)
2005 2nd Most downloaded paper in the International Journal of Heat and Mass Transfer
2001 Excellent Thesis Award by Pontificia Bolivariana University

Synergistic Activities

- Member American Society of Mechanical Engineering (ASME) and Sigma Xi, The Scientific Research Society.
- Reviewer for the National Science Foundation. Reviewer for the following Journals: Nanotechnology, Energy, The International Journal, IEEE Transactions on Control Systems Technology, IEEE Transactions on Applied Superconductivity, Thermal Engineering (RETERM), Medical Physics, Journal of Porous Media , ASME Journal of Heat Transfer, Journal of Applied Physics, International Journal of Heat and Mass Transfer
- Editorial board, JP Journal of Heat and Mass Transfer (2006-2009), Member of the Editorial Advisory Board for The Open Energy and Fuels Journal (since 2007)
- *Associate Technical Editor*, Thermal Engineering, Journal of the Brazilian Society of Mechanical Sciences and Engineering (2004-2009).

10 Relevant Publications

1. A.M. Morega, J.C. Ordonez, J.V.C. Vargas and S. Kosaraju, ``A Finite Element Method Analysis and Optimization of a Polymer Electrolyte Membrane Fuel Cell with Interdigitated Flow Field Design," International Journal of Energy Technologies and Policy (IJETP). Special Issue: Computational Fluid Dynamics Simulations in Energy Technologies and Processes, 2007.
2. L.S. Mainardes, R.S. Matos, J.V.C. Vargas, and J.C. Ordonez, Optimally Staggered Finned Circular and Elliptic Tubes in Turbulent Forced Convection, Journal of Heat Transfer, 2007. (In Press)

3. P.J. Masson, P.Tixador, J.C. Ordonez, A.M. Morega, and C.A. Luongo, "Electro- Thermal Model for HTS Motor Design", IEEE Transactions on Applied Superconductivity. 2007. (In Press)
4. J. C. Ordonez , S. Chen , J. V. C. Vargas , F. G. Dias , J. E. F. C. Gardolinski , D. Vlassov, "Constructal Flow Structure for a Single SOFC," International Journal of Energy Research, 2007 (In press).
5. W.Wechsatol, J.C. Ordonez, and S. Kosaraju," Constructal Dendritic Geometry and the Existence of Asymmetric Trees," Journal of Applied Physics, 100 (2006) 113514, 1-11.
6. J.C. Ordóñez. Integrative Energy-System Design: System Structure from Thermodynamic Optimization. Ph.D., Dissertation. Duke University, Durham, NC, 2003.
7. S. Chen, J.C. Ordonez, and J.V.C. Vargas, "Transient Operation and Shape Optimization of a Single PEM Fuel Cell," Journal of Power Sources, 162(1), (2006) 356-368.
8. A.M. Morega, J.C. Ordonez, A.P. Negoias and R. Hovsapian. Spherical Photovoltaic Cells – A Constructal Approach to their Optimization. 10th International Conference on Optimization of Electrical and Electronic Equipments OPTIM'06. May 18-19, 2006, Brasov, Romania.
9. J.V.C. Vargas, J.C. Ordóñez, and A. Bejan. Constructal Flow Structure for a PEM Fuel Cell. International Journal of Heat and Mass Transfer, 47 (2004) 4177–4193.
10. J.C. Ordóñez and A. Bejan. Minimum Power Requirement for Environmental Control of Aircraft. Energy, 28 (2003) 1183-1202.

Refereed Journal Publications: 29 Conference Presentations: 41

Patents

Eliana Leal Ferreira, Jose Viriato Coelho Vargas, Marcos Carvalho Campos, Marcos Leal Brioschi, Joao Luiz Alves, Juan C. Ordonez . Heating and Humidification System for Mechanical Ventilation of ICU Patients ("Sistema de Aquaecimento e Umidificacao de ar para ventilacao mecanica de pacientes de unidad de terapia intensiva"), UFPR, Brazil. 2006 (Under review).

Thesis and Post Doctoral Advisor in Last Five Years

Present – PhD Students: Thomas Brinson (co-advisor with C.A. Luongo), Wen Hang, Rob Hovsapian (co-advisor with A.Krothapalli), Srinivas Kosaraju
MS. Students: Nikhil Anthony, Michael Coleman, Heriberto Cortez, Thomas Tracy
Past - Postdoctoral Associates: W. Wechsatol (2005); PhD Students: Marcos C. Campos (co-advised with J.V.C. Vargas, Federal University of Parana, Brazil) MS Students: Sheng Chen, Lauber de Souza Martins (UFPR,Brazil), Fabricio Ferrari (UFPR, Brazil), Mohit Mathur, Chad McIntosh and Nischal Srivastava

Research Awards in Past 5 Years

PI or Co-PI for project of over $2.0M, from NASA, ONR, DOE.

BIOGRAPHICAL SKETCH

MUHAMMAD MUSTAFIZUR RAHMAN
Professor, Department of Mechanical Engineering, University of South Florida
4202 E. Fowler Avenue, ENB 118, Tampa, Florida 33620
Tel: (813) 974-5625, Fax: (813) 974-3539, E-mail: rahman@eng.usf.edu

EDUCATION

Bangladesh University of Engineering & Technology	Mechanical Engineering	B.Sc (1980)
University of Manitoba	Mechanical Engineering	M.Sc (1983)
University of California, Berkeley	Mechanical Engineering	Ph.D (1988)

EMPLOYMENT

University of South Florida, Tampa, Florida
Professor, August, 2007 - present (tenured).
Associate Professor, August, 1999 – August 2007 (tenured).
Assistant Professor, August, 1993 - August, 1999.
Mainstream Engineering Corporation, Rockledge, Florida
Senior Research Mechanical Engineer, August, 1991 - August, 1993.
Wright State University, Dayton, Ohio
Research Assistant Professor, July, 1989 - August, 1991.
Research Associate, March, 1988 - June, 1989.

PUBLICATIONS (Partial List, Journal = 48, Peer Reviewed Conference Proceedings = 92)

Related to Proposed Research:

1. M.M. Rahman and J.C. Lallave, "A Comprehensive Study of Conjugate Heat Transfer During Free Liquid Jet Impingement on a Rotating Disk," Numerical Heat Transfer, Part A, Vol. 51, pp. 1041-1064, 2007.
2. S.S. Shevade and M.M. Rahman, "Heat Transfer in Rectangular Microchannels During Volumetric Heating of the Substrate," International Communications in Heat and Mass Transfer, Vol. 34, pp. 661-672, 2007.
3. S.H. Ho and M.M. Rahman, "Three-Dimensional Analysis for Liquid Hydrogen in a Cryogenic Storage Tank with Heat Pipe – Pump System," Cryogenics, 2007 (in press -available online).
4. S.H. Ho and M.M. Rahman, "Nozzle Injection Displacement Mixing in a Zero Boil-Off Hydrogen Storage Tank," International Journal of Hydrogen Energy, 2007 (in press – available online).
5. J.C. Lallave and M.M. Rahman, "Modeling of Convective Cooling of a Rotating Disk by Partially Confined Liquid Jet Impingement," ASME Journal of Heat Transfer, (in press).

Other Publications:

6. K.D. Rhodes, J.E. Strom, M.M. Rahman, and M.D. VanAuker, "Prediction of Pressure Recovery Location in Aortic Valve Stenosis: An In-Vitro Validation Study," The Journal of Heart Valve Disease, Vol. 16, No.5, pp. 489-494, 2007.
7. M.M. Rahman, A.A. Gari, and S. Shevade, "Heat Transfer in Circular Microchannels During Volumetric Heating with Magnetic Field," Heat and Mass Transfer, 2007 (in press - available online).
8. A.J. Bula and M.M. Rahman, "Analysis of Heat and Mass Transfer in a Mixed Convective Diffusion Flame Attached to a Vertical Fuel Surface," Latin American Applied Research Journal, (in press).
9. M.M. Rahman and S.S. Shevade, "Development of Microchannel Heat Exchanger for Magnetic

Refrigeration Applications," *Proceedings ICME 2003*, pp. 1-14, Dhaka, Bangladesh, December 2003 (Keynote Paper).

10. J.R. Rujano, R.A. Crane, M.M. Rahman, and W. Moreno, "Numerical Analysis of Stabilization Techniques for Oscillatory Convective Flow in Czochralski Crystal Growth," *Journal of Crystal Growth*, Vol. 245, pp. 149-162, 2002.

SYNERGISTIC ACTIVITIES

1. Chair, ASME Advanced Energy Systems Division (2006 - 2007).
2. Director of Graduate Programs in Mechanical Engineering Department, USF (1997-2001, 2007 - Present).
3. Technical Program Chair, ASME Conference "Energy Sustainability 2007"in Long Beach, California, June 2007.
4. Associate Technical Editor, ASME Journal of Energy Resources Technology (2007 – 2009).
5. Member of Editorial Board, International Journal of Energy Research (2007 – 2009).
6. USF Graduate Council: Chair, Fellowship Committee (2003-2004); Chair, Curriculum Committee (2002-2003).
7. Associate Technical Editor, ASME Journal of Solar Energy Engineering (1998-2004).

AWARDS 1. Fellow of American Society of Mechanical Engineers (ASME) (Elected in February 2007).

2. ASME Advanced Energy Systems Division Best Paper Award, 2007.
3. ASME Florida West Coast 2004 Engineer of the Year (Awarded in February 2005).
4. University of South Florida President's Award for Excellence, 2003.
5. SAE (Society for Automotive Engineers) Ralph R. Teetor Educational Award, 1999.
6. State of Florida Teaching Incentive Program Award, 1998.
7. University of South Florida Outstanding Teaching Award, 1996-97.

COLLABORATORS

Venkat Bethanabotla (USF), Shekhar Bhansali (USF), Roger Crane (USF), Thomas Eason (USF), Daniel Hess (USF), Burton Krakow (USF), John E. Leland (University of Dayton), Lanchao Lin (UES, Inc), George Moore (USF), Wilfrido Moreno (USF), Rengasamy Ponnappan (Air Force Research Laboratory), Jose Porteiro (USF), Hassan M. Soliman (University of Manitoba), Elias Stefanakos (USF) Joel Strom (USF), and Michael VanAuker (USF).

ADVISORS

Hassan M. Soliman, University of Manitoba (M.S. Thesis), Van P. Carey, University of California, Berkeley (Ph.D. Dissertation), Amir Faghri, University of Connecticut (Research at Wright State University).

ADVISEES

Post Doctoral Scholars: Luis Rosario, Ahmed Hassaneen (1999-2000), Abo Hemida (1998-1999)
Doctoral Students (Graduates): Jorge Lallave, Shantanu Shevade, Son Ho (2007), Abdullatif Gari (2006), Antonio J. Bula (1999)
Masters Students (Graduates): Phaninder Injeti (2007), Cesar Hernandez-Ontiveros (2007), Mark Brown (2006), Hamza Begdouri (2005), Santosh Mukka (2005), Son Ho (2004), Chin T. Hong (2004), Shantanu Shevade (2004), Sharath Rao (2004), Ryan Mead (2003), Vinod Challa (2003), Samer El Ajouz (2003), Padmaja Dontaraju (2002), Tolani Owosina (2001), Raveendra Siribaddana (2000), Luis Rosario (1999), Amjad E. Musallam (1999), Kiran K. Ambatipudi (1999), Shan Gao (1998), Steven T. Weber (1998), Antonio J. Bula (1997), Jagannath Raghavan (1997), Chockalignam Pathanjali (1996), Prashant Gadepalli (1995), José Rujano (1995), Sathyamurthy Rajagopalan (1995).

BIOGRAPHICAL SKETCH

Ali T-Raissi

Director, Advanced Energy Research Division, Florida Solar Energy Center, University of Central Florida
Phone: (321) 638-1446, Fax: (321) 638-1010 E-mail: ali@fsec.ucf.edu

Research Specialty Areas:
Hydrogen production, storage and detection; solar energy; biomass-derived fuels; photocatalysis

Education:

University of California at Berkeley	Mechanical Engineering	Ph.D.	1982
Lehigh University, Bethlehem, PA	Mechanical Engineering	M.S.	1978
University of Tehran, Iran	Mechanical Engineering	B.S.	1975

Position and Employment:

2002 – Present	Director, Advanced Energy Research Division, Florida Solar Energy Center, University of Central Florida (UCF).
1995 – 2002	Principal Research Faculty, Florida Solar Energy Center, UCF
1987 – 1995	Research Faculty, Florida Solar Energy Center, UCF
1986 – 1987	Research Faculty, Natural Resources Research Institute, University of Minnesota, Duluth, MN.
1985 – 1986	Assistant Professor of Mechanical Engineering, University of Hawaii (UH), Honolulu, HI.
1982 – 1985	Research Fellow, Hawaii Natural Energy Institute, Honolulu, HI.

Research Focus:
Dr. Ali T-Raissi is a 25-year veteran of hydrogen research and education. He has conducted extensive R&D in the areas of solar and hydrogen energy technologies, alternative fuels, thermochemical water-splitting cycles, biomass energy conversion, environmental photocatalysis and electrochemical separation processes.

Honors and Awards:
- 2004 Innovative Technology Award, 15th World Hydrogen Energy Conference, Yokohama, Japan.
- Member, UCF Office of Research & Commercialization Millionaire's Club – 2003, 2005 & 2006.
- UCF Institutes & Centers Award for Excellence in Research (2002-03 & 1992-93).
- University of Central Florida Research Incentive Award (2002-03).

Professional Affiliation:
- American Society of Mechanical Engineers
- American Chemical Society
- American Institute of Chemical Engineers
- International Association for Hydrogen Energy
- Int. Advisory Committee, TiO_2 Photocat. Purification & Treatment of Water & Air.
- Editorial Board, Int. J. Hydrogen Energy (ISSN 0360-3199).

Recent Publications (out of more than 200):
- Huang, C., **T-Raissi, A.** "Analyses of One-Step Liquid Hydrogen Production from Methane and Landfill Gas," to appear in *J. Power Sources*.

- Ramasamy, K.K., **T-Raissi, A.** "Hydrogen Production from Used Lubricating Oils," to appear in *Catalysis Today* (**2007**), doi:10.1016/j.cattod.2006.09.037.
- Elbaccouch, M.M., Shukla, S., Mohajeri, N., Seal, S., **T-Raissi, A.** "Microstructural Analysis of Doped-Strontium Cerate Thin Film Membranes Fabricated via Polymer Precursor Technique," *Solid State Ionics* 178 (**2007**) 19-28.
- Mohajeri, N., **T-Raissi, A.**, Adebiyi, O. "Hydrolytic Cleavage of Ammonia Borane Complex for Hydrogen Production," *J. Power Sources*, 167 (**2007**) 482–5.
- Huang, C., **T-Raissi, A.** "Thermodynamic Analyses of Hydrogen Production from Sub-quality Natural Gas, Part II: Steam Reforming and Autothermal Steam Reforming," *J. Power Sources* 163 (**2007**) 637–44.
- Huang, C., **T-Raissi, A.** "Thermodynamic Analyses of Hydrogen Production from Sub-quality Natural Gas, Part I: Pyrolysis and Autothermal Pyrolysis," *J. Power Sources* 163 (**2007**) 645–52.
- **T-Raissi, A.**, Muradov, N.Z., Huang, C., Adebiyi, O. "Hydrogen from Solar via Light-Assisted High-Temperature Water Splitting Cycles," *J. Solar Energy Engineering*, 129, 2, May **2007**.
- Mohajeri, N., **T-Raissi, A.**, Ramasamy, K.K. "Thermal Conductivity of Pure Ammonia-Borane Complex and its Composites with Aluminum Powder," *Thermochimica Acta* (**2006**), in press.
- Muradov, N.Z., **T-Raissi, A.** "Solar Production of Hydrogen Using "Self-Assembled Polyoxometalate Photocatalysts," *J. Solar Energy Engineering,* 128, 3, August **2006**.
- Elbaccouch, M.M., **T-Raissi, A.** "Hydrogen Flux in Terbium Doped Strontium Cerate Membrane," *Ceramic Engineering and Science Proceedings, Advanced Ceramic Coatings and Interfaces*, Volume 27, Issue 3, 119-23; D. Zhu and U. Schultz, Editors, **2006**.
- Block, D.L., **T-Raissi, A.** "NASA Hydrogen Research at Florida Universities - Program Year 2003," NASA/CR-2006-214326, August **2006**.
- **T-Raissi, A.**, Huang, C., Muradov, N.Z., Olawale, A., Mohajeri, N. "Production of Hydrogen via Solar Powered Sulfur-Ammonia Thermochemical Water Splitting Cycle," *Proc. of the 16th World Hydrogen Energy Conference*, Lyon, France, **2006**.
- Muradov, N.Z., Smith, F., Huang, C., **T-Raissi, A.** "Catalytic Activity of Carbons for Methane Decomposition Reaction," *Catalysis Today*, 116 (**2006**) 281–8.

Patents (*as of* ***Oct. 1, 2007*****):** U.S. No. 7,074,369; 6,582,666; 6,551,561; 6,531,035; 6,342,128; 6,334,936; 6,315,870; 6,309,611; 5,935,538; 5,842,110; 5,744,407; 5,604,339; 5,296,110; WO 2007/002614; Canadian: 2,268,469 & 2,451,786. U.S. Utility Applications: 11/414,572; 11/414,900 & 60/694,273.

BIOGRAPHICAL SKETCH

Robert M. Reedy: Director, Solar Energy Division, Florida Solar Energy Center, 1679 Clearlake Road, Cocoa, FL 32922. Phone (321) 638-1470, email: reedy@fsec.ucf.edu

Fields of Interest: Photovoltaic Systems and Devices, Distributed Generation, Power Systems Analysis, Power Systems Protection and Control, Optics, Solar Thermal Systems.

Education:

Auburn University, 1973, BEE in Electrical Engineering
Auburn University, 1975, MS in Electrical Engineering
Florida Southern College, 1990, MBA in Business Administration

Research and Professional Experience:

Director, Solar Energy Division, Florida Solar Energy Center, UCF (2007-present)
Manager, Transmission Line Design, Georgia Transmission Corporation, Tucker, GA (2005-07)
Research Manager, Georgia Transmission Corp, Tucker, GA (2003-2005)
Vice President, Chief Operations Officer, Turbec Americas, Inc., Celebration, FL and Malmö, Sweden (2001-2003)
Marketing Manager, The Energy Authority, Inc. Jacksonville, FL (1998-2001)
Manager of Wholesale & Renewable Energy Business, Lakeland Electric Utilities, Lakeland, FL (1996-1998)
Director of Engineering & Operations Group, Lakeland Electric Utilities, Lakeland, FL (1985-98)
Manager of Engineering, Lakeland Electric Utilities, Lakeland, FL (1981-1985)
Superintendent, System Control and Relay Division, Lakeland Electric Utilities, Lakeland, FL (1979-1981)
Electrical Engineer, System Control and Relay Division, Lakeland Electric Utilities, Lakeland, FL (1975-1979)
Graduate Teaching Assistant and Research Assistant, Electrical Engineering Dept., Auburn University, Auburn, AL (1972-1974)
Engineering Trainee, Tampa Electric Company, Tampa, FL (1969-1972)

Synergistic Activities:

Instructor of tutorials and presenter at seminars and conferences.
Presenter of proposals to government and potential business partners.
"Founding member" of the Utility Solar Hot Water Initiative (USH2O).
Member of the IEEE Power Engineering Society
Member of the American Solar Energy Society.
Member of the Florida Energy Commission, Advisory Committee on Renewable Energy

Relevant Publications:

Reedy, R.M., Comber, M.G., Vermilye, M.G., LaCasse, S.F., "Lightning Protection of Transmission Lines with Polymer-Housed Surge Arresters." Edison Electric Institute Transmission and Distribution Conference, May, 1994.
Reedy, Robert M., "Chapter 6 - Other Techniques" of Detection of Downed Conductors on Utility Distribution Systems, IEEE PES Tutorial Course 90EH0310-3-PWR 1989.
Reedy, R. M., "Minimize the Public Risk of Downed Conductors," Electrical World, Sep. 1989, pp. S-36, 38, 40.
Reedy, Robert Martin, A Study of the Effect of Earthwire Materials on Lightning Induced Voltages and Currents in Transmission Lines, Graduate Thesis, Auburn University, Auburn, Alabama, June 5, 1975.

BIOGRAPHICAL SKETCH

Stanley R. Russell AIA
15350 Amberly Dr, Apt 1221.
Tampa, Fl., 33647
813-746-6724
russell@arch.usf.edu

Education

May 1985
Master of Architecture, University of Pennsylvania, Philadelphia, Pa.
Chair: Adele Santos

Thesis: Low to Moderate Income Housing in North Philadelphia

Advisor: Alan Levy

May 1982
Bachelor of Design, College of Architecture, University of Florida, Gainesville, Florida graduated with Honors, Dean's List, President's List, class President

Licensure
Registered architect, State of Ohio

Professional Experience

2000-Present
Principal and Owner, *Design Works Architects L.L.C.* in Waynesville, Ohio
1992-1999
Principal and Owner, *Teuchi Kenchiku* [Handmade Architecture] in Hyogo, Japan.
1991-1992
Apprenticed with Japanese master carpenter Tamotsu Edo on Awaji Island in Hyogo, Japan.
1986-1991
Designer in the office of *Team Zoo Atelier Iruka* in Kobe, Japan.
1985
Designer in the office of *Balkrishna V. Doshi* in Ahmedabad, India.

Master Plan for Vidyadhar Nagar, Jaipur
Aranya government subsidized housing, Indore

Awards

Townscape Award
from the city of Kobe, Japan for the design of *Iwaya Elderly Center*
ARCASIA Gold Medal
For the design of *Izushi Elementary School*

Teaching Experience
Fall 2003 – Spring 2006
Visiting Professor- *Miami University School of Architecture and Interior Design, Oxford Ohio*
Courses:
2nd year undergraduate design studio
3rd & 4th year undergraduate design studio
Graduate design studios

Graduate thesis advisor
Japanese Architecture seminar
Japan Summer Studio study abroad
Environmental Controls seminar
Design/Build studio

Fall 2006-Present
Assistant Professor- *University of South Florida School of Architecture and Community Design*
Courses:
Advanced design courses
Core design courses
Japan Summer Studio study abroad
Japanese Architecture seminar
Design/ Build studio
Environmental Controls seminar

Presentations/Publications
Presentations:
2007 Hawaii International Conference on Arts and Humanities
Presented Workshop titled *Handmade Architecture: The Craftsman's tradition in Japan*
2007 ACSA National Conference titled Fresh Air
Presented Paper titled *Shokunin: A Search For the Source of Quality in Japanese Architecture*
2007 ConnectED International Conference on Design Education
Story of Place
2007 ACSA SE Regional Conference Stewardship
Community Stewardship and the Hidden Curriculum
2007 ACSA Central Regional City Campus
The SACD and the East Tampa initiative

Publications:
Conference proceedings- 2007 ACSA National Conference titled *Fresh Air*
Conference proceedings- 2007 Connected International Conference on Design
Conference proceedings- 2007 ACSA SE Regional Conference *Stewardship*
Conference proceedings- 2007 ACSA Central Regional City Campus

BIOGRAPHICAL SKETCH

Franky So - fso@mse.ufl.edu

Associate Professor, Department of Materials Science and Engineering

P.O. Box 116400, Gainesville, FL 32611-6400

Education

Ph.D., Electrical Engineering, University of Southern California, 1991
Advisor: Professor Stephen Forrest
M.S., Materials Science, Massachusetts Institute of Technology, 1982
B.A., Physics, Hamilton College, 1979

Professional Experience

- Associate Professor (August, 2005 to present)
  Department of Materials Science and Engineering, University of Florida
- Head of Materials and Devices Research (2001 to 2005)
  OSRAM Opto-Semiconductors, Inc.
- Program Manager (1996 to 2001) and Senior Staff Scientist (1993 to 1996)
  Motorola Corporate Research Labs
- Research Physicist (1991 to 1993)
  Hoechst Celanese Research Division

Honors and Awards

- Motorola Distinguished Inventor
- Motorola Master of Innovation
- Senior Member of IEEE

Synergistic Activities

- Guest Editor, IEEE Journal of Special Topics in Quantum Electronics on Solid State Lighting, 2007
- Associate Editor, IEEE Journal of Display Technology (2007-present)
- Member of Editorial Board, Materials Science and Engineering Reports (2007-present)
- Member of Editorial Advisory Board, Recent Patents on Materials Science (2007-present)
- Co-Editor, Proceedings of SPIE Symposium on Organic Light Emitting Devices, 2006
- Co-Editor, Materials Research Society Proceedings Vol. 965, Warrendale, PA, 2006
- Symposium Chair:
  - Symposium on Organic Electronics, MRS Fall, 2006
  - SPIE Symposium on OLED Materials and Devices, 2006-2007
- OLED Science Panel Co-Chair, Department of Energy Basic Energy Sciences Solid State Lighting Workshop, May, 2006
- Program committee member:
  - SPIE Photonic Devices and Applications, August, 2007
  - SPIE Organic-based Chemical and Biological Sensors, August, 2007
  - Organic and inorganic LEDs for Solid State Lighting and Displays, Conference on Lasers and Electro-Optics (CLEO), May, 2007

Publications and Patents
52 patents issued

- D. Poplavskyy and F. So, "Bipolar carrier transport in a conjugated polymer by complex admittance spectroscopy", J. Appl. Phys. **99**, 33707(2006)
- M. Mathai, V. Choong, S. Choulis, B. Krummacher and F. So, "Highly efficient solution processed blue organic electrophosphorescence with 14 lm/W luminous efficacy", Appl. Phys. Lett. **88**, 243512(2006)
- B. Krummacher, V. Choong, M. Mathai, S. Choulis, and F. So, F. Jermann, T. Fiedler and M. Zachau, "Highly efficient white organic light-emitting diode", Appl. Phys. Lett. **88**, 113506 (2006)
- S. Choulis, M. Mathai, V. Choong, and F. So, "Highly efficient organic electrophosphorescent with modified cathode", Appl. Phys. Lett. **88**, 203502 (2006)
- S. Choulis, V. Choong, A. Patwardhanm M. Mathai, and F. So, "Interface modification to improve hole-injection properties in organic electronic devices", Adv. Function. Mater. **16**, 1075 (2006)
- S. Choulis, V. Choong, M. Mathai and F. So, "The effect of interfacial layer on the performance of organic light emitting diodes", Appl. Phys. Lett. **87**, 113503 (2005)
- Dmitry Poplavskyy and Franky So, "Bipolar charge transport, injection, and trapping in a model green emitting polyfluorene copolymer", J. App. Phys. **98**, 14501(2005)
- Vi-En Choong, Jay Curless and Franky So "Bipolar Transport Organic Light Emitting Diodes with Enhanced Reliability", Appl. Phys. Lett. **76**, 958 (2000).
- J. Curless, Vi-En Choong and Franky So, "Reliability Comparison of BTEL and Bilayer Organic LEDs", Synthetic Metals, **107**, 153 (1999)
- Vi-En Choong, Jay Curless, Franky So, Jun Shen and Jie Yang, "Organic Light Emitting Diodes with a Bipolar Transport Layer", Appl. Phys. Lett., **75**, 172 (1999).

BIOGRAPHICAL SKETCH

Mark T. Stewart, Professor, Ph.D., P.G.
Department of Geology
SCA 528 USF
Tampa, FL 33620
813-974-8749
813-974-2654 (fax)
mark@cas.usf.edu

Education

Cornell University	Geological Sciences	A.B., 1970
University of Wisconsin	Geology	M.S., 1973
University of Wisconsin	Water Resources Management	M.S., 1974
University of Wisconsin	Geology	Ph.D.,1976

Appointments

2001 – present	Professor, Director, USF Water Institute
1990 – 2001	Professor, Department Chair, USF Geology Dept.
1986 – 1990	Professor, USF Geology Department
1981 – 1986	Associate Professor, USF Geology Department
1976 – 1981	Assistant Professor, USF Geology Department

Recent Research Areas

Subsurface sequestration of carbon dioxide
Quantifying ground-water contributions to stream flow
Geophysical methods for detection and quantification of organic contaminants

Selected Publications

(i) *Hydrogeology*

Stewart, M., J. Cimino, M. Ross, 2007. Calibration of base flow separation methods with streamflow conductivity. Ground Water, vol. 45, no. 1, pg. 17-27

Weber, K., and M. Stewart, 2004. A critical analysis of the cumulative rainfall departure concept. *Ground Water*, v. 42, n. 6, p. 935-939.

Stewart, M., and C. Langevin, 1999. Post-audit of a numerical prediction of wellfield drawdown in a semi-confined aquifer system. *Ground Water*, v. 37, no. 2, p. . 245-252.

Stewart, M., 1998. The Florida water wars, a geologic perspective. *Geotimes*, v. 43, n. 3, p. 24-27.

Langevin, C., M. Stewart, C. Beaudoin, 1998. Effects of canals on the freshwater resources of Big Pine Key, Florida. *Ground Water*, v.36, n.3, p. 503-509.

Juster, Thomas; Kramer, P A; Vacher, H L; Swart, P K; Stewart, M. Groundwater flow beneath a hypersaline pond, Cluett Key, Florida Bay, Florida, 1997.Journal of Hydrology, vol.197, no.1-4, pp.339-369.

(ii) *other (geophysics, modeling, pathogens)*

Stewart, M., and L. North, 2006. A borehole geophysical method for quantifying dense non- aqueous phase liquids (DNAPL) in saturated soils. Applied Geophysics, 60, 87-99

Stewart, M, 2005. Geophysical method for quantification of dense non-aqueous phase liquids in the subsurface. US Pantent granted 1/11/2005, US 6,840,091.

Nicosia, L A; Rose, J B; Stark, L; Stewart, M T. A field study of virus removal in septic tank drainfields . Journal of Environmental Quality, vol.30, no.6, pp.1933-1939, Dec 2001

Stewart, M., 1999. Geophysical Methods. *Coastal Aquifers: Concepts, Methods and Practices.* J. Bear, A. Cheng, S. Sosek, L. Herrera, and D. Ouaqar, eds. Chapter 1, Kluwer Academic Publishers, Norwell, Mass., p. 9-50.

Stewart, M., 1990, Rapid reconnaissance of fresh-water lenses on small oceanic islands. *Environmental Geophysics*, S. H. Ward ed., Society Exploration Geophysicists, Tulsa, OK, pg. 57-66.

Synergistic Activities

Collaboration on an integrated ground-water/surface-water modeling system

Trout, K; Stewart, M; Ross, M; Tara, P. Parameter optimization and uncertainty analysis of an integrated hydrologic model, 2000. Proceedings of the Seventeenth Annual Meeting of the American Society for Surface Mining and Reclamation; a new era of land reclamation, Daniels, W Lee; Richardson, Steven G , eds., Proceedings of the Annual National Meeting - American Society for Surface Mining and Reclamation, vol.17, pp.694-699, 2000

Ross, M., P. Tara, J. Geurink, M. Stewart, 1997. FIPR Hydrologic Model: User's Manual and Technical Documentation. Center for Modeling Hydrologic Systems, University of South Florida, Tampa, FL.

1. *Collaborative work with US Geological Survey*

Fish, J. E., and M. Stewart, 1991. Hydrogeology, aquifer characteristics, and ground-water flow of the surficial aquifer system, Dade County, Florida. U.S. Geological Survey, Water Resources Inv. 91-4000.

Isotopic and Geochemical Determination of Base Flow, Hillsborough River Basin, FL. Southwest Florida Water Management District and US Geological Survey, 2002-2006.

Selected Grants

Florida Institute of Phosphate Research. 2005-2009. Hydrology of clay storage areas. Co-PI's M. rains, M. Ross, K. Trout. $980,000

Southwest Florida Water Management District. 2002-2006. Base flow contributions to stream flow, Hillsborough River Basin, Florida. $1,000,000 total (with USGS, USF $200,000). Co-PI's M.Rains and T. Pichler, USF, G. Kish and J. Trommer, USGS.

National Science Foundation, 2005. Development of a green technology for water treatment in lesser-developed countries. $100,000. Co-PI's N. Alcantar, B. Joseph, K. Davis-Salazar

Graduate Teaching in Hydrology

GLY 6825 *Advanced Hydrogeology*. A second or third course in hydrogeology that examines mathematical models of hydrologic systems, both analytical and numerical, and an extensive review of original literature on ground-water flow systems.

Gly 6905 *Numerical methods in Hydrogeology.* An upper-level graduate course in the theory and application of numerical models to the solution of problems in ground-water hydrology.

BIOGRAPHICAL SKETCH

Aydin K. Sunol, PhD
Professor of Chemical Engineering
University of South Florida, Tampa Fl 33620
Tel: (813) 974-3566 Fax: (813) 974-3651
e-mail: sunol@eng.usf.edu http://www.eng.usf.edu/~sunol/

Aydin K. Sunol is a Professor of Chemical Engineering, educated in Chemical Engineering (PhD from Va. Tech, 1982) and Industrial Engineering. He has authored three books on Batch Processing Systems, Artificial Intelligence in Engineering, and Pollution Prevention through Supercritical Fluids as well as over 100 publications and presentations, and four patent portfolios. He has won departmental teaching award Virginia Tech (1981), the college of Engineering teaching award at U. of South Florida (1984) and the University of South Florida Outstanding Teaching award (2003). He directed the NATO Advanced Study Institute on Batch Processing Systems and initiated the Artificial Intelligence program in Systems group of Technical Chemistry at ETH Zurich Switzerland. He served as Tokten (Unesco) fellow to Turkey. Dr. Sunol had industrial positions with ICI (UK), Ciba-Geigy and Sandoz (Switzerland), BASF (Germany) and Kimsas (Turkey). At U. of South Florida, he regularly teaches the capstone Plant and Product Design course as well as courses in Thermodynamics, Mathematical Methods, and Separation Processes and Systems Engineering. He initiated the Green Engineering work group.

The unifying theme of his research is "Environmentally Friendly Engineering Systems" with following specifics:

- **Supercritical Fluid Technology:** High pressure, Physico-chemical Property Measurement and Estimation, Reactions in Supercritical Fluids, Mass transfer, Design of Innovative Processing Schemes for Separation and Materials Processing, and Applications of Critical Region Technology to Pharmaceuticals, Forest Products, Food and Beverages, Synthetic Fuels, Microelectronics, Environmental, Biochemical and Materials.
- **Processing Systems Engineering:** Knowledge Based Systems, Machine Learning, Optimization, Fault Diagnosis, Uncertainty and Risk analysis, Process and Product design, and Economic Analysis, Engineering Data Bases and mining, Scheduling and Planning

With funding from DOE, NSF, NATO, UNESCO, NAVY, NASA, Weyerhauser, Calgon Carbon, Merck, MEI, ASTI, International Paper, Kamyr, Florida High Tech Counsel, Florida Enterprise, ACES, Baxter, Exigent, PsiloQuest, Anheauser Busch, Donovan Industries, Advanced Material Development Inc, Space Propulsion Systems Inc and Temptroll.

Dr. Sunol advised 11 doctorate and 22 Master students in his fields of research, Systems Engineering and Supercritical Fluids through graduate programs in Computer Science, Industrial Engineering, and Chemical Engineering. He currently has 8 graduate students.

Dr. Sunol organized sessions in AIChE meetings on Supercritical Fluids (Orlando, March 1990, Minneapolis, August 1992, Miami, November 1992, Los Angeles 1997; San Francisco 2006; Co-organized symposium at ACS on Supercritical Fluid Extraction (New Orleans, March 1996; organized NATO Advanced Study Institute on Batch Processing Systems Engineering, May 29-June 7, 1992, Turkey; organized AIENG 96 (International Conference on Artificial Intelligence in Engineering), Clearwater Florida, September 1996.

Selected Publications
Books

G.V. Reklaitis, Aydin K. Sunol, D.W.T. Rippin, O. Hortaçsu (ed.); Batch Processing Systems: Fundamentals and Applications for Chemical Engineering, *Springer, 1996*

Adey, B., Rzevski, B., and Aydin K. Sunol (ed.) Applications of Artificial Intelligence in Engineering XI, *Computational Mechanics Publications*, 1996

Martin Abraham and Aydin K. Sunol (ed.); Supercritical Fluids: Extraction and Pollution Prevention, *ACS Symposium Series*, 1997

Selected Chapters

Aydin K. Sunol, Sermin G. Sunol and Naveed Aslam *"Supercritical Fluid Technology - Reactions"* ed. Sunggyu Lee, C. W. Encyclopedia of Chemical Processing (ECHP), Marcel Dekker, Inc., 2005

Aydin K. Sunol and Sermin G. Sunol *"Synthesis of Surfactant-templated Aerogels with Tunable Nanoporosity"* ed. James A. Schwarz, Cristian Contescu, and Karol Putyera; first edition of the Dekker Encyclopedia of Nanoscience and Nanotechnology. 2004

Aydin K Sunol and Sermin G. Sunol, "*Substitution of Solvents by Safer Products and Processes, Supercritical Solvents*" in Solvent Handbook, Chapter 19.1, edited by George Wypych, Chem Tech Publishing, 2001.

S. G. Sunol, B. Mierau, I. Serifoglu, and A. K. Sunol "*Estimation of Physicochemical Properties using Supercritical Fluid Chromatography*" in Martin Abraham and Aydin K. Sunol (ed.); Supercritical Fluids: Extraction and Pollution Prevention, *ACS Symposium Series*, 1997

Patents
Aydin K. Sunol, et.al "Self Heating Systems for Modulation of Temperature" provisional (2005) and US Patent Application (2006)

Aydin K. Sunol et al. "*Supercritical Fluid Aided Coating of Particulate Material",* US patent # 6,426,116, July 2002.

Aydin K. Sunol, "*Supercritical Fluid Aided Treatment of Porous Materials*" *U.S. process patent, # 5169687, December 1992.*

Selected Recent Publications

Keyur S. Patel and Aydin K. Sunol *"Modeling and Simulation of Methane Steam Reforming in Thermally Coupled Membrane Reactor"* International Journal of Hydrogen Energy, 32 (13): 2344-2358 SEP 2007
Naveed Aslam and Aydin K. Sunol "*Reliable computation of solid solubility in dense gases through homotopy continuation approach*" Chemical Engineering Science 61 (11): 3419-3428 JUN 2006

BIOGRAPHICAL SKETCH

PAUL MICHAEL SOTKIEWICZ
Director, Energy Studies
Public Utility Research Center, University of Florida
330 Matherly Hall
PO Box 117142 Gainesville, FL 32611-7142
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Web Page: http://www.cba.ufl.edu/purc/facultyinfo.asp?WEBID=2095

EDUCATION

PhD, Economics, University of Minnesota, 2003
M.A., Economics, University of Minnesota, 1995
B.A. (High Honors), History/Economics, University of Florida, 1991

ACADEMIC AND PROFESSIONAL EXPERIENCE

2000– Director of Energy Studies, Public Utility Research Center Lecturer, Department of Economics, University of Florida, Gainesville, Florida
1999–2000 Economist, Office of Markets, Tariffs, and Rates, United States Federal Energy Regulatory Commission, Washington, DC
1998–1999 Economist, Office of Economic Policy, United States Federal Energy Regulatory Commission
1992–1998 Instructor, Department of Economics, University of Minnesota, Minneapolis, MN

SELECTED RECENT CONSULTING AND ADVISING EXPERIENCE

2007 Independent Expert in the Matter of the Public Utilities Commission of Belize Initial Decision in the 2007 Annual Review Proceeding for Belize Electricity Limited

2006 Advisor to the Division of Air Resource Management, Florida Department of Environmental Protection (FDEP) Regarding Implementation the Clean Air Interstate Rule (CAIR)

SELECTED HONORS AND AWARDS

2007 Fulbright Senior Specialist Grant in Economics with a specific request for expertise in electricity markets, electricity regulation, and distribution tariff design, Universidad de la República, Montevideo, Uruguay.

2006 "Efficient Market Clearing Prices in Markets with Non-Convexities" published in *European Journal of Operational Research* received New Jersey Policy Research Organization Bright Idea Research Award in Decision Sciences.

2003 Transportation and Public Utilities Group, Ph.D. Utilities Dissertation Award for "The Impact of State-Level Public Utility Commission Regulation on the Market for Sulfur Dioxide Allowances, Compliance Costs, and the Distribution of Emissions"

SELECTED PUBLICATIONS AND BOOK CHAPTERS

Sotkiewicz, Paul M. and Vignolo, J. Mario, "Towards a Cost Causation Based Tariff for Distribution Networks with DG." *IEEE Transaction on Power Systems*, Vol. 22, No. 3, August 2007, pp. 1051-1060.

Sotkiewicz, Paul and Vignolo, Jesus Mario. "Distributed Generation." The Encyclopedia of Energy Engineering and Technology, Vol. 1, pp 296-302. Ed. Barney Capehart. New York: CRC Press, Taylor and Francis Group, 2007.

Sotkiewicz, Paul. "Emissions Trading." The Encyclopedia of Energy Engineering and Technology, Vol. 1, pp. 430-437. Ed. Barney Capehart. New York: CRC Press, Taylor and Francis Group, 2007.

Vignolo, Jesus Mario and Sotkiewicz, Paul M., "Towards Efficient Tariffs for Distribution Networks with Distributed Generation", *Cogeneration and On-site Power Production*, November-December 2006, pp. 67-75.

Jamison, Mark A. and Sotkiewicz, Paul M., "Defining the New Policy Conflicts," *Public Utilities Fortnightly*, July 2006, pp. 36-40, 50.

Sotkiewicz, Paul M. and Vignolo, Jesus Mario "Nodal Pricing for Distribution Networks: Efficient Pricing for Efficiency Enhancing DG." *IEEE Transaction on Power Systems*, Vol. 21, No. 2, May 2006, pp. 639-652.

Sotkiewicz, Paul M. and Vignolo, Jesus Mario "Allocation of Fixed Costs in Distribution Networks with Distributed Generation," *IEEE Transaction on Power Systems*, Vol. 21, No. 2, May 2006, pp. 1013-1014.

Sotkiewicz, Paul M., and Lynne Holt, "Public Utility Commission Regulation and Cost Effectiveness of Title IV: Lessons for CAIR." *Electricity Journal* 18(8): 68-80, October 2005.

O'Neill, Richard P., Sotkiewicz, Paul M., Hobbs, Benjamin F., Rothkopf, Michael H., and Stewart, William R. Jr., "Efficient Market Clearing Prices in Markets with Non-Convexities." *European Journal of Operational Research*, Volume 164, Issue 1, 1 July 2005, Pages 269-285.

Sotkiewicz, Paul M., "The Impact of State-Level Public Utility Commission Regulation on the Market for Sulfur Dioxide Allowances, Compliance Costs, and the Distribution of Emissions" Ph.D. Dissertation, Department of Economics, University of Minnesota, January 2003.

O'Neill, Richard P., Helman, Udi, Sotkiewicz, Paul M., Rothkopf, Michael H., and Stewart, William R. Jr., "Regulatory Evolution, Market Design, and the Unit Commitment Problem" The Next Generation of Unit Commitment Models, B. Hobbs, M. Rothkopf, R. O'Neill, and H.P. Chao editors. 2001.

Sotkiewicz, Paul M. "Opening the Lines", Forum for Applied Research and Public Policy, Special Issue on the Role of Public Power in Utility Restructuring, Summer 2000, pp. 61-64.

SELECTED WORKING PAPERS AND UNPUBLISHED MANUSCRIPTS

O'Neill, Richard P., Sotkiewicz, Paul and Rothkopf, Michael. "Equilibrium Prices in Exchanges with Non-convex Bids." PURC Working Paper, January 2006, updated September 2007. Under review at *Operations Research*.

Sotkiewicz, Paul M. and Vignolo, Jesus Mario "The Value of Intermittent Wind DG under Nodal Prices and Amp-mile Tariffs, PURC Working Paper, December 2006.

BIOGRAPHICAL SKETCH

Elias (Lee) Stefanakos: 4202 E Fowler Avenue, University of South Florida, ENB 118, Tampa, Florida 33620, Phone (813) 974-4413, email: stefanak@eng.usf.edu

Fields of Interest: Photovoltaic devices & systems, renewable energy, hydrogen and fuel cells and electric and hybrid vehicles.

Education:

PhD - 1969	Engineering Science, Washington State University, Pullman, Washington
MS - 1965	Electrical Engineering, Washington State University, Pullman, Washington
BS - 1964	Electrical Engineering, Washington State University, Pullman, Washington

Research & Professional Experience:

1998-Present **Professor** and **Director**, **Clean Energy Research Center,** College of Engineering**,** University of South Florida. Research and development related to PV devices and systems, renewable energy sources, hydrogen production and storage, fuel cells, solar charging stations, battery testing, hybrid electric vehicles, etc.

11/89- 8/03 **Professor and Chairman**, Department of Electrical Engineering, USF
Manage a department of up to 28 faculty members and 500 students (BS, MS, Ph.D) and a budget of ~$4 million. Carry out research on clean energy systems.

8/85 - 11/87 **Professor**, Electrical Engineering, USF.

6/77 - 8/85 **Professor/Research Director,** Electrical Engineering/Rockwell Solid State Electronics Lab, North Carolina A&T State University, Greensboro, NC.
Taught undergraduate and graduate courses in the areas of semiconductor theory and devices, solid state energy conversion and solar energy. Directed research activities in the Rockwell Solid State Electronics Lab in the growth and fabrication of electronic and optoelectronic devices (including solar cells) made of III-V semiconductor compounds.

9/73 - 5/77 **Associate Professor**, Electrical Engineering, University of Idaho, Moscow, Idaho. Teaching and research in the area of solid state materials and devices.

Journal Editorial Activities:

Associate Editor, Journal of Solar Energy
Co-Editor – USA, Journal of Asian Electric Vehicles

Books:

1. E. K. Stefanakos, Editor, Symposium on "**Emerging Energy Alternatives for the Southeastern States" NASA Conference Publication 2042**, 146 pages, March 31, l978.
2. Goswami, D.Y., Klett, D.E., Raiford, M.T. and Stefanakos, E.K, ***Solar Radiation Design Data for North Carolina,*** **N. C. Department of Commerce**, Raleigh, NC, 1979.
3. E. Delyannis and E. Stefanakos (Guest Editors). Special Issue on **Solar Desalination**, **Journal of Solar Energy,** Volume 75, Number 5, pp.355-438, 2003.

Book Chapters:

E. Stefanakos, D. Y. Goswami, S. Srinivasan and J. Wolan, "**Hydrogen Energy**" (Hydrogen Production, Storage and Conversion) Chapter in the "**Environmentally Conscious Alternative Energy Production**", **John Wiley & Sons,** October, 2007.

10 Relevant Publications:

1. Lamb, H., Stefanakos, E., Smith, T., Krakow, B., Hernandez, R., Kovac, M., "Direct DC/DC Electric Vehicle Charging with a Utility Interconnected PV System", **12th European PV Conference** and Exhibition, Amsterdam, The Netherlands, April 11-13, 1994
2. H. Lamb, E. Stefanakos, et. al., "Data Acquisition and Performance Analysis from a Network of EVs: Including PV Charging", **12th International Electric Vehicle Symposium** (EVS-12), Anaheim, California, December 5-7, 1994.
3. Lamb, H., Stefanakos, E., Arbogast, T., Smith, T., "Comparative Studies of Direct Photovoltaic and AC Rectified Power Supplies for Battery Charging", **30th Intersociety Energy Conversion Engineering** Conference Orlando, FL, July 31- August 4, 1995.
4. Stefanakos, E., Buckle, K., et. al. "Design, Development and Testing of the Rivolta Isigo Neighborhood EV", **17th International EV Symposium and Exhibition,** Montreal, Canada, October, 2000
5. S. Srinivasan, J. Wade and E. Stefanakos, "Visible Light Photocatalysis via Nano-Composite CdS/TiO_2 Materials, **Materials Research Society Proceedings, Vol. 876E,** 2005.
6. S. Srinivasan, J. Wade, E Stefanakos "Synthesis and Characterization of Photocatalytic TiO2-$ZnFe_2O_4$ Nanoparticles, **Journal of Nanonomaterials,** Vol. 2006, Article 45712, pp. 1-4, July 2006
7. S. Krishnan, S. Bhansali, K. Buckle, E. Stefanakos "Fabrication and Characterization of Thin-Film Metal-Insulator-Metal Diode for use in Rectenna as Infrared Detector", **Materials Research Society Symposium Proc. Vol. 935**, p. K03-18, 2006
8. M. Ulrich Juczyk, A. Kumar, S. Srinivasan, E. Stefanakos, "Polyaniline-based Nanocomposite Materials for Hydrogen Storage", **International Journal of Hydrogen Energy, Accepted,** July, 2006
9. S. Ioannou, E. K. Stefanakos and P. H. Wiley, "State of the Art Lithium Battery Technology", **IEEE Transactions on Power Systems**, February 14, 2007 (accepted).
10. M. Sarehraz, K. Buckle, E. Stefanakos, T. Weller, Y. Goswami, "Solar Rectenna Efficiency", **Journal of Solar Energy**, (accepted**),** 2007**.**

BIOGRAPHICAL SKETCH

Pallavoor N. Vaidyanathan: 10215 Blanchard Park Trail, #2321, Orlando, FL 32817,
Phone (407) 823-0455

Education:

Business	Master of Business Administration University of Florida, Gainesville, FL, 1978
Technical	Degree of Engineer (52 Credits beyond Master's) Materials Science & Engineering, University of Florida, Gainesville, FL, 1980 M.S. in Production Engineering, University of Madras, India, 1971 B.S. in Mechanical Engineering, University of Madras, India, 1970 B.S. in Physics, University of Madras, India, 1967

Research and Professional Experience

1999 Oct to Date	Assistant VP for Research University of Central Florida, Orlando, FL Building teams for multidisciplinary research, assisting faculty members with proposal preparation and industrial liaison, identifying funding opportunities, managing intellectual property, patenting and licensing.
1998 Aug to Sept 1999	Director, Business Development TransTech Systems, Schenectady, NY Developed two new research ideas, obtained funding and explored additional areas for new products and research funding.
1997 to 1998 July	Director, R&D Marketing X-Ray Optical Systems, Inc. Albany, NY Generated new application areas for capillary optics technology, obtained over six million dollars funding from Federal and State Agencies. Initiated joint research programs with three companies, established national and international contacts for sale and joint applications research with fifteen organizations and managed programs.
1989 to 1997	Assistant Director MICROFABRITECH, University of Florida, Gainesville, FL Established and managed Industrial Liaison Program connecting with over 200 companies for Research and Technology Transfer. Initiated several inter and multidisciplinary programs by creating teams involving faculty from different disciplines and obtained significant funding from local, State and federal agencies and commercial organizations for research and educational projects.

1985 to 1989	Master Technical Staff, Greenleaf Corporation, Saegertown, PA Conceptualized, proposed and conducted joint research projects resulting in two new composite materials for cutting tool applications with an annual market of about forty million dollars. Developed ceramic composite material processing technology contributing to significant increase in manufacturing productivity with a savings of six million dollars per year. Initiated an internal education program, evaluated CAD/CAM systems, purchased, installed and implemented the system for cutting tools and tool holders, with integration to business functions.
1982 to 1985	Senior Development Engineer Allied/Bendix Corporation, Akron, OH Investigated Rapidly Solidified Alloys and developed two new compositions for cutting tool applications. Utilized PVD coating technology and introduced the first Titanium Nitride coated cutting tool with sales of over ten million dollars per year. Evaluated CAD/CAM systems, purchased systems, developed and implemented training courses, established data base structures and successfully integrated computer systems for several divisions.
1980 to 1982	Engineer University of Florida, Gainesville, FL Designed and established an advanced ceramics processing laboratory, established procedures and accounting systems with financial controls.
1972 to 1980	Held Research and Teaching Positions University of Florida, Gainesville, FL Assisted in the management of research programs in materials science and mechanical engineering. Assisted in teaching courses in materials Science, management, Industrial Engineering and Mechanical Engineering. Developed curricula for new programs.

Computer Skills:

Hardware:	Worked with IBM, VAX, Apollo and PC environments.
Software:	Word Processing, Spreadsheet, Desk Top Publishing, Statistical and Simulation, Linear Programming and CAD/CAM packages, FORTRAN and COBOL languages. Very familiar with Internet searches.
Honors and Awards:	Government of India Merit Scholarship ASM International Lectureship
Professional Activities:	Published over thirty papers in the areas of materials science, Computed-Aided Design and Manufacturing (CAD/CAM), management. Presented over twenty papers in conferences on a variety of topics including cutting tools, technology transfer and (about) an ancient Indian Temple. Jointly edited one book.

A BRIEF SUMMARY OF ACCOMPLISHMENTS

Internal Coordination: Developed multi investigator teams within a single department or group, interdisciplinary teams within a college or discipline, multidisciplinary teams between colleges within the university and build multi institutional teams - all to respond to new research initiatives such as Engineering research Center (NSF), Industry University Cooperative Research Center (NSF), University Research Initiative (DOD) etc. Such coordination at UCF has led to multi investigator and interdisciplinary programs with significant funding and national visibility.

Funding Agency Contacts: Strengthened contacts and initiated new ones with Federal and State Funding Agencies such as National Science Foundation, Department of Education, Department Of Defense, Defense Advanced Research Projects Agency, Department Of Energy, National Research Council, Office of Naval Research and several foundations for research funding. These contacts have enabled UCF to secure funding for a number of larger, multidisciplinary research and educational programs.

Industrial Liaison: Strengthened existing ties with industry and brought additional contacts for research, education and technology transfer programs. These contacts have led to new research programs funded or supported by industry, support from industry for larger research efforts, placement opportunities and internships for students and faculty, and equipment grants and donations from industry. UCF has also developed and delivered focused educational programs for industry.

Faculty Support: Provided support to faculty in identifying funding sources and collaborators including industrial connections, help them to transfer technology to Industry via funded programs such as the STTR, and assisted them in intellectual property related issues. I have also assisted several faculty members in the preparation of their Career Grant proposals, six of whom have been funded. Assisted faculty in preparing major equipment grants and obtained funding.

Graduate Program Support: Assisted faculty members in developing proposals for graduate fellowships from the Federal Agencies and industry. Developed internships programs with industry leading to joint research, industrial experience and placement of graduates.

Undergraduate Program Support: Initiated programs with NSF with industrial support to upgrade undergraduate teaching laboratories and obtain state of the art equipment. This has resulted in two new REU's and support for two undergraduate programs.

Strengthen ties with Community Colleges: Initiated and strengthened ties with Community Colleges in the State, through programs such as Undergraduate Faculty Enhancement, to assist in the recruitment of undergraduate students. Several proposals have been submitted to funding agencies.

Informal Science Education: Initiated a conversation with the Orlando Science Center and the Miami Museum, to work cooperatively on proposals for informal science education program. Two proposals have been submitted. These contacts have also been very useful to several faculty members, as they have included the museums for their educational outreach programs.

Multidisciplinary and International Effort: Developed a travel program for India, submitted a proposal to Fulbright-Hayes Travel Abroad program, obtained funding and took 15 educators to India on a 28 day trip, visiting three major cities and three side trips. Arranged 38 lectures and 45 site visits in India. The educators were drawn from several disciplines including Art, Film, Music, Theatre, Costume Design, World History, Religion, English etc. Cultural immersion was also arranged through individual day visit to Indian families for each of the participants.

BIOGRAPHICAL SKETCH

Robin K. Vieira

EDUCATION:

Master of Business Administration University of Central Florida, Orlando, FL, 1993
Master of Science, Applied Solar Energy Trinity University, San Antonio, TX, 1983
Bachelor of Arts, Physics Susquehanna University, Selinsgrove, PA, 1980

POSITIONS:

2001-Present **Florida Solar Energy Center, Cocoa, FL**
Director, Building Research Division

Responsible for a research and development division of twenty professionals and ten support personnel, with a combined state, contract and grant budget of $2.4 million.

1989-2001 **Florida Solar Energy Center, Cocoa, FL**
Manager, Sustainable Design and Development

Responsible for developing goals, acquiring funds, managing budgets, conducting research, hiring and supervising personnel, developing and conducting educational programs, and writing reports.

1983-1987 **Florida Solar Energy Center, Cocoa, FL**
Principal Investigator, Research Analyst

Developed passive and mechanical cooling methods for off-shore equipment enclosures for the U.S. Navy. Researched a new cooling concept using a radiative/desiccant roof system that provides cooling and dehumidification and uses the building structural components to store heat and moisture. Modeled residential sensible and latent loads for hot and humid U.S. cities. Performed extensive analysis on the performance of window glazings.

SELECTED PUBLICATIONS:

Vieira, R., "The Energy Policy Pyramid - A Hierarchal Tool For Decision Makers," Fifteenth Symposium on Improving Building Systems in Hot and Humid Climates, July 24-26, 2006 Orlando, FL.

Sonne, J., Vieira, R., Cummings, J., "School Conditions Will Continue to Earn Failing Grades," Fifteenth Symposium on Improving Building Systems in Hot and Humid Climates, July 24-26, 2006 Orlando, FL.

Fairey, P., Vieira R., Elder, M., Tait, J., Kettles, C., "Florida's Energy Future: Opportunities for Our Economy, Environment and Safety," FSEC-CR-1676-04, Report to the Department of Environmental Protection, January 2004

Vieira, Robin K., Jennifer L. Languell, Karen Childress, Cynthia Caterham, Eric Martin "Complying with Florida's Green Land Development Standard: Case Studies and Lessons Learned," Presented at GreenBuild International Conference and Expo, Pittsburgh, PA, United Sates Green Building Council, Nov. 2003.

Martin, E, R. Vieira, "Energy and Environmental Integration through a Green Municipality Designation." Presented at the International Green Building Conference and Exposition, United States Green Building Council, Austin, Texas, November 2002.

Martin, E., R. Vieira, J. Sonne, and B. Hanson. *Do ENERGY STAR Homes Live Up to Their Promoted Energy Savings? A Comparison of Utility Bill Data for Recently Built ENERGY STAR and Control Homes in Alachua County, Florida*. ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, CA, August 19-23, 2002.

Sonne, J., R. Vieira, "Below Canopy Meteorological Measurements at Three Florida Sites with Varying Tree Cover and Development," *Symposium on Improving Building Systems in Hot Humid Climates Proceedings*, June 2000.

Vieira, R.K., J.E. Cummings, P.W. Fairey, K. Hannani, "How to Calculate Financial Information for Home Energy Raters, Lenders, and Savvy Home Buyers," *1998 ACEEE Summer Study on Energy Efficiency in Buildings Proceedings*, Volume 7, Market Transformation, August, 1998.

Vieira, R., J. Sonne, J. Klongerbo, J.E. Cummings, "Survey Results of Florida Air Conditioning Contractors Sizing Methods," *ASHRAE Summer Meeting*, San Diego, June, 1995.

Vieira, R., "Forecasted Energy Savings of Reducing the Growth Rate of Florida Household Vehicle Miles Traveled," *Transportation Quarterly*, Vol. 47, October 1993.

Vieira, R., D. Parker, "Energy Use in Attached and Detached Residential Developments," The 3rd Visions of Quality Developments Seminar: Designing Places for Affordable Living, June, 1991.

Vieira, Robin K., J. Cummings, M. Houston, "Prioritizing Energy-Saving Measures for New Homes," *Proceedings of the Fourteenth National Passive Solar Conference*, American Solar Energy Society, June 19-22, 1989.

Vieira, R. and Sheinkopf, K., *Energy-Efficient Florida Home Building*, FSEC-GP-33-88, Florida Solar Energy Center, Cape Canaveral, FL, 1988.

Vieira, R., "Relative Benefits of Low-Emissivity Windows for Florida Residents," ASHRAE Winter Meeting, New York City, January 1987.

Vieira, R.K., G. Clark, J. Faultersack, "Energy Savings Potential of Dehumidified Roof Pond Residences," *Proceedings of the Eighth National Passive Solar Conference*, American Solar Energy Society, Sept. 7-9, 1983.

SYNERGISTS ACTIVITIES: **Nominating Committee Chair of the Florida Green Building Coalition, LEED for Homes TASC member.**

BIOGRAPHICAL SKETCH

ERIC D. WACHSMAN
Materials Science and Engineering
University of Florida
Gainesville, FL 32611-6400
Phone: (352) 846-2991 Fax: (352) 846 0326 Email: ewach@mse.ufl.ed

Director, Florida Institute for Sustainable Energy
Director, UF-DOE High Temperature Electrochemistry Center
UF Research Foundation Professor, University of Florida

Professional Preparation

Ph.D. Materials Science & Engineering, Stanford University, 1990
M.S. Chemical Engineering, Stanford University, 1986
B.S. Chemical Engineering, University of California at Berkeley, 1982

Appointments

Director, Florida Institute for Sustainable Energy, University of Florida, 2006-present.
Florida Center of Excellence to develop and commercialize energy technologies.

Director, UF-DOE High Temperature Electrochemistry Center, University of Florida, 2005-present. US Department of Energy research center on fundamental investigations of fuel cells, gas separation membranes and other high temperature electrochemical energy devices.
Professor, Materials Science and Engineering, University of Florida, 1997-present.
Development of solid state fuel cells, batteries, sensors, and gas separation membranes, and the elucidation of both transport mechanisms and electrocatalytic mechanisms.
Senior Scientist, Materials Research Center, SRI International, Menlo Park, CA, 1989-1997. Principal investigator for projects on the development of moderate temperature solid oxide fuel cells (SOFC), solid state gas sensors, and the electrocatalytic reduction of NO_X.

Publications Closely Related to the Proposed Project

More than 110 publications, 5 books and 8 patents.

1. "The Effect of Point Defects on the Physical Properties of Non-Stoichiometric Oxides," K. Duncan, Y. Wang, S.R. Bishop, F. Ebrahimi, and E. D. Wachsman, *Journal of Applied Physics*, accepted (2007).
2. "A Co-doping Approach Towards Enhanced Ionic Conductivity in Fluorite Based Electrolytes," S. Omar, E. D. Wachsman, and J. C. Nino, *Solid State Ionics*, **177**, 3199-3203 (2006).
3. "The Role of Point Defects in the Physical Properties of Fluorite Oxides," K. L. Duncan, Y. Wang, S. R. Bishop, F. Ebrahimi, and E. D. Wachsman, *Journal of the American Ceramic Society*, **89**, 3162-3166 (2006).
4. "Effect of Harsh Anneals on the LSM/YSZ Interfacial Impedance Profile," J. R. Smith and E. D. Wachsman, *Electrochimica Acta*, **51**, 1585-91 (2006).
5. "Ionic Conduction in Zirconia Films of Nanometer Thickness," X. Guo, E. Vasco, S. Mi, K. Szot, E. Wachsman, and R. Waser,' *Acta Materialia*, **53**, 5161-5166 (2005).

Other Relevant Publications

1. "Fabrication and Characterization of High-Conductivity Bilayered Electrolytes for Intermediate-Temperature Solid Oxide Fuel Cells," J.Y. Park and E.D. Wachsman, *Journal of the American Ceramic Society*, **88** [9], 2402-2408 (2005).

2. "Bismuth-Ruthenate-Based Cathodes for IT-SOFCs," A. Jaiswal and E.D. Wachsman, *Journal of the Electrochemical Society*, **152**, A787-790 (2005).
3. "Effect of Oxygen Sublattice Order on Conductivity in Highly Defective Fluorite Oxides," E. D. Wachsman, *Journal of the European Ceramic Society*, **24**, 1281-1285 (2004).
4. "Functionally Gradient Bilayer Oxide Membranes and Electrolytes," E. D. Wachsman, *Solid State Ionics*, **152-153**, 657-662 (2002).
5. "A Higher Conductivity Bi_2O_3-Based Electrolyte," N. Jiang, E. D. Wachsman, and S. H. Jung, *Solid State Ionics*, **150**, 347-353 (2002).

Synergistic Activities

1. **Director**, Florida Institute for Sustainable Energy
2. **Editor**, *Ionics*; **Associate Editor**, *Journal of The American Ceramic Society*
3. **Chair**, High Temperature Materials Division, **Board of Directors**, and **Fuel Cell Organizing Committee** of *The Electrochemical Society*.
4. **Invited panelist:** US Department of Energy "***Fuel Cell Report to Congress***" and "***Basic Research Needs Related to High Temperature Electrochemical Devices for Hydrogen Production, Storage and Use***;" National Science Foundation "***Workshop on Fundamental Research Needs in Ceramics***;" NATO "***Mixed Ionic-Electronic Conducting Perovskites for Advanced Energy Systems***;" and the National Academies "***Global Dialogues on Emerging Science and Technologies***."
5. **Board of Directors**, The Electrochemical Society
6. **Faculty Advisor**, University of Florida Student Chapter of The Electrochemical Society
7. **Senator**, University of Florida Faculty Senate
8. **Technical Advisory Board**, Kainos Energy, Inc.
9. **International Advisory Board**, Euroconferences on Science and Technology of Ionics, Sponsored by the European Community DGXII: "Human Potential Program - High Level Scientific Conferences," 2001 - present.

Collaborators and Co-editors

U. Balachandran, Argonne National Lab, IL; V. Birss, University of Calgary, Canada; M. F. Carolan, Air Products and Chemicals, PA; F. Garzon, Los Alamos National Lab, NM; P. Knauth, Univerite de Provence, France; M. Liu, Georgia Institute of Technology, GA; C. Masquelier, Universite de Picardie, France; R. Mukundan, Los Alamos National Lab, NM; S. C. Singhal, Pacific Northwest National Lab, WA; J. R. Stetter, SRI International, CA; K. Swider-Lyons, Naval Research Laboratory, WDC; E. Traversa, University of Rome, Italy

Graduate and Postdoctoral Advisees

Post-Doctoral Associates (total of 29 past advisees)
K. Duncan, University of Florida; X. Guo, Research Center Julich, Germany; A. Jaiswall, Kainos Energy, CA; J. Rhodes, Intel, OR; S. J. Song, Argonne National Lab, IL; J. Yoo, Ceramatec, UT
G. Zhang, Lawrence Berkeley Lab, CA

BIOGRAPHICAL SKETCH

Anjaneyulu Krothapalli: **2525 Pottsdamer Street, Mechanical Engineering Dept., Florida State University, Tallahassee, FL 32310, Phone (850) 644-5885, email: akrothapalli@sesec.fsu.edu**

Fields of Interest: Multi-generation concentrating solar thermal systems, Aviation biofuels from thermochemical process of Biomass, PEM Fuel cells and Energy systems for sustainable rural development.

Education:
Madras Institute of Technology, 1973, B.S. in Aeronautical Engineering
University of Tennessee, 1975, M.S. in Aerospace Engineering
Stanford University, 1978, M.S. in Mechanical Engineering
Stanford University, 1979, Ph.D. in Aeronautical and Astronautical Engineering

Research and Professional Experience:
Affiliated Professor of Energy, Royal Institute of Technology (KTH), Stockholm, Sweden, (07-)
Director, Sustainable Energy Science & Engineering Center, Florida State University (03-)
Don Fuqua Eminent Scholar Chair in Engineering, Florida State University (93-)
Chairman, Mechanical Engineering Department, Florida State University (87-02)
Professor, Mechanical Engineering Department, Florida State University (87-)
Associate Professor, Mechanical Engineering Department, Florida State University (83-87)
Acting Assistant Professor, Aeronautics & Astronautics Department, Stanford University (81-83)
Assistant Professor, Mechanical Engineering Department, University of Oklahoma (79-80)

Awards:
2006 - Visiting professor of Energy, Royal Institute of Technology (KTH), Stockholm, Sweden
2002 – Visiting Professor, Indian Institute of Science, Bangalore, India
1999 - Office of Naval Research CTAP Award for the development of CCTVC

1995 - National Research Council Senior Research Fellowship

1993 – Don Fuqua Eminent Scholar Chair, Florida State University

1987 - NASA Certificate of Recognition for the development of Particle Image Velocimetry,

1978 - Pre-doctoral Fellowship, Stanford University

Selected Professional and Entrepreneurial Activities:
2006 – present; President, Sustainable Technology LLC. Tallahassee, FL
2005 - Chairman, International Symposium on Recent advances in Aeroacoustics and Active Flow-Combustion Control, Goa, India.
1992 - Chairman, 45th Fluid Dynamics Meeting of the American Physical Society
1986-1993; President, Fluid Flow Diagnostics, Inc., Tallahassee, FL

Memberships:
Fellow, American Society of mechanical Engineers
Associate Fellow, American Institute of Aeronautics & Astronautics
Member, American Physical Society

Patents:
2005 - 6,837,456: Microjet Based Control System
2007 - 7,213,788: Microjet Based Control System for Cavity Flows

Three other patents pending

Selected Publications within the Last Five Years:

4. Krothapalli, A., and Greska, B., "Multi-generation Concentrating Solar-Hydrogen Power System for Sustainable Rural Electrification", Proceedings of 20th World Energy Congress, Rome, Italy, November 2007.
5. Choutapalli, I., Krothapalli, A. Alkislar, M.B., and Lourenco, L.M., "Flow Field and Noise Characteristics of Twin Supersonic Impinging jets", *AIAA Journal*, **44** (4)**,** 2007, 793-805.
6. Venkatakrishnan, L. and Krothapalli, A., "Forward Flight Effects on fan Noise from Supersonic 2-D inlets, *Journal of Aircraft,* **43** (5), 2006, 1549-1551.
7. Krothapalli, A., "A renewed look at sustainable energy: the solar strategy", Keynote Lecture, 18th International Congress of Mechanical Engineering (COBEM 2005), Ouro Preto, Brazil, November, 2005.
8. Arakeri, J.H., Das, D., Krothapalli, A., and Lourenco, L., "Vortex Ring Formation at the Open End of a Shock Tube: a PIV Study", *Physics of Fluids*, **16** (4), 2004, 1008-1019.
9. Moreno, D., Krothapalli, A., Alkislar, M.B. and Lourenco, L.M., "Low Dimensional Model of a Supersonic Rectangular Jet", *Physical Review E,* **69** *(2),* 2004. 026304.1–12.
10. Alkislar, M.B., Krothapalli, A., and Butler, G.W., "The effect of streamwise vorticity on the aeroacoustics of M = 0.9 jet", *J. Fluid Mechanics*, **578**, 2007, 139-169.
11. Krothapalli, A., Venkatakrishnan, L., Lourenco, L., Greska, B., and Elavarasan, R., "Turbulence and Noise Suppression of a Supersonic Jet by Water Injection", *J. Fluid Mechanics,* **491**, 2003, 131-159.
12. Arakeri, V.H., Krothapalli, A., Siddavaram, V., Alkislar, M. and Lourenco, L., "On the use of Microjets to Suppress Turbulence in a Mach 0.9 Axisymmetric Jet", *J. Fluid Mechanics,* **490***,* 2003, 75-98.
13. Alkislar, M. B., Krothapalli, A., and Lourenco, L. M., "Structure of a Screeching Rectangular Jet: a stereoscopic PIV Study", *J. Fluid Mechanics,* **489,** 2003, 121-154.
14. Alvi, F.S., Elavarasan, R., Shih, C., Garg, G., and Krothapalli, A., "Control of Supersonic Impinging Jet Flows using Microjets", *AIAA Journal*, **41** (7)**,** 2003, 1347-1355.

Refereed Journal Publications: 71 ***Conference Proceedings:*** 112

Recent Graduate Students/Postdoctoral Fellows:
M.B. Alkislar, Ph.D., 2001 – Boeing Corporation
S. Prestemon, Ph.D., 2001 – Lawrence Berkeley Laboratories
Brent Greska, Ph.D., 2004- Sustainable Technology LLC.
Maria Madruga-Santos, Ph.D., 2005 - Portuguese Air Force Academy
Isaac Choutapalli, Ph.D., 2006 – Texas A &M University

Dr. Isaac Choutapalli, Ph.D., ((2006-2007)
Dr. M.B. Alkislar, Ph.D. 2002-2005
Dr. D. M. Hernandez, Ph.D., 2001-2003

Average Annual Research Expenditures over the last Five years ≅ $ 1,200,000

Florida Energy Systems Consortium (FESC)
Letters of Support

The planning team has received 42 letters expressing support for the formation of Florida Energy Systems Consortium. These are summarized below, and, 21 letters are included in their entirety. Companies whose names are in **bold** have expressed intent to make financial commitments to FESC, currently totaling $12.7 million cash and $10.6 million in-kind. Plant and facilities that These companies further indicate that they are planning to invest within Florida in plants and facilities for amount approaching $600 million.

APECOR	**Green Team Ventures**	Progress Energy
Areva T&D	Gulf Power	Seminole Electric
BioEnergy	**Hydrogen Technology Applications**	Sharp Energy Solutions Group
Biomass Gas and Electric	InnovaLight	**Siemens**
BP Solar	IP-Biz	**Solarsa**
Brightwatts, Inc.	King of Fans	**SPG**
Citrus Energy	Kore Consulting Group	SRI International
Dunellon Solar	LynnTech	**Tampa Electric Co.**
ElectroEnergy	Novaray	Triad Research Corp.
Florida Crystals Corp.	**Orlando Utilities Commission**	Tropical Breeze
Florida High Tech Corridor	**Owl's Head Development**	Turbogenix
Florida Power and Light	**Petra Solar**	U.S. Dept. of Energy
FMPA	Plum Creek	**Verenium**
Green Power Systems	**Prado and Associates**	**White-Star, Inc.**

"The proposed Center of Excellence…will provide the organization necessary for Florida to achieve a position of national leadership in energy research." - R. Zwirn, CEO, Siemens Power Generation

"Electricity is the lifeblood of our lifestyle and economy and we must be researching new technologies to sustain our energy supplies and cost advantages. A consortium of the universities working together with industry will be a major asset in addressing these challenges and opportunities."
- S. Story, CEO, Gulf Power Corp.

"The Florida Energy Systems Consortium vision …addresses critical needs in Florida"
- A. Olivera, President, FP&L

"… a sustainable future for the generations of Floridians to come. We believe the work the Super Center for Excellence will do is a critical step…" - K. Ksionek, CEO, OUC

"State support to strengthen and grow Florida's energy-related research, development, education, outreach, and technology transfer infrastructure is …especially important to successfully developing new energy sources such as renewables, biomass, and municipal solid waste."
- I. Krieg, President, Green Power Systems

"The FESC …programs can provide a substantial leadership role in developing and demonstrating new renewable energy and energy efficiency technologies that have critical importance to the State of Florida and the nation." - R. Berridge, President, FL High Tech Corridor

"Your (FESC) proposal is vitally important to energy sustainability in Florida and also to the nation as a whole" - E. Pollock, R&D Mgr., U.S. Dept. of Energy

Orlando Utilities Commission
500 South Orange Avenue
P.O. Box 3193
Orlando Florida 32802
Phone: 407.423.9100
Administrative Fax: 407.236.9616
Purchasing Fax: 407.384.4141
Website: www.ouc.com

OUC
The *Reliable* One®

November 30, 2007

Dr. R.E. LeMon
Vice Chancellor, Academic and Student Affairs
Florida Board of Governors
Florida Education Center, Suite 1614
325 West Gaines Street
Tallahassee, FL 32399

Dear Dr. LeMon:

The Orlando Utilities Commission (OUC) strongly supports the development and potential funding of the Florida Energy Sustainability Consortium, a statewide collaboration to coordinate and unify efforts in research, development, technology commercialization, education, outreach and technology transfer in energy. We support this research and are eager for the opportunity to partner with some of the best and brightest energy researchers on their work currently underway at Florida universities.

Please know that if this proposal is funded, OUC will contribute $1 million in research funding contingent upon receiving a seat on the Center's Advisory Board. In addition, we will offer the use of our facilities and staff to assist in research and development efforts.

We look forward to the opportunity to work with UCF, UF, FSU and USF to create a Super Center for Excellence that will focus on six key areas: enhancing efficiency and conservation programs; biomass and waste-to-energy program development; sustainable solar development; nuclear and carbon capture projects; Florida's energy delivery infrastructure; and statewide long-term growth policies. Specifically, OUC is interested in zero-energy communities and plug-in hybrids; carbon sequestration technologies; energy efficient buildings and grid-integration for distributed generation.

As the second-largest municipal utility in Florida, OUC is very excited about this potential endeavor and the role it will play in helping to map out a sustainable future for our state. OUC has a long history of environmental stewardship, and we are committed to promoting conservation, efficiency and the development of alternative fuels while still maintaining the best reliability and most affordable rates for our more than 200,000 customers in Central Florida.

The State of Florida and OUC are focused on creating a sustainable future for the generations of Floridians to come. We believe the work the Super Center for Excellence will do is a critical step in that direction and we are looking forward to being involved in this important research and development endeavor.

Sincerely,

Ken Ksionek
General Manager & CEO

Providing innovative, friendly, dependable service

Florida Power & Light Company, 700 Universe Blvd , Juno Beach, Florida 33408

FPL

November 29, 2007

Florida Technology, Research, and Scholarship Board
Dr. R. E. LeMon, Vice Chancellor
Florida Board of Governors
Florida Education Center, Suite 1614
325 West Gaines Street
Tallahassee, Florida 32399

Re: **THE FLORIDA ENERGY SYSTEMS CONSORTIUM: FLORIDA'S ENERGY CENTER OF EXCELLENCE**

Dear Board Members:

Florida Power and Light Company (FPL) is pleased to support the proposal from The Florida Energy Systems Consortium (as represented by UCF, UF, USF and FSU), and separately from FAU, whose goal is to give Florida a clear position of leadership in key emerging technology areas with the unique potential for economic and societal impact in the years to come

We are particularly interested in four projects currently being proposed by the Florida Universities:

- Carbon Capture and Sequestration Program
- Concentrating Solar Power Program
- Zero Energy Home/ Plug in Hybrid Program
- Ocean Energy Technology Research at FAU

Our support will include:

- Advice on research and development activities and research areas for new faculty members for renewable energy and energy efficiency technology development in Florida
- Assistance in the creation of legislative initiatives that move Florida toward the vision of an energy-independent Florida
- Financial support of at least $500,000 with the specifics of funding for particular projects and timing to be worked out as the process evolves

The Florida Energy Systems Consortium vision for the Center of Excellence addresses critical needs in Florida and in the nation for energy efficiency and renewable energy development and production The proposal, based on sound principles of collaboration with industry partners as well as other research and development organizations at universities and national labs, will facilitate the achievement of moving new technology from the laboratory bench to the production lines of industry and to the hands of consumers.

We look forward to working with the Florida Universities on these exciting new energy technologies

Sincerely yours,

Armando J. Olivera

Armando J. Olivera
President
Florida Power and Light Company

TAMPA ELECTRIC

CHARLES R. BLACK
PRESIDENT

November 28, 2007

Dr. Yogi Goswami, P.E.
Clean Energy Research Center
University of South Florida
4202 East Fowler Avenue, ENB 118
Tampa, Florida 33620-5350

Dear Dr. Goswami:

I want to express Tampa Electric's support for the establishment of a Center of Excellence at the University of South Florida for Energy Security and Resilience. There are several key concepts for this Center of Excellence that I believe are important for the state of Florida to successfully meet its energy, economic development and sustainability responsibilities.

First, the concept of a Board directed research and policy agenda that includes the major stakeholders of the state (i.e. industry, government and the State University System). The recent Energy Summit in Tampa identified a Board directed program as a needed component for a Center of Excellence. This helps ensure that the work undertaken by the Center will be of value to the citizens of Florida.

Second, the leverage of the best and most knowledgeable State University System resources will be employed to accomplish the research and policy agenda directed by the Center's Board. This multi-institution and multi-discipline approach further ensures that the work undertaken by the Center will be of value to the citizens of Florida.

Third, the Center will provide a broad forum to discuss and outline the advantages, disadvantages, economic impact and economic development potential of energy issues that Florida will face in the future.

Tampa Electric is working to structure a carbon-dioxide capture and sequestration demonstration project at our Polk Unit 1 IGCC facility.

We believe that this project can most effectively be executed utilizing the structure of the Center of Excellence described above.

Tampa Electric has worked with the University of South Florida on preliminary engineering with respect to the demonstration project and are committed to utilizing the unique aspects of our IGCC facility to further the science of carbon capture and sequestration. It is anticipated that this project would be a multi-year demonstration. Tampa Electric's total financial commitment to this activity is estimated to be between $1,000,000 and $3,000,000.

Please accept this letter as Tampa Electric's commitment of support for the proposed Center of Excellence for Energy Issues.

Sincerely,

C. R. Black, President
Tampa Electric Company

CRB:mgm

November 28, 2007

Dr. Kirby Kemper
VP for Research
Florida State University
Tallahassee, FL 32306

Re: Florida Energy Systems Consortium

Dear Dr. Kemper,

Please accept this letter as evidence of Biomass Gas & Electric of Tallahassee's (a subsidiary of Biomass Gas & Electric, LLC) intent to fund an Endowment of two million dollars ($2,000,000) to the School of Engineering's Sustainable Energy Engineering Program simultaneously with the start of construction on our Roberts Road project. We are estimating that financing will close and construction will begin late 3rd, early 4th quarter 2008. In addition to the above grant we intend to build a three thousand square feet research laboratory for and to be used by the University for experiments, advanced studies, and demonstration of the research FSU does in advanced Sustainable Energy systems. Also as part of the agreement BG&E of Tallahassee intends to provide a slip stream of hydrogen and/or syngas produced from the project's advanced gasification system to further such activities.

Being a project developer using renewable fuels in advanced conversion systems for energy production, we are always interested in pressing the envelop in the new development of such technology. We also look forward to participating in your programs where practical. Our company has unique experience in the development and commercialization of new technology. We assume that the grant will be used for a multitude of purposes such as specific and nonspecific research and development, support for the Center, and support for research fellowships. We at BG&E of Tallahassee welcome and are proud to be a part of such an exciting public private partnership with Florida State University.

Sincerely,

S. Glenn Farris
CEO and President
Biomass Gas & Electric of Tallahassee

3500 Parkway Lane • Suite 440 • Norcross, GA 30092 • 770.662.0256

GREEN POWER SYSTEMS

Dedicated to the Development of a Better Future

27 November 2007

Florida Board of Governors,
Florida Technology Research and Scholarship Board (FTRSB)
c/o Rick Meeker
Florida State University,
Center for Advanced Power Systems
2000 Levy Ave.
Tallahassee, FL. 32310

Subject: Florida Centers of Excellence Program
Proposal to Establish the Florida Energy Systems Consortium (FESC)

Dear members of the FTRSB and interested parties:

We are pleased to learn of the proposal by Florida's leading universities to establish a major new collaboration in energy, and, would like to express our earnest and sincere support for this endeavor. State support to strengthen and grow Florida's energy-related research, development, education, outreach, and technology transfer infrastructure is vital to meeting the State's future energy needs and challenges, and, is especially important to successfully developing new energy sources such as renewables, biomass, and municipal solid waste.

Green Power Systems, LLC is a Jacksonville, Florida based company organized to develop electric generating facilities utilizing plasma arc technology. The use of plasma torches to convert organic matter into synthesis gas (syngas), which in turn can fuel the production of electricity, is the ultimate in renewable energy technology. Organic matter, which is ordinarily disposed of in landfills, can be converted to electricity. Green Power Systems, LLC is dedicated to the development, optimization and construction of a refuse to energy renewable energy power plant fueled by municipal solid waste (MSW) to be located in the Tallahassee area.

For the purposes of the referenced proposal, Green Power Systems will work in conjunction with Florida State University and the Florida Energy Systems Consortium to address the special requirements and challenges associated with successful implementation of a plasma arc refuse to energy plant, especially means to enable and demonstrate he viability of the application for more broad deployment throughout Florida.

Green Power Systems is prepared to provide support for addressing workforce training needs in the amount of $230,000, to be complemented by equivalent state funded efforts through the new center of excellence. Green Power Systems will also be interested in engaging with FESC on various other activities supporting development of commercial-scale plasma arc waste-to-energy technology.

State of Florida support for the new Florida Energy Systems Consortium will play an important and vital role in moving this alternative energy options such as plasma-arc waste-to-energy towards more widespread application in the state for meeting renewable energy goals as well as dealing with solid waste. We encourage your most serious consideration of this Center of Excellence proposal. We are pleased to answer any questions or provide additional information.

Sincerely,

Ingo Krieg
President

Shihab Kuran, Ph.D.
President and CEO
25 World's Fair Drive
Somerset, NJ 08873
(732) 379 5599

November 28, 2007

Dr. R. E. LeMon
Vice Chancellor, Academic and Student Affairs Florida Board of Governors
Florida Education Center, Suite 1614
325 West Gaines Street
Tallahassee, Florida 32399

Dear Dr. LeMon:

It is with great enthusiasm that I write this letter of interest and support for a Florida Center of Excellence entitled Florida Energy Systems Consortium (FESC) being proposed by the University of Central Florida and other state universities.

As President and CEO of Petra Solar, I am pleased to inform you that our company is ready to commit a total of $3M of its R&D funds to support the proposed research program in FESC that addresses the development of new and advanced solar energy conversion technologies that meets our Generation II AC Modules design objectives. This commitment is contingent upon UCF's providing $1 for $1 match, reaching acceptable IP and research terms, having Petra Solar representation on FESC Advisory Board, and obtaining Company's board final approval. Moreover, I am pleased to let you know that Petra Solar will be ready to relocate its R&D facilities to the award-winning University of Central Florida Research Park and Incubator to be close to UCF's power electronic research laboratories.

The purpose is of these commitments is to support the proposed Center of Excellence in Energy to develop advanced micro inverters as part of the AC Modules.

Petra Solar is willing to support the Center of Excellence in Energy because of the State of Florida's need to develop and provide reliable, economical, innovative and even alternative forms of energy to the state and its businesses and residents. Meeting immediate and future energy needs in Florida require ground-breaking ideas and experienced research leaders to carry those ideas from paper to products. My company and I believe 100 percent in the team of four universities proposing this Center of Excellence in Energy and in its ideas for tangible, real-product solutions to meet Florida's high energy demands.

Petra Solar focuses on increasing efficiencies and significantly reducing the cost of installed solar electric systems in particular. With the vast quantities of solar opportunities in the "Sunshine State," Petra Solar is intent on introducing intelligent, digitally controlled, distributed and scalable products that manage power out of solar modules and into the grid, batteries and loads. Our objectives closely match those of the Center of Excellence in Energy and we firmly believe our company's financial research sponsorship will give this Center of Excellence in Energy the innovation and infrastructure to truly advance revolutionary energy solutions to put the State of Florida at the forefront of new world-wide energy solutions.

Petra Solar has worked closely with one team member of the Center, University of Central Florida, and we are fully committed to this center based upon UCF's outstanding track record in Power Electronics, Alternative Energy Research and ability to produce market-ready products in the area of energy and alternative energy.

Petra Solar administration and I are happy to answer any questions regarding our offer of support for this Center with any interested parties. I also hope to be an active participant in this Center when it is funded by the State of Florida and its Board of Governors.

Sincerely,

Dan Cook, CFO for

Shihab Kuran, Ph.D.
President and CEO
Shihab.Kuran@PetraSolar.com
www.PetraSolar.com

Solarsa
RENEWABLE ENERGY AND SUSTAINABLE TECHNOLOGIES
4015 Dale Mabry South, Tampa, Florida 33611

Dr. Yogi Goswami, Ph.D, PE
University of South Florida / Clean Energy Research Center
4202 East Fowler Ave., ENB 118
Tampa, Florida 33620

November 2, 2007

Dear Dr. Goswami:

Solarsa International Ltd. Co. will be pleased to support your efforts to build a $40 million Super Center for Energy. This letter is to confirm our interest in supporting industry wide training for engineers, contractors, installers and service personnel for solar thermal energy systems and specifically the commercialization of a "combined power and cooling thermodynamic cycle" machine that can be used with solar collectors producing both cooling and electricity from a single machine.

Solarsa's mission is to manufacture, assemble and mass produce solar thermal collectors, concentrating solar collectors, chillers and pre-packaged Solar HVAC units that provide heating, cooling and hot water.

Solar cooling systems conserve energy, reduce peak energy demand loads and increase the energy efficiency of building and equipment. Cooling, heating and hot water consume almost ½ of Florida's annual $20 billion dollars energy payments to other states and countries. In three years, a move to solar powered cooling system could shift a total of $35 million dollars of fossil fuel purchases from other states and countries to payments for renewable energy systems creating over 100 new jobs - the equivalent of building a 50 megawatt rated coal generator with a 75% capacity factor.

With a focused commercialization effort of your existing work on a "combined power and cooling" machine, we estimate commercial prototypes available in 12 months and full commercialization in two years. We estimate total commercialization of product and establishment of a manufacturing facility to cost a minimum of $5 million dollars.

A manufacturing plant could initially employ 20 people and have the ability to increase employment to 125 full time employees as sales increase. An installer training facility can be located on the property and provide year round training in multiple languages for contractors, engineers and service personnel from Florida, the Caribbean and the Americas. The training facility expects to train over 75 people per year in solar cooling installations and service. Solar cooling provides significant economic development.

The plant will have the manufacturing capacity of 50,000 tons of solar cooling per year with system sizes ranging from the smallest of 4 tons to the largest of over 100 tons. A total project investment of almost $5 million over two years will provide solar cooling systems that will generate 100 new installer/service positions in Florida within two years.

Installer and service personnel represent the largest group benefitting from an increase in jobs due to the shift from fossil fuels to renewable energy. At 10 cents/kwh electric and $12/Dth heat, each 50,000 tons of solar cooling systems will shift $10 million dollars per year from fossil fuel purchases to renewable energy systems providing local jobs in the installation, service and maintenance sectors. Each 50,000 tons of solar cooling is equivalent to a 16 megawatt rated coal generator operating at 75% capacity factor.

Solarsa is actively developing the solar thermal and solar cooling markets. And Solarsa has taken the first step of market development by standardization of solar cooling systems with four solar powered HVAC demonstration systems with two being located in the Tampa Bay area.

Solarsa has installed the world's first commercially available combined heat and electric concentrating solar system in downtown Tampa. The only concentrating solar technology developed exclusively for Florida's humid and hurricane prone environment. The innovative technology uses 1/10th the amount of silicon and produces both hot water and electricity in one solar collector system. Additionally, the concentrating collectors are upgradeable and the concentrating solar electric cells/panels can be replaced with more efficient cells as technology improves.

As part of this initiative developing solar thermal and solar cooling/power systems, Solarsa will commit in-kind services, materials and cash contributions valued at $750,000 during a two year commercialization period. Solarsa intends to work closely with you to develop products that provide job creation and establishment of a manufacturing industry for Florida.

Sincerely,

Scott E. Jorgensen
President & CEO
Solarsa International Ltd. Co.

Green Team Ventures, LLC

Dr. J. N. Chung
Department of Mechanical and Aerospace Engineering
University of Florida
P.O. Box 116300
Gainesville, FL 32611-6300

Subject: Letter of Support Commitment for $5.1 million

Dear Dr. Chung:

On behalf of Green Team Ventures, LLC, we are very pleased to confirm our commitment to support the proposed Super Center of Excellence on Energy at the University of Florida.

Green Team Ventures is a Florida based company and is located in Live Oak, FL. We have recently invested in a technology and equipment that serves the waste disposal and management industry. Our focus is to use as our base fuel municipal solid waste, used tires, bio-mass and other energy sources to generate bio fuel gas and electrical power. After extensive research and investigation, we believe that the high-temperature pyrolytic gasification system holds the key to a win-win scenario for addressing Florida's solid waste disposal and renewable energy issues.

The high temperature pyrolytic gasification system can convert municipal solid waste and biomass to high quality, clean synthesis gaseous fuels with much lower harmful emissions than allowed. The synthesis gas can be used to generate electrical power in a turbine or converted to liquid fuels such as ethanol and biodiesel. Both cases coincide with some of the objectives listed under the Thrust Area of "Developing Florida's Biomass and Waste to Energy Resources" in your proposal to the Florida State University system Board of Governors. We have purchased a high-temperature pyrolytic gasification and gas turbine generation system marketed by the Freeomics Inc. based in California. We will make the gasification unit exclusively available to your research team for your research and development needs at no cost to UF for the entire three years. Our eventual goal is to become a world leader in producing the best and most efficient pyrolytic gasification and power generating systems. We envision that by supporting your research and development group at the University of Florida and with the assistance from the State Center of Excellence funding support, the success of your project will certainly benefit our company through technology sharing and transfer. The success of our company will contribute directly to the state of Florida in terms of renewable energy development and state economical growth.

We pledge our support and cost share as detailed below:

- A 162,000 square foot building housing our test facility, manufacturing center and research and development laboratory. The market value to lease this facility is $5.40 per square foot per year.
- One ten ton per day gasifier/2.5 MW power generation unit that will be made available for all engineering experimentation, technical evaluation and process optimization. The use of this system with the support of our technicians and operators and the level of maintenance required for its operation over the three year period is valued at $2,475,600.
- The estimated total value of this in kind contribution from Green team Ventures for the duration of this project is $5,100,000.

    - 5.40/sq ft x 162,000 sq ft x 3 years = $2,624,400.
    - use of 10-ton per day gasifier/generator = $2,475,600.
    - Total in-kind support = 5,100,00.

We at Green Team Ventures are excited with this prospect of joining forces and using the expertise each entity has so as to bring this technology and process to commercial viability. We look forward to working with you and extend to you our best efforts and resources.

Sincerely yours,

Brent Wainwright, President and CEO
Green Team Ventures, LLC

SIEMENS

Randy H. Zwirn
President and Chief Executive Officer

November 29, 2007

Timothy J. Anderson
Office of Research and Graduate Programs
University of Florida College of Engineering
300 Weil Hall
Gainesville, FL 32611-6550

Subject: The Florida Energy Systems Consortium, Florida's Energy Center of Excellence

Dear Dr. Anderson;

Siemens Power Generation is pleased to support the Florida Energy Systems Consortium proposal for a Florida Energy Center of Excellence. The proposed Center of Excellence will provide significant economic benefits to the state as well as employment opportunities for highly skilled workers in the energy field. The U.S and the State of Florida face major challenges in energy of vital importance to national security, economic prosperity and environmental preservation. The proposed Center of Excellence with major thrusts in renewable energy, energy efficiency, and the security of Florida's energy delivery infrastructure, will provide the organization necessary for Florida to achieve a position of national leadership in energy research.

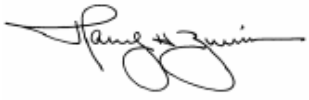
Siemens Power Generation has a long history of supporting energy technology development at Florida's universities. Increasing the number of skilled engineers and technology graduates is both a critical need for the energy industry and key objective of our university partnership programs. At present, we have on-going funded technology development and applied research programs underway at the partner universities and would anticipate continuing that level of support within the structure of the Florida Energy Systems consortium. Siemens also maintains a summer engineering internship program and actively recruits new graduates for a wide spectrum of energy-related careers. In addition, our innovative University Embryonic Programs initiative provides seed-money grants to nurture and evaluate new ideas, focusing on proof-of-principle and on defining value.

We look forward to working with the university Consortium to develop a robust portfolio of projects targeting commercially-viable technologies and would be pleased to participate on the proposed Industrial Advisory Board and in the Industry Affiliates Program. In addition, we would expect to target a specific number of our on-going Student Internship and Co-op positions to support the Consortium's programs. Siemens Power Generation key experts, provided as in-kind support, would be able to participate in joint Workshops on energy-related topics and perhaps provide seminars on specific topics of interest.

Although many specific research programs under the Florida Energy Systems Consortium have yet to be defined, we anticipate providing both in-kind support and direct funding for those programs that align with our technology commercialization priorities. For example, we are able to make a specific commitment relative to a biogas development program at the University of Florida that has been integrated into the Consortium initiative, with Siemens Power Generation offering to provide a 5KW solid oxide fuel cell system at a discount of over $100,000 to support research into the proposed biogas program. We would anticipate reviewing and discussing other initiatives with the Consortium and look forward to partnership programs in a number of areas.

The unique resources of this proposed facility will benefit participants across a wide range of industries, and will allow the State of Florida the opportunity to become a research leader in worldwide energy research for electrical power generation. We are excited to be a partner in the development of this program and look forward to the collaborative benefits of a multiple university and industry team.

Best regards,



Randy Zwirn

White Starr, Inc.
Starr Sanford Design Associates
Amelia Island, Florida
jsadesign@att.net

November 29, 2007

Dr. Steinar Dale, Director
Center for Advanced Power Systems
Florida State University
2000 Levy Ave., Suite 170
Tallahassee, FL 32310

Dear Dr. Dale,

White Starr, Inc., the developers of Sky, an environmentally sensitive and energy efficient project gearing up in Calhoun County, Florida is eager to participate in the research to determine the feasibility and best practices method for implementing an energy system that greatly increases energy efficiency through neighborhood integration of heating and cooling systems.

We want to express our company's interest and support for a Florida Center of Excellence focusing on energy. White Starr, Inc is committed to a cost share of $2,700,000 towards the **Establishing an Efficient and Reliable Energy Delivery Infrastructure** program.

The State's need for adequate, reliable and economical energy supplies is critical to the success of business, economic development and the health, safety and well being of our residents. There will be many challenges to meet Florida's future energy needs. A consortium of the Universities working together with industry will be a major asset in addressing these challenges.

We understand that for this proposal to be acceptable to the State of Florida, you need a tangible evidence of support from the industry. We will be happy to discuss the level of support from White Starr, Inc. with you or other representatives from the Consortium developing the Center of Excellence proposal.

Please keep us informed as to the progress of the proposal for the Center so that we may participate at the appropriate times.

Sincerely,

Bruce White
White Starr, Inc.

November 27, 2007

Dr. Steinar Dale
Director
Center for Advanced Power Systems
Florida State University
2000 Levy Ave., Suite 170
Tallahassee, FL 32310

Dear Dr. Dale,

I want to express my company's interest and support for a Florida Center of Excellence focusing on energy. Please find attached the Florida Energy Systems Consortium's form indicating specific areas where a commitment by Owl's Head Development, LLC and/or the Magnolia Creek CDD could be made. We have approximately $1.2 million in our development budget that could be allocated to fund our cost share obligation toward the implementation of cost effective load management measures selected for implementation from recommendations made by the Energy Center.

The State's need for adequate, reliable and economical energy supplies is critical to the success of business, economic development and the health, safety and well being of our residents. There will be many challenges to meet Florida's future energy needs. A consortium of universities working together with industry will be a major asset in addressing these challenges.

We understand that for this proposal to be acceptable to the State of Florida, you need a tangible evidence of support from industry. We will be happy to discuss our level of support with you or other representatives from the Consortium developing the Center of Excellence proposal.

Please keep me informed regarding the progress of the proposal for the Center so that we may participate at the appropriate time.

Sincerely,

Shelton S. Stone, NCARB
General Manager

Owl's Head Development, LLC

OWL'S HEAD DEVELOPMENT, LLC

VERENIUM
THE NATURE OF ENERGY™

www.verenium.com

55 Cambridge Parkway, Cambridge, MA 02142
617.674.5300

November 21, 2007

Dr. Lonnie O. Ingram
Director, Center for Renewable Chemicals and Fuels
Department of Microbiology and Cell Science
PO Box 110700, Bldg 981 Museum Road
University of Florida
Gainesville, FL 32611

Dear Dr. Ingram:

It is exciting to see the University continue to build on its leadership position in cellulosic ethanol technology research. It is also exciting to see the state's support for the further development of this cellulosic technology through the multi-university Energy Center. Funding of this State Energy Grant will accelerate the technology development by making the conversion process more efficient, while evaluating the various and abundant feedstocks available in Florida.

As an exclusive UF licensee, we have suppored improvements in biomass to ethanol research through a Sponsored Research Agreement at UF for over 16 years. This collaboration has been highly productive, resulting in over 15 US patents and many more foreign counterparts being issued. Progress on the commercialization of the licensed technology has been exceptional. The world's first wood-to-ethanol plant using waste wood as a feedstock, with a capacity of 1.3 million liters per year, is in operation with our Asian partners in Osaka, Japan. Verenium's 1.5 million gallon facility in Jennings, LA is well into construction and will be operational in the first half of 2008. The combination of the UF technology together with the experience garnered at these two Verenium facilities provides us the design basis for our commercial plan to construct numerous 30 million gallon per year ethanol plants in Florida and other regions of the southeast. Our belief, and that of other industry experts, is that indigenous biomass supply in Florida has the potential to support over 100 of these facilities.

Verenium is currently providing UF with funding under a Sponsored Research Agreement. We expect that our funding to UF over the next three years will be in excess of $2,000,000. We are delighted to be listed as a corporate match for the proposed research grant.

Sincerely,

Timothy R. Eves
Vice President Business Development

BIOENERGY
INTERNATIONAL, LLC

December 1, 2007

Professor Lonnie Ingram
University of Florida
Department of Microbiology & Cells Science
Room 1052, Building 981
POB 1100700
Gainesville, FL 32611

Dear Dr. Ingram:

I write to offer BioEnergy International LLC's strong support forthe Florida Energy Systems Consortium: Florida's Energy Center of Excellence. As a science and technology leader in the development of biorefineries that produce biofuels and specialty chemicals from renewable resources, BioEnergy commends the Consortium's vision to launch Florida as a leader in the renewable energy and biorefinery sectors by uniting the state's academic and research community with key industry partners.

BioEnergy's particular focus is on the conversion of biomass to fuels and renewable chemicals. With oil pushing $100 a barrel and hydrocarbons fueling a climate crisis, collaboration is vital to help us collectively achieve energy independence, combat global climate change and provide jobs and economic development in Florida and throughout the country.

BioEnergy is proud of our successful collaboration with the University of Florida (UF) as a licensee of UF technology for the production of biobased specialty chemicals from renewable resources. We have committed $1 million for sponsored research through an existing agreement, and ongoing in-kind support from our Alachua lab. In addition, BioEnergy recently expanded in Florida with the establishment of a research and development laboratory at the UF Sid Martin Biotechnology Incubator to further collaboration with scientists and facilities at UF.

Today, we not only have the responsibility to transition away from fossil fuels, we also have the ability to do so if we invest in next generation technologies for biorefineries and renewable energy, and provide supportive markets for the growth of the industry. I believe we are close to the day when a pound of sugar can replicate a barrel of crude in the manufacture of everything from the fuel we put in our cars to the plastics and fabrics we use in our everyday lives. I am especially proud of our work with you and the UF to have boosted the ethanol industry.

Toward our shared commitment to advancing and optimizing next generation technologies, I offer my strongest support to the Florida Energy Systems Consortium: Florida's Energy Center of Excellence. We at BioEnergy look forward to continuing to work closely together to accelerate commercialization of products produced by microbial fermentations of sugars derived from biomass to further the fight to reduce our nation's dependency on imported oil.

Sincerely,

Joseph Glas, Senior VP, Research & Development

99 Longwater Circle 2nd Floor • Norwell, MA 02061 • Phone: 781-681-5050 • Fax: 781-681-5055

Susan N. Story
President and
Chief Executive Officer

One Energy Place
Pensacola, Florida 32520-0100

Tel 850 444 6381
SNSTORY@southernco.com

GULF POWER
A SOUTHERN COMPANY

November 28, 2007

Dr. Steinar Dale
Director
Center for Advanced Power Systems
Florida State University
2000 Levy Ave., Suite 170
Tallahassee, FL 32310

Dear Dr. Dale,

I want to express Gulf Power's interest and support for a Florida Center of Excellence focusing on the future challenges we face in the energy industry.

Florida's need for adequate, reliable and economical energy supplies is critical to the success of business, economic development and the health, safety and well being of our residents. Electricity is the lifeblood of our lifestyle and economy and we must be researching new technologies to sustain our energy supplies and cost advantages.

A consortium of the universities working together with industry will be a major asset in addressing these challenges and opportunities.

Gulf Power supports this effort and believes that our future energy decisions must be based on sound science, solid economics and a healthy environment.

This Center of Excellence holds the promise of finding these types of solutions as we move forward.

Please consider Gulf Power a strong supporter of this effort.

Sincerely,

Susan N. Story

FMPA
Florida Municipal Power Agency

Roger A. Fontes
General Manager and CEO

November 29, 2007

D. Yogi Goswami, Ph.D, PE
John & Naida Ramil Professor,
Co-Director, Clean Energy Research Center,
University of South Florida
Tampa, FL

Dear Dr. Goswami:

The Florida Municipal Power Agency (FMPA) would like to express their wholehearted support for the Florida Energy Sustainability Consortium. FMPA is a non-profit, joint action agency created to serve the needs of municipal electric utilities in Florida. Of the 33 municipal systems in the State, 30 are FMPA members who participate at varying levels in Agency activities. Member utilities of the Agency serve approximately 750,000 retail customers statewide.

FMPA believes the Florida Energy Sustainability Consortium will bring substantial benefits to our member cities as well as the communities they serve. We expect the Consortium to help us build consensus and understanding of issues related to the state proposed electric utility greenhouse gas reduction program. Likewise, we believe that Florida must pull together the best ideas from energy production, emission control, generation efficiency, customer efficiency and renewable production. It is our understanding that the Florida Energy Sustainability Consortium will not only bring utility representatives together but representatives from state agencies as well as representatives from various other industry sectors.

Our organization has participated in numerous state activities such as the Municipal Efficiency Coalition a group, the Florida Municipal Electric Association and the Florida Reliability Coordinating Council. FMPA participates in these groups by regular attendance at meetings, assisting with task groups, providing meeting locations and by participating on the respective governing boards. We would expect to have similar involvement on the Florida Energy Sustainability Consortium. In addition, we would expect to be able to make a meaningful financial contribution each year.

We look forward to working with you.

Sincerely,

Roger A. Fontes
General Manager & CEO

8553 Commodity Circle | Orlando, FL 32819-9002
T. (407) 355-7767 | Toll Free (888) 774-7606
F. (407) 355-5794 | www.fmpa.com
roger@fmpa.com

HYDROGEN TECHNOLOGY APPLICATIONS, INC.

John T. Wolan, Ph.D.
Associate Professor
University of South Florida
Chemical Engineering Department
4202 E. Fowler Ave., ENB 118
Tampa, FL 33620

Dear John,

Hydrogen Technology Applications, Inc. is deeply committed to pursuing clean energy related research activities in an effort to reduce the amount of fossil fuels consumed to generate energy as well as clean up the environment. We are currently undertaking a number of energy projects; however, we are not able to disclose the nature of these projects at this time due to our Intellectual Property position.

The creation of the proposed Center of Excellence on Energy for the State of Florida and its research activities will help Hydrogen Technology Applications, Inc. in providing the necessary academic resources to aid in the development of energy related technologies relevant to our company. The development of these technologies will help our business expand and grow into a leader in clean energy related technologies.

Hydrogen Technology Applications, Inc. is willing to consider an in-kind contribution totaling $40,000 for this project. Of this total amount, $20,000 will be in the form of equipment and $20,000 will be in the form of Hydrogen Technology Applications, Inc. personnel time consisting of 80 hrs. for senior research and development personnel and 80 hrs of other staff.

Thank you for allowing Hydrogen Technology Applications, Inc. the opportunity to participate in a project with the proposed Center of Excellence on Energy for the State of Florida. We eagerly look forward to working with the excellent team of academic researchers you have assembled to develop clean energy technologies.

Sincerely,

Timothy J. Fawcett, Ph.D.
Director of Research and Development

4707 140th Ave. N. Suite 116
Clearwater, FL 33762
Voice: 727-531-5979, Fax: 727-531-3670
www.hytechapps.com, info@hytechapps.com

SPG, LLC
5150 Palm Valley Road, Suite 203
Ponte Vedra Beach, Fl 32082
November 27, 2007

Dr. Eric Wachsman
Director, Florida Institute for Sustainable Energy
Director, UF-DOE High Temperature Electrochemistry Center
UF Research Foundation Professor, Department of Materials Science and Engineering
PO Box 116400
Gainesville, FL 32611-6400

Dear Professor Wachsman:

I am writing to express my company's support for your proposal to the Florida Technology, Research and Scholarship Board to develop a Center of Excellence on Sustainable Energy. We believe the proposed research has tremendous commercial potential and is directly in line with SPG's business strategy.

SPG is a Florida start-up focusing on development and commercialization of organic solar cells. We have an office in Ponte Vedra Beach, Florida and will soon be opening an office in Gainesville, Florida. We will be collaborating with Dr. Franky So and his team at the University of Florida exploring new applications of organic solar cell technology.

Energy technologies have huge current and projected commercial markets. New technologies have the potential to provide cost-effective energy solutions, provide renewable, clean energy sources, reduce dependence on foreign fuels, and reduce pollution of the environment. To meet our future national energy needs, innovative ideas must be translated into viable commercial products. To this end, partnerships between Universities with small businesses play a critical role in the commercialization process for new commercially viable energy technologies.

We are extremely interested in the solar cell technologies we discussed with you and your group at University of Florida and are exploring potential commercialization route. We would like to contribute $190,000 per year in-kind contribution to support the research activities in organic solar cell technology. We are excited about the opportunity to work with the University of Florida research team to develop the organic solar cell technology.

We look forward to continuing to work with the University of Florida to develop and commercialize these energy technologies, and envision significant opportunities to work together in the future.

Sincerely,

Michael L. Starks
Founding Partner

Department of Energy
Washington, DC 20585
November 28, 2007

Dr. R. E. LeMon
Vice Chancellor, Academic and Student Affairs
Florida Board of Governors
Florida Education Center, Suite 1614
325 West Gaines Street
Tallahassee, FL 32399

Dear Dr. LeMon:

This letter is written in support of Florida's effort to form a super center of excellence in energy research and development among its state universities. Your "Florida Energy Systems Consortium (FESC): Florida's Energy Center of Excellence" proposal is vitally important to energy sustainability in Florida and also to the nation as a whole.

As you may already know, the U.S. Department of Energy (DOE), through its *Building America* program and its Solar America Initiative, presently funds substantial research and development and public and consumer outreach efforts on building energy efficiency and photovoltaic research, development and implementation in Florida through long-term cooperative agreements with the Florida Solar Energy Center's Building America Industrialized Housing Partnership (BAIHP), Southeast Residential Experiment Station (SERES) and Southern Energy Efficiency Center (SEEC). Combined, these programs are currently funded by DOE at more than $3 million per year. We believe your proposal will greatly enhance the work being performed under these cooperative agreements to the benefit of these Federal programs, the State of Florida and the Nation. For this reason the DOE wishes to express strong support for the building energy efficiency, photovoltaics and zero energy homes portions of your proposal.

It is our intent to fully capitalize on the enhanced research and development capabilities created by the formation of the FESC which has the potential to substantially enhance the Department of Energy's program efforts in building energy efficiency and zero energy homes. We are aware that Florida's homes and buildings constitute more than 80 percent of Florida's statewide electrical energy use. We also believe that the FESC proposal will materially enhance Florida's and the nation's ability to move toward the goal of sustainable energy independence. Thus, we intend to work closely with Florida's proposed FESC energy research and development efforts, leveraging the DOE's energy research development funding in the most efficacious way possible.

Sincerely

Edward Pollock
Acting Research and Development Manager
Building Technologies Program

30 November 2007

Dr. Tim Anderson
Professor & Associate Dean for Research & Graduate Programs
300 Weil Hall
P.O. Box 116550
Gainesville, Florida 32611-6550

Dear Dr. Anderson:

I am writing to express SRI International's strong support for your proposal to the Florida Technology, Research and Scholarship Board to develop a Center of Excellence on Sustainable Energy.

We believe the proposed research initiative is closely aligned with on-going commercial and economic development initiatives that will have significant benefit to Florida and the nation. This research has the potential to provide a cost effective renewable energy solution, reduce dependence on imported fuels, and have a positive impact on the environment. Your program addresses significant technology gaps that need to be filled in order to meet our future national energy needs and to transition innovative ideas into viable commercial products.

SRI International and our industrial partners throughout the world are currently developing and commercializing a new process that converts the waste by-products of Florida's phosphate industry into low-cost, high-purity, solar-grade silicon feedstock for the production of photovoltaic (PV) solar cells. In essence transforming an environmental liability into an industrial asset.

We are pleased to be working with you and your team at the University of Florida in designing and optimizing PV solar cells utilizing silicon produced by SRI's new process. In addition, we believe that by combining the silicon feedstock with the proposed research we can enable the formation of a Florida-based PV industry – a multi-billion dollar global market that is growing at more than 25% per year.

We look forward to continuing to work with the University of Florida to develop and commercialize these energy technologies, and envision significant opportunities to work together in the future.

Sincerely,

J. Peter Marcotullio
Executive Director, Business Development

ELECTROENERGY

30 Shelter Rock Road Danbury, CT 06810 Tel: (203) 797-2699 Fax: (203) 797-3130

November 26, 2007

Ms. Canan "Juna" Balaban
Manager, NASA Hydrogen Research Program
University of Florida
PO Box 116400
Gainesville, FL 32611-6550

Dear Ms. Balaban,

Electro Energy Inc., a leading developer of rechargeable lithium-ion batteries for large energy storage systems, would like to provide this **Letter of Commitment** in support of the establishment of a Center of Excellence for a Sustainable Florida Energy Future. As a company with a division in Gainesville, Florida that is currently engaged in the production of lithium-ion batteries, we are keen to collaborate with University of Florida and to jointly advance the state of research in this key enabling field. We believe that this project will be help us in accelerating the commercialization of our advanced battery products and will enable the State of Florida and our Nation to gain technology leadership in the field of large scale energy storage.

We believe strongly and have reiterated publicly the value of lithium-ion rechargeable batteries to our National energy program for energy independence and technology leadership. Our participation in the establishment of a Center of Excellence for a Sustainable Florida Energy Future on the UF Campus would certainly ensure that these extremely important values reach a National Forum.

In order to facilitate the success of the project; **we agree to support UF and the Center of Excellence for a Sustainable Florida Energy Future in their research of advanced batteries and plug-in hybrid vehicles by providing our technical expertise and products on a mutually agreeable cost-shared basis to be determined at later date**. We also hope to expand our work with UF and the Center of Excellence in other joint collaborative research opportunities, providing new product opportunities and employment in Florida.

We look forward to working with the Center of Excellence Team on this exciting new project to demonstrate and develop new renewable energy technologies.

Please feel free to call me or contact me by e-mail if I can provide any further support.

Sincerely yours,

Michael E. Reed
President & Chief Technical Officer
Electro Energy Inc.

PRADO & ASSOCIATES
CONSULTING ENGINEERS
FLORIDA, U.S.A.

P.O. BOX 274206 TAMPA, FLORIDA 33688 Tel.: 813-961-1072 E-mail: rp@pradoeec.com web: www.pradoeec.com

21 November 2007

Dr. Babu Joseph
Department of Chemical Engineering
University of South Florida
Tampa, Florida 33620

Dear Dr. Joseph:

Prado & Associates and I personally will be pleased to participate and assist you and your Department in the proposed Florida Energy Systems Consortium (FESC) in the development of Thermochemical conversion of Biomass to Liquid Fuels process and a pilot plant. As president of Prado & Associates, I will work with my staff to further the goals of this Center. Later on, as the project matures, Prado & Associates would also be able to assist with the commercialization of the new "biomass to liquid fuels technology". As you know, our organization and the University of South Florida have cooperated in development projects over the past twenty years. We will be most happy to continue this trend.

In support of my offer, please note the following:

1) I personally worked on the SASOL Fischer-Tropsch project in South Africa in 1976. As you know, this was the first modern Fischer-Tropsch project to successfully produce liquid fuel hydrocarbons for automotive use. The plant is still in operation and is currently undergoing a major expansion.

2) Since then, my company has participated in several biomass-to-liquid fuels projects, including the Pearson ethanol (via gasification and Fischer-Tropsch) process.

3) We are currently involved with USF in a new project with one of our clients, to design and build a wood chips to liquid fuels plant in upstate New York.

4) My company has worked with USF on several bench scale and pilot plant projects in the past, all dealing with liquid fuels.

5) The development and commercialization of liquid fuels for transportation use is of critical importance to the State of Florida. As you know, there is not one oil refinery in the state, and all liquid fuels must be imported into Florida, most of them from out of the country. The construction of liquid fuels facilities in Florida will not only provide energy security for the state but also create well paying industrial jobs.

6) As in the past, my company is willing to make in kind contributions to the biomass to liquid fuels task at USF. The magnitude will amount to 80 man-hours of my personal time and another 80 of my staff, which is equivalent to $18,000.

Dr. Joseph, I look forward to working with you and the University staff to make the Super Center of Excellence on Energy a success.

Sincerely,

Faustino L. Prado, P.E.

File: 3043 USF Center on Energy.doc