CENTER FOR ENERGY SYSTEMS RESEARCH

TENNESSEE TECH UNIVERSITY

ANNUAL REPORT FOR FISCAL YEAR 2014 — 2015

Center for Energy Systems Research

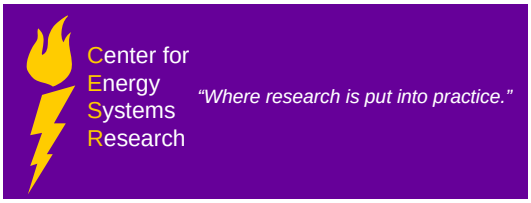
"Where research is put into practice."

TENNESSEE TECH UNIVERSITY

Annual Report for Fiscal Year

July 1, 2014 – June 30, 2015

Satish M. Mahajan, Director (January 2015 to present)
P. K. Rajan, Interim Director (retired December 2014)
www.tntech.edu/cesr



TENNESSEE TECH UNIVERSITY

Center for Energy Systems Research

1020 Stadium Drive
Prescott Hall 233
Campus Box 5032
Cookeville, TN 38505

(931) 372-3615
cesr@tntech.edu
www.cesr.tntech.edu/

Cover Description:

Smart Grid Lab (Robert Craven, R&D Engineer and Sina Zarrabian, PhD Research Assistant)

TABLE OF CONTENTS

PROGRAMMATIC REPORT

PLANS FOR 2015-2016

SUPPORTING MATERIALS

BUDGET MATERIALS

CIVIL ENGINEERING TEAM CONDUCTS BRIDGE STUDY

Dr. Matthew Yarnold and a team of Tennessee Tech University civil engineers monitored the demolition of an 85-year old bridge, with the hope that the data would help others to better understand bridge behavior.

MISSION

The Center for Energy Systems Research (CESR) was established to advance and apply scientific and engineering knowledge associated with energy systems and in particular with electric power while supporting the instructional program of Tennessee Technological University (TTU) in academic areas associated with energy systems. During the College of Engineering Strategic Planning of 2012-13, two strategic research areas, Smart Grid and Resilient Infrastructure, were assigned to the Center for Energy Systems Research as focus areas of research. Present research efforts, both theoretical and experimental, are focused on solving current and anticipated problems associated with energy and infrastructure systems. Special emphasis is given to the needs of the electric power industry by way of conducting research on Smart Grid.

VISION

The Center will be known and be recognized nationally for its research contributions in Energy Systems and Infrastructure areas.

The Center's vision is to enhance research and education in support of its mission. The Center will conduct advanced and applied research to enhance knowledge in currently needed and emerging technical areas of Energy and Infrastructure Systems. The Center also has major interests in the dissemination of knowledge and enhancing education in energy systems.

The Center draws upon the expertise from the faculty in the College of Engineering as well as from other faculty on campus. Participating faculty and faculty associates represent Basic Engineering, Chemical Engineering, Civil and Environmental Engineering, Computer Science, Electrical and Computer Engineering, Mathematics, Mechanical Engineering and Manufacturing and Engineering Technology.

HISTORY

The State of Tennessee established the Center for Electric Power in 1985 in the College of Engineering at Tennessee Technological University. Reflecting the broadening of the activities of the Center, its name was changed to Center for Energy Systems Research. Over the years, research projects have been sponsored by more than 20 major electric utilities, EPRI, federal agencies such as DOE, NASA, NSF, and ONR, State agencies such as TDOT and Tennessee Department of Education, and industries such as Buswell Energy.

During 2014-15 academic year, the College of Engineering identified six strategic research areas in which to focus the research efforts of its faculty and students. Of the six areas, CESR chose two areas, namely, 1) Smart Grid and 2) Resilient Infrastructure to focus its research. Development of large collaborative research proposals will be encouraged in these areas.

To promote the research and innovation, CESR provides services of an R&D Engineer, Network Manager, Financial Analyst, and Administrative Associate in support of the various research activities performed by faculty and students. The Center has set up laboratories and computational resources for the benefit of researchers.

The Center promotes international collaboration by hosting visiting scholars, scientists and engineers and establishing Memoranda of Understanding with international academic institutions and research organizations.

YEAR IN REVIEW

P.K. Rajan, Interim Director, CESR 2014

Dr. P.K. Rajan, Professor of Electrical and Computer Engineering, retired as the Interim Director of the Center for Energy Systems Research (CESR) at the end of December-2014 and Dr. Satish M. Mahajan became the new Director in January 2015. Dr. Satish M. Mahajan is a Professor of Electrical and Computer Engineering and has been with TTU since 1987.

Satish M. Mahajan, Director, CESR 2015

The Center for Energy Systems Research (CESR) houses two strategic research areas of the College of Engineering: Smart Grid and Resilient Infrastructure.

With the participation of Dr. Ambareen Siraj from the Computer Science Department, research on cyber security as applicable to smart grid has been initiated. Also Dr. Sheikh Ghafoor of the Computer Science Department has initiated research on high performance computing using GPU processors as applicable to analysis of power system and modeling of flood flows. Dr. Ghafoor will collaborate with Dr. Ghadir Radman of the ECE Department and Dr. Alfred Kalyanapu of the CEE Department.

Many CESR faculty associates earned recognitions for their outstanding contributions. During the past year, CESR affiliated faculty and students published 31 journal papers, 89 proceedings/conference presentations and contributed to 2 book chapters. These are listed in the following pages of this report.

During 2014-15 fiscal year, a total of 11 international faculty, students and researchers visited CESR and conducted research in the relevant areas of the Center for various periods. One faculty and four students from Annamalai University, India, visited under the Indo- US Obama-Singh 21st Century Knowledge Initiative Grant Program.

Executive Summary

As the new Director for the Center for Energy Systems Research, I am excited to have the opportunity to lead the Center during this time of Renaissance Engineers and the new University Flight Plan. As I did not serve as director for the 2014 calendar year, please bear with me during this transition period. I am anxious to help CESR move forward and will modify the direction of the Center as we chart our course for our two focus areas, Smart Grid, and Resilient Infrastructure. This first of three annual reports (College of Engineering, Tennessee Board of Regents, Institutional Effectiveness) will reflect the goals set forth by my predecessors and only after completing this review will I attempt any modification to future center goals. I would like to thank Linda Lee, Etter Staggs, Tony Greenway, and Robert Craven for their efforts in day to day center operation and specifically for coordinating the material presented in this annual report.

PROGRAMMATIC REPORT

Research contract and grant awards included in matching from July 1, 2014 thru June 30, 2015 a total of **$721,686**. Of this amount, $40,905 is from encumbrances from the Office of Naval Research Project as of June 30, 2014. The ONR funds were expended during Fiscal Year 2014-2015.

CESR continues to enjoy a broad base of support. The funding categories for 1985 thru 2015 as illustrated in Figure 1 are: in-state utilities, 12.35 percent; out-of-state utilities, 6.91 percent; state and local agencies, 11.04 percent; federal government, 56.07 percent; other, 13.63 percent. The "other" category includes a variety of national and international industries, universities and professional societies. Through June 2015, the cumulative research funding of the Center is $26,925,921. State appropriations are compared to matching, on an annual basis, in Figure 2. Matching is divided into contracts and grants (without indirect costs); equipment; and all other items such as software, books and reports, and funding for faculty and student exchange programs. The 30-year match of about $26.9 million represents 100.7 percent of the state appropriations of $26.7 million. Indirect costs of approximately $4.75 million have also been received. The 2014-2015 match is $721,686 and the state appropriation is $898,500. A list of the projects conducted under the major research areas is given in SM-3 in this report.

CESR RESEARCH FUNDING 1985 THRU 2015

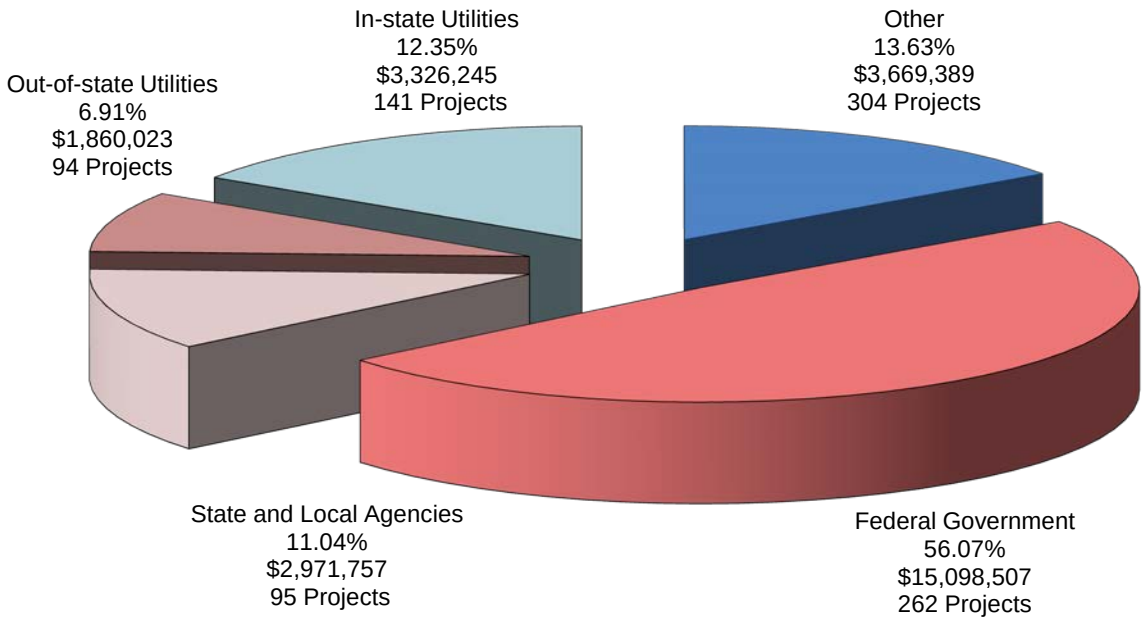


Figure 1: Types of Research Funding (Total $26,925,921)

Total Projects = 896

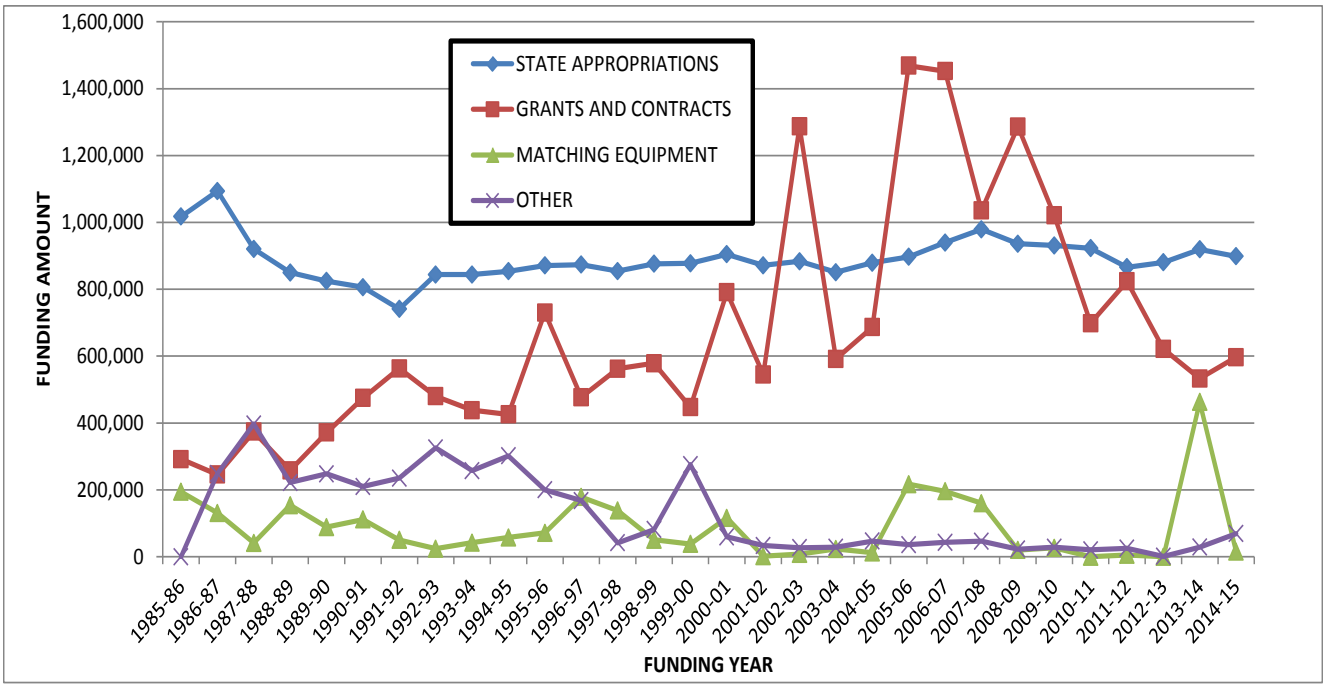


Figure 2: Historical State Appropriations and Matching 1985–2015 (spring)

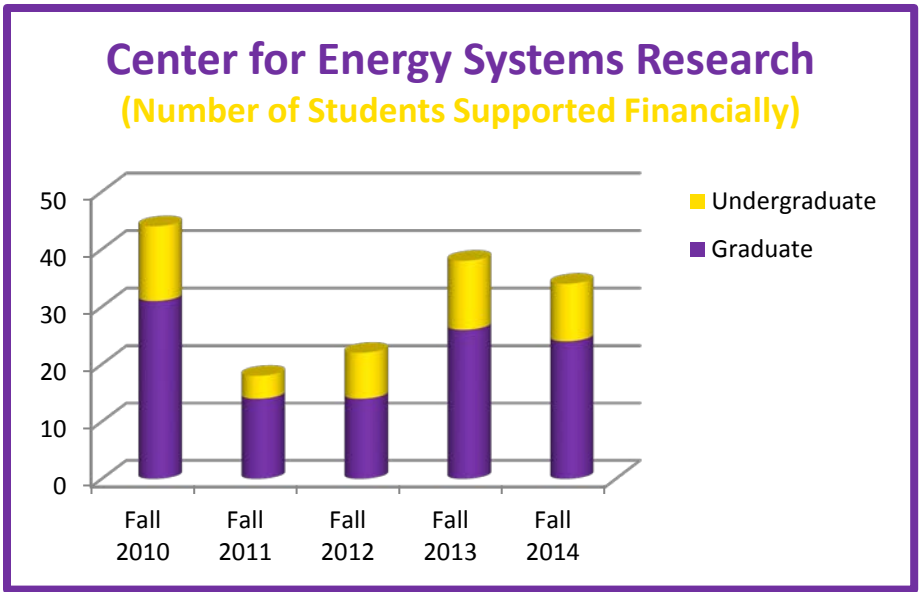


Fig. 3. Number of Students Supported

FACULTY AWARDS AND ACCOMPLISHMENTS 2014–2015

Dr. Ismail Fidan, MET Professor, was a recipient of the SME 2014 Award. This award has been bestowed on outstanding Society of Manufacturing Engineers (SME) members who, in the judgment of the International Awards & Recognition Committee, has made valued, balanced contributions to SME's professional activities and growth.

Dr. Fidan was presented the Faculty Fellow in Innovation & Techno-Entrepreneurship Award at the 2015 Engineer's Week Banquet.

Dr. Pedro Arce ChE Professor, was a recipient of the 2014 TTU Caplenor Faculty Research Award. This award is granted on the strength of overall accomplishments in scholastic impact, mentoring and publications, and letters of recommendation. .

Dr. STEPHEN CANFIELD, Mechanical Engineering Professor, was a recipient of the T.S. McCord Faculty in Innovation & Techno-Entrepreneurship at the 2015 Engineer's Week Banquet.

Dr. Daniel Badoe, CEE Engineering Professor, Daniel Badoe (center) receives TTU's Award for Excellence in University 1020 Instruction from President Phil Oldham (left) and Provost Bahman Ghorashi. The award is given based on student nominations.

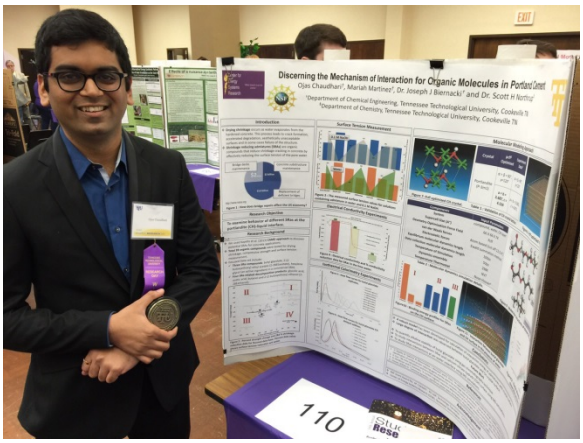
Dr. Syed Rafay Hasan, Electrical Engineering Assistant Professor, was a recipient of the Kinslow Award at the 2015 Engineer's Week Banquet.

STUDENT ACCOMPLISHMENTS AND AWARDS 2014–2015

Student Research Day at Tennessee Technological University is an event designed to showcase in a poster format the research of students. Several students submitted abstracts for Tennessee Tech University's ninth annual Student Research Day in Spring 2015. Of the submissions, several students presented posters. Faculty and community leaders volunteered as judges, selecting student winners in undergraduate and graduate categories.

Each participant received a Certificate of Appreciation and awards were presented for the best posters.

CESR Graduate Student Poster Winners: Ojas Chaudhari and Vitaly Ford



Ojas Chaudhari, Advisor Dr. Joseph Biernacki (Chemical Engineering), (title of poster) "Discerning the Mechanism of Interaction for Organic Molecules in Portland Cement". (Photo furnished by Ojas.)

Vitaly Ford (right), Advisor Dr. Ambareen Siraj (Computer Science), "Reliable and Efficient Protection of Consumer Privacy in Smart Metering Infrastructure" (Photo furnished by Vitaly.)

CEE MS student James Locum wins prestigious ASTM International Bryant and Katharine Mather Scholarship for concrete research

We are pleased to announce that James Tyler Locum has been selected to receive the $2,500 ASTM International Bryant and Katharine Mather Scholarship award.

The ASTM International Katharine and Bryant Mather Scholarship honors Katharine and Bryant Mather, who together contributed in excess of 100 years to the investigation and research of various concreting materials and construction techniques, and on the ability of hydraulic-cement concretes to remain durable under aggressive exposure conditions. The ASTM scholarship honors their leadership, dedication, determination, and technical knowledge.

ASTM International is one of the largest voluntary standards development organizations in the world - a trusted source for technical standards for materials, products, systems, and services. Known for their high technical quality and market relevance, ASTM International standards play important roles in the information infrastructure that guides design, manufacturing, construction and trade in the global economy.

On behalf of Committee C09 and the Staff at ASTM International, we also congratulate Tennessee Tech for your work and involvement with students pursuing degrees specializing in cement or concrete materials technology.

STUDENTS CONFERENCE PRESENTATIONS

ADENIYI BABALOLA

(Rabie Belkacemi, Advisor) presented paper "Multi-Agent System Algorithm for Preventing Cascading Failures in Smart Grid Systems" (Pullman, Washington), at 2014 North American Power Symposium in Pullman, Washington, September 2014

BROOK ABEGAZ

(Satish M. Mahajan, Advisor) presented paper "Optimal Real-Time Integration of a Virtual Power Plant" (Pullman, Washington), at 2014 North American Power Symposium in Pullman, Washington, September 2014

OJAS CHAUDHARI

(Joseph Biernacki, Advisor) presented paper and attended 2014 AIChE Annual Meeting in Atlanta, Georgia.

AARON CROWLEY

(L.K. Crouch, Advisor) presented paper and attended American Concrete Institute Fall 2014 Convention in Washington, DC, October 2014. Aaron's presentation described the component of his PhD research

NATHAN T. DICK

(Satish M. Mahajan, Advisor) presented paper attended the NANO Manufacturing 2014 from Innovation to Commercialization Conference in Greensboro, North Carolina.

WONDMAGEGN Y. YIGZAW

(Faisal Hossain, Advisor); presented paper "Land Use Land Cover Impact on Probable Maximum Flood and Sedimentation for Artificial Reservoirs: A Case Study in Western US", at American Geophysical Union (AGU) Fall Meeting, University of Washington Seattle Campus, Seattle, WA, December 2014.

VITALY FORD

(Ambareen Siraj, Advisor) attended IEEE SSCI 2014 Conference and presented paper "Smart Grid Energy Fraud Detection Using Artificial Neural Networks in Orlando, Florida.

SARAH DILLION

(L.K. Crouch, Advisor) attended Transportation Research Board 94th Annual Meeting and presented paper on Advances in Soil Stabilization in Washington, DC in January 2015.

(L.K. Crouch, Advisor) attended 2015 FDR Symposium in Greenville, South Carolina in February 2015.

(L.K. Crouch, Advisor) presented two papers and attended World of Coal Ash 2015 Conference in Nashville, Tennessee in May 2015.

BIBEK TIWARI AND RAJA PENUMAKA

(Indranil Bhattacharya, Advisor) presented papers and attended 42nd IEEE Photovoltaic Specialists Conference in New Orleans in June 2015.

FUTURE PLANS

CESR—New Home of the SMART GRID LAB

[Renovation just completed]

PLANS FOR 2015-2016

1. Increase research activity in the areas of the center

Generate external funding that will contribute to the long term growth and sustainability of the Center. As a minimum, the external funding generated per year by the center faculty should match the state funding.

This goal intersects the University Flight Plan's Multidisciplinary Research Innovation sub goal. The creation of the Smart Grid and Resilient Infrastructure focus areas is to foster multidisciplinary research efforts. Even within a department getting power engineers, communication engineers, cyber security researchers, etc. to focus on a common laboratory for collaborative efforts has resulted in several collaborative proposals being prepared.

2. Increase Student Research activity

Increase the number of MS and Ph.D. graduates in the strategic research areas of the Center by 25% during the next three years.

Support at least two undergraduate research projects per year in the areas related to energy systems.

This goal intersects the University Flight Plan's New Graduate Programs sub goal. Since the Center now has the Smart Grid and Resilient Infrastructure focus areas, graduate degrees resulting from this focused Center attention will yield more hire-able graduates in these areas of recognized national importance.

3. Increase Collaborative research

Develop and submit two collaborative proposals with interdisciplinary focus. The number of collaborative proposals submitted per year should be at least two per year.

This goal intersects the University Flight Plan's Multidisciplinary Research Innovation sub goal. The recently granted Autonomous drone for transmission line inspection project through the TBR exemplifies this as not only integrating multiple mechanical and electrical engineering researchers from TTU but also reaching out and collaborating with MTSU researchers with drone expertise.

4. Add Laboratory Facilities

Initiate the Smart Grid Laboratory

Initiate the Battery lab facility

This goal intersects the University Flight Plan's Physical Infrastructure Priorities sub goal and the Technology Service to Students sub goal, and the Technology in Teaching sub goal. Better facilities in areas of national importance like the Smart Grid benefit research, education, and hire-ability of our graduates.

5. Increase outreach activities

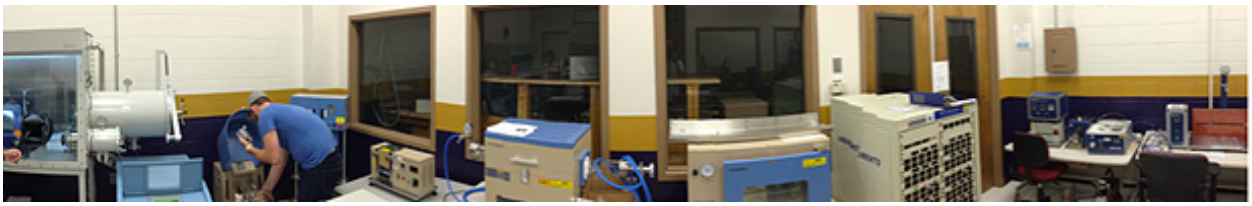
Organize a minimum of two seminars by external speakers per year.

This goal intersects the University Flight Plan's Co-Curricular Undergraduate Program sub goal and the Multidisciplinary Research Innovation sub goal. By having research area experts from outside the university come teach seminars, workshops or short courses the students will be exposed to a broader base of information and hopefully promote collaborative efforts from TTU researchers with those at other institutions.

6. Support faculty collaboration and development

The Center has helped faculty submit a number of research proposals and some of them have been accepted and activated. There are 9 proposals that have internally collaborative components and four proposals that have external to TTU collaborative components. There were 8 projects with collaborative components that were activated. There are four other collaborative efforts which include a pact with Annamalai University in India, hosting a Fulbright Scholar, Hosting a Brazilian scholar, and hosting a visiting scholar from the India Institute of Technology. Please find listings in the Collaborative Efforts Section.

SUPPORTING MATERIALS



Dr. Indranil Bhattacharya's SOLBAT-TTU Energy Research Laboratory

Dr. Joseph Ojo's DC–Bus Testbed Lab developed under the Durrip ONR Project

CESR FACULTY AND STAFF 2014-2015

Center Directors:	Dr. Satish M. Mahajan (January 2015 – Present)	Director, CESR
	Dr. Periasamy K. Rajan (July – December 2014)	Interim Director, CESR
CESR Staff:	Robert Craven	R&D Engineer
	Anthony Greenway	Information Technology Associate 9
	Linda Lee	Administrative Associate 3
	Etter Staggs	Financial Analyst
Visiting Post-doctoral Fellows:	Dr. Zahra Moravej	Visiting Scholar from Semnan University, Iran
	Dr. Sanjoy Parida	Indo-US Bhaskara Advanced Solar Energy Visiting Scholar
	Mr. Pavol Heretik	Visiting PhD Student from Slovakia
Visitors:	Michael W. Howard	Electric Power Research Institute, President and CEO
	B. Gbenga Olarinoye	Fulbright Visiting Scholar
	Dr. Ranjan Behera	Visiting Scholar
	Funso K. Ariyo	Visiting Research Scholar

Visitors from Annamalai University:

Faculty and Staff	Dr. Narayanasamy Radhakrishnan
Students	Amirtha Gianesan Arunkumar
	Ramakrishnan Raghuraman
	Srinivasan Sivabooshanam
	M. Muthamizh Selvi

FACULTY PARTICIPATION SM-2

Faculty participating in the Strategic Research of the Center are:

Smart Grid

Joseph Ojo - ECE - Coordinator
Ali Alouani - ECE
Adam Anderson -ECE
Steven Anton - ME
Rabie Belkacemi ECE
Indranil Bhattacharya ECE
Hicham Chaoui ECE
Robert Craven - CESR
Jie Cui - ME
Omar Elkeelany - ECE
Sheikh Ghafoor - CSC
Terry Nan Guo -CMR
Seyed Rafay Hasan - ECE
Satish Mahajan - ECE
Mohamed Mahmoud – ECE
Robert Qiu - ECE
Ghadir Radman - ECE
Stephen Scott – CSC
Alireza Pezhman Shirvanian - ME
Ambareen Siraj - CSC
Doug Talbert - CSC

Resilient Infrastructure

Joseph Biernacki, CHE - Coordinator
Daniel Badoe - CEE
Laura Arias Chavez
Stephen Canfield - ME
Steven Click - CEE
L. K. Crouch - CEE
Ahmed Elsawy - MET
Ismail Fidan - MET
David Huddleston -CEE
Sharon Huo - CEE
Stephen Idem - ME
Alfred Kalyanapu - CEE
Ahmed Kamal - MET
Jane Liu - CEE
Benjamin Mohr - CEE
John Peddieson - ME
Guillermo Ramirez -CEE
Matthew Yarnold - CEE

Activated Between July 1, 2014 and June 30, 2015

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
531234	PFI: Air Technology Translation - Computationally Designed Shrinkage Reducing Admixtures for Concrete - Year 2 (PI: Dr. Joseph Biernacki)	National Science Foundation	9/1/14-2/29/16	26,668	61,203
531234	VRS Supplement: PFI: AIR Technology Translation - Computationally Designed Shrinkage Reducing Admixtures for Concrete (PI: Dr. Joseph Biernacki)	National Science Foundation	9/1/14-2/29/16	10,000	10,000
531234	REU Supplement: PFI: AIR Technology Translation - Computationally Designed Shrinkage Reducing Admixtures for Concrete (PI: Dr. Joseph Biernacki)	National Science Foundation	9/1/14-2/29/16	5,500	5,500
531224	Collaborative Research: Structural Health Monitoring using Temperature Related Data (PI: Dr. Matthew Yarnold)	National Science Foundation	8/1/14-7/31/15	61,771	37,487
536241	Biaxial Material Model of Semi-Brittle Polymers - Phase 2 (PI: Dr. Jane Liu; Co-PI: Dr. John Peddieson)	United Launch Alliance	7/23/14-12/10/14	20,000	19,996
532049	The Future of Our Cities and Ageing Dams: Using NASA Satellites to Understand Changing Patterns of Infrastructure Safety for Resource-Hungry U.S. Cities (PI: Dr. David Huddleston)	National Aeronautics and Space Administration	9/1/14-8/31/15	27,600	28,022

Activated Between July 1, 2014 and June 30, 2015

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS) (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
538256	Study to Identify CFD Models for Use in Determining HVAC Duct Fitting Loss Coefficients (ASHRAE 1682-RP) (PI: Dr. Stephen Idem)	American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	6/1/14-11/30/15	47,473	40,662
531259	RAPID: Data Collection of Internal Forces During Dismantling of a Steel Bridge (PI: Dr. Matthew Yarnold)	National Science Foundation	8/15/14-7/31/15	24,810	24,710
539347	Development of Tennessee Travel Demand Model Users' Group (Year 3 of 5) (PI: Dr. Daniel Badoe)	The University of Tennessee from the Tennessee Department of Transportation	1/115-12/31/15	10,600	11,537
539286	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification (Federal) (PI: Dr. L. K. Crouch)	Tennessee Department of Transportation	1/1/15-12/31/15	4,000	53,776
539287	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification (State) (PI: Dr. L. K. Crouch)	Tennessee Department of Transportation	1/1/15-12/31/15	1,000	8,985
539236	Developing a High Mobility Manufacturing Robot (HMMR) for Ship Compartments (Agreement No. 2014-448) (PI: Dr. Ahmed Elsawy)	Advanced Technology International (ATI)	9/30/14-8/20/14	12,192	8,622

Activated Between July 1, 2014 and June 30, 2015

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS) (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
531234	Travel Supplement: PFI: AIR Technology Translation - Computationally Designed Shrinkage Reducing Admixtures for Concrete (PI: Dr. Joseph Biernacki)	National Science Foundation	5/31/15-2/29/16	2,792	2,231
532049	The Future of Our Cities and Ageing Dams: Using NASA Satellites to Understand Changing Patterns of Infrastructure Safety for Resource-Hungry U.S. Cities (PI: Dr. David Huddleston)	National Aeronautics and Space Administration	9/1/14-8/31/15	27,600	0
	SUB - TOTAL RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)			**282,006**	**312,731**

POWER-TEST-SERVICE ACCOUNT

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
538597	Power-Test-Service Account (PIs: Dr. Jie Cui, Dr. Stephen Idem, Dr. P. K. Rajan)			9,975	7,306
	SUB - TOTAL POWER-TEST-SERVICE ACCOUNT			**9,975**	**7,306**

Activated Between July 1, 2014 and June 30, 2015

MISCELLANEOUS

Contract Number	Title	Source	Project Dates	Total Amount	Expendit.
539513	Enabling Families, Infants and Toddlers Through Technology: Merging EIME Project (School Age) Year 3 (PI: Dr. Stephen Canfield)	Tennessee State Department of Education	7/1/14-6/30/15	7,000	7,367
539514	Enabling Families, Infants and Toddlers Through Technology: Merging EIME Project (Preschool Age) Year 3 (PI: Dr. Stephen Canfield)	Tennessee State Department of Education	7/1/14-6/30/15	7,000	7,531
531283	Collaborative Research: CyberWorkshops: Resources and Strategies for Teaching Cybersecurity in Computer Science (PI: Dr. Ambareen Siraj; Co-PI: Dr. Sheikh Ghafoor)	National Science Foundation	9/1/14-8/31/15	126,026	68,346
	SUB - TOTAL MISCELLANEOUS			**140,026**	**83,244**
	TOTAL CONTRACTS AND GRANTS ACTIVATED: 2014 - 2015			**432,007**	**403,281**

Activated Between July 1, 2013 and June 30, 2014
Not Counted in Match for 2013-2014 with Expenditures in 2014-2015

SMART GRID

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
532343	More Electric Integrated Power Systems with Multiphase Motors and Generators (Year 2) (PI: Dr. Joseph Ojo)	Office of Naval Research	6/15/13-3/15/15	57,114	95,227
	SUB-TOTAL: SMART GRID			**57,114**	**95,227**

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
539290	Developing Determining Concrete Chloride Permeability Rapidly and Effectively (Federal) (PI: Dr. L. K. Crouch; Co-PI: Dr. Daniel Badoe)	Tennessee Department of Transportation	8/1/13-7/31/18	151,664	69,750
539291	Developing Determining Concrete Chloride Permeability Rapidly and Effectively (State) (PI: Dr. L. K. Crouch; Co-PI: Dr. Daniel Badoe)	Tennessee Department of Transportation	8/1/13-7/31/18	45,132	18,059
539292	Enhance and Improve Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts (Federal) (Year 2) (PI: Dr. Sharon Huo)	Tennessee Department of Transportation	8/1/13-7/31/18	25,780	0
539293	Enhance and Improve Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts (State) (Year 2) (PI: Dr. Sharon Huo)	Tennessee Department of Transportation	8/1/13-7/31/18	21,822	4,190
	SUB - TOTAL RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)			**244,398**	**91,999**

Activated Between July 1, 2013 and June 30, 2014
Not Counted in Match for 2013-2014 with Expenditures in 2014-2015

MISCELLANEOUS

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
229501	CESR Smart Grid Lab Facility ($69,000 was the amount spent of the remaining budget from 2013-2014 of $121,400. This will leave $52,400 for the budget in 2015-2016.)	Tennessee Tech University	7/1/14-6/30/15	69,000	69,000
	SUB-TOTAL MISCELLANEOUS			**69,000**	**69,000**
	TOTAL CONTRACTS AND GRANTS ACTIVATED: 2013-2014 NOT COUNTED IN MATCH WITH EXPENDITURES IN 2014-2015			**370,512**	**256,226**
	TOTAL CONTRACTS AND GRANTS DURING 2014-2015			**802,519**	**659,507**

STATUS OF PROPOSALS
Submitted Between July 1, 2014 and June 30, 2015

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
1.	CFD and Experimental Analysis of Flow Around the Valves in a Hermetic Compressor - Phase I (Test Service Project)	Dr. Jie Cui, Dr. Stephen Idem	Bristol Compressors International, Inc.	7,500	Funded
2.	Understanding Intrinsic Forces in 3-D Structural Steel Systems	Dr. Matthew Yarnold	American Institute of Steel Construction (AISC)	200,000	Unfunded
3.	MARCOES: MultidisciplinAry Research in COmputational Earth Sciences	Dr. Sheikh Ghafoor, Dr. Alfred Kalyanapu	National Science Foundation	359,190	Unfunded
4.	REU Site: Research Experiences for Undergraduates in Solar Energy Generation, Grid Integration and Battery Storage	Dr. Indranil Bhattacharya	National Science Foundation (REU)	261,585	Unfunded
5.	Multiple Element Impact Vibration Dampers with Integrated Piezoelectric Sensors for Energy Harvesting	Dr. Steven Anton, Dr. Mohan Rao, Dr. John Peddieson	National Science Foundation	473,716	Resubmitted in February 2015
6.	Rollable and Printable Magneto-Optic Sensors	Dr. Holly Stretz, Dr. Satish Mahajan	Department of Energy	569,816	Unfunded
7.	Investigation of Effective Management of Energy Demand in Distribution Management Systems of Smart Grids using Formal Verification Methods	Dr. Syed Rafey Hasan	ICT Fund (Information & Communication Technology Fund)	24,522	Pending
	SUBTOTAL, PROPOSALS FOR 2014-2015			**1,896,329**	

STATUS OF PROPOSALS
Submitted Between July 1, 2014 and June 30, 2015

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
8.	Water Infrastructure Sustainability Evaluation (WISE) Center for Modeling Research	Dr. Alfred Kalyanapu, Dr. Sheikh Ghafoor	University of Utah (Requesting funding from the EPA)	210,028	Unfunded
9.	Developing a High Mobility Manufacturing Robot (HMMR) for Ship Compartments	Dr. Ahmed Elsawy	NSRP ASE Subcontract through Advanced Technology International (ATI)	12,192	Funded (Activated)
10.	Design, Modeling, and Experimental Validation of Cost-Effective High-Efficiency Multijunction Solar Cells	Dr. Indranil Bhattacharya	National Science Foundation (CBET)	299,998	Unfunded
11.	Self-Charging Autonomous Aerial Vehicle for Power Lines Inspection	Dr. Rabie Belkacemi, Dr. Satish Mahajan, Dr. Vahid Motevalli, Dr. Jeff Austen, and Dr. Hicham Chaoui	Tennessee Board of Regents	40,000	To be funded in 2015-2016
12.	Universal Control for Permanent Magnet Synchronous Machine Drives with no priori System Identification	Dr. Hicham Chaoui, Dr. Rabie Belkacemi	National Science Foundation (CMMI SDC)	468,493	Unfunded
13.	Multiple-Element Impact Vibration Dampers with Integrated Piezoelectric Sensors for Energy Harvesting	Dr. Steven Anton, Dr. Mohan Rao, Dr. John Peddieson	National Science Foundation (CMMI SDC)	416,043	Unfunded
	SUBTOTAL, PROPOSALS FOR 2014-2015			**1,446,754**	

STATUS OF PROPOSALS
Submitted Between July 1, 2014 and June 30, 2015

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
14.	Collaborative Research: 3D Printing of Civil Infrastructure Materials with Controlled Microstructural Architecture	Dr. Joseph Biernacki	National Science Foundation (CMMI MEP)	176,872	Unfunded (To be resubmitted in October 2015)
15.	Knowledge-based Flood Inundation Forecast on Affordable Mobile Platforms to Empower Farmers	Dr. Sheikh Ghafoor	USAID through the University of Washington	35,000	To be funded in 2015-2016
16.	Traffic Monitoring Program	Dr. Daniel Badoe, Dr. Steven Click, Dr. Jessica Matson	Tennessee Department of Transportation	118,402	Pending
17.	Biodiesel Produced from Jatropha Seed Oil - A Feasibility Study	Dr. Ahmed Elsawy, Dr. Daniel Swartling	National Academy of Sciences	200,000	Pending
18.	Travel Supplement: PFI: AIR Technology Translation - Computationally Designed Shrinkage Reducing Admixtures for Concrete	Dr. Joseph Biernacki	National Science Foundation	2,792	Funded (Activated)
19.	Alkali Silica Reactivity (ASR) Risk Assessment	Dr. Ben Mohr	Tennessee Department of Transportation	109,015	Pending
20.	Internal Concrete Curing	Dr. Ben Mohr, Dr. Matthew Yarnold	Tennessee Department of Transportation	115,016	Pending
21.	Verification of the ADI/ASHRAE Flexible Duct Calculator (Project total is $3,750; $1,875 also paid in May 2014)	Dr. Stephen Idem	M&M Manufacturing	1,875	Activated
	SUBTOTAL, PROPOSALS FOR 2014-2015			**758,972**	

STATUS OF PROPOSALS

Submitted Between July 1, 2014 and June 30, 2015

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
22.	Administrative Expenses for Obama-Singh 21st Century Knowledge Initiative	Dr. P. K. Rajan	Annamalai University	600	Activated
	SUBTOTAL, PROPOSALS FOR 2014-2015			**600**	
	TOTAL, PROPOSALS FOR 2014-2015			**4,102,655**	

ALOUANI, ALI

"Efficient prediction of maximum PV module output power through dynamic modeling", Mohammad Saad Alam, Ali T. Alouani b, Mohammad F. Azeem, (Elsevier) Sustainable Energy Technologies and Assessments, 11 (2015) 27–35.

ANTON, STEVEN

Journal Articles: Van Buren, K. L., Hall, T. M., Gonzales, L. M., Hemez, F. M., Anton, S. R., 2015, A Case Study to Quantify Prediction Bounds Caused by Model-Form Uncertainty of a Portal Frame, Mechanical Systems and Signal Processing, Vols. 50-51, pp 11-26

Conference Papers: Wilson, B. E., Anton, S. R. and Meneghini, R. M., Development of Biomechanical Knee Force Model for Evaluation of Piezoelectric Sensors for In-Vivo Monitoring, *Proc. ASME SMASIS*, 2014, SMASIS2014-7692.

Wilson, B. E., Meneghini, R. M., and Anton, S. R., Embedded Piezoelectrics for Sensing and Energy Harvesting in Total Knee Replacement Units, Proc. SPIE, 2015, Vol. 9431, 943111E (10 pp.).

Ray, C. A. and Anton, S. R., Evaluation of Piezoelectret Foam in a Multilayer Stack Configuration for Low-Level Vibration Energy Harvesting Applications, Proc. SPIE, 2015, Vol. 9431, 943111 (11 pp.).

ARIAS CHAVEZ, LAURA

Journal Publications: Lu, X.; Arias Chavez, L. H.; Romero-Vargas Castrillón, S.; Ma, J.; Elimelech, M. Influence of Active Layer and Support Layer Surface Structures on Organic Fouling Propensity of Thin-Film Composite Forward Osmosis Membranes. *Environmental Science & Technology* 2015, *49* (3), 1436-1444.

de Faria, A. F.; Perreault, F.; Shaulsky, E.; Arias Chavez, L. H.; Elimelech, M. Antimicrobial Electrospun Biopolymer Nanofiber Mats Functionalized with Graphene Oxide – Silver Nanocomposites. *ACS Applied Materials & Interfaces*, 2015, *7* (23), 12751-12759.

Conference Presentations: Esfahani, M. R.; Languri, E. M.; Arias Chavez, L. H. Computational fluid dynamics modeling of forward osmosis: Combined effect of cross-flow velocity and pore dimensions on internal concentration polarization, In *25th Annual Meeting of the North American Membrane Society*, Boston, MA, 2015. (Poster

BADOE, DANIEL

Mwakalonge, J. and Badoe, D.A. (2014) "Trip Generation Modeling using Data Collected in Single and Repeated Cross-sectional Surveys"**.** *Journal of Advanced Transportation*, Volume 48, Issue 4, pp. 318-331.

Dillon, S.A., Crouch, L.K., Browning, A. and Badoe, D.A. (2015), "Modification of an East Tennessee High Plasticity Silt with Lime and Substandard Fly Ash". Presented at the 94th *Annual Transportation Research Board Conference,* Washington D.C., January 2015

Crouch, L.K., Crowley, A., Badoe, D.A (2014). "Preliminary Research on Development of Surface Resistivity as a Function of Heat Evolution". Presented at the *American Concrete Institute Fall 2014 National Convention on Improving Early-Age Properties of Concrete with Supplementary Cementitious Materials,* Washington D.C., October 2014

Crouch, L.K., Hendrix, J., Sparkman, A. and Badoe, D.A. (2014). "Optimizing Pervious Concrete Engineering Properties with the Tennessee Concrete Association Mixture Adjustment Method". Presented at the Biannual Pervious in Paradise Conference, San Diego, California, August 5-8th, 2014

BELKACEMI, RABIE

Belkacemi, S. Zarrabian, A. Babalola and R. Craven, “Experimental Transient Stability Analysis of MicroGrid Systems: lessons learned,” in IEEE Power and Energy Society General Meeting, 2015.

R. Belkacemi, A. Babalola and S. Zarrabian, " Experimental Implementation of Multi-Agent System Algorithm to Prevent Cascading Failure after N-1-1 Contingency in Smart Grid Systems," in IEEE Power and Energy Society General Meeting, 2015.

R. Belkacemi, A. Babalola, S. Zarrabian and R. Craven, “Multi-Agent System Algorithm for Preventing Cascading Failures in Smart Grid Systems,” in North American Power Symposium, Pullman, WA, September 2014.

BHATTACHARYA, INDRANIL

B. Tiwari, R. Penumaka, I. Bhattacharya* and S. M. Mahajan, “A Novel GaP/InGaAs/InGaSb Triple Junction Photovoltaic Cell with Optimized Quantum Efficiency”, 42nd IEEE Photovoltaic Specialists Conference, New Orleans, LA, June 14-19, 2015.

R. Penumaka, B. Tiwari, I. Bhattacharya*, S. Y. Foo, “Indium Gallium Antimonide a better bottom subcell layer in III-V multijunction solar cells”, 42nd IEEE Photovoltaic Specialist Conference, June 14-19, 2015, New Orleans, LA.

BIERNACKI, JOSEPH

Journal Publication: M. Gottapu and J. J. Biernacki, *A Multi-ionic Continuum-Based Model for C_3S Hydration*, J. Am. Ceram. Soc., in press.

M. Gottapu and J. J. Biernacki, An Advanced Single-Particle Model for C3S Hydration – Validating the Statistical Independence of Model parameters, Computers and Concrete, 15(6), 989-999 (2015).

Presentations and Posters J. J. Biernacki and M. Gottapu, Investigation of Recent C3S Hydration Inferences…, ACerS Annual Cements Division Meeting, Cookeville, TN, July, 2014.

O. Chaudhari, J. J. Biernacki, and S. Northrup, Conflicting functionality of a Potential Shrinkage Reducing Compound: Molecular Dynamics Study, ACerS Annual Cements Division Meeting, Cookeville, TN, July, 2014. (This poster received a best poster award)

O. Chaudhari, J. J. Biernacki and S. Northrup, Effect of Glycolic Acid on Hydration of Tricalcium Silicates – A Molecular Dynamics Study, AIChE Annual Meeting, November, 2014.

CANFIELD, STEPHEN

Canfield, S. L., and S. Ghafoor, “A Matlab-Based Toolkit to program Microcontrollers for use in Teaching Mechanisms and Robotics,” Proc. of the 2014 ASME International Design Engineering Technical Conferences, Buffalo NY, Aug. 2014, DETC2014-35355.

Proceedings: Canfield, S. L., Qualls, J. and A. Shibakov, “Kinematic and Dynamic Evaluation of Mobile Robots Performing Welding Tasks,” *Proc. of the 2014 ASME International Design Engineering Technical Conferences*, Buffalo NY, Aug. 2014, DETC2014-35109.

CHAOUI, HICHAM

Journal papers: H. Chaoui, N. Golbon, I. Hmouz, R. Souissi, and S. Tahar: "Lyapunov-Based Adaptive State of Charge and State of Health Estimation for Lithium-Ion Batteries", *IEEE Transactions on Industrial Electronics,* 63 (3), pages 1610-1618, March 2015.

B. Hamane, M. L. Doumbia, H. Chaoui, M. Bouhamida, A. Cheriti, and M. Benghanem**:** "PI and RST Control Design and Comparison for Matrix Converters Using Venturini Modulation Method", *Journal of Power and Energy Engineering*, 3 (8), pp. 36-54, 2015.

International conference proceedings: H. Chaoui, A. Oukaour, H. Gualous and Pierre Sicard: "Power Factor Compensation Based Control Scheme for Permanent Magnet Synchronous Machine Drives", *IEEE Transportation Electrification Conference & Expo (ITEC)*, Dearborn, MI, USA, June 2015.

H. Chaoui, S. Miah, A. Oukaour, and H. Gualous: "State-of-Charge and State-of-Health Prediction of Lead-Acid Batteries with Genetic Algorithms", *IEEE Transportation Electrification Conference & Expo (ITEC)*, Dearborn, MI, USA, June 2015.

H. Teiar, H. Chaoui, and P. Sicard: "PMSM Control Based on Adaptive Fuzzy Logic and Sliding Mode", *IEEE Transportation Electrification Conference & Expo (ITEC)*, Dearborn, MI, USA, June 2015.

H. Chaoui, S. Miah, M.R. Kafi, and B. Hamane: "Neural Network Balance Control of Hopping Robots in Flight Phase under Unknown Dynamics", *IEEE International Conference on Control, Engineering & Information Technology (CEIT)*, Tlemcen, Algeria, May 2015.

M.R. Kafi, H. Chaoui and A. Debilou: "Design and Realization of a Real-Time Control Platform for Quadrotor Unmanned Aerial Vehicles", *IEEE International Conference on Control, Engineering & Information Technology (CEIT)*, Tlemcen, Algeria, May 2015.

B. Hamane, M.L. Doumbia, A. Chériti, H. Chaoui, M. Bouhamida, and M. Benghanem: "Fuzzy-PI and RST Control Design and Comparison for Matrix Converters Using Venturini Modulation Method", *IEEE International Conference on Control, Engineering & Information Technology (CEIT)*, Tlemcen, Algeria, May 2015.

H. Chaoui, S. Miah, A. Oukaour, and H. Gualous: "Maximum Power Point Tracking of Wind Turbines with Neural Networks and Genetic Algorithms", *IEEE 40th Annual Conference on Industrial Electronics Society* (*IECON),* Dallas, TX, USA, Oct.-Nov. 2014.

CRAVEN, ROBERT

"Multi-Agent System Algorithm for Preventing Cascading Failures in Smart Grid Systems," R. Belkacemi, A. Babalola, S. Zarrabian and R. Craven, in North American Power Symposium, Pullman, WA., Sept. 2014, pp. 1-6.

"A Cheaper Estimate of Concrete Heat Evolution Due to Hydration," L. K. Crouch, Aaron Crowley, Daniel Badoe, Tony Greenway, Robert Craven and Heather P. Hall, Tennessee Concrete Magazine, Winter 2014/15 Vol. 28, No. 3, pp 10-17

"Development of a Real Time Wind Turbine Emulator based on RTDS using Advanced Perturbation Methods," (R. V. Gokhale, B. Abegaz, R. Craven, and S. M. Mahajan), Proceedings of the International Conference on Environment and Electrical Engineering, EEEIC, Rome Italy, June 2015.

Papers Submitted and Accepted (yet to be presented as of July 1 2015)

R. Belkacemi, S. Zarrabian, A. Babalola and R. Craven, "Experimental Transient Stability Analysis of MicroGrid Systems: lessons learned," in IEEE Power and Energy Society General Meeting, 2015.

CROUCH, L.K.

Aaron Crowley, L. K. Crouch, and Daniel Badoe "Preliminary Research on Development of Surface Resistivity as a Function of Heat Evolution" ACI Fall 2014 Convention, October 26-30, 2014, Washington, D.C.

Dillon, Sarah, Crouch, L. K., Browning, Allen, and Badoe, Daniel, "Modification of an East Tennessee High Plasticity Silt with Lime and Substandard Fly Ash", Transportation Research Board 2015 Annual Meeting Compendium of Papers, January 2015.

Dillon, Sarah, Crouch, L. K., and Ferguson (Kelly), Kayla, "High Volume Substandard Fly Ash Roller-Compacted Concrete," Ash Library Website www.flyash.info , May, 2015. Downloaded 5/05/15

Dillon, Sarah, Crouch, L. K., and Young, Kevin, "Full-Depth Reclamation with Lime and Substandard Fly Ash," Ash Library Website www.flyash.info , May, 2015. Downloaded 5/05/15

"Experimenting with High Volume Fly Ash Concrete in Tennessee", L. K. Crouch, Aaron Crowley, Alan Sparkman, Heather P. Hall and Daniel Badoe, Tennessee Concrete, Vol. 28, No. 2, Fall 2014.

"Concrete Community Service: Helping Raptors and the Upper Cumberland Area", L. K. Crouch, Jason E. Miller, Aaron Crowley and Alan Sparkman, Tennessee Concrete, Vol. 28, No. 3, Winter 2014/15.

"A Cheaper Estimate of Concrete Heat Evolution Due to Hydration", L. K. Crouch, Aaron Crowley, Daniel Badoe, Tony Greenway, Robert Craven and Heather Hall, Tennessee Concrete, Vol. 28, No. 3, Winter 2014/15.

CUI, JIE

Kulkarni, D., Cui, J., and Idem, S., "CFD ANALYSIS OF TURBULENCE DEVELOPMENT IN FLAT OVAL DUCTS FOR VARIOUS ENTRANCES", TRNS-00264-2013, 2015 ASHRAE Winter Conference, Chicago, IL, January 24 – 28, 2015

ELKEELANY, OMAR

Omar Elkeelany, Kiran Prince, Siraj Fulum Mossa, 'System-on-a-Chip design for YUV2 to RGB Color Space Conversion on Altera DE2 FPGA Board,' ICIEEE proceedings, Pp. 159 – 163, 2015. Excellent paper content and presentation.

S. R. Hasan, S. F. Mossa, O. S. A. Elkeelany, F. Awwad, "Tenacious Hardware Trojans Due to High Temperature in Middle Tiers of 3-D ICs", Proceedings of the MidWest Symposium on Circuit and Systems (MWSCAS'2015), August, 2015.

S. F. Mossa, S. R. Hasan, O. S. A. Elkeelany, "Grouped TSV for Lower Ldi/dt drop in 3-D IC", IET Circuits, Devices & Systems (in press, 2015).

ELSAWY, AHMED

Matthew Holman, Chase Malone, Brian Katz and Ahmed ElSawy, "Automation of Biodiesel Reactor for the Production of Biodiesel From WVO Using PLC & Small Scale Continuous Ultrasonic Processor", Proceedings of the 2014 IAJC/ISAM Joint International Conference (ISBN 978-1-60643-379-9), September 25-27, 2014 – Orlando, Florida.

Michael Kronland, Nicholas Leak, Joseph Randall, Cory Womack, and Ahmed Elsawy "An Investigation into Combined Concentrated Photovoltaic and Fluidic Thermal Extraction in Harnessing the Power of Sun", submitted and accepted for presentation and publication in IYCE'15 – 5th International Youth Conference on Energy, 27-30 May 2015, Pisa, Italy.

GHAFOOR, SHEIKH

S. Ghafoor and Canfield, S. L., "A Matlab-Based Toolkit to program Microcontrollers for use in Teaching Mechanisms and Robotics," in Proc. of the 2014 ASME International Design Engineering Technical Conferences, Buffalo NY, Aug. 2014, DETC2014-35355.

HASAN SYED

Journal Published: G. B. Hamad, *S. R. Hasan,* O. A. Mohamed, Y. Savaria, "*New Insights Into the Single Event Transient Propagation Through Static and TSPC Logic*", IEEE Transaction on Nuclear Science, Vol. 61, No. 4, August 2014, pp. 1618 - 1627

G. B. Hamad, S. R. Hasan, O. A. Mohamed, Y. Savaria, "Characterizing, modeling, and analyzing soft error propagation in asynchronous and synchronous digital circuits*",* Microelectronics Reliability Vol. 55, No. 1, January 2015, pp. 238 - 250

Conference Publications: F. K. Lodhi, *S. R. Hasan*, O. Hasan, F. Awwad, "Hardware Trojan Detection in Soft Error Tolerant Macro Synchronous Micro Asynchronous (MSMA) Pipeline", in MidWest Symposium on Circuits and Systems (MWSCAS'2014)*,* August, 2014

W. Gul, *S. R. Hasan,* O. Hasan, "Yield Aware Inter-Logic-Layer Communication in 3-D ICs: Early Design Stage Recommendations", in MidWest Symposium on Circuits and Systems (MWSCAS'2014)*,* August, 2014

G. B. Hamad, *S. R. Hasan,* O. A. Mohamed, Y. Savaria, "Modeling, Analyzing, and Abstracting Single Event Transient Propagation at Gate Level", in MidWest Symposium on Circuits and Systems (MWSCAS'2014), August, 2014

F. K. Lodhi, *S. R. Hasan*, O. Hasan, F. Awwad, "Low Power Soft Error Tolerant Macro Synchronous and Micro Asynchronous Pipeline", in IEEE International Symposium on VLSI (ISVLSI' 2014), July 2014

Extended Abstract and Poster Presentations:

S. R. Hasan, S. F. Mossa, O. S. A. Elkeelany, "Tenacious Hardware Trojans Due to High Temperature in Middle Tiers of 3-D ICs" , (extended abstract) in Design Automation Conference (DAC), 2015.

IDEM, STEPHEN

Behls, H. and Idem, S., 2015, "Predicted Pressure Loss in Low Pressure Wire-Wound Flexible Ducts," ASHRAE Transactions, Vol. 121, Part 1, pp. 79-101.

Kulkarni, D., Cui, J., and Idem, S., 2015, "CFD Analysis of Turbulence Development in Flat Oval Ducts for Various Entrances," ASHRAE Transactions, Vol. 121, Part 1, CH-15-001.

Silaipillayarputhur, K. and Idem, S., "Transient Performance Model for a Multi-Pass Cross Flow Heat Exchanger," Heat Transfer Engineering, Vol. 35, No. 1, 2014, pp. 15-24.

Kulkarni, D. and S. Idem, 2015, "Loss Coefficients of Bends in Fully Stretched Nonmetallic Flexible Ducts," Science and Technology for the Built Environment, Vol. 21, pp. 413-419.

Leverette, J., Gebke, K., and S. Idem, 2014, "Pressure and Velocity Variation in a Fabric Air Dispersion System," HVAC&R Research, Vol. 20, No. 8, pp. 862-874.

Silaipillayarputhur, S. and Idem, S., November 2014, "Transient Performance of Multi-Pass Parallel and Counterflow Crossflow Heat Exchangers," IMECE2014-37030, Proceedings of IMECE, Montreal, Quebec.

Srinivasan, B. and Idem, S., 2014, "Pressure Drop Testing of Corrugated Stainless Steel Pliable Gas Tubing (PLT)," IMECE2014-36668, Proceedings of IMECE, Montreal, Quebec.

KALYANAPU, ALFRED

Kalyanapu, A.J., Ghafoor, S. K., Marshall, R.J., Dullo*, T. T., Judi, D. R., and Shankar, S. (2014). "Benchmark Exercise for Comparing the Computational Performance of Two-Dimensional Flood Models in CPU, Multi-CPU, and GPU Frameworks" World Environmental and Water Resources Congress 2014: pp. 1322-1331, doi: 10.1061/9780784413548.133

KAMAL, AHMED

NSF scholarship to attend and present poster at Hi-Tec Conference held in Chicago 22-24, July 2014.

Ahmed Kamal "Autonomic Function Assessment in Diabetic Patients Using Dynamic Nonlinear Methods" Published at Biomedical Engineering Society Conference Proceeding held in San Antonio, Texas October 2014

Ahmed Kamal "Novel Method to Assess Autonomic Function in Health and Disease an Application to Epileptic Patients", International Journal of Neuro Rehabilitation,1,133, Dec 2014.

LIU, JANE

Conference Proceedings: Jane Liu, John Peddieson, "Application of Groebner Bases to Nonlinear Mechanics Problems," Mathematical Software – ICMS 2014, Volume 8592 of the Series Lecture Notes in Computer Science pp 398-405, Springer.

Peer Reviewed Conference Papers: Jane Liu, John Peddieson, "Application of Groebner Bases to Nonlinear Mechanics Problems," Proceeding of the ICMS 2014, 4th International Congress on Mathematical Software, August, 2014, Seoul, Korea.

Jane Liu, Rafal Ablamowicz, "Groebner Bases in Teaching Computational Methods in Engineering," Presentation at the ICMS 2014, 4th International Congress on Mathematical Software, August, 2014, Seoul, Korea.

Markus Rosenkranz, Jane Liu, Alexander Maletzky, and Bruno Buchberger, "Two-Point Bounddary problems with One Mile Singularity and an Application to Graded Kirchhoff plates," Proceeding of Computer Algebra in Scientific Computing (CASC) 2015, June, 2015 Aachen, Germany.

Conference Presentations: Tim Harrell, Steve Mills, Jane Liu, and David Mills, "Equi-Biaxial Loading of Rohacell 200WF," Presentation at JEC Conferences Americas 2015, Houston, At Houston, TX, USA, June, 2015.

MAHAJAN, SATISH M.

Journal: "Voltage stability index-based reactive power compensation scheme", (With Damian O. Dike), International Journal of Electrical Power and Energy Systems (Elsevier), IJEEPS, (Vol. 73), Accepted in January 2015, pp. 734-742.

Proceedings: "Optimal Real-Time Integration Control of a Virtual Power Plant", (With Brook Abegaz), North American Power Symposium (NAPS), Seattle, September 2014.

"Development of a Real Time Wind Turbine Emulator based on RTDS using Advanced Perturbation Methods" (With R. V. Gokhale, B. Abegaz and R. Craven), International Conference on Environment and Electrical Engineering, EEEIC, Rome Italy, June 2015.

"Power Consumption Analysis of Computing Facilities with Superconducting Josephson Junction Quantum Computers", (With B. Abegaz, and R. W. Johnson), International Conference on Environment and Electrical Engineering, EEEIC, Rome Italy, June 2015.

"A Novel GaP/InGaAs/InGaSb Triple Junction Photovoltaic Cell with Optimized Quantum Efficiency", (With B. Tiwari, R. Penumaka, I. Bhattacharya, and Simon Foo), 42th IEEE Photovoltaic Specialist Conference, New Orleans, July 2015.

Conference presentations: "Enhanced Verdet Constant via Fold Coated Iron Nanoparticles", (With Nathan T. Dick, and Holly A. Stretz), Poster presentation at Nano-manufacturing Conference, Greensboro, NC, September 2014.

"Optimal Dispatch Control of Energy Storage Systems using Forward-Backward Induction", (With B. Abegaz), International Conference on Clean Electric Power (ICCEP), Taormina, Italy, June 2015.

"Using Baja SAE for International Student Outreach", (With D. A. Wilson, M. Rao, S. B. White, O. Basil Hall III, Sam W. Keener, L. Atkins, K. M. Hall, D. Tyrell Laxton, and M. Gage Babb), A Poster presented at the ASEE, June 2015.

"International Education Outreach: A Report on the SAE Baja Workshops in India", (With Mohan Rao, and Dale Wilson), 2nd International Conference on Transformations in Engineering Education, January 5-8, 2015, Bangalore, India.

MAHMOUD, MOHAMED

K. Rabieh, M. Mahmoud, M. Azzer, M. Allam, "A Secure Event Reporting Scheme for Vehicular Ad Hoc Networks", Wiley Security and Communication Networks, published online 8 APR 2015.

M. Mahmoud, J. Misic, K. Akkaya, X. Shen, "Investigating Public-Key Certificate Revocation in Smart Grid", IEEE Journal on Internet of Things (IoT), published online 04 March 2015.

M. Mahmoud, X. Lin, and X. Shen, "Secure and reliable routing protocols for heterogeneous multihop wireless networks", IEEE Transactions on Parallel and Distributed Systems (IEEE TPDS), vol.26, no.4, pp.1140,1153, April 2015.

M. Mahmoud, S. Taha, J. Misic, and X. Shen, "Lightweight privacy-preserving and secure communication protocol for hybrid ad hoc wireless networks", IEEE Transactions on Parallel and Distributed Systems (IEEE TPDS), vol. 25, no. 8, pp. 2077- 2090, Aug. 2014.

K. Rabieh, M. Mahmoud, A. Seraj, J. Misic, "Efficient Privacy-Preserving Chatting Scheme with Degree of Interest Verification for Vehicular Social Networks", Proc. of IEEE Global Communications Conference, Selected Areas in Communications: Social Networks ('GC' 15 - SAC - Social Networks'), San Diego, USA, 2015.

Haddad, M. Mahmoud, S. Taha, and Imane Saroit, "Secure and Privacy-Preserving AMI-Utility Communications via LTE-A Networks", Proc. of IEEE 11th International Conference on Wireless and Mobile Computing, Networking and Communications, IEEE WiMob'15, Abu Dhabi.

K. Rabieh, M. Mahmoud, M. Younis, "Privacy-Preserving Route Reporting Scheme for Traffic Management in VANETs", Proc. of IEEE International Conference on Communications (ICC), London, UK, 8-12 June, 2015.

K. Rabieh, M. Mahmoud, T. Guo, M. Younis, "Cross-Layer Scheme for Detecting Large-scale Colluding Sybil Attack in VANETs", Proc. of IEEE International Conference on Communications (ICC), London, UK, 8-12 June, 2015.

M. Mahmoud, Kemal Akkaya, Khaled Rabieh, and Samet Tonyali, "An Efficient Certificate Revocation Scheme for Large-Scale AMI Networkss", Proc. of 33rd IEEE International Performance Computing and Communications Conference , IEEE IPCCC, Austin, USA, Dec. 2014. [PDF]

K. Akkaya, K. Rabieh, M. Mahmoud, S. Tonyali, "Efficient Generation and Distribution of CRLs for IEEE 802.11s-based Smart Grid AMI Networks", Proc. of IEEE SmartGridComm'14, Italy, November, 2014.

OJO, JOSEPH O.

Journal/Transactions: Mehdy Khayamy and Eseme Sota, and Olorunfemi Ojo “A Nonlinear Controller Approach for an Autonomous Battery Assisted Photo-Voltaic System Feeding an AC Load with a Nonlinear Component,” IET Journal of Renewable Power Generation, Vol. 24, No. 8, pp. 838-848, November 2014.

Conference: Adeola Balogun, Olorunfemi Ojo and Frank Okafor, “Shorted Stator Mode Control of a Doubly-Fed Induction Generator Connected to a Weak Grid,” pp. 1847-1851, 2014 IEEE ECCE (Energy Conversion Congress and Exposition), 2014 Annual Meeting, September 2014, Pittsburgh, USA.

Bhanu Angirekula and Olorunfemi Ojo, “Single Phase Synchronous Reference Frame Power Control of Grid Connected Multi String Inverters,” pp. 142 – 149, 2014 IEEE ECCE (Energy Conversion Congress and Exposition), 2014 Annual Meeting, September 2014, Pittsburgh, USA.

Kennedy Aganah and Olorunfemi Ojo, “Pulse- Width Modulation Technique for Family of (3n+3) – Switch Converters,” pp. 1035-1042, 2014 IEEE ECCE (Energy Conversion Congress and Exposition), 2014 Annual Meeting, September 2014, Pittsburgh, USA.

PEDDIESON, JOHN

“Biaxial Material Model of Semi-Brittle Polymers-Phase 2,” with J Liu, final report submitted to ULA, September 2014.

“Size Class Convergence in Multiphase Continuum Mechanics Modeling of Convective Fragmentation,” with A. Jayanthi, International Journal of Energy and Technology, 7, 2015, pp. 1-18.

J. Liu and J. Peddieson, “Application of Groebner Basis Methodology to Nonlinear Mechanics Problems,” Proceedings of ICMS, H. Hong and Y. Yap eds., pp. 398-405, Springer, Berlin (August 2014).

QIU, ROBERT

JOURNAL PAPERS: R. C. Qiu, "The Foundation of Big Data: Experiments, Formulation, and Applications", preprint, 2014. (PDF)

X. Li, Z. Hu, R. C. Qiu, Z. Wu, J. P. Browning, and M. C. Wicks, "Demonstration of Cognitive Radar for Target Localization under Interference," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 50, No. 3. July 2014. PDF

PROCEEDING PAPERS: J. Aribido, T. Guo, and R. C. Qiu, "Visualization of Large Wireless Network Behavior Using Random Matrix Theory," IEEE Wireless Communications and Networking Conference. New Orleans, LA. March 9-12, 2015. (PDF)

R. C. Qiu, "Big Data of a Large-Scale Cognitive Radio Network: Testbed, Data Representation and Analytics," Wireless Networks for Big Data, Hefei, Anhui, China, September 29-30, 2014. INVITED PAPER.

RADMAN, GHADIR

Journal/Transactions: Arash Jamehbozorg and Ghadir Radman "Small Signal Analysis of Power Systems with Wind and Energy Storage Units", IEEE TRANSACTIONS ON POWER SYSTEMS, VOL. 30, NO.1, JANUARY 2015.

Waheed Oyekanmi, Ghadir Radman, and Lazarus Uzoechi "Power System Contingency Ranking Based on the Generator Algebraic State Variables Score in Dynamic Security Assessment" *IEEE International Conference on Adaptive Science and Technology, Covenant University, Nigeria,* October, 2014.

Waheed Oyekanmi, Ghadir Radman, Adeniyi Babalola, and Titus Ajewole "Effect of STATCOM on the Critical Clearing Time of faults in Multi-machine Power Systems during Transient Stability studies" *IEEE International Conference on Adaptive Science and Technology, Covenant University, Nigeria,* October, 2014.

Waheed Oyekanmi, Ghadir Radman, Adeniyi Babalola, and Titus Ajewole " Power system simulation and contingency ranking using load bus voltage index" *IEEE International Conference on Electronics, Computer and Computation, Abuja Nigeria,* pp. 135-138, Sept., 2014.

SIRAJ, AMBAREEN

Siraj, Ambareen, Blair Taylor, Siddarth Kaza, Sheikh Ghafoor (2015), "Integrating Security in The Computer Science Curriculum," *ACM Inroads*, 6(2), pp 77-81

Lenin Mookiah, William Eberle, and Ambareen Siraj, "Survey of Crime Analysis and Prediction," International Conference of the Florida AI Research Society (FLAIRS), May 2015.

Vitaly Ford, Ambareen Siraj, William Eberle. "Smart Grid Energy Fraud Detection Using Artificial Neural Networks". *IEEE Symposium Series on Computational Intelligence (SSCI) 2014*, held in Orlando, FL, December 9-12, 2014.

Vitaly Ford and Ambareen Siraj. "Applications of Machine Learning in Cyber Security", *ISCA 27th International Conference on Computer Applications in Industry and Engineering (CAINE-2014)*, held in New Orleans, LA, October 13-15, 2014.

YARNOLD, MATTHEW

Journals: Yarnold, M.T., Moon, F.L., Aktan, A.E. (2015). "Temperature-Based Structural Identification of Long-Span Bridges," *Journal of Structural Engineering.*

Yarnold, M.T., Moon, F.L. (2015). "Temperature-Based Structural Health Monitoring Baseline for Long-Span Bridges," *Engineering Structures, 86(0), 157-167.*

Yarnold, M.T. & Dubbs, N.C. (2015). “Bearing Assessment using Periodic Temperature-Based Measurements,” *Journal of the Transportation Research Record, 2481, 115-123.*

Conference Papers: Yarnold, M.T. & Weidner, J. (2016 Submitted). "Monitoring of a Bascule Bridge during Construction," *Transportation Research Board, Washington, DC.*

Yarnold, M.T., Murphy, B., Glisic, B., and Reilly, J. (2016 Submitted). "Temperature-Based Evaluation and Monitoring Techniques for Long-Span Steel Bridges," *Transportation Research Board, Washington, DC.*

Yarnold, M.T. & Wilson, S. (2015). “Forensic Investigation of the Route 61 Bridge,” *ASCE Structures Congress*, 309-321. Portland, OR.

Yarnold, M.T. (2015). “Preparing Engineers for Evaluation of Constructed Systems,” *ASCE Structures Congress*, 2590-2599. Portland, OR.

QIU, ROBERT

R. C. Qiu, "Introduction to Smart Grid," John Wiley, 2014.

OJO, JOSEPH O.

Hossein Karimi-Davijani and Olorunfemi Ojo, Controllability Analysis of Renewable Energy Systems, Chapter 8 in **Power Electronics for Renewable Energy Systems**, Transportation and Industrial Applications, IEEE Press, New York, 2014

DR. N. RATHAKRISHNAN, (exchange visitor from Annamalai University in India) presented a seminar titled, “Simple Solutions to Power Quality Problems in Converters,” Brown Hall 208, Tuesday, November 11, 2014.

DR. SIRIPONG MALASRI, presented a seminar titled, “Packaging Research at Christian Brothers University Healthcare Packaging Consortium,” on September 23, 2014 in Prescott Hall 225.

DR. ABRAHAM GEORGE (SS Energy Technologies Brentwood, TN), presented a seminar titled, “Energy Management, Alternate Energy and Distributed Generation,” Tuesday, November 25, 2014 in Brown Hall 208

DR. ZHI LI presented a seminar titled “Filling the Gaps – Research Efforts on a Variety of Smart Grid Technologies,” Monday, June 22, 2015 in Prescott Hall 225.

GRADUATE THESIS/DISSERTATIONS AND OTHER STUDENT PUBLICATIONS

MASTERS

OLUWASEUN ARIBIDO

Predictive Analysis of Wireless Network Behavior from Packet Drop Data Using Random Matrix Theory from Packet Drop Data Using Random Matrix Theory

Fall 2014

Dr. Robert Qiu

Electrical and Computer Engineering

MOHAMMAD BIN JASSAS

Real-Time Economic Dispatch and Power Management in Microgrids

December 2014

Dr. Rabie Belkacemi

Electrical and Computer Engineering

NATHAN DICK

Enhanced Verdet Constant Via Gold Coated Iron Oxide Nanoparticles and Via Change in Host Medium

December 2014

Dr. Satish Mahajan

Electrical and Computer Engineering

JOJO FRANCE-MENSAH

Development of Leachate Test for Delayed Ettringite Formation Potential in Cementitious Materials

August 2014

Dr. Ben Mohr

Civil and Environmental Engineering

TIM HARRELL

Application of Groebner Basis to Geometrically Nonlinear Analysis of Axistmmetric Circular Isotropic Plates

August 2014

Dr. Jane Liu

Civil and Environmental Engineering

TA-YU KUAN

Non-Thesis Graduate Student

August 2014

Dr. Ghadir Radman

Electrical and Computer Engineering

MARUTHI REDDY

Evaluation of a Model for Two Phase Flow in Porous Media

August 2014

Dr. John Peddieson

Mechanical Engineering

GRADUATE THESIS/DISSERTATIONS AND OTHER STUDENT PUBLICATIONS

PhD

AARON MARTIN CROWLEY

The Development of a Lower Heat Concrete Mixture for Mass Concrete Placement Conditions

May 2015

Dr. L. K. Crouch

Civil and Environmental Engineering

SARAH ANN DILLON

Investigation into Beneficial Uses of Substandard Fly Ash

May 2015

Dr. L. K. Crouch

Civil and Environmental Engineering

EMANUEL MATEE

Optimum Economic Scheduling of Output Power of a Wind Farm Equipped with Energy Storage System

December 2014

Dr. Ghadir Radman

Electrical and Computer Engineering

	M.S.	Ph.D.
Number of Students	**7**	**3**

MS STUDENTS

Name	Dept.	Source of Support	Anticipated Graduation Date	Advisor
Adapa, Satya	CSC	NSF, CSC	Left TTU	Dr. Siraj
Cooper, Traci	CEE	CESR, CEE	Spring 2016 (exp.)	Dr. Click
Cruz Rangel, Dario	CHE	CESR	Summer 2015	Dr. Biernacki
Dachepally, Harshini	ME	CESR, ME	Spring 2016 (exp.)	Dr. Liu, Dr. Peddieson
Drane, Benjamin	CEE	CESR, CEE	Fall 2015 (exp.)	Dr. Liu
Eagan, Blakeslee	CEE	TDOT	Summer 2015	Dr. Crouch
Ford, Vitaly	CSC	CESR	Summer 2015	Dr. Siraj
Locum, James	CEE	TDOT	Fall 2015 (exp.)	Dr. Crouch
Oke, Shadrach	ECE	CESR	Spring 2016 (exp.)	Dr. Ojo
Pick, Jonathan	CSC	NSF	Left TTU	Dr. Siraj
Qualls, Joshua	ME	NSF, CESR	Fall 2015 (exp.)	Dr. Canfield
Salehi, Mohammad	ME	Embry-Riddle Aeronautical University, ASHRAE	Spring 2016 (exp.)	Dr. Idem
Sota, Eseme	ECE	CESR	Fall 2015	Dr. Radman

PHD STUDENTS

Name	Dept.	Source of Support	Anticipated Graduation Date	Advisor
Babalola, Adeniyi	ECE	CESR	Spring 2017 (exp.)	Dr. Belkacemi
Chaudhari, Ojas	CHE	CESR, NSF	Spring 2016 (exp.)	Dr. Biernacki
Crowley, Aaron	CEE	TDOT	Spring 2015	Dr. Crouch
Dillon, Sarah	CEE	TDOT, CESR, CEE	Spring 2015	Dr. Crouch
Ghosh, Arnab	ECE	CESR	Spring 2017 (exp.)	Dr. Johnson
Khayamy, Mehdy	ECE	CESR, ECE	Summer 2016 (exp.)	Dr. Chaoui
Marshall, Ryan	CSC	CESR	Spring 2016 (exp.)	Dr. Ghafoor
Murphy, Brittany	CEE	NSF	Spring 2018 (exp.)	Dr. Yarnold
Ramezani, Mehdi	ECE	CESR	Summer 2016 (exp.)	Dr. Ojo
Zarrabian, Sina	ECE	CESR	Spring 2018 (exp.)	Dr. Belkacemi
Yigzaw, Wondmagegn	CEE	NASA, CESR	Summer 2016 (exp.)	Dr. Hossain/ Dr. Huddleston

ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers

CEE Civil and Environmental Engineering (Tennessee Technological University)

CESR Center for Energy Systems Research (Tennessee Technological University)

CSC Computer Science (Tennessee Technological University)

ECE Electrical and Computer Engineering (Tennessee Technological University)

ME Mechanical Engineering (Tennessee Technological University)

NASA National Aeronautics and Space Administration

NSF National Science Foundation

TDOT Tennessee Department of Transportation

HOURLY STUDENT PERSONNEL SM-10

GRADUATE/UNDERGRADUATE STUDENTS	DEGREE AND MAJOR
Oluwaseun Joseph Arbido	M.S. EE
Adeniyi Babalola	Ph.D. EE
Matthew Blaylock	B.S. ME
William Caruthers	B.S. CHE
Emily Casey	B.S. CE
Ojas Chaudhari	Ph.D. CHE
Traci Cooper	M.S. CE
Kayla Cornett	B.S. CE
Aaron Crowley	Ph.D. CE
Dario A. Cruz Rangel	M.S. CHE
Kallie Curtis	B.S. CE
Harshini Dachepally	M.S. ME
Sarah Dillon	Ph.D. CE
Tigstu Dullo	Ph.D. CE
Blakeslee Eagan	M.S. CE
Vitaly Ford	M.S. CSC
Arnab Ghosh	Ph.D. ECE
Erik Graubner	M.S. ECE
Scott Hill	B.S. ME
Jobayer Hossain	M.S. ECE
Md T. Islam	M.S. CSC
Eric James	M.S. CE
Mehdy Khayamy	Ph.D. EE
James Locum	M.S. CE
Ryan Marshall	Ph.D. CSC
Mariah Martinez	B.S. CHE
Leora Maxwell	B.S. CHE
Benjamin McComb	B.S. CHE
Brittany Murphy	Ph.D. CEE
Jonathan Pick	B.S. CSC
Joshua Qualls	M.S. ME
Raja Penumaka	M.S. ECE
Mehdi Ramezani	Ph.D. EE
Maruthi Reddy	M.S. ME
Stephen Salaman	M.S. CE
Mohammad Salehi	M.S. ME
Natalia Shlonimskaya	M.S. CHE
Jagadish Babu Sirigineedi	M.S. ECE
Caleb Smith	B.S. CE
Eseme Sota	M.S. ECE

HOURLY STUDENT PERSONNEL SM-10

GRADUATE/UNDERGRADUATE STUDENTS (CONTINUED)	DEGREE AND MAJOR
Joseph Tatarczuk	M.S. CSC
Allen Uhlik	M.S. ECE
Samuel Wehunt	B.S. CSC
Michael Whittenburg	B.S. CE
Wondmagegn Yigzaw	Ph.D. CEE
Sina Zarrabian	Ph.D. ECE

WORK STUDY/WORK SCHOLARSHIP	DEGREE AND MAJOR
Amber Patterson	B.S. CSC
Bishoy Mousa	B.S. EE
Derek Bush	B.S. ME
Austin Jenkins	B.S. ME
Andrew Moore	B.S. CHE
Adam Porche	B.S. ME
Billy York	B.S. BIOLOGY

UNDERGRADUATE RESEARCH PROJECTS SM-11

Undergraduate Student	Sponsor	Program	Faculty Advisor
Will Caruthers	National Science Foundation	REU PFI Project 531234	Dr. Joe Biernacki
Mariah Martinez	National Science Foundation	REU PFI Project 531234	Dr. Joe Biernacki
Ben McComb	National Science Foundation	REU PFI Project 531234	Dr. Joe Biernacki
Jonathan Pick	National Science Foundation	CReST Project 531283	Dr. Ambareen Siraj
Kallie Curtis	The Ureca! Grant and the Center for Energy Systems Research for Summer 2015	Material Property Measurement for Polycarbonate by DIC Technique with 3D Printed Specimens	Dr. Jane Liu
Michael Whittenburg	National Science Foundation and the Center for Energy Systems Research	NSF Ettringite Project Index 531216 ended 8/31/14; CESR 533392 is paying through Spring 2015	Dr. Ben Mohr
Scott Hill	National Science Foundation	CCLI/TUES Index 531258	Dr. Stephen Canfield
Caleb Smith	Tennessee Department of Transportation	Catalog Project	Dr. L. K. Crouch
Kayla Cornett	National Science Foundation	Ettringite Project Index 531216; Project ended 8/31/2014	Dr. Ben Mohr
Samuel Wehunt	National Science Foundation	CReST Project Index 531283	Dr. Ambareen Siraj
Vance Trammell	National Science Foundation	CReST Project Index 531283	Dr. Ambareen Siraj

CENTERS OF EXCELLENCE ACTUAL, PROPOSED, AND REQUESTED BUDGET

Institution: Tennessee Technological University **Center:** Center for Energy Systems Research

	FY 2014-15 Actual			FY 2015-16 Proposed			FY 2016-17 Requested		
	Matching	Appropr.	Total	Matching	Appropr.	Total	Matching	Appropr.	Total
Expenditures									
Salaries									
Faculty	$151,762	$100,836	**$252,598**	$95,308	$238,704	**$334,012**	$87,921	$122,164	**$210,085**
Other Professional	$11,914	$208,982	**$220,896**	$3,636	$232,127	**$235,763**	$0	$190,068	**$190,068**
Clerical/ Supporting	$2,409	$77,444	**$79,853**	$450	$134,699	**$135,149**	$500	$108,788	**$109,288**
Assistantships	$162,298	$165,129	**$327,427**	$115,440	$359,152	**$474,592**	$111,100	$135,000	**$246,100**
Total Salaries	**$328,383**	**$552,391**	**$880,774**	**$214,834**	**$964,682**	**$1,179,516**	**$199,521**	**$556,020**	**$755,541**
Fringe Benefits	$109,504	$219,812	**$329,316**	$82,494	$437,870	**$520,364**	$86,453	$295,930	**$382,383**
Total Personnel	**$437,887**	**$772,203**	**$1,210,090**	**$297,328**	**$1,402,552**	**$1,699,880**	**$285,974**	**$851,950**	**$1,137,924**
Non-Personnel									
Travel	$19,127	$11,131	**$30,258**	$24,350	$52,413	**$76,763**	$19,050	$26,500	**$45,550**
Software		$2,330	**$2,330**	$1,000	$3,023	**$4,023**	$1,000	$3,500	**$4,500**
Books & Journals		$52	**$52**	$500	$500	**$1,000**	$500	$500	**$1,000**
Other Supplies	$164,990	$51,617	**$216,607**	$33,972	$126,100	**$160,072**	$26,651	$43,000	**$69,651**
Equipment	$55,082	$28,134	**$83,216**		$126,702	**$126,702**	$0	$5,000	**$5,000**
Maintenance		$57,189	**$57,189**		$1,000	**$1,000**		$1,000	**$1,000**
Scholarships			**$0**			**$0**			**$0**
Consultants	$12,000	$1,806	**$13,806**	$22,600	$2,000	**$24,600**	$19,000	$2,000	**$21,000**
Renovation			**$0**			**$0**			**$0**
Other (Specify):			**$0**			**$0**			**$0**
Participant Support	$32,600		**$32,600**	$64,750		**$64,750**	$114,550		**$114,550**
			$0			**$0**			**$0**
			$0			**$0**			**$0**
Total Non-Personnel	**$283,799**	**$152,259**	**$436,058**	**$147,172**	**$311,738**	**$458,910**	**$180,751**	**$81,500**	**$262,251**
GRAND TOTAL	**$721,686**	**$924,462**	**$1,646,148**	**$444,500**	**$1,714,290**	**$2,158,790**	**$466,725**	**$933,450**	**$1,400,175**
Revenue									
New State Appropriation		$898,500	**$898,500**		$889,000	**$889,000**		$933,450	**$933,450**
Carryover State Appropriation		$851,252	**$851,252**		$825,290	**$825,290**		$0	**$0**
New Matching Funds	$680,781		**$680,781**	$444,500		**$444,500**	$466,725		**$466,725**
Carryover from Previous Matching Funds	$40,905		**$40,905**			**$0**			**$0**
Total Revenue	**$721,686**	**$1,749,752**	**$2,471,438**	**$444,500**	**$1,714,290**	**$2,158,790**	**$466,725**	**$933,450**	**$1,400,175**

JUSTIFICATION FOR 2016 — 2017 APPROPRIATIONS REQUEST

The Center for Energy Systems Research (CESR) is requesting a 5% increase in the Appropriations Request for 2016-2017. Currently, the Center for Energy Systems Research only has two individuals working in the office. These two individuals manage the research projects, prepare personnel appointments (including student appointments and visiting scholar appointments) and contracts, assist with the purchase of supplies and the preparation of travel paperwork and arrangements as well as gathering data and information to prepare reports and other documents as needed and to respond to reviews and audits. Also, additional audits of federal projects are expected to occur. As a result, it is proposed to hire another individual for office support. In addition, there has not been a faculty member based in the CESR during the last few years to prepare proposals and obtain research funding. Therefore, the CESR is preparing to request the appointment of at least one Post-doctoral Research Associate during 2015-2016 and hopes to continue the appointments during 2016-2017. Also, the CESR would like to hire a new faculty member to be based in the CESR to concentrate on research. The College of Engineering is requesting that graduate students on Graduate Research Assistantship appointments be paid at least $1,500 per month at the PH.D. level and at least $1,200 per month at the M.S. level. Currently, the CESR has not been able to pay the graduate students at this level. It is also expected that these levels of support will be requested to increase during the next fiscal year. It is also expected that additional supplies will be needed in the new Smart Grid Laboratory which should be operational during 2015-2016.