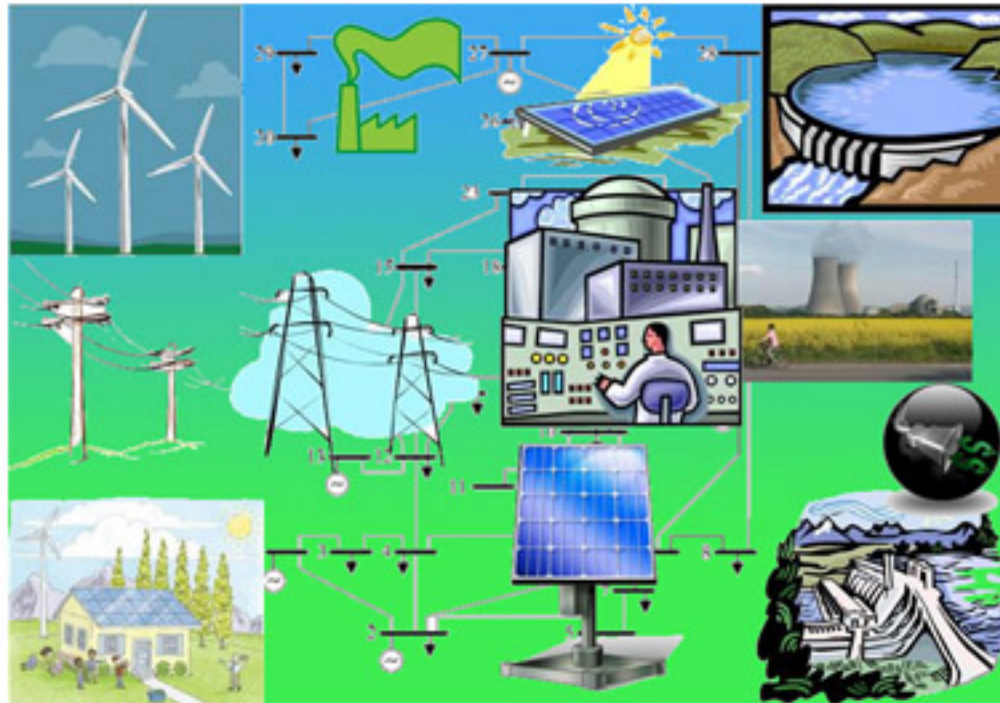


CENTER FOR ENERGY SYSTEMS RESEARCH

TENNESSEE TECH UNIVERSITY

ANNUAL REPORT FOR FISCAL YEAR 2012 — 2013

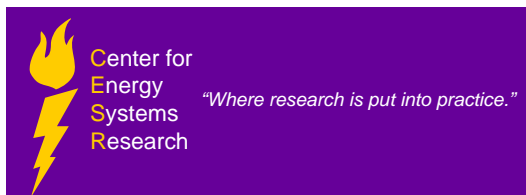


Annual Report for Fiscal Year

JULY 1, 2012 – JUNE 30, 2013

P.K. Rajan, Interim Director

www.tntech.edu/cesr



Center for Energy Systems Research

1020 Stadium Drive

Prescott Hall 414

Campus Box 5032

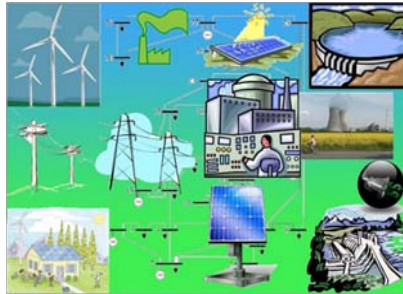
Cookeville, TN 38505

(931) 372-3615

cesr@tntech.edu

www.cesr.tntech.edu/

Smart Grid



Resilient Infrastructure



Cover Description:

The Center for Energy Systems Research is the home of two strategic research areas: Smart Grid and Resilient Infrastructure.

The Center's mission statement summarizes its overall purpose: 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.

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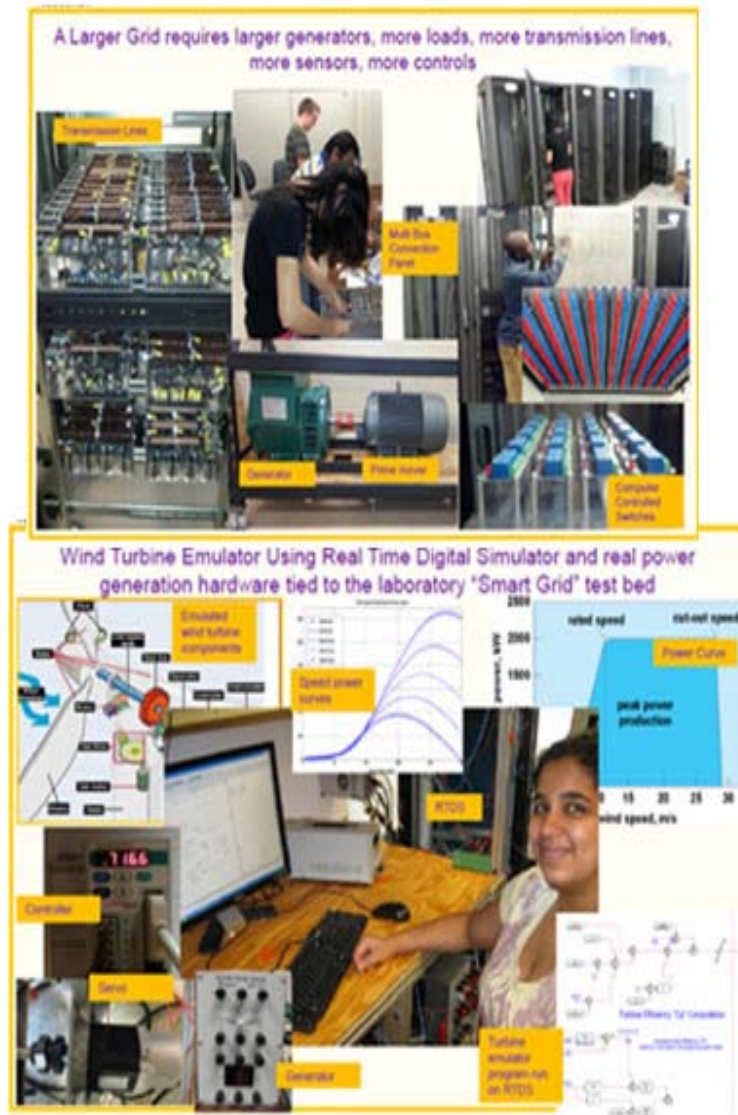
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PROGRAMMATIC REPORT



CESR students working on a Laboratory sized power Grid (LabGrid)Microgrid Test bed.

A wind turbine emulator developed by graduate student Richa Gokhale.Laboratory sized power Grid (LabGrid) Microgrid Test bed

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.

Research efforts, both theoretical and experimental, are focused on solving current and anticipated problems associated with energy systems. Special emphasis is given to the needs of the electric power industry.

VISION

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 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 2012-13 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.

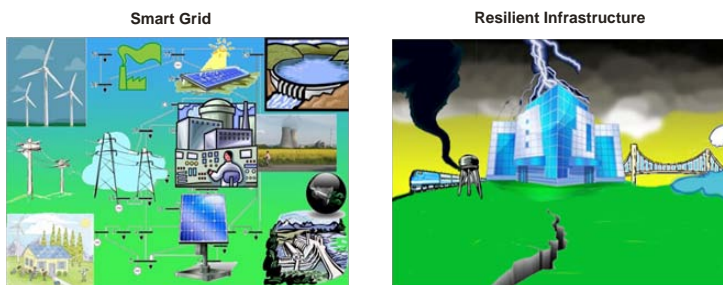
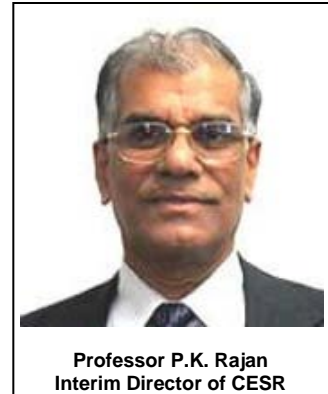
The Center promotes international collaboration by hosting visiting scholars, scientists and engineers and establishing Memoranda of Understanding with international academic institutions and research organizations.

YEAR IN REVIEW

Dr. P.K. Rajan was appointed as the Interim Director of the Center for Energy Systems Research (CESR) at the beginning of the fiscal year 2012-2013. He replaced Dr. Subramaniam Deivanayagam, Associate Dean of Research and Graduate Studies, following his retirement from July 1, 2012

The Center is the home of two strategic research areas of the College of Engineering: Smart Grid and Resilient Infrastructure.

The term smart grid signifies a modern electric power system that employs power electronics, advanced instrumentation, secure communication, and information technologies so that it is robust against disturbances with the least likelihood of blackouts and is efficient in energy transfer between sources and loads leading to lowest cost to consumers.



Resilient Infrastructure denotes the continued functioning of infrastructures even if some elements of the infrastructure do not survive or are not equipped to handle conditions that exceed the design criteria and operational guidelines. A physical infrastructure is considered resilient if it can anticipate, survive, adapt and recover from external disruptions, such as wear and tear, natural forces (e.g. severe weather, hurricanes, earthquakes), man-made forces (population pressure, extreme overuse, landscape change, terrorist attacks), etc. Given the current situation with our nation's infrastructure, understanding resilience appears to be a key way forward for the engineering community to safeguard the continued functionality of critical infrastructure for society.

Proposal submission and grant activation activities continued during the past year. In the Smart Grid area, one Major Research Instrumentation (MRI) proposal to NSF and one Defense University Research Instrumentation Program (DURIP) proposal to Office of Naval Research were submitted. The DURIP proposal has been approved for funding. In the Resilient Infrastructure area several projects totaling more than \$500K have been activated. Additionally, projects to enhance engineering education to the order of \$148K were executed. In summary, total external funding amounted to \$742,296. CESR continues to enjoy a broad base of support. Through June 2013, the cumulative research funding of the Center is \$25,098,808 (Fig. 1). State appropriations are compared to matching in Fig. 2, on an annual basis. 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 28-year match of about \$24.9 million represents 100.0 percent of the state appropriations of \$24.9 million. Indirect costs of approximately \$4.53 million have also been received. The 2012-2013 match is \$622,495 compared to the state appropriation of \$880,700. A list of the projects conducted under the major research areas is given in SM-3 in this report. The research activations and the number of students supported during the past five years are shown in Figs. 3 and 4.

Many CESR faculty associates earned recognitions for their outstanding contributions. During the past year CESR affiliated faculty and students made 23 conference presentations and published 27 articles in refereed journals. These are listed in the following pages of this report.

CESR RESEARCH FUNDING 1985 THRU 2013

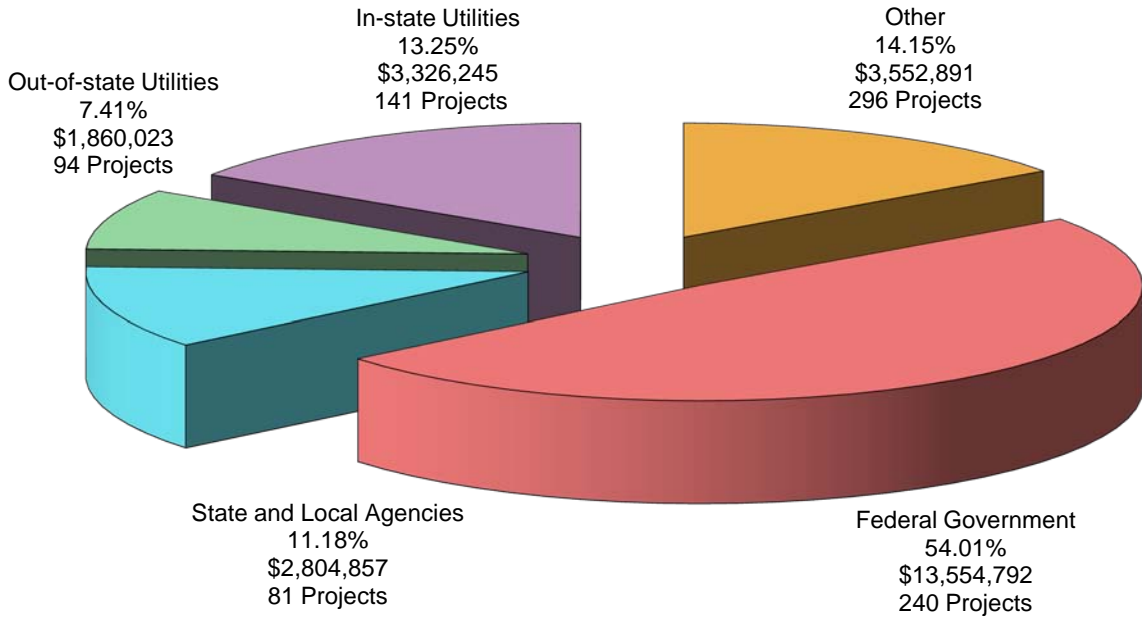


Figure 1: Types of Research Funding (Total \$25,098,808)

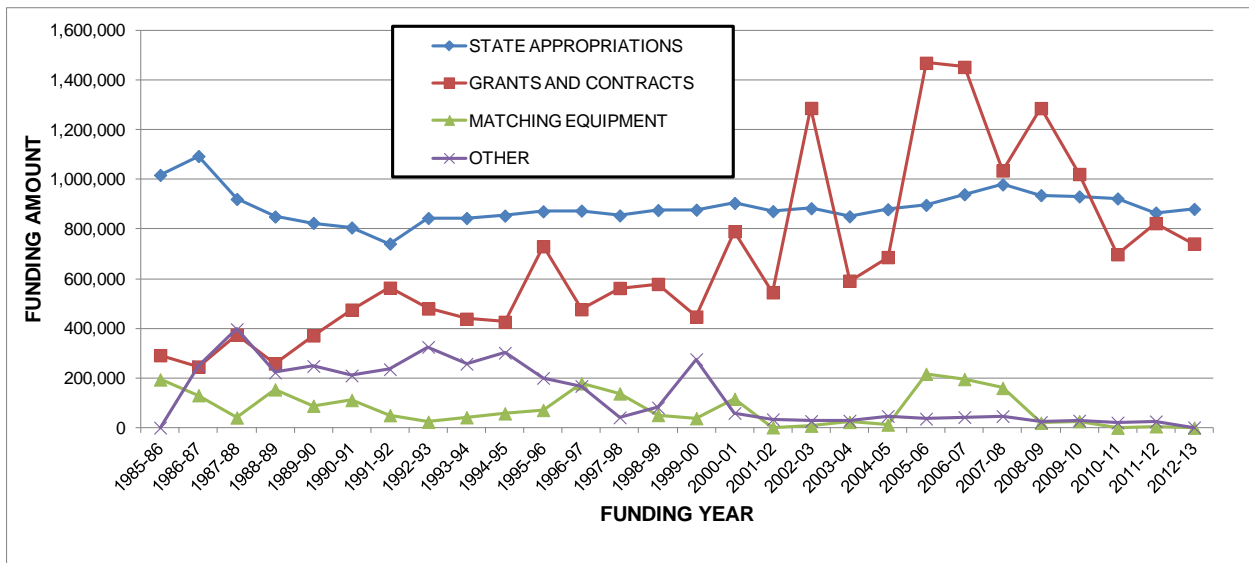


Figure 2: Historical State Appropriations and Matching

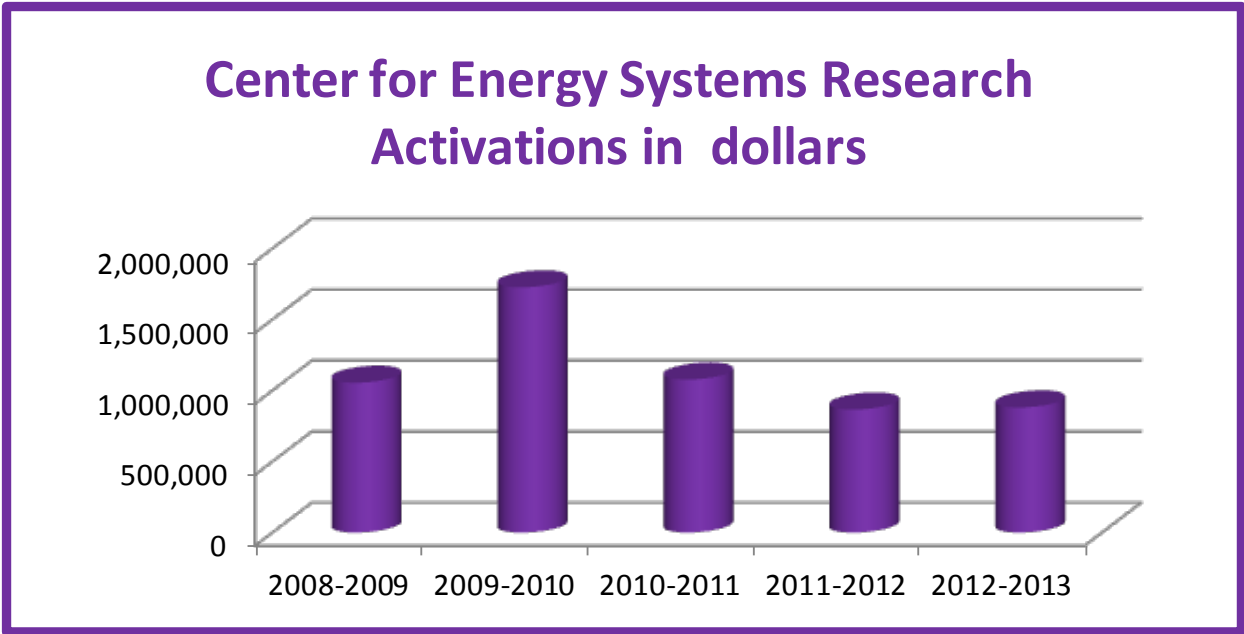


Fig. 3. Research Activations

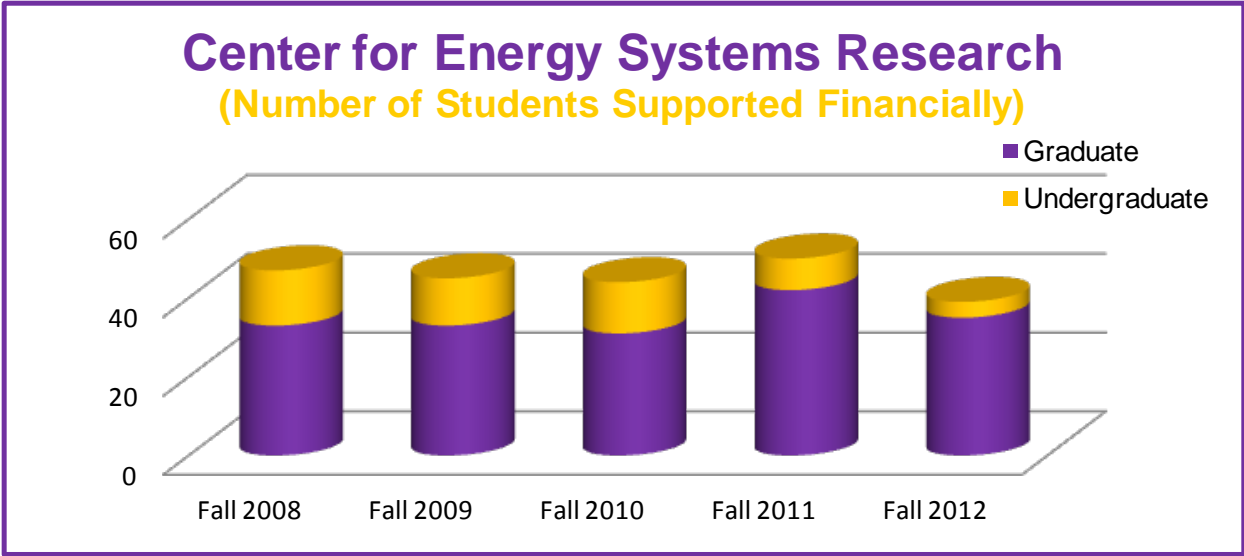


Fig. 4. Number of Students Supported

RESEARCH HIGHLIGHTS

2012-2013

Professors and graduate students performing research with the Center for Energy Systems Research (CESR) can draw upon the many labs and resources of the university, college, and various departments. In addition to these facilities the center has several resources that may prove useful for new research endeavors.

In order to make the most of precious resources, CESR looks to groups of professors and staff to band together in common research areas so that resources spent on basic development work can have the most benefit for all. Teaching, research, and external collaborative efforts will all benefit from this synergistic environment. In CESR, two strategic research groups, (a) Smart Grid Group and (b) Resilient Infrastructure Group have been formed.

Smart Grid Group

The Smart Grid Group is working on three areas: 1) Smart Grid Test Facility, 2) Power Electronics, and Power Systems.

Test Facility

The process of developing a smart grid test facility. This facility will be a comprehensive facility where the performance of various algorithms can be tested. The facility will include the microgrid and wind and solar simulations units. Dr. Rabie Belkacemi is leading this effort. Drs. Alouani, Radman and Ojo are also contributing towards. Drs. Robert Qiu and Nan Guo are working on setting up a wireless communication facility on the grid and Dr. Ambareen Siraj and Dr. Omar Elkeelany are working on securing the grid communications. A part of this activity, a major research instrumentation grant proposal was submitted to NSF. Research in the areas of electric power, smart grid, power electronics, power disturbance mitigation, communications, control, computer programming, and security can all benefit from this common research facility. The inclusion of wind and solar power sources highlights the interest in "green energy" research.

Power Electronics

Dr. Ojo and his students have conducted research on power electronic circuits and their application to wind generators and their integration into the grid. Dr. Ojo submitted a successful equipment proposal to Office of naval Research under the Defense University Research Instrumentation program.

Power Systems

Dr. Radman and his group have conducted research on the stability and reliability of power systems.

Resilient Infrastructure Group

As a part of resilient infrastructure, research is going on three areas: 1) Sustainable water resources infrastructure 2) Cement and Concrete properties and 3): Bridges and Transportation

Water Resources

Dr. Faisal Hossain and Dr. Alfred Kalyanapu conduct research in this area. With funding from NASA, Dr. Hossain is conducting research on Improving the Accuracy and Reliability of Space-Borne Discharge Estimation from Surface Water and Ocean Topography (SWOT) for Low-Lying Humid Tropical Regions of the World. Dr. Kalyanapu is working on the prediction of floods in water ways.

Cement and Concrete

Dr. L. K. Crouch is the principal investigator on four multi-year Tennessee Department of Transportation (TDOT) funded projects. The projects are investigations of Class S-Lower Heat Portland Cement Concrete and Class D-LP Concrete Mixture. His research is supported by Tennessee Department of Transportation (TDOT). Dr. Ben Mohr, with funding from NSF, is investigating the durability of cement-based materials using a novel in-situ technique – dielectric broadband spectroscopy. This analytical tool allows for the determination of free and bound water components in a hydrating cementitious systems at early ages and beyond. Another prong of the research being conducted has been the investigation of the mechanisms responsible for delayed ettringite formation – a deleterious reaction that occurs in concrete materials that have typically been exposed to high temperatures at early ages. The current emphasis has been to evaluate the effect of pore sizes on the extent of expansion and damage. These pore sizes range from 2-20 nm and are being investigated via small angle x-ray scattering (SAXS) and water vapor sorption isotherms (WVSI). Dr. Joe Biernacki and his students are studying the properties of fly ash based concrete.

RESEARCH HIGHLIGHTS

2012-2013

Bridges and Transportation

With funding from TDOT Dr. Sharon Huo is engaged in developing rating aids for the evaluation of existing concrete box culverts in Tennessee. Dr. Daniel Badoe is working on travel demand modeling issues for Tennessee Department of Transportation and the Metropolitan Planning Organizations within the State. Dr. Steven Click conducted research on signaling schemes

Other Areas

Dr. Sabine Le Borne conducted research with funding from NSF on Algebraic Hierarchical Matrix Preconditioners for Two- and Three-Dimensional Saddle Point. This project deals with the development, analysis and implementation of novel techniques for the solution of large, sparse linear systems of equations of saddle point type. Despite much recent progress, the solution of large systems of equations remains one of the main bottlenecks in many numerical simulations. Applications include fluid dynamics, magneto hydrodynamics, image processing, and many more.

Drs. Steven Canfield and Sheikh Ghafoor continued their NSF funded educational research on teaching of programming with hardware aids. Dr. Canfield also continued his work on the development of aids for young children with disabilities.

FACULTY AWARDS AND ACCOMPLISHMENTS

2012–2013



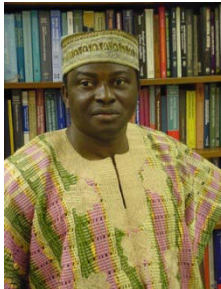
Dr. Stephen Canfield, Mechanical Engineering Professor, was an invited participant in the Frontiers of Engineering Education symposium, sponsored by the National Academy of Engineering.



Dr. Satish Mahajan, ECE Professor, received the 2013 Kinslow Engineering Research Award. The Kinslow Award was established to recognize high-quality, archival publications by Engineering faculty members at TTU.



Dr. Robert Qiu received the 2012 Caplenor Faculty Research Award. The award was presented at TTU's fall commencement ceremony in December 2012. The Caplenor Award is TTU's premier research award. First presented in 1984, it is named in honor of David Caplenor, former associate vice president for research and dean of instructional development. Caplenor died in 1979.



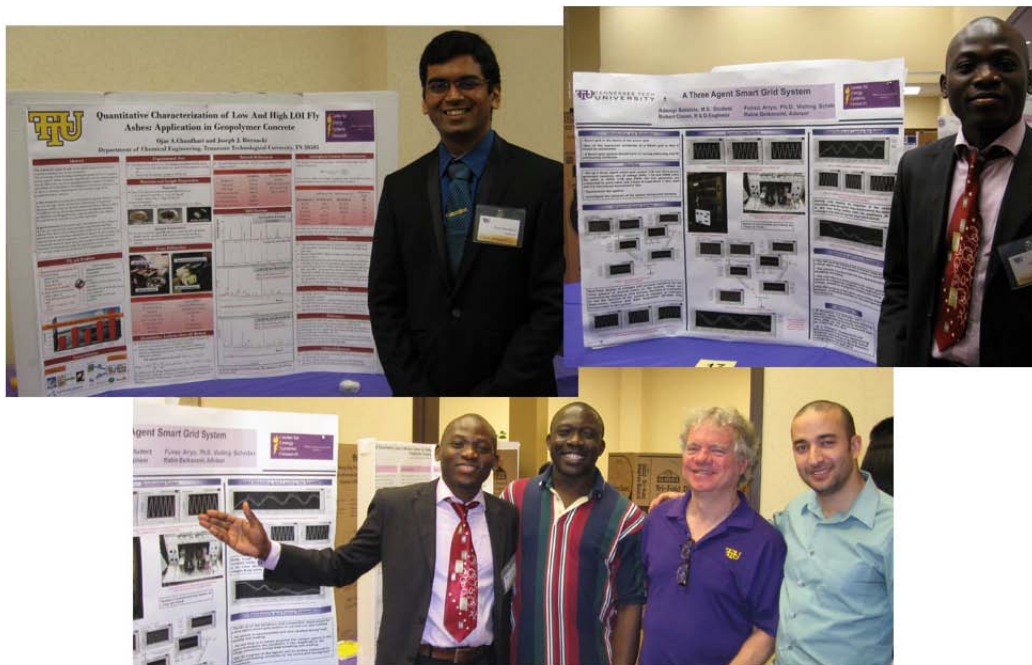
Dr. Joseph O. Ojo, Professor of Electrical and Computer Engineering was named a Fellow of the Nigerian Academy of Engineering and attended the induction ceremony held in Nigeria, in June 2013. Members are selected for their analytical skills and outstanding knowledge of engineering theory and practice.

STUDENT ACCOMPLISHMENTS AND AWARDS

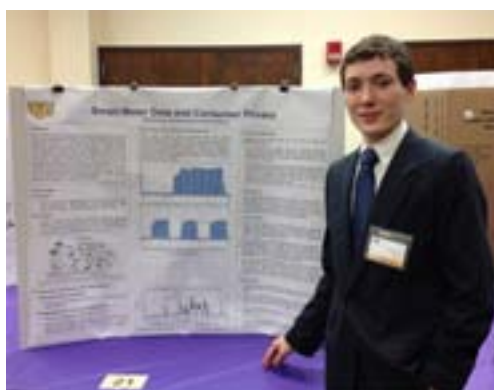
2012–2013

Student Research Day at Tennessee Technological University is an event designed to showcase in a poster format the research of students. Nearly 140 students submitted abstracts for Tennessee Tech University's eighth annual Student Research Day in spring 2013. Of the submissions, 122 students presented posters. More than 50 faculty and community leaders volunteered as judges, selecting student winners in undergraduate and graduate categories.

Each participant received a certificate of appreciation and a bronze medallion.



Ojas Chaudhari, PhD Chemical Engineering student (advisor Dr. Joseph Biernacki – photo - top left); Adenlyl Babolola MS Electrical Engineering student (Advisor, Dr. Rabie Belkacemi –photo - top right); (bottom photo) left to right Adenlyl Babalola, Funso Ariyo, PhD Visiting Scholar, Robert Craven, R&D Engineer; and Dr. Rabie Belkacemi (Photo courtesy of CESR)



Vitaly Ford, PhD Computer Science student (advisor Dr. Ambareen Siraj) was selected as award winner with his poster in the graduate student category. (Photo courtesy of Vitaly)

+++

Ojas, Adenlyl and Vitaly, CESR Research Assistants, displayed their posters at TTU's 2013 Student Research Day. (Photo courtesy of CESR)

FACULTY AND STAFF CONFERENCE PARTICIPATIONS

Ali Alouani

Attended the Future of Instrumentation International Workshop (FIIW12) in Gatlinburg, TN, October 2012.

Daniel Badoe

Attended a the Transportation Research Board (TRB) 92nd Annual Meeting in Washington, DC, January 2013 and presented two papers.

Jie Cui

Attended the ANSYS Technology Oak Ridge Seminar in Oak Ridge, Tennessee, September 2012.

Robert Craven

Attended the TREEDC DIY solar installation workshop at the University of Tennessee Conference Center in Knoxville, TN, October 2012.

Attended the Developing, Monitoring and Control Systems with LabVIEW and CompactRIO Hands-On Seminar in Brentwood, Tennessee, February 2013.

Omar Elkeelany

Attended the Cyber Security Expo and Workshop in Memphis, TN, October 2012.

Xiaoming (Sharon) Huo

Attended the TDOT Research Focus Group meeting in Nashville, Tennessee, September 2013.

Joseph Ojo

Presented the paper, "Electromechanical Systems in Aircraft Power Systems", at the Wright Patterson Air Force Base (WPAFB) at the Air Force Research Laboratory, Dayton, Ohio, August 2012.

Made an invited presentation "Optimum Control of Grid Connected Interior Permanent Magnet Wind Turbine Generator", at IEEE Energy Conversion Congress and Exposition (ECCE 2012) in Raleigh, North Carolina, September 2012.

Attended the ONR Naval S&T Partnership Conference and ASNE Expo as presenter in Arlington, Virginia, October 2012.

Made a presentation at the Applied Power Electronics Conference and Exposition (APEC 2013) in Long Beach, California, March 2013.

Ghadir Radman

Presented the paper, "Wide Area Phasor Measurements Based Disturbance Monitoring For Line Trip Event", at the IEEE Power and Energy Conference, San Diego, California, July 2012

STUDENTS CONFERENCE PRESENTATIONS

Arash Jamehbozorg (Ghadir Radman, Advisor) presented paper, “Enhancement of Micro-Grid Dynamics in Presence of Wind Units Using Energy Capacitor Systems”, at the North American Power Symposium (NAPS) 2012 in Champaign Illinois, September 2012.

Sosthenes Karagaba (Joseph Ojo, Advisor) presented paper “Space Vector and Carrier-Based PWM Modulation Schemes for Maximum Utilization of Voltage Sources of a Nine-Switch Converter”, at the IEEE Energy Conversion Congress and Exposition (ECCE 2012) in Raleigh, North Carolina, September 2012.

Medhi Ramezani (Joseph Ojo, Advisor) presented paper “Computation of Equivalent Circuit Parameters of Nine-phase Induction Motor in Different Operating Modes”, at the IEEE Energy Conversion Congress and Exposition (ECCE 2012) in Raleigh, North Carolina, September 2012.

Aditya Jayanthi (John Peddieson, Advisor) presented paper “Discrete Population Balance Multiphase Mixture Modeling of Fragmentation in Fully Turbulent Duct Flow”, at American Physical Society 65th Annual DFD Meeting in San Diego, California, November 2012.

Ojas Chaudhari (Joseph Biernacki, Advisor) presented paper “Semi-Empirical AM1, PM3 and PM6 Calculations On the Metakaolin Molecular Structure: Practical Application in Geopolymer Cement Production”, at the AIChE Annual Conference, in Pittsburgh, Pennsylvania, October 2012.

Samuel Wanjoeh (Joseph Ojo, Advisor) attended Smart Grid Workshop in Chattanooga, Tennessee, October 2012.

Waheed Oyekanmi (Joseph Ojo, Advisor) attended Smart Grid Workshop in Chattanooga, Tennessee, October 2012.

Kwadwo Agyemang Duah (Joseph Ojo, Advisor) attended Smart Grid Workshop in Chattanooga, Tennessee, October 2012.

Aaron Crowley (L.K. Crouch, Advisor) attended ASTM Symposium on Thermal Methods for Prediction of Properties of Cementitious Systems in Atlanta, Georgia, December 2012.

Sarah Dillon (L.K. Crouch, Advisor) attended the Introduction to Mechanistic Empirical Pavement Design Conference in Huntsville, Alabama, June 2013.

Vitaly Ford (Ambareen Siraj, Advisor) attended the Trusted Infrastructure Workshop at the Pennsylvania State University, June 2013.

FUTURE PLANS



Dr. L.K. Crouch's PhD Student, Sarah Dillon (Research for CESR)
Produce a TDOT 312 Aggregate-Lime-Fly Ash Stabilized Base Course with commercially available materials (Cumberland City Class F fly ash). Replace Cumberland City Class F fly ash with Colbert fly ash (LOI = 8%, TVA's worst) on a 1:1 weight basis. Compare compressive strength and static modulus of elasticity on laboratory compacted samples.

(Photo courtesy of Dr. Crouch)

PLANS FOR 2013-2014

During 2013-14, it is planned to hire a new director and recruit research faculty. During 2012-13 academic year the Center has assisted the Electrical and computer Engineering Department and Civil and Environmental Engineering Department to recruit one new faculty member each. These faculty members will support the Smart Grid and Resilient Infrastructure research areas, respectively. The Center for Energy Systems Research has provided start up packages that include funds to buy equipment for research, summer support and travel funds. It is also planned to assist the departments to recruit highly qualified faculty members in the Smart Grid and Resilient Infrastructure areas during 2013-14 academic year.

It is also planned to set-up a smart grid laboratory to support the research of faculty in this area. This facility will enable the testing of ideas developed as part of the smart grid research. The Laboratory will have a facility to test not only power systems algorithms but also communication and security aspects of the grid

SUPPORTING MATERIALS



Dr. Benjamin Mohr, Associate Professor of Civil and Environmental Engineering, in his research laboratory with samples of corrugated concrete for research for his NSF Ettringite project.

Concrete samples can be stored in different environments and tested periodically for efforts of aging. (Photo courtesy of CESR)

CESR FACULTY AND STAFF 2012-2013

Center Director:	Professor P.K. Rajan	Interim Director
CESR Staff:	Robert Craven	R&D Engineer
	Anthony Greenway	Information Technology Associate 9
	Linda Lee	Administrative Associate 3
	Etter Staggs	Financial Analyst

Faculty participating in the Strategic Research of the Center are:

Smart Grid

Joseph Ojo - Co-ordinator

Adam Anderson

Ali Alouani

Omar Elkeelany

Ahmed Elsayy

Ahmed Kamal

Satish Mahajan

Robert Qiu

Ghadir Radman

Ambareen Siraj

Robert Craven

Syed Rafay Hasan

Faculty participating in the Strategic Research of the Center are:

Resilient Infrastructure

Faisal Hossain, Co-ordinator

Joseph Biernacki, Co-ordinator

Benjamin Mohr

Alfred Kalyanapu

L.K. Crouch

Jane Liu

Sharon Huo

Steven Click

Stephen Canfield

John Peddieson

Ahmed Elsayy

Ismail Fidan

Sheikh Ghafoor

Ahmed Kamal

Matthew Yarnold

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2012 and June 30, 2013**

SMART GRID

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
531652	CAREER: Wind Power -- Multi-Level Control, Intelligent Grid Integration and Real Time Digital Simulation (Year 4 of 5)	National Science Foundation	9/1/12-8/31/13	80,000	154,886
SUB - TOTAL				80,000	154,886
SMART GRID - TOTAL					

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2012 and June 30, 2013**

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
531216	Nanoscale Characterization of Expansion Due to Delayed Ettringite Formation (Year 3 of 3)	National Science Foundation (CMMI)	9/1/12-8/31/13 (Extended to 8/31/14)	113,520	64,625
539286	Development of a Class S-Lower Heat Portland Cement Concrete (S-LH PCC) (Federal) (Year 2 of 5)	Tennessee Department of Transportation	1/1/13-12/31/13	52,000	33,795
539287	Development of a Class S-Lower Heat Portland Cement Concrete (S-LH PCC) (State) (Year 2 of 5)	Tennessee Department of Transportation	1/1/13-12/31/13	13,000	4,411
539284	Development of a Class D-LP (Lower Permeability) Concrete Mixture (Federal) (Year 2 of 3)	Tennessee Department of Transportation	8/1/12-7/31/13	44,000	54,891
539285	Development of a Class D-LP (Lower Permeability) Concrete Mixture (State) (Year 2 of 3)	Tennessee Department of Transportation	8/1/12-7/31/13	11,000	5,850
539281	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (Federal)	Tennessee Department of Transportation	8/1/12-7/31/13	34,400	38,652
539282	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (State) (Year 2 of 3)	Tennessee Department of Transportation	8/1/12-7/31/13	8,600	7,128

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2012 and June 30, 2013**

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS) (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
532349	Improving the Accuracy and Reliability of Space-Borne Discharge Estimation from SWOT for Low-Lying Humid Tropical Regions of the World (Year 1 of 3)	National Aeronautics and Space Administration	1/9/13-1/8/14	73,424	24,040
539288	Expanding the Informational Catalog of TDOT Low Permeability Bridge Deck Mixtures (Federal) (Year 1 of 5)	Tennessee Department of Transportation	5/15/13-5/14/15	104,000	14,962
539289	Expanding the Informational Catalog of TDOT Low Permeability Bridge Deck Mixtures (State) (Year 1 of 5)	Tennessee Department of Transportation	5/15/13-5/14/15	26,000	0
539347	Development of Tennessee Travel Demand Model Users' Group (Year 1 of 5)	The University of Tennessee, (Tennessee Department of Transportation)	1/1/13-12/31/13	10,000	0
532333	Supplementary Fund Request	NASA	10/12/12-5/31/13	12,399	12,397
SUB - TOTAL				502,343	260,751
RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)					

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2012 and June 30, 2013**

POWER-TEST-SERVICE ACCOUNT

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
538597	Power-Test-Service Account				
	Early Strength Mix Design Confirmation	Builders Supply Company	6/11/12-7/6/12	75	75
	Flexible Duct Testing	Thermaflex	1/1/12-6/30/12	7,000	7,000
	Lightweight Insulating Concrete Strength Testing	R&D Services, Inc.	12/10/12-12/21/12	1,200	1,200
	Traffic Signal Timing Concepts Course Development	Iteris	7/1/12-8/15/12	2,900	1,681
	SUB - TOTAL			11,175	9,956
	POWER-TEST-SERVICE ACCOUNT				

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2012 and June 30, 2013**

MISCELLANEOUS

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
539513	Enabling Families, Infants, and Toddlers through Technology: Merging EIME Project (School Age) (Year 1 of 3)	State Department of Education -- Division of Special Education	7/1/12-6/30/13	7,000	6,649
539514	Enabling Families, Infants, and Toddlers through Technology: Merging EIME Project (Preschool) (Year 1 of 3)	State Department of Education -- Division of Special Education	7/1/12-6/30/13	7,000	6,600
531258	Enhancing the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences: Phase II (Year 3 of 3)	National Science Foundation	9/15/12-8/31/13 (Extended to 8/31/14)	133,658	212,978
229342	TTU Research Indirect Costs	TTU	7/1/12-6/30/13	100	100
229660	CESR Indirect Costs Faculty Resarch Funds	TTU	7/1/12-6/30/13	1,020	1,140
SUB - TOTAL MISCELLANEOUS				148,778	227,467
TOTAL CONTRACTS AND GRANTS: 2012 - 2013				742,296	653,060

**STATUS OF PROPOSALS
Submitted Between July 1, 2012 and June 30, 2013**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
1.	Multi-scale Mechanistic Study of Cellulose Pyrolysis	Dr. Joseph Biernacki	TNSCORE	39,297	Unfunded
2.	REU Site: Innovative Methods for Biosignal Acquisition, Processing and Analysis	Dr. Ahmed Kamal	National Science Foundation	453,179	Pending
3.	More Electric Integrated Power Systems with Multiphase Motors and Generators	Dr. Joseph Ojo	Office of Naval Research	508,327	Funded; to be activated in 2013-2014
4.	Formal Verification of Algorithms for Distribution Management Systems Smart Grids	Dr. Syed R. Hasan	The National Academies, Pakistan-U.S. Science and Technology Cooperation Program	242,650	Unfunded
SUBTOTAL, PROPOSALS FOR 2012-2013				1,243,453	

**STATUS OF PROPOSALS
Submitted Between July 1, 2012 and June 30, 2013**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
5.	Improving Infrastructure Resilience and Risk Management of Dam-Reliant Large Cities in the 21st Century under Changing Patterns of Extreme Weather	Dr. Faisal Hossain, Dr. Alfred Kalyanapu	National Science Foundation	503,293	Pending
6.	Determining Concrete Chloride Permeability Rapidly and Effectively	Dr. L. K. Crouch, Dr. Daniel Badoe, Dr. Benjamin Mohr	Tennessee Department of Transportation	230,000	To be funded in 2013-2014 at \$240,000
7.	Expanding the Informational Catalog of TDOT Low Permeability Bridge Deck Mixtures	Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe	Tennessee Department of Transportation	125,000	Funded
8.	Supplementary Fund Request to NASA for NNXAR32G	Dr. Faisal Hossain	National Aeronautics and Space Administration	12,399	Funded
SUBTOTAL, PROPOSALS FOR 2012-2013				870,692	

**STATUS OF PROPOSALS
Submitted Between July 1, 2012 and June 30, 2013**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
9.	The Future of Our Cities and Ageing Dams: Using NASA Satellites to Understand Changing Patterns of Infrastructure Safety for Resource-Hungry U.S. Cities	Dr. Faisal Hossain	National Aeronautics and Space Administration	27,600	Pending
10.	Altimetry River Height Data Extraction Toolbox; Applications support for Jason-2 and SWOT (Supplemental Request to NASA NN13AD97G)	Dr. Faisal Hossain	National Aeronautics and Space Administration	41,301	Pending
11.	MRI: Development of a Large Scale Smart Grid Laboratory Testbed	Dr. Rabie Belkacemi, Dr. Robert Qiu, Dr. Joseph Ojo, Dr. Ali Alouani, Dr. Ghadir Radman, Dr. Omar Elkeelany, Dr. Ambareen Siraj, Dr. Syed Hasan, Dr. Satish Mahajan, Mr. Robert Craven	National Science Foundation	717,119	Unfunded
SUBTOTAL, PROPOSALS FOR 2012-2013				786,020	

**STATUS OF PROPOSALS
Submitted Between July 1, 2012 and June 30, 2013**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
12.	Development of Tennessee Travel Demand Model Users' Group	Dr. Daniel Badoe	TDOT	53,000	Funded
13.	Biaxial Material Model of Semi-Brittle Polymers	Dr. Jane Liu, Dr. John Peddieson	United Launch Alliance	20,000	Pending
14.	Developing Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts in Tennessee (Phase II)	Dr. X. Sharon Huo	TDOT	135,000	To be funded in 2013-2014
SUBTOTAL, PROPOSALS FOR 2012-2013				208,000	
TOTAL, PROPOSALS FOR 2012-2013				3,108,165	

ALOUANI, ALI

A.T. Alouani, "Integrated Monitoring and Control in Smart Grid", 2012 Future of Instrumentation International Workshop, Gatlinburg, TN, October 2012.

A.M. Najafabadi and A.T. Alouani, "Real Time Estimation of Sensitive Parameters of Composite Power System Load Model," 2012 IEEE Power and Energy Society (PES), San Diego, CA, July 2012.

BIERNACKI, JOSEPH

O. Chaudhari and J. J. Biernacki, *Leaching Behavior of Hazardous Heavy Metals from Lime Fly Ash Cements*, J. Env. Eng., (in press: posted ahead of print 2 Aug. 2012).

D. M. Kirby and J. J. Biernacki, *The Effect of Water-to-Cement Ratio on the Hydration Kinetics of Tricalcium Silicate Cements: Testing the Two-step Hydration Hypothesis*, Cem. Concr. Res., 42(8), 1147-1156 (2012).

T. Xie, and J. J. Biernacki, *Growth of Calcium Hydroxide Islands in Tricalcium Silicate-based Cements at Early Age*, J. Am. Cer. Soc, 95(9), 2808-2819 (2012).

CANFIELD, STEPHEN

Stacy, J and S. L. Canfield, "Theoretical and Empirical Validation of a Mobile Robotic Welding Platform," In final review, *Welding Journal*, January, 2012.

Canfield, S. L., Ghafoor, S., and M. A. Abdelrahman, "Enhancing the Programming Experience for First-Year Engineering Students through Hands-on Integrated Computer Experiences," in final review to *Journal of Stem Education*, January 2012.

CLICK, STEVEN

"Applicability of Bluetooth Data Collection Methods for Collecting Traffic Operations Data on Rural Freeways" *Transportation Research Record: The Journal of the Transportation Research Board*, under review.

CROUCH, L.K.

Crouch, L. K., Dillon, Sarah., and Knight, Marcus L., "Tennessee Lime-Fly Ash-Stabilized Base Using a High Loss-on-Ignition Fly Ash," *Lime: Building on the 100-Year Legacy of The ASTM Committee C07, ASTM STP 1557*, Margaret L. Thomson, and Joseph H. Brisch, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2012, pp. 60-75.

Crouch, L. K., Hendrix, J. P., Sparkman, Alan and Badoe, Daniel, "Variability of Fresh and Hardened Voids of Pervious Concrete," *Pervious Concrete, ASTM STP 1551*, Heather J. Brown and Matthew Offenberg, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2012, pp. 52-68.

Crouch, L. K. and Brown, H. J., "Evaluating Polish Resistance of Tennessee Bituminous Surface Aggregates," *Pavement Performance: Trends, Advances, and Challenges, ASTM STP 1555*, Bouzid Choubane, Ed., American Society for Testing and Materials, West Conshohocken, PA, 2012, pp. 1-19.

Crouch, L. K., Browning, G. Allen, II, Sparkman, Alan and Dillon, Sarah, "Green²: High Volume Slag Substitution in Pervious Concrete," *2012 International Concrete Sustainability Conference (NRMCA)*, May 7-10, 2012, Seattle, Washington, USA.

Dillon, Sarah, Crouch, L. K., and Knight, Marcus, "Tennessee Stabilized Base Using Substandard Fly Ash and Byproduct Limestone Screenings", Transportation Research Board 92nd Annual Meeting Compendium of Papers DVD, January 2013.

"TCA Pervious Concrete Mixture Design and Adjustment Method Based on ASTM C 1688", L. K. Crouch, Martin L. Medley, John Hendrix and Alan Sparkman, *Tennessee Concrete*, Vol. 26, No. 6, Fall 2012.

"LGM PCC Update", L. K. Crouch, Samantha Pittman, and Daniel Badoe, *Tennessee Concrete*, Vol. 26, No. 3, Winter 2012/13.

CUI, JIE

Devendra, D., Cui, J. and Idem, S., "CFD Studies of Developing Turbulent Flows with Various Entrance Conditions," International Journal of Heating Ventilating Air Conditioning and Refrigerating Research, in press, 2012

ELKEELANY, OMAR

Rami Amiri and Omar Elkeelany, "A Reconfigurable Hardware Networking Platform for Smart Grid", (in proceedings of the IEEE Southeast Conference 2012, SECON'12, Florida, 2012).

Rami Amiri and Omar Elkeelany, "An Embedded TCP/IP Hard Core for Smart Grid Information and Communication Networks," In Proceedings of the IEEE Southeast Symposium on system Theory SSST'12, Florida, 2012.

GHAFOOR, SHEIKH

Sheikh Ghafoor, Stephen Canfield, John Hale, "Providing Multiple Context in Introductory Programming Class" , submitted to The 44th ACM Technical Symposium on Computer Science Education (SIGCSE 2013). The paper was rejected. I am reworking the paper currently to submit to a Journal of Engineering Education

Mike Rogers, Sheikh Ghafoor, Brett Harper, "Towards Document Composition Framework", in *Proceedings of The 2012 International Conference on Internet Computing (ICOMP12)* as part of *The 2012 World Congress in Computer Science, Computer Engineering, and Applied Computing (WORLDCOMP'12)*, July 16-19, Las Vegas, Nevada, 2012.

Stephen Canfield, Sheikh Ghafoor, and Mohamed Abdelrahman, "Enhancing the Programming Experience for First-Year Engineering Students through Hands-On Integrated Computer Experiences", *Journal of STEM Education: Innovations and Research*. Volume 13, Issue 4, July-September, 2012.

IDEM, STEPHEN

Silaipillayarputhur, K. and Idem, S., 2012, "Step Response of a Single-Pass Crossflow Heat Exchanger with Variable Inlet Temperatures and Mass Flow Rates," *Journal of Thermal Science and Engineering Applications*, In Press.

Silaipillayarputhur, K. and Idem, S., 2012, "A General Matrix Approach to Model Steady State Performance of Crossflow Heat Exchangers," *Heat Transfer Engineering*, In Press.

Idem, S., and D. C. Gibbs, "Measurements of Flat Oval Diverging Flow Fitting Loss Coefficients", *ASHRAE Transactions*, in Press, 2012.

Idem, S., and A. N. Nalla, "Laboratory Testing of Saddle Tap Tees to Determine Loss Coefficients", *ASHRAE Transactions*, in Press, 2012.

Idem, S., D. Kulkarni, D. Nalla, and K. Gebke, "Laboratory Testing of a Fabric Air Dispersion System", *ASHRAE Transactions*, in Press, 2012.

MAHAJAN, SATISH M.

Mahajan, S.M., Panmand, R.P., Kumar, G., Shroff, N., Kale, B.B. and Gosavi, Suresh W., "Growth of the Bi₂Te₃ quantum dots / rods in glass: A unique highly stable nanosystem with its novel functionality for high performance magneto optical devices:", **Phys. Chem. Chem. Phys.**, **2012**, **14**, 16236-16242; DOI: 10.1039/C2CP43169F.

Mahajan, S.M., Kumar, G., Stretz, H., and Apte, S., "Tuning the magneto-optic response of maghemite doped poly phenyl methyl vinyl siloxane through electric field based nanoparticle orientation", **Optical Materials Express**, Vol. 2, Issue 6, pp. 864-871 (2012), <http://dx.doi.org/10.1364/OME.2.000864>.

Mahajan, S.M., Chukwu, U. "Economic Justification for a V2G Facility in a Radial Distribution Network", *International Journal of Emerging Electric Power Systems (IJEPS)*, Volume 13, Issue 3, Pages -, ISSN (Online) 1553-779X, DOI: [10.1515/1553-779X.2990](https://doi.org/10.1515/1553-779X.2990), August 2012.

MAHAJAN, SATISH M. (CONTINUED)

Mahajan, S.M., Uzoechi, L., "Economic Justification for a V2G Facility in a Radial Distribution Network", *International Journal of Emerging Electric Power Systems (IJEPS)*, Volume 13, Issue 3, Pages -, ISSN (Online) 1553-779X, DOI: [10.1515/1553-779X.2990](https://doi.org/10.1515/1553-779X.2990), August 2012.

Kumar, G., Mahajan, S. M., Stretz, H. A., "Tuning the magneto-optic response of maghemite doped poly phenyl methyl vinyl siloxane through electric field based nanoparticle orientation," *Optical Materials Express*, 2 (2012) 864.

OJO, JOSEPH O.

Olorunfemi Ojo and Hossein Karimi-Davijani, "Controllability Analysis of Interior Permanent Magnet Wind Turbine Generator Connected to the Grid," pp. 2198-2203, IEEE-Industrial Electronics Annual Conference, October 2012, Montreal, Canada.

Sosthenes Karugaba, Annette Muetze and Olorunfemi Ojo, "On the Common Mode Voltage in Multilevel Multiphase Single and Double-Ended Diode Clamped Voltage Source Inverter Systems," *IEEE Trans. on Industry Applications*, pp. 2079-2091, November/December 2012.

Sosthenes Karugaba and Olorunfemi Ojo, "A method for Five-Phase Carrier Based PWM Modulation for Balanced and Unbalanced Reference Voltages." *IEEE Trans. on Industry Applications*, pp. 2102-2109, November/December 2012.

Grain Adam, Stephen Finney, Olorunfemi Ojo and Barry Williams, "Quasi Two-Level and Three-Level Operation of a Diode-Clamped Multi-Level Inverter Using Space vector Modulation," *IET Proceedings on Power Electronics*, Vol. 5, No. 5, pp. 542-551, 2012.

Ranjan Behara, Shyama Das and Olorunfemi Ojo, "A Utility TLNPC Converter Fed High Performance Induction Motor Drive," *IET Proceedings on Power Electronics*, Vol. 5, No. 7, pp 1196-103, 2012.

PEDDIESON, JOHN

"Small Oscillations of a Rotating Inextensible String with End Masses," with K. Kala, *Acta Mechanica*, DOI 10.1007/s00707-011-0595-7, 2012.

"Modeling of Wrinkling of Thin Circular Sheets," with N. Jillella, *International Journal of Non-Linear Mechanics*, 47, pp. 85-91, 2012.

RADMAN, GHADIR

A. Jamehbozorg and G. Radman, "Dynamic Studies of Multi-Machine Power Systems Integrated with Large Photovoltaic Power Plants," *IEEE PES General Meeting 2012 Conference and Exhibition*.

G. Radman, M.A. Tabrizi, "Calculation of Dynamic Frequency Measured by PMUs/FDRs during Simulation Phase," in *Proc. International Journal of Emerging Electric Power Systems*, Vol. 13, No. 5, ISSN (Online) 1553-779X.

Lazarus O. Uzoechi, Satish M. Mahajan, and Ghadir Radman, "Transient Stability Constrained Line-Flow-Based Optimal Power Flow Analysis", *International Journal of Emerging Electric Power Systems*, Manuscript 119.

BIERNACKI, JOSEPH

J. J. Biernacki, J. W. Bullard, D. Constantiner, M. Juenger, J. H. Cheung, W. Hansen, R. D. Hooton, A. Luttge, and J. Thomas, *Paving the Way for a More Sustainable Concrete Infrastructure – A Vision for the Development of a Comprehensive Description of Cement Hydration Dynamics*, National Institute of Standards and Technology (NIST), in press.

Alouani, Ali T.

Member:

IEEE Control Systems Society
Optical Engineering

Editor for:

Hindawi Journal of Engineering

Reviewer

IEEE Transactions on Circuits and Systems

Badoe, Daniel A.

Member:

Assoc. Member, American Society of Civil Engineers
Institution of Transportation Engineers
Southeastern Division of the Institute of Transportation Engineers
Judge, American Council of Engineering Companies of Tennessee Engineering Excellence Awards
Editorial Board Member, ASCE Journal of Urban Planning and Development

Belkacemi, Rabie

Reviewer:

IEEE Transaction on Smart Grid

Biernacki, Joseph

Member:

American Ceramic Society
American Institute of Chemical Engineers
American Concrete Institute
American Society for Engineering Education
Tennessee Academy of Sciences
Sigma Xi

Honors/Awards:

2012 Leighton E. Sissom Innovation and Creativity Award
University Distinguished Faculty Fellow (2011-2013)

Canfield, Steve

Member:

American Society of Mechanical Engineering (ASME)
American Society of Engineering Education (ASEE)
Sigma Xi
Phi Kappa Phi

Honors/Awards

Partners and Leadership Award, Tennessee Department of Health, 2011

Click, Steven

Member:

Transportation Research Board
Institute of Transportation Engineers
American Society for Engineering Education
Traffic Signal Systems Committee of the Transportation Research Board (2008-present)
Proctor, Fundamentals of Engineering Exam (2006-present)
Reviewer of Papers for the 85th Annual Meeting of the Transportation Research Board (2006-present)

Crouch, L.K.

Member:

American Concrete Institute International
American Society for Testing and Materials
Member, Committee D-04 on Road and Paving Materials
Member, Committee C-09 on Concrete and Aggregates

Cui, Jie

Member:

American Society of Mechanical Engineers (ASME)

Elkeelany, Omar

Member:

American Society of Engineering Education (ASEE)

Reviewer:

Transactions on Emerging Telecommunications Technologies
International Journal of Adaptive Control and Signal Processing
IEEE Transactions on Instrumentation and Measurement

Conference Committee:

ASEE-SE (2013) Site and Planning Committee
IEEE SSST (2012, 2013) Technical Committee
International Conference on Electronics, Communication & Computer Science (ECCS 2012) Technical Committee

EISawy, Ahmed

Member:

Sigma Xi, Scientific Research Society, Full Member.
American Society for Manufacturing Engineer
American Welding Society
American Society of Engineering Education
American Association of Industrial Technology

Fidan, Ismail

Member:

National Coalition of Advanced Technology Centers (NCATC)
Tennessee Academy of Science (TAS)
Society of Manufacturing Engineers (SME)
Institute of Electrical and Electronics Engineers (IEEE)
American Society of Mechanical Engineers (ASME)
American Society for Engineering Education (ASEE)

Huo, Xiaoming (Sharon)

Member:

American Society of Civil Engineers (ASCE)
American Concrete Institute (ACI)
American Society for Engineering Education (ASEE)
Precast/Pre-stressed Concrete Institute (PCI)

Idem, Stephen A.

Member:

American Society of Engineering Education (ASEE)
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Kamal, Ahmed

Member:

American Medical Physics Society
American Biomedical Science Instrumentation
Institute of Electrical & Electronic Engineers (IEEE)
Institute of IEE, England

Le Borne, Sabine

Reviewer:

Scientific Journals (Computing, SIAM J. Sci. Comp.
SIAM Journal Mat. Anal.
Journal Math

Served on NSF Panels

Liu, Y. Jane

Member:

Associate Member, American Society of Civil Engineers (ASCE)
American Society of Mechanical Engineers (ASME)
United States Association for Computational Mechanics (USACM)

Mahajan, Satish

Reviewer:

IEEE Transactions on Power Delivery
IEEE transactions on Dielectrics and Electrical Insulation

Technical Committee Chair for:

International Conference on Clean Electric Power (ICCEP), 2013 Italy

Conference Committee for:

Served as Panelist during 2012 IEEE International Electric Vehicle Conference (IEVC) Greenville, SC, March 2012

Mohr, Benjamin

Member:

American Concrete Institute (ACI)
Voting Member, ACI Committee 231, Properties of Concrete at Early Ages, 2006–
Voting Member, ACI Committee 236, Materials Science of Concrete, 2005–
Associate Member, ACI Committee 308, Curing Concrete, 2007–
Associate Member, ACI Committee 213, Lightweight Aggregate and Concrete, 2010–
RILEM (International Union of Laboratories & Experts in Construction Materials, Systems & Structures)
American Ceramic Society, Cements Division (ACerS)
American Society of Civil Engineers (ASCE)
Faculty advisor for TTU Chapter of American Society of Civil Engineers (ASCE) 2006–

Ojo, Joseph O.

Fellow

Academy of Engineering, Lagos, Nigeria - 2013
Institute of Electrical and Electronics Engineers (IEEE)
Fellow, Institute of Electrical Engineers (IEE), (UK)

Member:

IEEE Static Power Conversion Committee
IEEE Industrial Drive Committee
IEEE Electric Machine Committee
Associate Editor, Transactions on Power Electronics
Board Member, IEEE-Industry Applications Society (IAS)
Chair of the Industry Drive Committee of the IEEE Industry Applications Society (IAS) for the Industrial Power Converter System Department

Peddieson, John

Member:

Sigma Xi
Phi Kappa Phi
Society of Engineering Science
American Academy of Mechanics
American Filtration and Separation Society

Radman, Ghadir

Member:

Institute of Electrical and Electronics Engineers (IEEE) Power Engineering Society (PES)

Reviewer:

Electric Power Systems Research, IEEE Power & Energy Society General Meeting
International Journal of Emerging Electric Power Systems, IEEE Southeastcon 2012.

Rajan, P.K.

Fellow:

Institute of Electrical and Electronics Engineers (IEEE)
Chair, IEEE Education Society, Tennessee Chapter

Siraj, Ambareen

Working Group Member, National Cybersecurity Sports Federation

VISITORS

SM-7

Tony Richman	Nashville Electric Service	December 11, 2012
Landon Roeder	Nashville Electric Service (Meeting with Dr. Rajan and Smart Grid Group)	December 11, 2012
Deryl K. Gentry	Tennessee Department of Education (EIME Project Meeting)	March 20, 2013
Jonathan McCallie	Chroma (Regional Sales Manager) (Meeting with Robert Craven, Joseph Ojo, Rabie Belkacemi)	June 13, 2013
Tapan Manna	Sr. Electrical Engineer, Transmission & Distribution Burns & McDonnell, Overland Park, KS	November 15 and 16, 2012

MANNA, TAPAN

Dr. Tapan K. Manna, P.E., a former CESR student, presented a seminar Thursday November 15, 2012 at 3:00 p.m. in Brown Hall 208 entitled Field Testing of Oil Filled Transformers. This correlates well to CESR smart grid research in that Dr. Mahajan has been developing smart sensors to provide effective age of transformers. He also presented a second seminar on Friday November 16, 2012 at 3:00 p.m. in Brown Hall 208 entitled HVDC Growth in US Transmission Networks. It is of note that under a recent DOE project, power line sag instrumentation developed at TTU was tested at the ORNL HVDC field test site.

GRADUATE THESIS/DISSERTATIONS**MASTERS****SRINATH BALASUBRAMANIAN**

Magnetization Studies of Embedded and Coated Thin Films Using Magneto-Optic Kerr Effect
December 2012 Advisor: Dr. Satish Mahajan Electrical and Computer Engineering

MICHAEL BEDNARCYK

A Comparison of Load Factor Rating (LFR) and Load and Resistance Factor Rating (LRFR) in Reinforced Concrete Box and Slab Culverts
August 2012 Advisor: Dr. X. Sharon Huo Civil Engineering

JOHN C. DEATON

Monitoring the Quality of Insulation During Aging of Distribution Transformers
December 2012 Dr. Satish Mahajan Electrical and Computer Engineering

ROLAND DECICCO

Structural Damage Localization Using Lamb Wave Signals Filtered with Gabor Functions
May 2013 Dr. Christopher Wilson Mechanical Engineering

AMRIT GAUTAM

Modeling, Analysis and Performance of Variable Speed Nine Phase Electric Drives
December 2012 Dr. Joseph Ojo Electrical and Computer Engineering

RICHA V. GOKHALE

A Real Time Wind Turbine Emulator
December 2012 Dr. Satish Mahajan Electrical and Computer Engineering

DAVID N. HALBROOKS

CFD Simulation of Turbulent Airflow Around Wind Turbine Airfoils
August 2012 Dr. Jie Cui Mechanical Engineering

RABAB T. HASSAN

Voluntary Under-Frequency Load Shedding at Consumer Level
December 2012 Dr. Ghadir Radman Electrical and Computer Engineering

TRISTAN HILL

Development and Experimental Validation of the Kinematic and Dynamic Modeling of a Tracked Skid Steer Mobile Robot
May 2013 Dr. Stephen Canfield Mechanical Engineering

TYLER HUGHES

Scale Model Testing of JEA Northside Units 1 and 2 Primary Air Distribution System and Windbox
May 2013 Dr. Stephen Idem Mechanical Engineering

MD ISLAM

A Software Toolkit for Programming MCU in MATLAB
May 2013 Dr. Sheikh Ghafoor Computer Science

CALEB JONES

Developing Rating Aids for the Evaluation of Concrete Culverts in Tennessee
May 2013 Dr. X. Sharon Huo Civil and Environmental Engineering

DANIEL G. KEATON

Nano-Scale Pore Analysis of Cementitious Mortars Undergoing Delayed Ettringite Formation
August 2012 Dr. Benjamin Mohr Civil and Environmental Engineering

GRADUATE THESIS/DISSERTATIONS**MASTERS****KAYLA KELLY**

Trip Generation, Telecommuting and Their Interrelationship
May 2013 Dr. Daniel Badoe Civil and Environmental Engineering

LAKSHMI KOLLURU

Determination of Power System Component Parameters using Non-Linear Dead Beat Estimation Method
August 2012 Dr. Ghadir Radman Electrical and Computer Engineering

KEHELWALA MADURANGA

Representations and Characters of Salingaros' Vee Groups
May 2013 Dr. Rafal Ablamowicz Mathematics

AMIN MAHDIEH NAJAFABADI

Real-Time Identification of Composite Load Model Using Multiple Model Approach
December 2012 Dr. Ali Alouani Electrical and Computer Engineering

BENJAMIN P. ROSE

Monitoring Transformer Oil Insulation Using Optical Absorption Properties
December 2012 Dr. Satish Mahajan Electrical and Computer Engineering

SULAYMAN USMAN

Wide Area Voltage Monitoring, State Estimation and Control of Power Systems with Embedded Facts
Devices using PMU Measurements
August 2012 Dr. Ali Alouani Electrical and Computer Engine

SAMUEL WANJOEH

Simulation of PMU/FDR Measurements Using Newton Raphson Method
May 2013 Dr. Ghadir Radman Electrical and Computer Engineering

GRADUATE THESIS/DISSERTATIONS**PhD****ADITYA JAYANTHI**

Discrete Population Balance Mixture Multiphase Model Solutions for Fragmenting Flows
May 2013 Dr. John Peddieson and Dr. Jie Cui Mechanical Engineering

HOSSEIN KARIMI-DAVIJANI

Analysis and Control of a Microgrid With Converter Fed Distributed Energy Sources
December 2012 Dr. Joseph Ojo Electrical and Computer Engineering

SOSTHENES F. KARUGABA

Speed Sensorless Control and Optimization of Double-End Converter Fed Five-Phase Induction Motor Drive
December 2012 Dr. Joseph Ojo Electrical and Computer Engineering

JUSTIN P. STACY

Towards Autonomous Mobile Robotic Welding: Theoretical Development and Empirical Validation
December 2012 Dr. Stephen Canfield Mechanical Engineering

GANG ZHENG

Power System Disturbance Detection and Classification Based on Wide Area Phasor Measurements
December 2012 Dr. Ghadir Radman Electrical and Computer Engineering

Name	Dept.	MS STUDENTS Source of Support	Graduation Date	Advisor
Angirekula, Bhanu Naga	ECE	CESR	Summer 2013 (exp.)	Dr. Ojo
Anagal, Viraj	ECE	CESR, ECE	Spring 2014 (exp.)	Dr. Belkacemi
Babalola, Adeniyi	ECE	CESR	Spring 2014 (exp.)	Dr. Belkacemi
Bule, Mehari	ECE	CESR	Unknown	Dr. Ojo
France-Mensah, Jojo	CEE	NSF (Ettringite)	Spring 2014 (exp.)	Dr. Mohr
Gaw, Derek	CEE	CESR, CEE	Fall 2013 (exp.)	Dr. Liu
Hale, John	CSC	NSF (Integrated Computer Experiences)	Fall 2013 (exp.)	Dr. Ghafoor
Hawkins, Sarah	CEE	CESR	Summer 2013 (exp.)	Dr. Liu
Hughes, Tyler	ME	CESR	Spring 2013	Dr. Idem
Islam, MD	CSC	NSF (Integrated Computer Experiences), CSC	Spring 2013	Dr. Ghafoor
Jones, Caleb	CEE	TDOT (Culverts)	Spring 2013	Dr. Huo
Katko, Chris	ME	NSF (Integrated Computer Experiences)	Spring 2015 (exp.)	Dr. Canfield
Maduranga, Kehelwala	MATH	NSF (Saddle Point Problems)	Spring 2013	Dr. Ablamowicz
Paulson, Shane	CEE	CESR, CEE	Fall 2013 (exp.)	Dr. Liu
Rameriz, Alfredo	MATH	NSF (Saddle Point Problems)	Fall 2013 (exp.)	Dr. Smith
Reddy, Maruthi	ME	CESR, ME	Spring 2014 (exp.)	Dr. Peddieson
Rogers, Christopher Lee	CEE	TDOT (DLP)	Spring 2014 (exp.)	Dr. Crouch
Thompson, Jared	CEE	NSF (Ettringite)	Summer 2013 (exp.)	Dr. Mohr
Wanjoe, Samuel	ECE	CESR, ECE	Spring 2013	Dr. Radman

Name	Dept.	PHD STUDENTS Source of Support	Graduation Date	Advisor
Chaudhari, Ojas	CHE	CESR	Fall 2015 (exp.)	Dr. Biernacki
Crowley, Aaron	CEE	CESR, TDOT (SLH)	Spring 2015 (exp.)	Dr. Crouch
Dillon, Sarah	CEE	CESR, CEE	Spring 2015 (exp.)	Dr. Crouch
Ford, Vitaly	CSC	CESR, CSC	Fall 2015 (exp.)	Dr. Siraj
Jamehbozorg, Arash	ECE	CESR	Summer 2013 (exp.)	Dr. Radman
Karimi-Davijani, Hossein	ECE	CESR, ECE	Fall 2012 (exp.)	Dr. Ojo
Khayamy, Mehdy	ECE	CESR	Spring 2015 (exp.)	Dr. Ojo
Ramezani, Mehdi	ECE	CESR, ECE	Summer 2015 (exp.)	Dr. Ojo

CEE Civil and Environmental Engineering (Tennessee Technological University)

CESR Center for Energy Systems Research (Tennessee Technological University)

ChE Chemical Engineering (Tennessee Technological University)

CSC Computer Science (Tennessee Technological University)

DLP Class D Lower Permeability

ECE Electrical and Computer Engineering (Tennessee Technological University)

ME Mechanical Engineering (Tennessee Technological University)

NSF National Science Foundation

SLH Class S Lower Heat

TDOT Tennessee Department of Transportation

ACTUAL, PROPOSED, AND REQUESTED BUDGET

SCHEDULE 7

**CENTERS OF EXCELLENCE/CENTERS OF EMPHASIS
ACTUAL, PROPOSED, AND REQUESTED BUDGET**

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

	FY 2012-13 Actual			FY 2013-14 Proposed			FY 2014-15 Requested		
	Matching	Appopr.	Total	Matching	Appopr.	Total	Matching	Appopr.	Total
Expenditures	517,005	669,719	1,186,724	828,480	1,656,960	2,485,440	451,705	903,410	1,355,115
Salaries									
Faculty	173,109	21,615	194,724	125,466	230,975	356,441	55,694	159,560	215,254
Other Professional	16,139	169,937	186,076	9,495	287,547	297,042	49,150	145,111	194,261
Clerical/Supporting	2,159	72,788	74,947	6,677	157,901	164,578	800	135,158	135,958
Assistantships	123,591	154,541	278,132	159,836	249,761	409,597	61,500	125,000	186,500
Total Salaries	314,998	418,881	733,879	301,474	926,184	1,227,658	167,144	564,829	731,973
Fringe Benefits	113,141	180,629	293,770	113,627	433,105	546,732	57,195	272,671	329,866
Total Personnel	428,139	599,510	1,027,649	415,101	1,359,289	1,774,390	224,339	837,500	1,061,839
Non-Personnel									
Travel	16,785	12,286	29,071	30,460	47,000	77,460	21,422	20,910	42,332
Software	0	10,554	10,554	1,000	0	1,000		1,000	1,000
Books & Journals	0	164	164	300	0	300		200	200
Other Supplies	32,979	43,268	76,247	55,796	88,721	144,517	159,801	38,300	198,101
Equipment	0	0	0	107,080	160,000	267,080	0	5,000	5,000
Maintenance	3,000	429	3,429	0		0		500	500
Scholarships	0	0	0	0		0			0
Consultants	36,102	1,174	37,276	218,743	1,950	220,693	46,143		46,143
Renovation	0	0	0	0		0			0
Other (Advertising)	0	2,334	2,334	0		0			0
			0			0			0
			0			0			0
			0			0			0
Total Non-Personnel	88,866	70,209	159,075	413,379	297,671	711,050	227,366	65,910	293,276
GRAND TOTAL	517,005	669,719	1,186,724	828,480	1,656,960	2,485,440	451,705	903,410	1,355,115
Revenue									
New State Appropriation	0	880,700	880,700	0	877,100	877,100		903,410	903,410
Carryover State Appropriation		568,879	568,879	0	779,860	779,860			0
New Matching Funds Carryover from Previous Matching	622,495		622,495	438,550		438,550	451,705		451,705
	284,440		284,440	389,930	0	389,930			0
Total Revenue	906,935	1,449,579	2,356,514	828,480	1,656,960	2,485,440	451,705	903,410	1,355,115

SCHEDULE 13A

ACTUAL PERSONNEL

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
ACTUAL, 2012-2013**

Tennessee Technological University Center for Energy Systems Research June 30, 2013

a1. Faculty whose actual center effort was at least 25% of full effort.

Name and Faculty Rank	Department Affiliation	Center Effort in %
Rabie Belkacemi, Assistant Professor	Electrical and Computer Engineering	40
Steve Canfield, Professor	Mechanical Engineering	30
L. K. Crouch, Professor	Civil and Environmental Engineering	45
Sheikh Ghafoor, Associate Professor	Computer Science	25
Stephen Idem, Professor	Mechanical Engineering	35
Y. Jane Liu, Professor	Civil and Environmental Engineering	30
Satish Mahajan, Professor	Electrical and Computer Engineering	25
Benjamin Mohr, Associate Professor	Civil and Environmental Engineering	40
Joseph Ojo, Professor	Electrical and Computer Engineering	40
Ghadir Radman, Professor	Electrical and Computer Engineering	25
Ambareen Siraj, Associate Professor	Computer Science	25

*NOTE 1: Center faculty members. **Number 11 FTE 3.60**

a2. Faculty whose actual center effort was less than 25% and all other personnel categories.

	Number	FTE
a. Faculty	13	17.20
b. Other Professionals	3	2.33
c. Clerical/Supporting	3	2.07
d. Assistantships	27	17.86
e. Hourly Students	36	2.40
TOTAL, all categories	93	45.46

SCHEDULE 13B

PROPOSED PERSONNEL

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
PROPOSED, 2013-2014**

Tennessee Technological University

Center for Energy Systems Research

June 30, 2013

a1. Faculty whose actual center effort will be at least 25% of full effort.

Name and Faculty Rank	Department Affiliation	Center Effort in %
Rabie Belkacemi, Assistant Professor	Electrical and Computer Engineering	40
Indranil Bhattacharya, Asst. Professor	Electrical and Computer Engineering	40
Steve Canfield, Professor	Mechanical Engineering	30
L. K. Crouch, Professor	Civil and Environmental Engineering	45
Sheikh Ghafoor, Associate Professor	Computer Science	25
Y. Jane Liu, Professor	Civil and Environmental Engineering	30
Satish Mahajan, Professor	Electrical and Computer Engineering	25
Benjamin Mohr, Associate Professor	Civil and Environmental Engineering	40
Joseph Ojo, Professor	Electrical and Computer Engineering	40
John Peddieson, Professor	Mechanical Engineering	25
Ghadir Radman, Professor	Electrical and Computer Engineering	25
Ambareen Siraj, Associate Professor	Computer Science	25
Matthew Yarnold, Assistant Professor	Civil and Environmental Engineering	40

*NOTE 1: Center faculty members.

Number 13 FTE 4.30

a2. Faculty whose actual center effort will be less than 25% and all other personnel categories.

	Number	FTE
a. Faculty	12	1.37
b. Other Professionals	4	3.00
c. Clerical/Supporting	3	3.00
d. Assistantships	23	19.70
e. Hourly Students	40	3.00
TOTAL, all categories	95	34.37

SCHEDULE 13C

REQUESTED PERSONNEL

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
REQUESTED, 2014-2015**

Tennessee Technological University Center for Energy Systems Research June 30, 2013

a1. Faculty whose actual center effort will be at least 25% of full effort.

Name and Faculty Rank	Department Affiliation	Center Effort in %
Rabie Belkacemi, Assistant Professor	Electrical and Computer Engineering	40
Indranil Bhattacharya, Asst. Professor	Electrical and Computer Engineering	40
Steve Canfield, Professor	Mechanical Engineering	25
L. K. Crouch, Professor	Civil and Environmental Engineering	40
Sheikh Ghafoor, Associate Professor	Computer Science	25
Y. Jane Liu, Professor	Civil and Environmental Engineering	30
Satish Mahajan, Professor	Electrical and Computer Engineering	30
Benjamin Mohr, Associate Professor	Civil and Environmental Engineering	40
Joseph Ojo, Professor	Electrical and Computer Engineering	40
John Peddieson, Professor	Mechanical Engineering	30
Ghadir Radman, Professor	Electrical and Computer Engineering	25
Ambareen Siraj, Associate Professor	Computer Science	25
Matthew Yarnold, Assistant Professor	Civil and Environmental Engineering	40

*NOTE 1: Center faculty members. **Number 13 FTE 4.30**

a2. Faculty whose actual center effort will be less than 25% and all other personnel categories.

	Number	FTE
a. Faculty	12	1.37
b. Other Professionals	3	3.00
c. Clerical/Supporting	3	3.00
d. Assistantships	25	21.00
e. Hourly Students	50	3.50
TOTAL, all categories	106	36.17

SCHEDULE 14A

2011-2012 PURCHASED EQUIPMENT

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
PURCHASED EQUIPMENT, 2012-2013**

INSTITUTION: Tennessee Technological University
2013
CENTER OF EXCELLENCE: Energy Systems Research

DATE: June 30,

State Appropriations

Description	Number	Unit Cost	Total
Subtotal, State Appropriations			\$0.00

Matching

Description	Number	Unit Cost	Total
Subtotal, Matching			\$0.00
GRAND TOTAL			\$0.00

Grand Total
\$0.00

Matching
\$0.00

Appropriation
\$0.00

SCHEDULE 14B**PROPOSED EQUIPMENT**

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
PROPOSED EQUIPMENT, 2013-2014**

INSTITUTION: Tennessee Technological University
CENTER OF EXCELLENCE: Energy Systems Research

DATE: June 30, 2013

State Appropriations

Description	Number	Unit Cost	Total
Smart Grid Research Equipment	1	\$90,000	\$90,000
Resilient Infrastructure Equipment	1	\$70,000	\$70,000
Subtotal, State Appropriations			\$160,000

Matching

Description	Number	Unit Cost	Total
Power Systems Research Equipment	1	\$107,080	\$107,080
Subtotal, Matching			\$107,080
GRAND TOTAL			\$267,080

Grand Total	Matching	Appropriation
\$267,080	\$107,080	\$160,000

SCHEDULE 14C

REQUESTED EQUIPMENT

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
REQUESTED EQUIPMENT, 2014-2015**

**INSTITUTION: Tennessee Technological University
CENTER OF EXCELLENCE: Energy Systems Research**

DATE: June 30, 2013

State Appropriations

Description	Number	Unit Cost	Total
Research Laboratory Equipment	1	\$5,000	\$5,000
Subtotal, State Appropriations			\$5,000

Matching

Description	Number	Unit Cost	Total
Subtotal, Matching			0

GRAND TOTAL **\$5,000**

Grand Total	Matching	Appropriations
\$5,000	\$0	\$5,000

SCHEDULE 15A

BASE SUPPORT AND NON-EQUIPMENT MATCHING

ACTUAL 2012-2013		
		2012-2013
Budget Account Numbers		Actual Expenditures
2-10406, 2-10407, 2-10409, 2-10436, 2-10437, 2-10438, 2-10411, 2-10412, 2-10413, 2-10108, 2-10499, 2-10416, 2-10417, 2-10418, 2-10421, 2-10423, 2-10431, 2-10432, 2-10426, 2-10427, 2-10428, 2-10460, 2-45016, 2-29144		10,582,427
TOTAL BASE SUPPORT		10,582,427
Non-Equipment Matching		
Restricted Accounts		
(No equipment or indirect costs included)		
Account Number	Project Title and Sponsor	Amount
539281	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee--Federal, Year 2 (Tennessee Department of Transportation)	29,913
539282	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee--State, Year 2, (Tennessee Department of Transportation)	7,478
531216	Nanoscale Characterization of Expansion Due to Delayed Ettringite Formation, Year 3 (National Science Foundation)	81,376
539513	Enabling Families, Infants, and Toddlers Through Technology: Merging EIME Project (School Age), Year 1 (State Department of Education, Division of Special Education)	6,482
539514	Enabling Families, Infants, and Toddlers Through Technology: Merging EIME Project (Preschool Age), Year 1 (State Department of Education, Division of Special Education)	6,482
531652	CAREER: Wind Power -- Multi-Level Control, Intelligent Grid Integration and Real Time Digital Simulation, Year 4 (National Science Foundation)	80,000
539284	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (Federal), Year 2 (Tennessee Department of Transportation)	38,261
539285	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (State), Year 2 (Tennessee Department of Transportation)	9,565

SCHEDULE 15A

BASE SUPPORT AND NON-EQUIPMENT MATCHING

Non-Equipment Matching		
Unrestricted Matching		
(No equipment or indirect costs included)		
Account Number	Project Title and Sponsor	Amount
539286	Development of a TDOT Class S-Lower Heat Portland Cement Concrete (S-LH PCC) (Federal), Year 2 (Tennessee Department of Transportation)	45,217
539287	Development of a TDOT Class S-Lower Heat Portland Cement Concrete (S-LH PCC) (State), Year 2 (Tennessee Department of Transportation)	11,305
531258	Enhancing the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences: Phase II (National Science Foundation)	108,966
532333	Supplementary Fund Request to NASA for NNXAR32G, National Aeronautics and Space Administration (NASA)	10,782
532349	Improving the Accuracy and Reliability of Space-Borne Discharge Estimation from SWOT for Low-Lying Humid Tropical Regions of the World, Year 1, (National Aeronautics and Space Administration)	52,634
539288	Expanding the Informational Catalog of TDOT Low Permeability Bridge Deck Mixtures--Federal, Year 1 (Tennessee Department of Transportation)	90,434
539289	Expanding the Informational Catalog of TDOT Low Permeability Bridge Deck Mixtures--State, Year 1 (Tennessee Department of Transportation)	22,609
539347	Development of Tennessee Travel Demand Model Users' Group, Year 1 (University of Tennessee from the Tennessee Department of Transportation)	8,696
538597	Power-Test-Service Account	11,175
Subtotal, Restricted Accounts		621,375

SCHEDULE 15A

BASE SUPPORT AND NON-EQUIPMENT MATCHING

Unrestricted Matching		
(No equipment or indirect costs included)		
Account Number	Project Title	Amount
229342	TTU Research Indirect Costs	100
229660	Dr. Munukutla Indirect Costs	1,020
	Subtotal, Unrestricted Accounts	1,120
Other Matching		
(Gifts and other non-equipment support not having account numbers)		
1.	Carryover Match, Operations, 2011-2012	284,440
	Subtotal, Other Matching	284,440
	TOTAL, NON-EQUIPMENT MATCHING	906,935

SCHEDULE 15B PROPOSED BASE SUPPORT AND NON-EQUIPMENT MATCHING

PROPOSED, 2013-2014		
		2013-2014
		Proposed Expenditures
Budget Account Numbers		
2-10406, 2-10407, 2-10409, 2-10436, 2-10437, 2-10438, 2-10411, 2-10412, 2-10413, 2-10108, 2-10499, 2-10416, 2-10417, 2-10418, 2-10421, 2-10423, 2-10431, 2-10432, 2-10426, 2-10427, 2-10428, 2-10460, 2-45016, 2-29144		10,899,900
TOTAL BASE SUPPORT		10,899,900
Non-Equipment Matching		
Restricted Accounts		
(No equipment or indirect costs included)		
1.	National Aeronautics and Space Administration (NASA)	50,730
2.	National Science Foundation (NSF)	80,000
3.	Office of Naval Research (ONR)	40,350
4.	Tennessee Department of Transportation (TDOT)	147,430
5.	Tennessee State Department of Education	12,960
	Subtotal, Restricted Accounts	331,470
Unrestricted Accounts		
Account Number		Amount
2-29342	TTU Research Indirect Costs	-
	Subtotal, Unrestricted Accounts	-
	TOTAL, NON-EQUIPMENT MATCHING	331,470

SCHEDULE 15C

BASE SUPPORT AND NON-EQUIPMENT MATCHING

REQUESTED, 2014-2015		
		2014-2015
		Proposed Expenditures
Budget Account Numbers		
2-10406, 2-10407, 2-10409, 2-10436, 2-10437, 2-10438, 2-10411, 2-10412, 2-10413, 2-10108, 2-10499, 2-10416, 2-10417, 2-10418, 2-10421, 2-10423, 2-10431, 2-10432, 2-10426, 2-10427, 2-10428, 2-10460, 2-45016, 2-29144		11,226,897
TOTAL BASE SUPPORT		11,226,897
Non-Equipment Matching		
Restricted Accounts		
(No equipment or indirect costs included)		
1.	National Aeronautics and Space Administration (NASA)	51,287
2.	National Science Foundation (NSF)	200,000
3.	Office of Naval Research (ONR)	100,000
4.	State Department of Education	12,962
5.	Tennessee Department of Transportation (TDOT)	9,215
6.	Industry Sponsors	78,241
Subtotal, Restricted Accounts		451,705
Unrestricted Accounts		
Account Number		Amount
2-29342	TTU Research Indirect Costs	-
Subtotal, Unrestricted Accounts		-
TOTAL, NON-EQUIPMENT MATCHING		451,705