



Center for Energy and Environmental Sustainability


External Advisory Board & Internal Steering Committee Meeting

September 17, 2021



Raghava R. Kommalapati, PhD, PE, BCEE, F. ASCE
Director and PI
Professor of Civil & Environmental Engineering
Prairie View A&M University






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History of CEES

- CEES was Established in October 2010 with 10 Researchers from 3 Colleges and 6 Departments
- **Funding of \$5M**
- TAMU System Recognized
 - it is an administrative unit within the college
- Collaborations from more than 20 entities
- CEES Phase I Concluded - August 31, 2021
- CEES Phase II Proposal was submitted in December 2018
- Team of 12 researchers from 3 colleges
- **Awarded \$5M with a start Date of October 2019**

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CREST Program Overview (NSF)





Centers of Research Excellence in Science and Technology (CREST) Program Mission


- The CREST provides support to enhance the research capabilities of minority-serving institutions through the establishment of centers that effectively integrate education and research.
- CREST promotes the development of new knowledge, enhancements of the research productivity of individual faculty, and an expanded presence of students historically underrepresented in STEM disciplines.




Source: CREST Program Solicitation, NSF 18-509




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Vision for CEES






➤ Build a nationally recognized multi-disciplinary, self sustaining education and research community around CEES that will enhance research infrastructure and productivity of the university and provide educational and research experiences to diverse group of undergraduate and graduate students in the STEM disciplines and prepare them for workforce.



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Phase I Goals




- ❑ Research focus on transitional and transformative technologies for global energy solutions
- ❑ Develop new national and international partnerships to form collaborative teams of researchers in three thrust areas: **Biofuel Productions, Wind Energy, and Energy and the Environment**
- ❑ Lead the development of “Energy Engineering Minor” and graduate a level energy focus at PVAMU
- ❑ Objectives
 - Significantly increase productivity in energy research
 - Establish energy research infrastructure (both shared laboratory facilities and technical support personnel)
 - Increase connections and collaborations among PVAMU energy research programs
 - Strengthen current research collaborations and build new collaborations
 - Provide national visibility for CEES
 - Integrate CEES research into the curriculum
 - Provide training for workforce development




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CEES Phase II Theme



CENTER FOR ENERGY AND ENVIRONMENTAL SUSTAINABILITY

RESEARCH

BioEnergy

Offshore Wind Energy

Environmental Sustainability

PARTNERSHIPS (Industry)

Internships

COMMUNITY

K-12 Outreach

OPPORTUNITIES

EDUCATION

MS: Energy Concentration

BS: Energy Minor

Student Research

Research Seminar

UNIVERSITY OUTREACH

Joint Research


COLLABORATIONS (Academia)

“GREAT EXCHANGE” Program


ENERGY ENGINEERING RESEARCH LEARNING INITIATIVE




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CEES Phase II Goals







- Address diverse global energy issues related to renewable energy and sustainability **and position PVAMU as a national resource.**
- Enhance institutional capabilities of PVAMU (improve physical infrastructure & professionally develop key personnel)
- Develop activities to sustain CEES research and education excellence well beyond NSF funding.
- Expand collaborations within academia and strengthen partnerships with the energy industry, particularly in the Greater Houston area.
- Increase the preparedness and number of students from underrepresented groups who successfully complete degrees in STEM fields with a focus on Energy Engineering, to build a diverse workforce















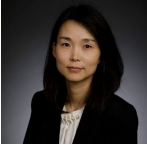
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CEES Team





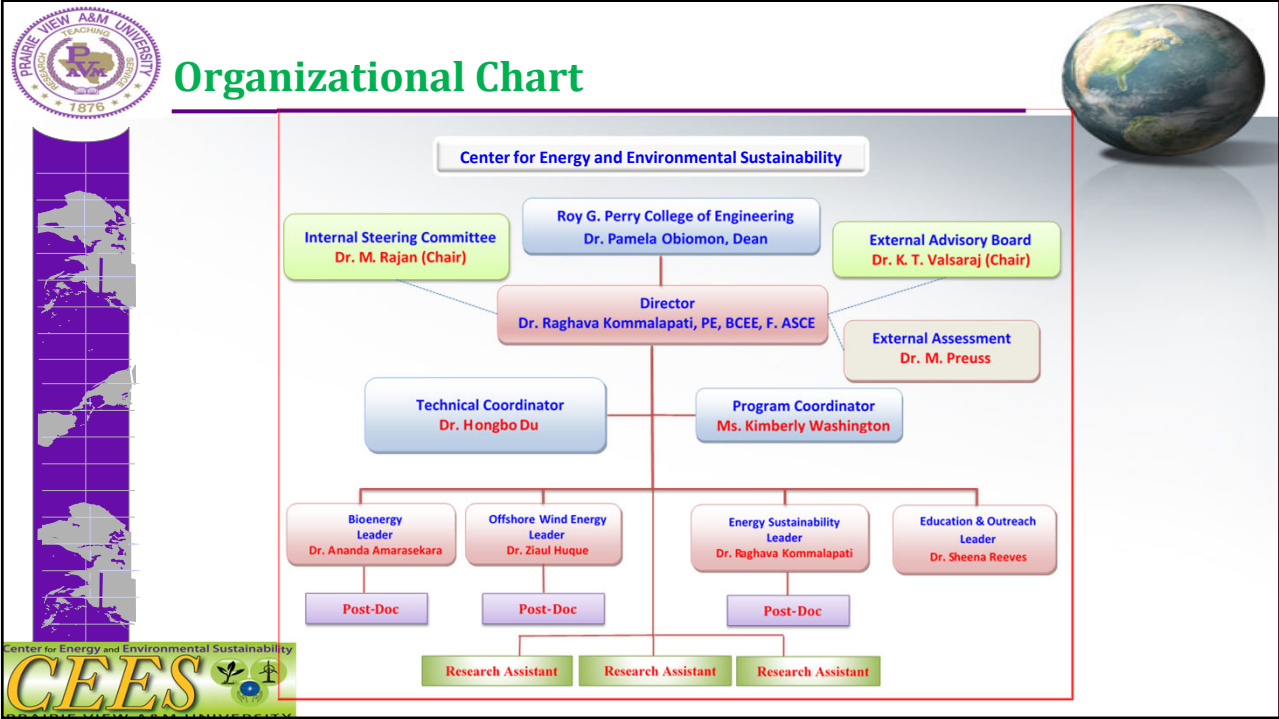
				
Raghava Kommalapati PI & Director Civil & Environmental Engineering	Ananda Amarasekara Co-PI & Bioenergy Team Lead Chemistry	Ziaul Huque Co-PI & Offshore Wind Team Lead Mechanical Engineering	Hongbo Du Co-PI & Technical Coordinator CEES	Sheena Reeves Co-PI & Education & Outreach Coordinator Chemical Engineering
				
Peter Ampim Bioenergy Agriculture	Ripendra Awal Bioenergy Agriculture	Nabila Shamim Environmental Sustainability Chemical Engineering	Sherri Frizell Education & Outreach Computer Science	April Lovelady Bioenergy Mechanical Engineering
		Kimberly Washington Program Coordinator CEES		Doeun Choe Former Co-PI Civil & Environmental Engineering <i>No longer with the University</i>




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External Advisory Board









Kalliat T. Valsaraj, Chair
Charles & Hilda Roddey Distinguished Professor, Ike East Professor, Cain Department of Chemical Eng. Former Vice President for Research and Economic Development, Louisiana State University




Michelle Long
General Manager, Chevron Environmental Management and Real Estate Company




Robin Autenrieth
A.P. & Florence Wiley Prof III, Former Department Head, Zachry Dept. of Civil & Environ., Texas A&M University




Eric Dargan (Alum)
Chief Operating Officer, City of Houston Public Works




John Pappas
Director, TEES Center Operations
Director, TEES Clean Energy Incubator
Texas A&M Engineering Experiment Station (TEES)




Jeff Sammons
Associate Director, Texas A&M Energy Institute



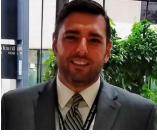
Vasivi Wlited
Jayrhi Wlited-Kwoy, JMW@PVU




Wayne Simmons
Strategic Advisor, Forge Nano, Inc.




Robin D. Rogers
Research Professor, Chemistry/Biochemistry, The University of Alabama, President/Owner of 525 Solutions, Inc.




Taimur A. Shaikh
Senior Policy Advisor – Energy Issues, Air and Radiation Division, Region 6, Environmental Protection Agency





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Internal Steering Committee









Magesh Rajan, Chair
Vice President, Office of Research, Innovation, and Sponsored Programs




Pamela Obiomon, Co-Chair
Dean, Roy G. Perry College of Engineering




James Palmer
Provost & Senior Vice President, Academic Affairs




Cynthia Carter-Horn
Senior Vice President, Office of Business Affairs



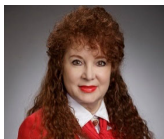
Gerard D'Souza
Dean, College of Agriculture & Human Sciences




Dorie J. Gilbert
Dean, Brailsford College of Arts & Sciences



Munir Quddus
Dean, College of Business




Ikhlas Sabouni
Dean, College of Architecture




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Raghava Kommalapati

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Role of External Advisory Board







- Consist of Representatives from academic institutions, industry, national labs and governmental agencies.
- Provide guidance and Advice
- Review Center Activities and Progress to meet its vision, goals and objectives
- Make suggestions for possible new strategies or directions.
- Provide feedback on the needs of the Center's stakeholders
- Function as the champions of the center, helping to increase national visibility
- Working to connect the center with potential collaborators and stakeholders in academia, industry and national labs.




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External Collaborators

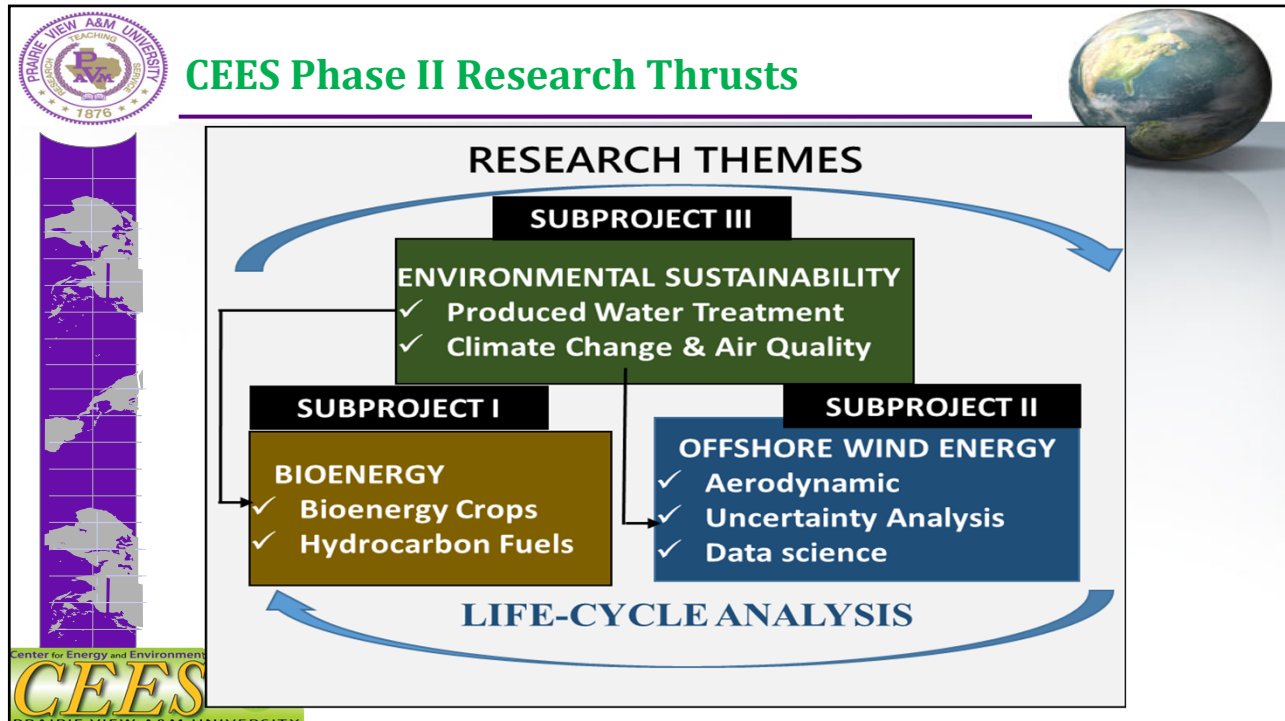


#	Name and Organization	Area of Collaboration
National Lab, Institutes and Centers		
1	Moe Khaleel, Oak Ridge National Laboratory	Center Level, EO, and ES
2	Efstathios Pistikopoulos, Texas A&M Energy Institute	Center Level Collaboration
3	Abolghasem Shahbazi, CREST Center, North Carolina A&T	Center Level and BE
4	Arturo Pacheco-Vega, CREST Center, California State	Center Level and ES
5	Eduardo Montova, CREST Center, California State Univ.	Center Level and ES
6	Marwa Hassan, Tran-SET, Louisiana State University	Center Level and EO
7	Lijun Qian, CREDIT Center, Prairie View A&M University	Center Level and OWE
Academia		
1	Yunsoo Choi, University of Houston	Air Quality, ES
2	John L. Jifon, Texas A&M AgriLife Research	Energy Crops, BE
3	Jamil A. Khan, University of South Carolina	Wind Turbine, OWE
4	Waruna Kulatilaka, Texas A&M University	Offshore Wind Turbines, OWE
5	Devin Shafer, University of Houston	Produced Water Treatment, ES
6	Xinhua Shen, University of Northern Iowa	Air Quality Modeling, ES
7	Tatiana Timofeeva, New Mexico Highlands University	Biofuels, BE
8	Ranil Wickramasinghe, University of Arkansas	Produced Water Treatment, ES
Industry Partners		
1	Apergy (S. Somasundram)	Center Level and EO
2	Athenian Consulting Group (Tymesha Marion)	Center Level and EO
3	Barr Engineering (Jeong-Yun Won)	Offshore Wind Power, OWE
4	Dow (Emmitt Wooten)	Center Level and EO
5	Enercon Services (Suresh Raja)	Air Quality, ES
6	General Motors (Lakenva Henderson)	Center Level and EO
7	Shell (Bhala Kanade)	Center Level and EO
8	Stapan Company (Sunny Anighoro)	Center Level and EO
9	Sterlitech Corporation (Senideh Jankhah)	Produced Water Treatment, ES
10	VL Offshore LLC (Shelley Steffen)	Offshore Structures, OWE



ES: Environmental Sustainability; EO: Education and Outreach; BE: BioEnergy; OWE: Offshore Wind Energy


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- CEES Phase II Research Thrusts**
- BioEnergy**
- Production of biomass-based hydrocarbon fuels from drought-resistant energy crops
 - Production of energy crops with treated produced water
- Offshore Wind Power**
- Improvement of the feasibility and reliability of massive offshore power generation
- Environmental Sustainability**
- Innovative process engineering and statistical approaches to enhance sustainability of fossil fuel energy sources
- Center for Energy and Environmental Sustainability
CEES

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Thrust Area 1: BioEnergy

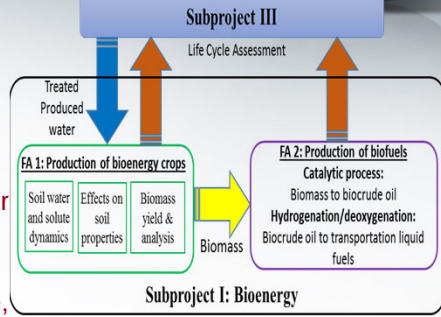



Group

- Dr. Ananda Amarasekara (Chem), Group Leader
- Dr. Peter Ampim & Dr. Ripendra Awal (Ag)
- Dr. April Lovelady (Mech Eng).


Goal

- Study the potential of using treated produced water to irrigate perennial grasses switchgrass grown as bioenergy feedstocks
- Develop an innovative, energy-efficient, recyclable, catalytic process for the transformation of biomass to biocrude oil.
- Two focus areas:
 - Energy Crop Cultivation
 - Conversion of Biomass into Bio Crude Oil






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Thrust Area 2: Offshore Wind Power

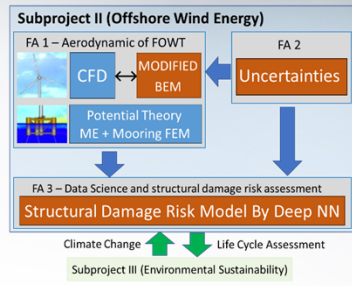



Group

- Dr. Ziaul Huque (Mech Eng), Group Leader
- Dr. Doeun Choe (Civil & Env Eng) – No longer with the university


Goal

- Investigate current challenges of Floating Offshore Wind Turbines (FOWT)
- Improving the feasibility, efficiency, and cost-effectiveness of the offshore wind energy technologies
- Three focus areas:
 - Improve blade aerodynamics prediction for FOWT
 - Model and analyze structural uncertainty in the FOWT system
 - Data science of damage risk assessment for FOWT blade






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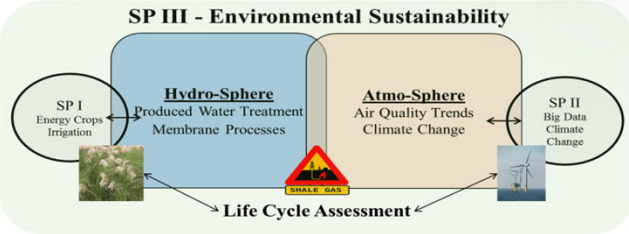
Thrust Area 3: Environmental Sustainability



Group
 Goal


- Dr. Raghava Kommalapati (Civil & Env Eng), Group leader,
- Dr. Hongbo Du (CEES)
- Dr. Nabila Shamim (Chem Eng)

- Enhance the sustainability of fossil fuel energy sources, under a regime of climate change and evolving energy portfolios.
- Three focus areas:
 - Shale gas & oil produced water (PW) treatment
 - Climate change and air quality
 - Life cycle assessment (LCA)




SP III - Environmental Sustainability


The diagram illustrates the interaction between the **Hydro-Sphere** (Produced Water Treatment, Membrane Processes) and the **Atmo-Sphere** (Air Quality Trends, Climate Change). It also shows the integration of **SP I** (Energy Crops, Irrigation) and **SP II** (Big Data, Climate Change) into a **Life Cycle Assessment** framework, with a central focus on **SHALE GAS**.



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Education and Outreach



CURRICULUM
 MS: Energy Concentration
 "Energy System Design"
 BS: Energy Minor


OUTREACH
 "GREAT EXCHANGE" Program
 Recruitment
 K-12 Outreach
 Community Engagement & Intervention

PROFESSIONAL DEVELOPMENT
 Mentorship
 CREST Center Symposium
 NSF Graduate Research Fellow
 Postdoctoral Researcher
 Junior Faculty
 Research Initiatives


STUDENT ENRICHMENT

COLLABORATIONS RESEARCH PARTNERSHIPS COMMUNITY

ENERGY ENGINEERING RESEARCH LEARNING INITIATIVE





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Education and Outreach

Energy Engineering Research Learning Initiative





Group


- Dr. Sheena Reeves (Chem Eng), Group Leader
- Dr. Raghava Kommalapati (Civil & Env Eng)
- Dr. Sherri Frizell (Comp Sci)
- Ms. Kimberly Washington (CEES)

➤ Establish an **Energy Engineering Research and Learning Initiative (EERLI)**

- EERLI will be the vehicle that will catapult CEES towards attaining national recognition
- Integrate the Center's diverse research projects with its education and outreach programs, and help develop a network of like-minded collaborators and industrial partnerships
- CEES will be the synergy needed to bring researchers and students together from the colleges of engineering, the sciences, agriculture as well as social science.





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Education and Outreach

Energy Engineering Research Learning Initiative





➤ **Student centered Activities**


- Energy Curriculum Development
- Student-Enrichment Activities
- Mentorship
- Student Publications

➤ **Outreach**


- **Recruitment**
 - Goal: To increase visibility and recruitment efforts of CEES at PVAMU
 - Target: local school districts, including Houston, Fort Bend, and Cy-Fair ISDs
- **K-12 Outreach**
 - The Science and Engineering Fair of Houston
 - NEED Project 2019 in Galveston, TX
 - PVAMU's Ag Field Day
 - Energy Day
- **The Great Exchange**
- **Community Engagement**




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Accomplishments- Research






▶ Publications & Funding


	Peer Reviewed Publications		Presentations			Funding Grants	
	Journal Papers & Book chapters	Conf. Proceedings	Total Presentations	Student Presentations	Thesis	No	Amount
Biofuels/Bioenergy							
Amaresekara, Ananda	56		9		8	7	\$8,253,644
Biney, Paul	1	1	11	11	1	2	\$772,893
Gyamerah, Michael	2		10	10	3	2	\$317,451
Ampim, Peter						4	\$409,186
Awal, Ripendra						1	\$54,331
Environmental Sustainability							
Kommalapati, Raghava	47	28	130	105	13+3	21	\$6,923,201
Du, Hongbo	1 (Book)						
Wind Energy							
Huque, Ziaul	32	16	38	29	10	2	\$3,019,568
Totals	138	45	198	155	38	39	\$17.32M
Target	50		100		15	10	1M




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Accomplishments- Research









▶ Research

- 9 post-doctoral candidates were supported and 7 of them moved on to permanent positions.
- Center researchers have published a total of **183** articles (1 book, 130 Journal Articles, 7 Book Chapters and **45** Peer Reviewed Conference Proceedings/Extended Abstracts).
- 38** MS Theses have been completed
- A total of **198** presentations were made at regional, national and international conferences.


▶ Funding

- Center researchers received funding in the amount of **\$17.32M** from **39** grants from funding agencies including DOE, NSF, NASA, DOT, USDA and ACS.





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Accomplishments- Students




		Demography of Students (%)			
		Funded	Women	Black/Hispanic/ Other Underrepresented	Citizens/PR
GRADUATE					
Target: 25	Funded	44	19/43%	17/39%	10/23%
Target: 15	Leveraged	24	8/33%	15/63%	9/38%
	Total	68	27/40%	32/47%	19/28%
UNDERGRADUATE					
Target: 45	Funded	75	37/49%	57/77%	66/88%
Target: 45	Leveraged	59	16/27%	37/63%	51/86%
	Total	134	53/40%	94/70%	117/87%
TOTAL					
	Funded	119	56/47%	74/62%	76/64%
	Leveraged	83	24/29%	52/63%	60/72%
	Total	202	80/40%	126/62%	136/67%





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Accomplishments- Students



- A total of 202 students (68 graduate and 134 undergraduate) were supported either directly through the Center grant or other leveraged activities
 - For graduate students directly funded or leveraged, 40% are women, 47% are from underrepresented groups and 28% are either citizens or permanent residents
 - For undergraduate students directly funded or leveraged, 40% are women, 70% are from underrepresented groups and 87% are either citizens or permanent residents
- 119 (75 undergraduate and 44 graduate) students were supported by CEES and other directly related projects
 - 47% are women, 62% are from underrepresented groups and 64% are either citizens or permanent residents
- An additional 80 (59 undergraduate and 21 graduate) students were supported through other leveraged activities (LSAMP, university support, Senior Design project etc.)
 - 29% are women, 61% are from underrepresented groups and 74% are either citizens or permanent residents





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Accomplishments- Education

- Worked with 4 Departments and the College of Engineering
 - Established the Energy Engineering Minor at the UG Level
 - Working to establish the Energy Engineering Concentration in the current MS in Engineering Program
- Offered scholarships to 46 students
- Offered or helped to offer courses that support the Energy Curriculum
 - A total of 948 UG students got exposed to 49 courses (25 different courses with 24 repeated) in the broader energy engineering field.
 - A total of 545 graduate students enrolled in 45 Grad course offerings (21 different courses with 24 repeated) in the broad energy engineering field.
 - 202 students have been trained in research and/or other experiences through the Center, including 62% from minority groups and 40% women



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Accomplishments- Infrastructure- Facilities

- Worked with the College and University Administration
 - Acquired 2900 sq. ft of space and spent \$0.75M of the leveraged grant and other funds to renovate and make them into suitable labs
 - The labs support Energy & Environment, Biofuels and Wind Energy research
 - Invested more than \$0.75M and acquired major laboratory equipment
 - Acquired 1500 sq. ft of Office Space for CEES staff and students
- These facilities, although established primarily for research, will also be used for teaching labs and demonstration of experiments.
- Several Ongoing Lab development activities are used to leverage equipment for the CEES
 - Title III Grant (Kommalapati) was mostly responsible for the lab renovation
 - Other sources



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Accomplishments- Infrastructure- Facilities





**Energy Laboratory
206 (A&B) &
Conference Room**







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Accomplishments- Infrastructure- Equipment



- Acquired or in the process of being delivered
 - 12 node – 48 core Cluster (CAMx, CFD & FEA)
 - Two High Performance Dell Workstations
 - Precision T7610 – 12 cores, 128 GB RAM and 5 TB Hard drive
 - Precision T7910 – 16 cores, 128 GB RAM and 12 TB Hard drive
 - TOC, HPLC, GC-MS, Ion chromatograph, CHNOS analyzer, TGA, etc..
 - Malvern Zetasizer, UV/Vis spectrophotometer
 - Precise Basic Glove Box
 - Spraybase Electrospinner
 - Thermo Scientific TSX Series Freezer
 - Sterlitech Membrane Systems
 - Contact Angle Meter(CAM Plus) Micro-Pyrolyzer
 - Micro-Balance
 - Fabricated Fixed Bed and Fluidized Bed Biomass Pyrolyzers
 - Air Quality Equipment
 - Hi-Vol Air Sampler, URG Air Sampling system, Fog Collector, and Ozone, CO₂, CO, Ammonia, NO_x, SO₂ analyzer
- All facilities available for different groups



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Accomplishments- Infrastructure- Equipment





ICS-5000- Dionex



HPLC System-Agilent 1200 Series Series



Elemental Analyzer (Flash 2000, Fisher Scientific)



TOC-L- Shimadzu



GCMS-2010 Plus-QP2020 Detector- Shimadzu



UV-Spectrophotometer (Shimadzu, UV-1800)



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Accomplishments- Infrastructure- Equipment





Glove Box (Labconco, Basic),



Ceramic Membrane System (Sterlitech).



Contact Angle Meter (CAM-Plus, ChemInstruments)



Motorized Test Stand



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Accomplishments- Infrastructure- Equipment






Teledyne NH₃ analyzer T201



Teledyne O₃ analyzer T400



Teledyne CO₂ analyzer T360



Teledyne NO_x analyzer T200



Teledyne CO analyzer T300



Teledyne SO_x analyzer T100



Center for Energy and Environmental Sustainability
CEES

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Accomplishments- Infrastructure- Equipment






Spraybase Electrosprinner (Thermo Scientific, TSX Series Freezer in the back) and Membrane System (Sterilitech, C6T17WK43A)





Micro-balance





Center for Energy and Environmental Sustainability
CEES


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 **Accomplishments- Infrastructure- Equipment** 


URG Air Sampling System


**High Volume Air Sampler
(Thermo Scientific, RFPS-1287-063)**


Bulk Fog/Cloud Sampler



Center for Energy and Environmental Sustainability

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Sustainability







- Many functions of CEES are and continue to be institutionalized, including the Energy Engineering curricula and new laboratories developed under NSF CREST funding
- The enhanced research programs, personnel, infrastructure and collaborations developed through CEES will enable PVAMU to compete more effectively for external research funding and continue Center activities
- Research funding by center affiliated faculty significantly increased over the years as reported earlier.




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Challenges






- Finding qualified graduate students and Post-Docs from underrepresented groups has been and continues to be a big challenge
- Access to specialized research equipment and engineering services like engineering shop or technician
- Equipment maintenance – no funds






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EAB Report



1. The EAB observed that substantial progress has been made by the Center and its associates on both education and research efforts. Substantial progress was also noticed on the infrastructure devoted to the Center and the hiring of a full time program coordinator. However, adequate program funding by the university to continue funding the Center beyond the NSF funds is still lacking. Thus, the question of sustainability has to be addressed soon as the Center is being recompeted in the near future. There are some other challenges that also need to be addressed. For example, more release time for the Center and some of the key faculty to pursue research and other administrative duties should be considered by the Administration.
2. The education front has seen substantial progress with the introduction of an Energy Engineering minor at the undergraduate level and the Energy Engineering Concentration at the graduate level. However, documentation of the same on student transcripts remain unanswered at this point.
3. EAB is pleased to note the good publication record that the faculty are establishing. With a 75% of the total student participation in the program and the thesis production rate bodes well for the future of the program. The total research dollars appear to exceed the target level even though much of it is leveraged funding.
4. A very positive development noted was the continuous evaluation of the program by the West Texas A&M university and the willingness of the leadership to consider the recommendations. EAB felt that a separate session with select students in the program in the future will be welcome.




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EAB Report

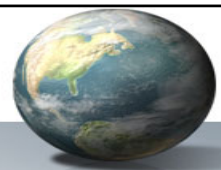
5. The student demographics was very good and impressive. We also felt that the leveraged funding scheme to attract more students into the program was encouraging. Several students have won awards or how norms for their work. Enrollment in the program has seen substantial growth during the past two years.
6. In relation to the potential application for Phase II funding EAB felt that there should be a willingness of the part of the Center leadership to critically assess each of the three sub-groups carefully and jettison those parts that are weak. One of the EAB members, John Kuruvilla will help the Center leadership in working this issue. A Red Team composed of Robin Autenreith, John Kuruvilla and John Pappas will be ready to help the Center leadership to work on the themes to go towards the Phase II application once the Center leadership conducts an internal workshop soon and comes up with likely themes. It was also felt that although some progress has been noted, the Center needs to accelerate its efforts towards increasing industrial involvement in the program.



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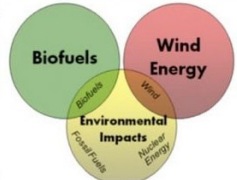
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CENTER FOR ENERGY & ENVIRONMENTAL SUSTAINABILITY (CEES)



PVAMU Engineering Center Awarded \$5M for Sustainable Energy Research
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Questions/Further Information?
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