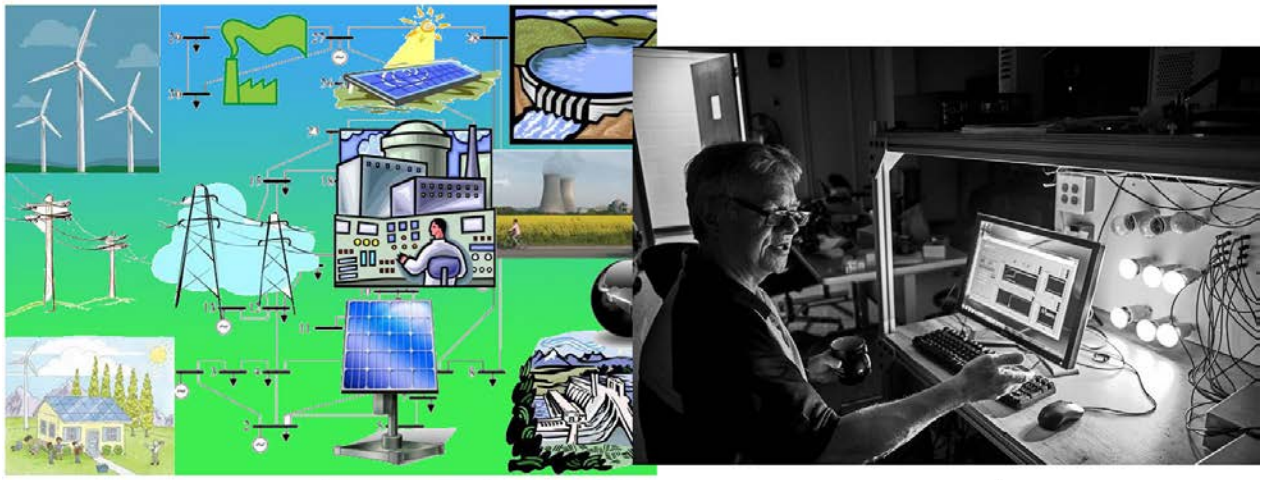
CENTER FOR ENERGY SYSTEMS RESEARCH

TENNESSEE TECH UNIVERSITY

ANNUAL REPORT FOR FISCAL YEAR 2013 — 2014



Center for Energy Systems Research

"Where research is put into practice."

TENNESSEE TECH UNIVERSITY

Annual Report for Fiscal Year

July 1, 2013 – June 30, 2014

P.K. Rajan, Interim Director
www.tntech.edu/cesr

Center for Energy Systems Research
"Where research is put into practice."

TENNESSEE TECH UNIVERSITY

Center for Energy Systems Research

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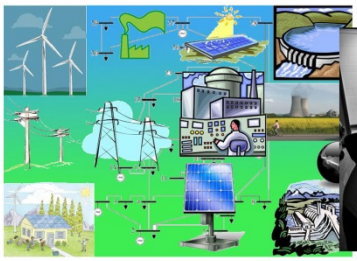
SMART GRID



ROBERT CRAVEN

ENGINEER

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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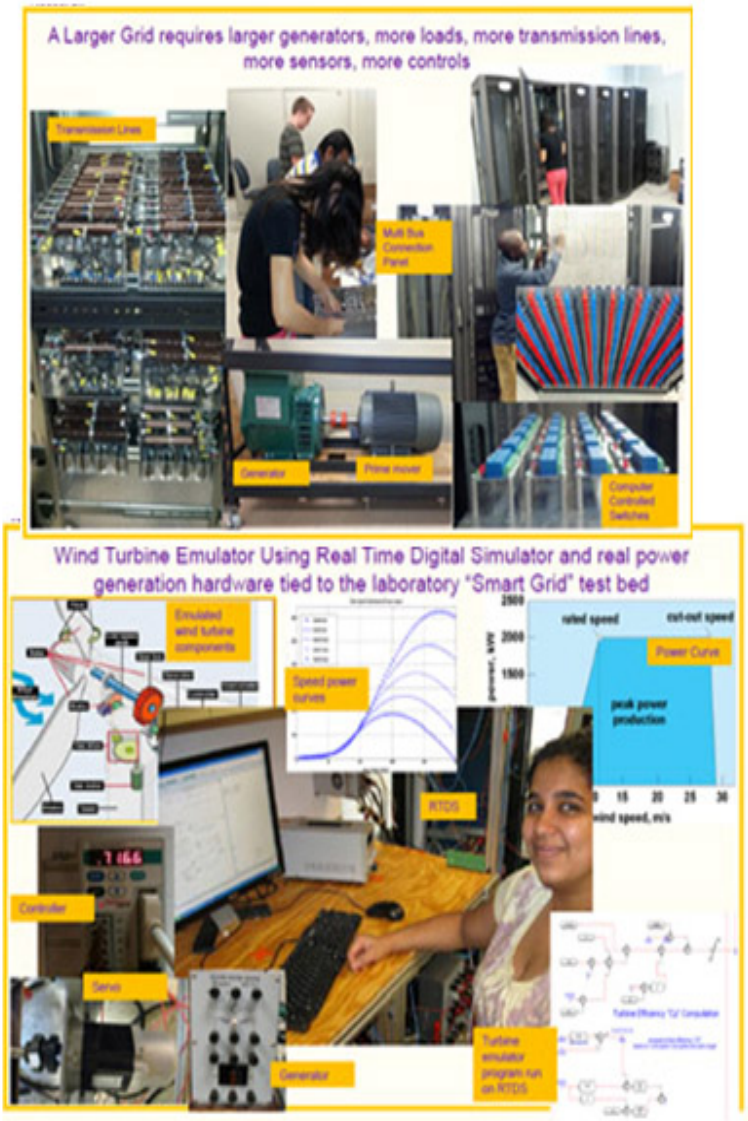


CESR students working on a Laboratory sized power Grid (LabGrid) Microgrid Test bed.

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. 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 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, Professor of Electrical and Computer Engineering, continued as the Interim Director of the Center for Energy Systems Research (CESR) for the fiscal year 2013-2014. The Search for a permanent Director is progressing. The Center houses two strategic research areas of the College of Engineering: Smart Grid and Resilient Infrastructure. At the beginning of Fall 2013 semester, two new faculty members with interest in smart grid (Dr. Indranil Bhattacharya and Dr. Mohamed Mahmoud) joined the Department of Electrical and Computer Engineering. Dr. Bhattacharya has expertise in battery technology and solar cells. Dr. Mahmoud has expertise in wireless networks and security. Also, one new faculty member Dr. Matthew Yarnold with expertise in resilient infrastructure joined the Civil and Environmental Engineering Department. Dr. Yarnold has expertise in bridge monitoring and testing. Also Dr. Vahid Motevalli joined the College as Associate Dean for Research and Innovation. He holds the rank of Professor of Mechanical Engineering and has expertise in hybrid electric vehicles. All these four new individuals will be affiliated with CESR and conduct research relating to Smart Grid and Resilient Infrastructure.

Professor P.K. Rajan
Interim Director of CESR

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. He will collaborate with Dr. Ghadir Radman of the ECE Department and Dr. Alfred Kalyanapu of CEE Department.

Proposal submission and grant activation activities progressed well during the fiscal year. A Defense University Research Instrumentation Program (DURIP) grant from the Office of Naval Research was activated. Details are provided in the following sections of this report. In the Resilient Infrastructure area several projects totaling more than $500K have been activated. Additionally, projects to enhance education to the order of $140K were executed. In summary, total external funding amounted to $1,395,106. CESR continues to enjoy a broad based support. Through June 2014, the cumulative research funding of the center is $30,887,416. Two NSF I-Corps projects have been initiated. Three undergraduate students were supported under the NSF REU (research experience for undergraduates) program. In the Smart Grid area one major Research Instrumentation (MRI) collaborative proposal was submitted to NSF. A number of research proposals were submitted to NSF and other funding agencies.

Many CESR faculty associates earned recognitions for their outstanding contributions. During the past year, CESR affiliated faculty and students made 33 conference presentations and published 41 articles in refereed journals. These are listed in the following pages of this report.

During 2013-14 fiscal year, a total of 16 international faculty, students and researchers visited CESR and conducted research in the relevant areas of the Center for various periods. Also one administrator from Annamalai University, India, visited under the Indo- US Obama-Singh 21st Century Knowledge Initiative Grant Program.

RESEARCH AREAS

Research contract and grant awards activated through CESR from July 1, 2013 thru June 30, 2014 total $1,545,106. The distribution among the Center for Energy Systems (CESR) areas of research is shown in the following table.

Research Area	Activated Amount
Smart Grid	$ 598,327
Resilient Infrastructure	$ 701,931
Testing and Service Contracts	$ 3,850
Miscellaneous Contracts	$ 240,998
Total Activated Amount	**$1,545,106**

CESR continues to enjoy a broad base of support. The funding categories for 1985 thru 2014 as illustrated in Figure 1 are: in-state utilities, 12.55 percent; out-of-state utilities, 7.02 percent; state and local agencies, 11.12 percent; federal government, 55.75 percent; other, 13.56 percent. The "other" category includes a variety of national and international industries, universities and professional societies. Through June 2014, the cumulative research funding of the Center is $26,493,914. 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 29-year match of about $26.2 million represents 101.6 percent of the state appropriations of $25.8 million. Indirect costs of approximately $4.67 million have also been received. The 2013-2014 match is $1,024,195 and the state appropriation is $919,300. A list of the projects conducted under the major research areas is given in SM-3 in this report.

CESR RESEARCH FUNDING 1985 THRU 2014

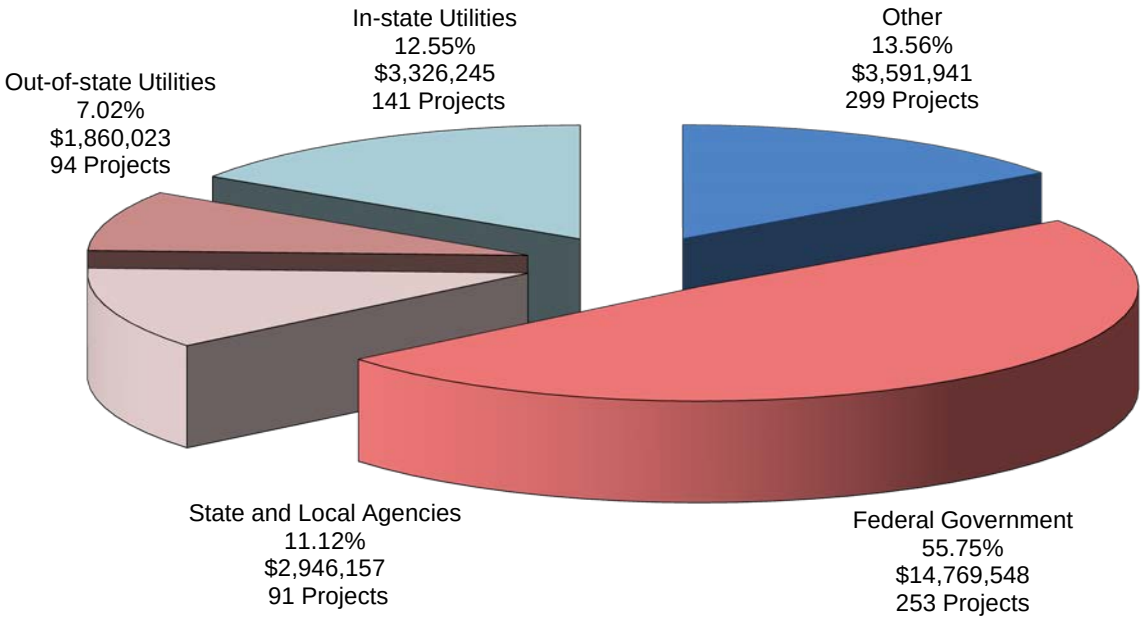


Figure 1: Types of Research Funding (Total $26,493,914)

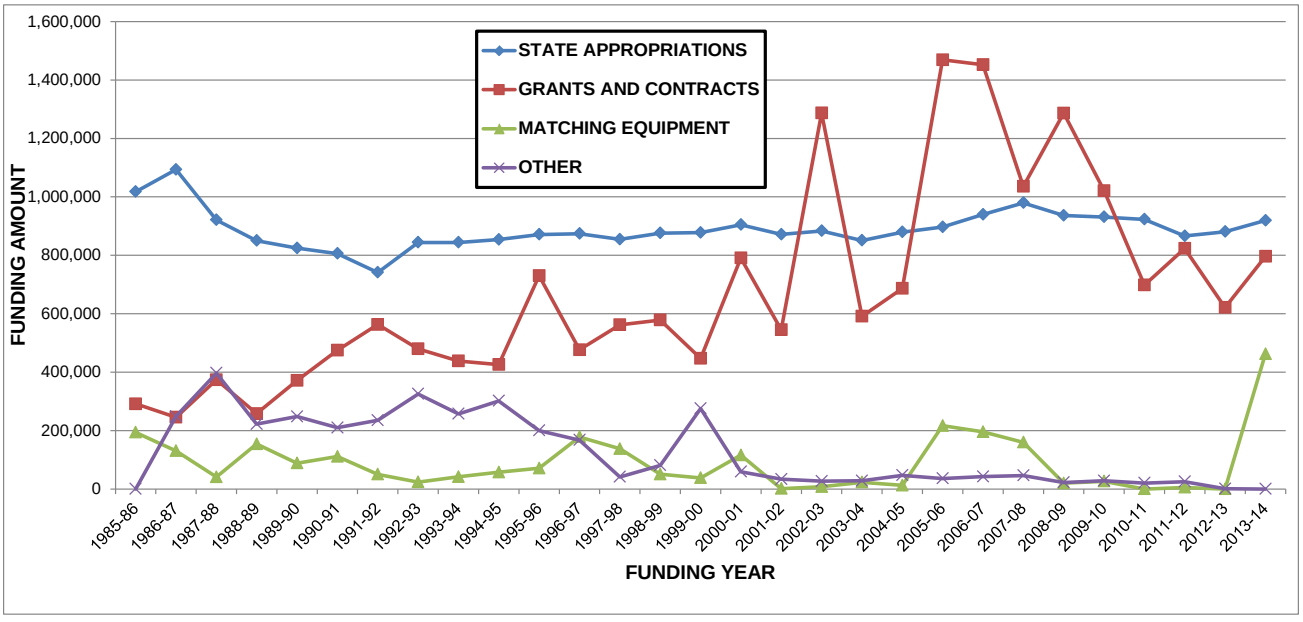


Figure 2: Historical State Appropriations and Matching

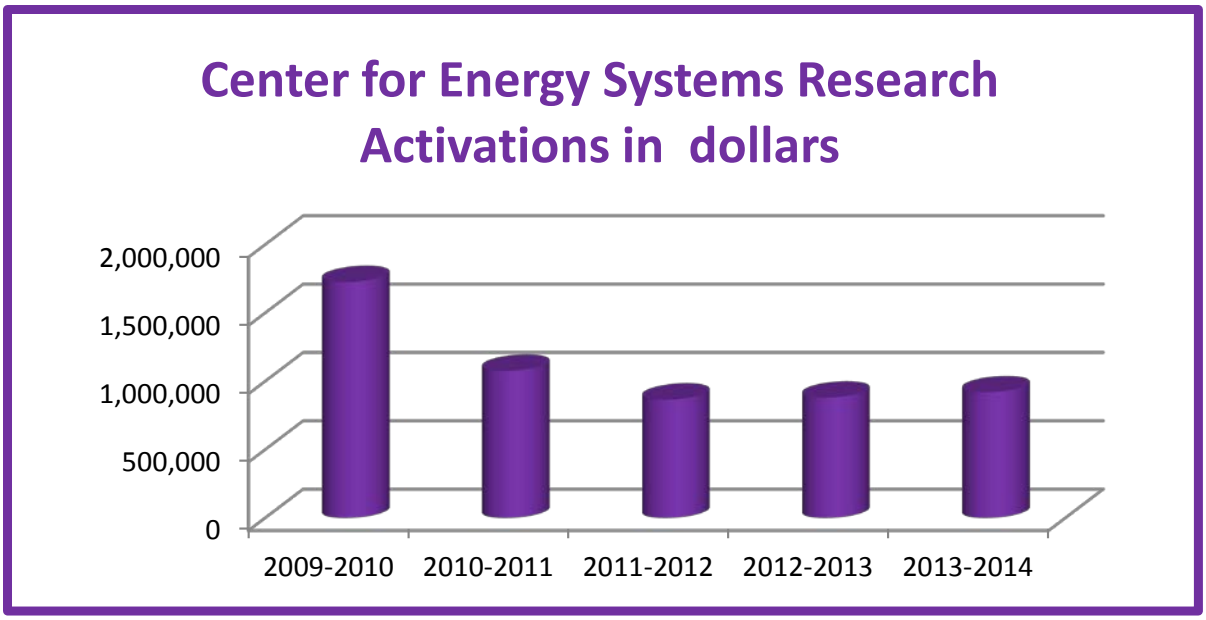


Fig. 3. Research Activations

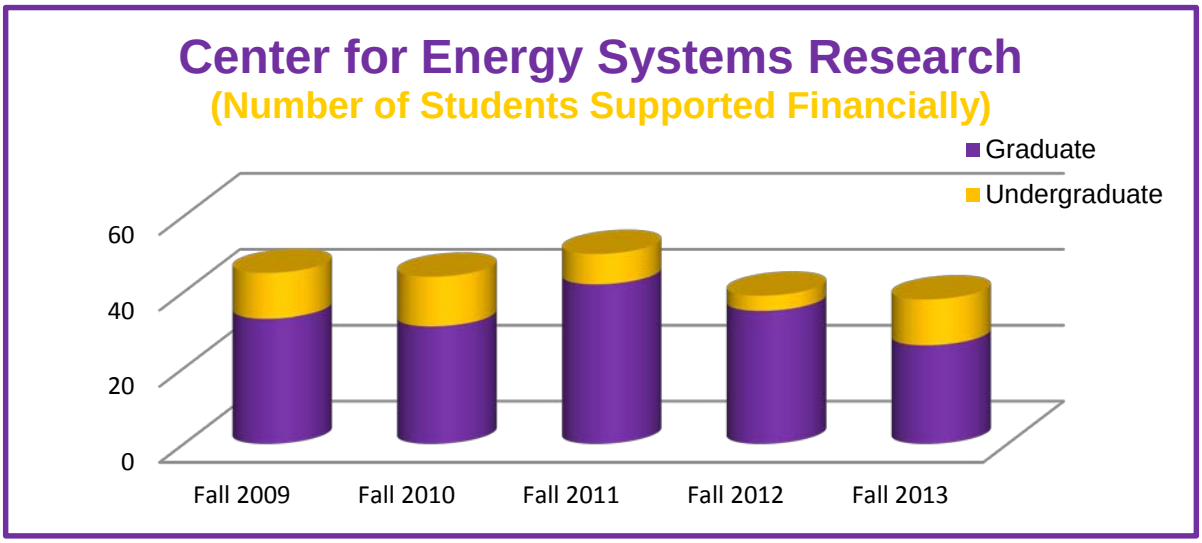


Fig. 4. Number of Students Supported

RESEARCH HIGHLIGHTS 2013-2014

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 additional 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 four areas: 1) Smart Grid Test Facility, 2) Power Electronics, 3) Power Systems and 4) Cyber Security.

Test Facility

The Center is in 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 this effort. 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 activated the successful equipment grant from the 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. Dr. Belkacemi and his students have been busy setting up a smart grid laboratory and conducting experiments on cascading faults and their mitigation using artificial intelligence techniques.

Resilient Infrastructure Group

As a part of resilient infrastructure, research is going on in three areas: 1) Sustainable Water Resources Infrastructure 2) Cement and Concrete properties and 3) Bridges and Transportation. The new faculty member, Dr. Matthew Yarnold, has been concentrating his effort in setting up a bridge testing facility and submitting proposals. He has been successful in getting funds from NSF and industry.

Water Resources

Dr. Alfred 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. He continues with investigations of Class S-Lower Heat Portland Cement Concrete and Class D-LP Concrete Mixture. His research is supported by the Tennessee Department of Transportation (TDOT). Dr. Ben Mohr is completing his NSF funded project, 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 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).

Cement and Concrete (continued)

Dr. Joe Biernacki and his students are studying the properties of fly ash based concrete. He has been successful in getting an NSF funded I-Corp project in collaboration with Dr. Don Visco of the University of Akron. He has also been able to get NSF funding to include undergraduates in his research under the REU program.

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.

Dr. Matthew Yarnold is conducting research on developing techniques and methods to evaluate / monitor bridge structures. He has received funding from two NSF grants as well as industry to carry out this research. Recently he has recruited three MS students, one PhD student and promotes undergraduate student research. During his first year at TTU, he has submitted many proposals to agencies such as: NSF, NCHRP, AISC, and FHWA.

Other Areas

Drs. Stephen 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 2013–2014

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. 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.

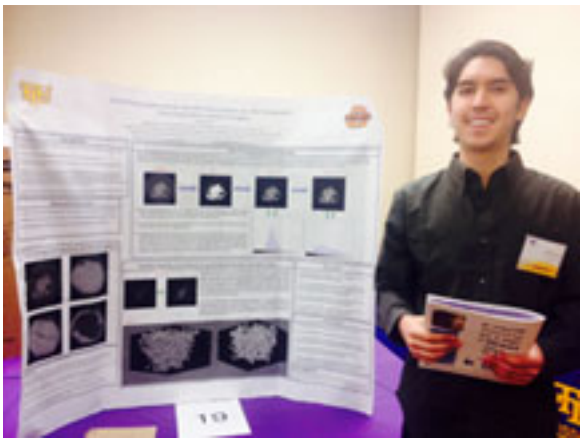
Dr. Ambareen Siraj, Associate Professor of Computer Science, received the TTU College of Engineering Teacher Scholar Award 2013.

STUDENT ACCOMPLISHMENTS AND AWARDS 2013–2014

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 2014. 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.

Adeniyi Babalola, Sina Zarrabian: "Experimental Implementation of MAS To Prevent Cascading Failure" (adviser: Rabie Belkacemi) As smart grids become more common for power distribution, it's vitally important to develop ways to restore them after a power outage; Babalola and Zarrabian have researched ways to use two-way communication devices and technology to restore power in a timely way. (Robert Craven, Adeniyi Babalola, Sina Zarrabian, Rabie Belkacemi, P.K. Rajan) (Photo courtesy of CESR)



Dario Cruz: "A Data Mining Approach for the Simulat of Portland Cement Hydration" (advisers: Joseph Biernacki, William Eberle) Hydration is vital to the strength and resilience of this ubiquitous building material, and Cruz's study uses new techniques to n this hydration. (Photo courtesy of Dario)

FACULTY AND STAFF CONFERENCE PARTICIPATIONS

ALI ALOUANI

Attended demo of the ORNL project in Oak Ridge, Tennessee, April 2014.

DANIEL BADOE

"Tennessee Stabilized Base Using 96.5 Percent Underutilized Materials" by Dillon, Crouch and Knight, January 2013 presented by Dr. Badoe.

"The Effect of Air Content on Rapid Chloride Permeability" by Crouch, Browning, Badoe, Crowley and Hall, January 2013 presented by Dr. Badoe.

"Comparison of Gravimetric and Hardened Air Contents with Pressure Method Air Content of a Tennessee Bridge Deck Mixture" by Crouch, Browning, Badoe, Kelly, Crowley and Hall, January 2013 presented by Dr. Badoe.

INDRANIL BHATTACHARYA

I. Bhattacharya and S. Y. Foo, "Novel Semiconductor Sub-cell Layers for Higher Photon Absorption in Multi-Junction (Quadruple Junction) Solar Cell", Solar Energy Journal (Under Review).

I. Bhattacharya and S. Y. Foo, "Modeling of Antimony based Subcell Layers for Higher Photon Absorption in Novel Multijunction Solar Cell", IEEE SoutheastCon 2013, April 4-7, Jacksonville, FL.

RABIE BELKACEMI

Attended Innovative Smart Grid Technologies Conference 2014 in Washington DC, February 2014.

Attended National Science Foundation CISE Career Proposal Workshop in Arlington, Virginia, March 2014.

STEPHEN CLICK

Attended TRB Subcommittee meeting in Portland, Oregon, July 2013

JIE CUI

Halbrooks, D., Cui, J., "CFD Simulation of Turbulent Airflow around Wind Turbine Airfoils," paper POWER2013-98180, ASME 2013 Power Conference, Boston, Massachusetts, USA, July 2013

ROBERT CRAVEN

Attended the IEEE SoutheastCon 2014 Conference in Lexington, Kentucky as presenter, March 2014.

Attended the 2014 Industry Conference in Knoxville, Tennessee, May 2014 with Dr. Ghadir Radman and Dr. Rabie Belkacemi.

XIAOMING (SHARON) HUO

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

JOSEPH OJO

Bhanu Angirekula, and Olorunfemi Ojo "A Karnaugh Mapping Technique for the Modeling of Single Phase Multi String Multi Level Inverter," Conference Record of the 30th Annual Applied Power Electronics Conference and Expositions (APEC), pp. 239-246, March 2014. (Fort Worth, Texas).

Mehdy Khayamy and Eseme Sota and Olorunfemi Ojo "A Comprehensive Study of an Autonomous PV System with Battery Storage Providing Power for a General AC Load," Conference Record of the 30th Annual Applied Power Electronics Conference and Expositions (APEC), pp. 699-706, March 2014. (Fort Worth, Texas)

Adeola Balogun, Olorunfemi Ojo and Frank Okafor, "Efficiency Optimization of Doubly-Fed Induction Generator Transitioning into Shorted-Stator Mode for Extended Low Wind Speed Application," Conference record of the IECON 2013 annual meeting, pp. 1599-1604, November 2013. (Vienna, Austria)

B. N. Angirekula and Olorunfemi Ojo, "Modeling and Analysis of Single-Phase Multi String Five Level Inverter for Distributed Energy Resources". Conference record of the IECON 2013 annual meeting, pp. 999-1004, November 2013.

Attended and presented at ECCE 2013 IEEE Energy Conversion & Expo in Denver, Colorado, September 2013.

GHADIR RADMAN

Attended and presented at the 2013 IEEE Power and Energy Society General Meeting in Vancouver, British Columbia, Canada, July 2013.

STUDENTS CONFERENCE PRESENTATIONS

NATALIA SHLONIMSKAYA

(Joseph Biernacki, Advisor) presented paper at the American Ceramic Society in Urbana, Illinois, July 2013.

Presented paper and attended AIChE National Conference in San Francisco, California, November 2013.

VITALY FORD

(Ambareen Siraj, Advisor) presented paper "Clustering of Smart Meter Data for Disaggregation", and attended the GlobalSIP 2013 Conference on Signal and Information Processing in Austin, Texas, December 2013.

ADENIYI BABALOLA

(Rabie Belkacemi, Advisor) presented paper "Restoration of Smart Grid Distribution System Two-Way Communication Capability" (Kansas State University), at 2013 North American Power Symposium in Manhattan, Kansas, September 2013

Attended and presented two papers "Real-Time Measurement of Frequency using Affordable Rotary Encoder and LabView" and "Experimental Implementation of Multi-Agent System Algorithm for Distributed Restoration of a Smart Grid System" at the IEEE SoutheastCon 2014 in Lexington, Kentucky, March 2014.

OJAS CHAUDHARI

(Joseph Biernacki, Advisor) presented poster and attended 5th Advances in Cement-based Materials: Characterization, Processing, Modeling and Sensing Conference on TTU Campus, July 2014.

ESEME SOTA

(Joseph Ojo, Advisor) presented paper and attended Applied Power Electronics Conference and Exposition 2014 in Fort Worth, Texas, March 2014

BROOK ABEGAZ

(Satish Mahajan, Advisor) attended and presented "Measurement and Characterization of Fluid Flow Profile using Electrical Capacitance Tomography" at the IEEE SoutheastCon 2014 in Lexington, Kentucky, March 2014.

EMANUEL STEPHEN MATEE

(Satish Mahajan, Advisor) attended and presented at the IEEE SoutheastCon 2014 in Lexington, Kentucky, March 2014.

WAHEED OYEKANMI

(Joseph Ojo, Advisor) attended and presented "Initial Value Calculation for Dynamic Simulation of Power Systems in the Presence of Disturbances within Transmission Network" at the IEEE SoutheastCon 2014 in Lexington, Kentucky, March 2014.

DARIO CRUZ

(Joseph Biernacki, Advisor) attended NIST Modeling Workshop, directly related to research activities on modeling of cement hydration in Gaithersburg, Maryland, June 2014.

AARON CROWLEY

(L.K. Crouch, Advisor) presented paper and Transportation Research Board 93rd Annual Meeting in Washington, DC, January 2014.

Presented paper "A High Volume Fly Ash Concrete Mixture for Tennessee Bridge Decks" and attended 2014 International Concrete Sustainability Conference organized by NRMCA in Boston, Massachusetts, May 2014.

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 2014-2015

During the 2013-2014 academic year, the Center assisted the Electrical and Computer Engineering Department to hire one new faculty member in the Smart Grid area and the Chemical Engineering Department to hire one new faculty member in the Energy area. In the 2014-2015 academic year these new faculty members it is expected that Dr. Bhattacharya's battery research will progress well with the setting up of the Battery Laboratory. Dr. Belkacemi's Smart Grid research is progressing well. He is expected to submit proposals in the identification and mitigation of cascading failures in power grids. With the enhancement of Dr. Ojo's Power Electronics Laboratory, advanced research on integration of renewable energy sources into grids will be undertaken. Dr. Sheikh Ghafoor is working with Dr. Radman and Dr. Kalyanapu in employing Graphical Processing Units to speed up computing operations in Power system analysis and in flood flow forecasting, respectively. Dr. Siraj, Dr. Mahmoud and Dr. Elkeelany are working on improving the security in smart grid applications. Dr. Yarnold's work on bridge monitoring and testing has opened up a new area of research in the resilient infrastructure area. This will be expanded further. Efforts are also underway to join the staff supports of CMR and CESR and create a single Engineering Proposals and Grants Support Office. It is also expected that the setting up of the Smart Grid Laboratory in Clement Hall will be completed. This new Laboratory will facilitate undertaking new research on various aspects of smart grid and proposals will be developed and submitted to funding agencies. This facility will also be useful for demonstrating the features of The modern electric power 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 2013-2014

Center Director:	**Dr. Periasamy K. Rajan**	**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

FACULTY PARTICIPATION SM-2

The following faculty members participated in center research activities during 2013-2014. Faculty involvement included conducting externally or internally funded research, preparing and presenting high quality research papers, preparing and marketing proposals, directing graduate students, and improving instructional courses and laboratories.

ACADEMIC AFFAIRS
X. Sharon Huo

CIVIL & ENVIRONMENTAL ENGINEERING
Daniel A. Badoe
Lewis K. Crouch
Faisal Hossain
David Huddleston
Alfred Kalyanapu
Y. Jane Liu
Benjamin Mohr
Guillermo Ramirez
Matthew Yarnold

CHEMICAL ENGINEERING
Joseph Biernacki
Holly Stretz

COMPUTER SCIENCE
Sheikh Ghafoor
Ambareen Siraj

ELECTRICAL AND COMPUTER ENGINEERING
Ali Alouani
Rabie Belkacemi
Indranil Bhattacharya
Omar Elkeelany
Syed Rafay Hasan
Wayne Johnson
Satish Mahajan
Mohamed Mahmoud
Joseph Ojo
Ghadir Radman

MECHANICAL ENGINEERING
Stephen Canfield
Jie Cui
Corinne M. Darvennes
Stephen A. Idem
John Peddieson

MANUFACTURING & ENGINEERING TECHNOLOGY
Ahmed H. Elsawy
Ahmed Kamal

MATHEMATICS
Allan Mills
Sabine LeBorne

CESR INTERNAL ADVISORY COMMITTEE
Joseph Biernacki
Steven Click
Wayne Johnson
Ben Mohr
Vahid Motevalli Joseph Ojo
Joseph Ojo
Mohan Rao

FACULTY PARTICIPATION SM-2

Faculty participating in the Strategic Research of the Center are:

Smart Grid

Joseph Ojo - ECE - Coordinator
Adam Anderson -ECE
Ali Alouani - ECE
Omar Elkeelany - ECE
Ahmed Elsawy - MET
Ahmed Kamal - MET
Satish Mahajan - ECE
Robert Qiu - ECE
Ghadir Radman - ECE
Ambareen Siraj - CSC
Robert Craven - CESR
Syed Rafay Hasan - ECE

Resilient Infrastructure

Joseph Biernacki, CHE - Coordinator
Benjamin Mohr - CEE
Alfred Kalyanapu - CEE
L.K. Crouch - CEE
Jane Liu - CEE
Sharon Huo - CEE
Steven Click - CEE
Stephen Canfield - ME
John Peddieson - ME
Ahmed Elsawy - MET
Ismail Fidan - MET
Sheikh Ghafoor - CSC
Ahmed Kamal - MET
Matthew Yarnold - CEE

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2013 and June 30, 2014

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 5 of 5)	National Science Foundation	9/1/2013-8/31/2014	80,000	115,582
532343	More Electric Integrated Power Systems with Multiphase Motors and Generators	Office of Naval Research	6/15/2013-12/31/2014	508,327	410,307
539341	Design and Development of Wireless Low Cost Power Data Loggers	Oak Ridge National Laboratory	11/15/2013-5/31/2014	10,000	9,999
	SUB - TOTAL SMART GRID			**598,327**	**535,888**

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2013 and June 30, 2014

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
539284	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (Federal) Year 3	Tennessee Department of Transportation	8/1/2013-7/31/2014	8,000	28,880
539285	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (State) Year 3	Tennessee Department of Transportation	8/1/2013-7/31/2014	2,000	13,434
539281	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (Federal)	Tennessee Department of Transportation	8/1/2013-7/31/2014	4,000	20,410
539282	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (State)	Tennessee Department of Transportation	8/1/2013-7/31/2014	1,000	7,857
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	National Aeronautics and Space Administration	9/1/2013-8/31/2014	27,600	23,688
539290	Developing Determining Concrete Chloride Permeability Rapidly and Effectively (Federal)	Tennessee Department of Transportation	8/1/2013-7/31/2018	192,000	40,336
539291	Developing Determining Concrete Chloride Permeability Rapidly and Effectively (State)	Tennessee Department of Transportation	8/1/2013-7/31/2018	48,000	2,867
531234	REU Supplement: PFI: AIR Technology Translation-Computationally Designed Shrinkage Reducing Admixtures for Concrete	National Science Foundation	9/1/2013-2/28/2015	5,500	2,239

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2013 and June 30, 2014

RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS) (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
531234	PFI: AIR Technology Translation - Computationally Designed Shrinkage Reducing Admixtures for Concrete	National Science Foundation	9/1/2013-8/31/2014	123,331	89,392
539292	Enhance and Improve Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts (Federal)	Tennessee Department of Transportation	8/1/2013-7/31/2018	108,000	33,828
539293	Enhance and Improve Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts (Federal)	Tennessee Department of Transportation	8/1/2013-7/31/2018	27,000	5,178
536231	Biaxial Material Model of Semi-Brittle Polymers	United Launch Alliance (ULA)	11/12/2013-12/9/2013	15,200	15,200
531218	NSF I-Corps: Shrinkage Reducing Admixture Business Development	National Science Foundation I-Corps	1/1/2014-6/30/2014	50,000	32,860
539347	Development of Tennessee Travel Demand Model Users' Group	University of Tennessee-Knoxville, Tennessee Department of Transportation	1/1/2014-12/31/2014	10,300	9,495
539286	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification (Federal)	Tennessee Department of Transportation	1/1/2014-12/31/2014	48,000	30,014
539287	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification (State)	Tennessee Department of Transportation	1/1/2014-12/31/2014	12,000	11,528
536325	Structural Health Monitoring of the Tacony-Palmyra Bridge Arch Span	Intelligent Infrastructure Systems	5/1/2014-5/31/2015	20,000	6,731
	SUB - TOTAL RESILIENT INFRASTRUCTURE (INFRASTRUCTURE MATERIALS)			**701,931**	**373,937**

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2013 and June 30, 2014

POWER-TEST-SERVICE ACCOUNT

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
538597	Power-Test-Service Account				
	Concrete Brick Strength Testing	R&D Services	8/19/2013-8/23/2013	100	100
	25% Class F Fly Ash Concrete Strength Testing	The SEFA Group	7/1/2013-9/30/2013	1,875	1,875
	Verification of ADI/ASHRAE Flexible Duct Calculator	M&M Manufacturing	3/1/2014-6/16/2014	1,875	1,857
	SUB - TOTAL POWER-TEST-SERVICE ACCOUNT			**3,850**	**3,832**

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2013 and June 30, 2014

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 2 of 3)	State Department of Education -- Division of Special Education	7/1/2013-6/30/2014	7,000	6,495
539514	Enabling Families, Infants, and Toddlers through Technology: Merging EIME Project (Preschool) (Year 2 of 3)	State Department of Education -- Division of Special Education	7/1/2013-6/30/2014	7,000	6,493
531258	NSF I-Corps Supplement to Enhancing the Programming Experience Type II Proposal	National Science Foundation	1/1/2014-12/31/2014	49,998	129,459
533122	TBR Course Revitalization Initiative for CEE 3110: Mechanics of Materials for Fall 2014-Spring 2015	Tennessee Board of Regents	3/10/2014-1/1/2015	13,500	0
533123	TBR Course Revitalization Initiative for CEE 2110: Engineering Mechanics - Statics for Fall 2014-Spring 2015	Tennessee Board of Regents	3/10/2014-1/1/2015	13,500	0
	SUB - TOTAL MISCELLANEOUS			**90,998**	**142,447**
	TOTAL CONTRACTS AND GRANTS: 2013 - 2014			**1,395,106**	**1,056,104**

STATUS OF PROPOSALS
Submitted Between July 1, 2013 and June 30, 2014

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
1.	CAREER: Distributed, Adaptive and Intelligent Multilevel Control of Smart Power Grid Systems	Dr. Rabie Belkacemi	National Science Foundation	402,190	Unfunded
2.	HydratiCA Sub-Code Development Effort	Dr. Joseph Biernacki	National Institute of Standards and Technology	94,949	Pending
3.	Rising Renaissance Scholars Project	Dr. Kristine Craven	National Science Foundation (S-STEM)	563,059	Unfunded
4.	REU Site: Summer Internships in Biomedical Engineering	Dr. Ahmed Kamal	National Science Foundation (REU)	360,000	Unfunded
5.	Design and Development of Wireless Low Cost Power Data Loggers	Dr. Ali Alouani	Oak Ridge National Laboratory	15,747	Funded at $10,000
6.	Fusing Communication Protocols with Adaptive Security Levels in Cyber Physical Systems via FPGA Reconfigurable Logic	Dr. Omar Elkeelany	National Science Foundation	505,694	Pending
	SUBTOTAL, PROPOSALS FOR 2013-2014			**1,941,639**	

STATUS OF PROPOSALS
Submitted Between July 1, 2013 and June 30, 2014

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
7.	Dynamics and Control of Emerging Hybrid AC-DC Integrated Micro-Grid Systems	Dr. Joseph Ojo	National Science Foundation	391,399	Pending
8.	I-Corps: Shrinkage Reducing Admixture Business Development	Dr. Joseph Biernacki	National Science Foundation	50,000	Funded
9.	EPAS: A New High Level Adaptive Control and Management for Cascading Failure Prevention in Smart Grid Systems	Dr. Rabie Belkacemi	National Science Foundation	243,290	Pending
10.	Structural Health Monitoring of the Tacony-Palmyra Bridge Arch Span	Dr. Matthew Yarnold	Intelligent Infrastructure Systems (IIS)	20,000	Funded
11.	Rapid Field Testing Method for Steel Girder Bridges	Dr. Matthew Yarnold	American Institute of Steel Construction (AISC)	125,013	Pending
12.	Study to Identify CFD Models for Use in Determining HVAC Duct Fitting Loss Coefficients	Dr. Stephen Idem	Embry-Riddle Aeronautical University to ASHRAE	47,473	To be funded
	SUBTOTAL, PROPOSALS FOR 2013-2014			**877,175**	

STATUS OF PROPOSALS
Submitted Between July 1, 2013 and June 30, 2014

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
13.	Development of TDOT Class P-SCC (Self-Containing Concrete) and Class A-SCC Concrete Mixtures	Dr. L. K. Crouch	University of Tennessee at Chattanooga (Funding from TDOT)	12,000	Unfunded
14.	Supplement to Enhance the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences: Type II Proposal	Dr. Stephen Canfield	NSF (I-Corps) Supplement to NSF TUES (TTU Index 531258)	49,998	Funded
15.	Collaborative Research: CyberWorkshops: Resources and Strategies for Teaching Cybersecurity in Computer Science	Dr. Ambareen Siraj, Dr. Sheikh Ghafoor	National Science Foundation	720,110	To be funded at $422,917
16.	Defects in Semiconductors and Dielectrics under Extreme Environments	Dr. Wayne Johnson	University of Maryland (Funding from the U.S. Department of Energy)	499,950	Pending
17.	Development of Large Scale Smart Grid Research Platform with Distributed and Intelligent Algorithm Testing Capability	Dr. Rabie Belkacemi	National Science Foundation	718,644	Pending
	SUBTOTAL, PROPOSALS FOR 2013-2014			**2,000,702**	

STATUS OF PROPOSALS
Submitted Between July 1, 2013 and June 30, 2014

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
18.	NCHRP 12-100: Guidelines for Maintaining Small Movement Bridge Expansion Joints	Dr. Matthew Yarnold	Transportation Research Board	149,324	Unfunded
19.	Collaborative Research: Structural Identification and Health Monitoring using Temperature-Driven Data	Dr. Matthew Yarnold	National Science Foundation (HMSE)	189,676	To be funded in 2014-2015
20.	Efficient and Reliable Protection of Consumer Privacy in Smart Metering Infrastructure	Dr. Ambareen Siraj	Google	31,481	Pending
21.	Biaxial Material Model of Semi-Brittle Polymers -- Phase 2	Dr. Jane Liu, Dr. John Peddieson	United Launch Alliance (ULA)	20,000	To be funded
22.	Design, Modeling, and Experimental Validation of Cost-Effective High-Efficiency Multijunction Solar Cells	Dr. Indranil Bhattacharya	National Science Foundation	498,071	Pending
	SUBTOTAL, PROPOSALS FOR 2013-2014			**888,552**	

STATUS OF PROPOSALS
Submitted Between July 1, 2013 and June 30, 2014

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
23.	REU Supplement: PFI: AIR Technology Translation -- Computationally Designed Shrinkage Reducing Admixtures for Concrete	Dr. Joseph Biernacki	National Science Foundation	11,000	Withdrawn; resubmitted as 2 proposals at $5,500 each
24.	EPA STAR National Center for Sustainable Water Infrastructure Modeling Research	Dr. Alfred Kalyanapu Dr. Sheikh Ghafoor	University of Utah (Funding from the Environmental Protection Agency)	279,520	Pending
25.	CPS: Synergy: The Cyber-Security Control and Simulation of More Electric Aircraft Power Systems	Dr. Joseph Ojo, Dr. Omar Elkeelany, Dr. Rafey Hasan, Dr. Mohamed Mahmoud	National Science Foundation	985,321	Pending
26.	REU Supplement: PFI: AIR Technology Translation-Computationally Designed Shrinkage Reducing Admixtures for Concrete	Dr. Joseph Biernacki	National Science Foundation	5,500	Funded
27.	REU Supplement: PFI: AIR Technology Translation-Computationally Designed Shrinkage Reducing Admixtures for Concrete	Dr. Joseph Biernacki	National Science Foundation	5,500	Pending
	SUBTOTAL, PROPOSALS FOR 2013-2014			**1,286,841**	

STATUS OF PROPOSALS
Submitted Between July 1, 2013 and June 30, 2014

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
28.	VRS Supplement: PFI: AIR Technology Translation-Computationally Designed Shrinkage Reducing Admixtures for Concrete	Dr. Joseph Biernacki	National Science Foundation	10,000	Pending
29.	Deconstruction Monitoring for Identification of Intrinsic Forces	Dr. Matthew Yarnold	National Science Foundation	24,810	Pending
30.	JEA Northside Units 1 & 2 Secondary Air System Flow Conditioning Design and Optimization	Dr. Stephen Idem, Dr. Jie Cui	JEA Northside Generating Station	41,970	Pending
31.	TBR Course Revitalization Initiative for CEE 3110: Mechanics of Materials for Fall 2014-Spring 2015	Dr. David Huddleston, Dr. Jane Liu, Dr. Guillermo Ramirez	Tennessee Board of Regents	13,500	Funded
32.	TBR Course Revitalization Initiative for CEE 2110: Engineering Mechanics Statics for Fall 2014-Spring 2015	Dr. David Huddleston, Dr. Jane Liu, Ms. Elizabeth Hutchins	Tennessee Board of Regents	13,500	Funded
33.	Verification of the ADI/ASHRAE Flexible Duct Calculator	Dr. Stephen Idem	M&M Manufacturing Company	3,750	Funded
	SUBTOTAL, PROPOSALS FOR 2013-2014			**107,530**	
	TOTAL, PROPOSALS FOR 2013-2014			**7,102,439**	

ALOUANI, ALI

A.M. Najafabadi and A.T. Alouani, “Real Time Parameter Identification of Composite Load Model”, IEEE Power and Energy Society General Meeting (PES), IEEE, July 2013.

BHATTACHARYA, INDRANIL

I. Bhattacharya and S. Y. Foo, "Novel Semiconductor Sub-cell Layers for Higher Photon Absorption in Multi-Junction (Quadruple Junction) Solar Cell", Solar Energy Journal (Under Review).

I. Bhattacharya and S. Y. Foo, “Modeling of Antimony based Subcell Layers for Higher Photon Absorption in Novel Multijunction Solar Cell”, IEEE SoutheastCon 2013, April 4-7, Jacksonville, FL.

CANFIELD, STEPHEN

Parker, J., Canfield, S. L. and S. Ghafoor, “Using Hardware-based Programming Experiences to Enhance Student Learning in a Junior-level Systems Modeling Course,” *Proceedings of the 2014 ASEE Annual Conference,* Indianapolis, IN, June 15-18, 2014.

CLICK, STEVEN

“Using College Student Competitions to Recruit Middle-School Students to Engineering.” Proceedings of the 2013 ASEE-SE Annual Conference.

CROUCH, L.K.

Magazine Articles:

“Lowering the Chloride Permeability of a TDOT Class D PCC Mixture: Part 1 Developing an Informational Catalog”, L. K. Crouch, Aaron Crowley, Lee Rogers, Heather P. Hall and Daniel Badoe, *Tennessee Concrete*, Vol. 27, No. 2, Fall 2013.

Publications:

“Lowering the Rapid Chloride Permeability of a TDOT Class D Mixture”, Crouch, Badoe, Crowley, Rogers, and Hall, TDOT-TCA Liaison Committee 1/17/13.

“Tennessee Stabilized Base Using 96.5 Percent Underutilized Materials” by Dillon, Crouch and Knight, January 2013 presented by Dr. Badoe.

“The Effect of Air Content on Rapid Chloride Permeability” by Crouch, Browning, Badoe, Crowley and Hall, January 2013 presented by Dr. Badoe.

“Comparison of Gravimetric and Hardened Air Contents with Pressure Method Air Content of a Tennessee Bridge Deck Mixture” by Crouch, Browning, Badoe, Kelly, Crowley and Hall, January 2013 presented by Dr. Badoe.

CUI, JIE

Lakshmiraju, M., and Cui, J., “Numerical Modeling of Transient Thermal Mixing,” International Journal of Latest Research in Science and Technology, Vol. 3, Issue 2, pp. 80-89, 2014.

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, Vol. 19, No. 1, pp. 38-52, DOI: 10.1080/10789669.2012.733645, 2013.

GHAFOOR, SHEIKH

Sheikh Ghafoor, John Hale, Ioana Banicescu, and Tomasz Haupt, “Simulation of an Adaptive Parallel System in High Performance Computing Environment”, Under Review, Cluster Computing, Springer.

Ambareen Siraj, Sheikh Ghafoor, Joshua Tower, and Ada Haynes, ”Empowering Faculty to Embed Security Topics into Computer Science Courses”, to appear in the proceedings of 19th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education, Uppsala, Sweden, June 23-25, 2014.

Stephen. Canfield, Sheikh Ghafoor, “A Matlab-Based Toolkit to program Microcontrollers for use in Teaching Mechanisms and Robotics” to appear in the proceedings of International Design and Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2014), August 17-20, Buffalo, NY, 2014.

GHAFOOR, SHEIKH

Johne Parker, Stephen Canfield, and Sheikh Ghafoor, "Using Hardware-based Programming Experiences to Enhance Student Learning in a Junior-Level Systems Modeling Course." To appear in the proceedings of 121st ASEE Annual Conference and Exposition, Indianapolis, June 15-18, 2014.

Alfred Kalyanapu, Sheikh Ghafoor, Ryan Marshall, Tigstu Dullo, and David Judi, "Benchmark exercise for comparing computational performance of two-dimensional flood models in CPU, Multi-CPU and GPU frameworks" in the proceedings of World Environmental and Water Resources Congress, June 1-5, Portland Oregon, USA, 2014.

IDEM, STEPHEN

Leverette, J., Gebke, K., and S. Idem, 2014, "Pressure and Velocity Variation in a Fabric Air Dispersion System," HVAC&R Research, In Press.

Kulkarni, D. and S. Idem, 2014, "Loss Coefficients of Bends in Fully Stretched Nonmetallic Flexible Ducts," HVAC&R Research, In Press.

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

Hodges, R.K., Kulkarni, D. and Idem, S. 2013, "Pressure Loss in Fully Stretched Nonmetallic Flexible Duct with a Bend," HVAC&R Research, Vol. 19, No. 1, pp. 87-100.

Kulkarni, D., Cui, J, and Idem, S., 2013, "CFD Studies of Developing Turbulent Flows with Various Entrance Geometries," HVAC&R Research, Vol. 19, No. 1, pp. 38-52.

Sleiti, A., Zhai, J. and Idem, S., 2013, "Computational Fluid Dynamics to Predict Duct Fitting Losses: Challenges and Opportunities," HVAC&R Research, Vol. 19, No. 1, pp. 2-9.

Silaipillayarputhur, K. and Idem, S., 2013, "A General Matrix Approach to Model Steady State Performance of Crossflow Heat Exchangers," Heat Transfer Engineering, Vol. 34, No. 4, pp. 1-12.

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.

MAHMOUD, MOHAMED

"A scalable public key infrastructure for smart grid communications", IEEE Global Communication Conference (IEEE GLOBECOM'13), Atlanta, GA, USA, December 9-13, 2013.

"Efficient public-key certificate revocation schemes for smart grid", Proc. of IEEE Global Communication Conference (IEEE GLOBECOM'13), Atlanta, GA, USA, December 9-13, 2013.

MOHR, BENJAMIN

Mohr, B.J., Bryant, L.B. "Nanoscale Pore Analysis of Mortars Subject to Delayed Ettringite Formation." *Cement and Concrete Research.* Submitted June 2013.

OJO, JOSEPH O.

Olorunfemi Ojo, Mehdy Khayamy and Mehari Bule, "An Insightful Steady-State Performance of A Squirrel-Cage Induction Generator Enhanced with STATCOM," Accepted for publication in the International Journal of Emerging Electric Power Systems, 2014.

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," Accepted for publication in the IET Journal of Renewable Power Generation, 2014.

Adeola Balogun, Olorunfemi Ojo and Frank Okafor, "Decoupled Direct Control of Natural and Power Variables of Doubly Fed Induction Generator for Extended Wind Speed Range Using Feedback Linearization", IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 1, no. 4, pp. 226- 237, December 2013.

Luca Zarri, Michele Mengoni, Angela Tani and Olorunfemi Ojo, "Range of the Linear Modulation in Matrix Converters," IEEE Transactions on Power Electronics, pp. 3166-3178, Vol. 29, No. 6, pp. 3166-3178, June 2014.

OJO, JOSEPH O.

Adeola Balogun, Olorunfemi Ojo and Frank Okafor, “Determination of the Steady-State and Dynamic Control Law of Doubly Fed Induction Generator Using Natural and Power Variables,” IEEE Transactions on Industry Applications, Vol. 49, No. 3, pp. 1343-1357, May/June 2013.

Charles Odeh and Olorunfemi Ojo, “Analytical Model of Four-cell Grid Connected Multilevel Cascaded H-bridge DC –DC Converter,” Electric Power Components and Systems,” Vol. 41, pp. 824-842, 2013.

PEDDIESON, JOHN

“Evaluation of Elastic Compensation Using Elastic/Plastic Rotating Circular Disk Problems,” with A. Khalili, Mechanics Research Communications, 55, 2014, 89-94.

“Application of Groebner Basis Methodology to Nonlinear Cable Analysis,” with J. Liu and G. Buchanan, ASME Journal of Offshore Mechanics and Artic Engineering, 135, 2013, 041601-1-041601-6.

“Elastic Stability of Annular Thin Plates with One Free Edge,” with N. Jillella, Journal of Structures, 2013, 2013, 389148-1-389148-9.

RADMAN, GHADIR

“Wide area phasor measurements based disturbance monitoring for line trip event”, Gang Zheng, Ghadir Radman, Wei Guan, Shanshan Yang, published in Power and Energy Society General Meeting (PES), 2013 IEEE.

SIRAJ, AMBAREEN

Ambareen Siraj, Sheikh Ghafoor, Joshua Tower and Ada Haynes. Empowering Faculty to Embed Security Topics into Computer Science Courses. 19th Annual Conference on Innovation and Technology in Computer Science Education (ITICSE), to be held in Uppsala, Sweden, June 23-25, 2014.

Summer Olmstead and Ambareen Siraj. “A Cyberlearning Environment for Smart Grid Security Education”, The 18h Colloquium for Information Systems Security Education (CISSE’18), to be held in San Diego, CA, June 16-18, 2014.

Vitaly Ford and Ambareen Siraj, "Clustering of Smart Meter Data for Disaggregation", IEEE Global Conference on Signal and Information Processing: Symposium on Information Processing in the Smart Grid held in Austin, TX, Dec 3-5, 2013.

Joseph Stites, Ambareen Siraj and Eric Brown, "Smart Grid Security Educational Training with ThunderCloud: A Virtual Security Test Bed", 2013 Information Security Curriculum Development Conference held in Kennesaw, GA, Oct 12-13, 2013.

YARNOLD, MATTHEW

Yarnold, M.T. (2013) "Structural Health Monitoring Temperature-Driven Baseline", Conference of the ASCE Engineering Mechanics Institute, Northwestern University, Evanston, IL.

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.

MAHMOUD, MOHAMED

M. Mahmoud and X. Shen, "Security for Multihop Wireless Networks", Springer Briefs in Computer Science, to appear.

ALOUANI, ALI T.

Member:
Senior Member IEEE
Sigma Xi

Editor for:
Journal of Engineering 2012 – present

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
Associate Editor:
ASCE Journal of Urban Planning and Development

BELKACEMI, RABIE

Reviewer:
IEEE Transaction on Smart Grid

BIERNACKI, JOSEPH

Trustee:
American Ceramic Society, Cement Division
Associate Editor:
Journal of the American Ceramic Society

Member:
American Ceramic Society (ACerS)
American Institute of Chemical Engineers
American Concrete Institute (ACI)
American Society for Engineering Education
Tennessee Academy of Sciences
Sigma Xi

BHATTACHARYA, INDRANIL

Reviewer:
IEEE Journal of Photovoltaics
IEEE Transactions on Photonics
IEEE Transactions on Smart Grid
IEEE Photonics Journal

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

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)
Sigma Xi, TTU Chapter, Secretary and Treasurer

DARVENNES, CORINNE

Member:

Institute of Noise Control Engineers (INCE)
Acoustical Society of America (ASA)
Society of Women Engineers (SWE)
Tau Beta Pi

ELKEELANY, OMAR

Vice Chair:

ASEE-SE Computer Engineering Division

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

ELSAWY, AHMED

Vice Chair:

Research & Development, Board of Certification, the Association of Technology, Management and Applied Engineers (ATMAE)

Member:

Non-US Accreditation Committee, Board of Accreditation, the Association of Technology, Management, and Applied Engineers (ATMAE)
International Review Board, the Technology Interface International Journal
International Review Board, the International Journal of Modern Engineering
International Review Board, the International Journal of Engineering Research & Innovation
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)

GHAFOOR, SHEIKH

Member:

American Society for Engineering Education (ASEE)
Association for Computing Machinery (ACM)

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)
ASHRAE Technical Committee 5.2, Duct Design: Committee Chair 1998-2001; Programs Subcommittee Chair, 1995-1998; 2001-present
ASHRAE Programs Subcommittee Chair, 1996-present
ASHRAE Technical Committee 5.1, Fans: Corresponding Member, 2003-present

JOHNSON, WAYNE

Vice President:

Publications, IEEE Components, Packaging and Manufacturing Technology Society

Member:

Institute of Electrical and Electronic Engineers (IEEE)
International Microelectronic and Packaging Society (IMPS)

KALYANAPU, ALFRED

Member:
Executive Committee, ASCE Computational Hydraulics Committee
EWRI Rainwater Harvesting Technical Committee
Secretary:
TN AWRA, Executive Committee
Associate Editor:
Special Issue on Human Impact on Climate Extremes for Water Resources Infrastructure Design, Operations and Risk Management in the on-line journal Earth Interactions, published by the American Geophysical Union, American Meteorological Society and American Association of Geographers

KAMAL, AHMED

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

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

MAHMOUD, MOHAMED

Member:
Institute of Electrical and Electronics Engineers (IEEE)

MOHR, BENJAMIN

Chair:
American Ceramic Society Cements Division
Honors:
TN Professional Engineer, TN #00116651, 2013-Present
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, (Nigeria)
Institute of Electrical and Electronics Engineers (IEEE)
Institute of Electrical Engineers (IEE), (UK)
Nigerian Academy of Engineering

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
National Honor Societies

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

Member:

Editorial Board, Journal of Electrical and Computer Engineering, Open Access Journal

SIRAJ, AMBAREEN

Member:

Executive Board, National Center for Women and IT (NCWIT)

Co-Chair:

Committee on Creating and Supporting Student Organizations that Promote Women in Computing, NCWIT
Working Group Member, National Cybersecurity Sports Federation
Association for Computing Machinery
Information Systems Security Association

Award:

TTU College of Engineering Teacher Scholar Award 2013

STRETZ, HOLLY

Chair:

AIChE, National Meeting Symposia

YARNOLD, MATTHEW T.

Member:

American Society of Civil Engineers (ASCE)

.

Visitors:	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. S. Ganapathy
	Dr. A. Sigappi
	Dr. M. T. Ansari
	Dr. J. Krishnan
	Dr. R. Malathi
	Mr. Shiv Das Meena
Students	C. K. Murugan
	D. Kalaichelvi
	R. Hiemaja
	S. Chinthana
	Rahimunnisha Begum
	Raj Raj
	S. Premkumar

Left to right — Dhandapani Kalaichelvi, Ramamurthy Hiemaja, Dr. P.K. Rajan, Dr. Ganapathy Somaskandan, C. Krishnamoorthy Murugan, (Photo courtesy CESR)

As part of the 2013 Obama-Singh 21st Century Knowledge Initiative Award Program, Tennessee Tech has been able to invite faculty and students from India's Annamalai University for an exchange program; the move puts TTU in the company of such schools as Harvard School of Public Health, Ohio State University, University of North Carolina, Chapel Hill and University of Massachusetts, Amherst.

Ganapathy is working closely with P.K. Rajan, Interim Director of TTU's Center for Energy Systems Research. He is also having discussions with faculty in the power area Drs. Alouani, Bhattacharya, Belkacemi, Mahajan, Ojo and Radman and their graduate students. He also made a seminar presentation on Load Frequency Control Strategies in Power Systems.

"In much of India, we have an abundance of wind and sunlight," said visiting professor Somaskandan Ganapathy. "What we do not have is a strong network or infrastructure to make good use of it in

generating electrical power, or much public awareness of the potential here. We hope to be able to use this opportunity to set up studies and collaborative efforts toward these goals."

Ganapathy is joined by students C.K. Murugan, D. Kalaichelvi and R. Hiemaja, all of whom are doing thesis work on energy systems. Ganapathy is in the United States on a month-long visit, while his students will be staying for six weeks. Along with their research into the potential of wind and solar power, the group is also working on how to incorporate smart grids and smart metering into existing electrical infrastructure. The target of the initiative is for Annamalai to launch a Master of Science program in Smart Energy Systems. It's hoped that in the spring semester of 2014, five students will come for the entire semester, along with three faculty members who can engage in collaborative research. This program will continue for a total of three years and it is hoped the contacts established will lead to continued collaboration between the two universities.

Among other activities, Ganapathy and students were able to visit Schneider Electric in Nashville, for a good look at the solar farm and a wide range of products and services the company has to offer. They also visited the control center of Nashville Electric Service.

Annamalai University is one of India's most respected institutions; founded in 1929, the university has ten colleges, with 49 programs of studies and over 3,000 faculty members. Annamalai boasts roughly 30,000 students, with ten times that number engaged in distance learning or online studies.

"Along with studies, this visit is a great opportunity for cultural exchange," said Ganapathy. "We're learning a lot about southern American customs and traditions, and people are so polite and friendly and helpful wherever we go."

Visitors from India January 2014, Annamalai, Sigappi and Ansari, Mohamed — faculty (not in photo) students left to right — Raj, Raj, Chinthana, Subramaniyan, Rahimunnisha Begum, Syed Noor, Sivakumar, Premkumar.

DR. RANJAN K. BEHERA, a visiting scholar under the Bhaskara Advanced Solar Energy Fellowship of the Government of India through the Indo-US Science and Technology Forum to conduct research on solar energy and its integration on the smart grid, presented a seminar Wednesday, May 21, 2014 at 10:00 a.m. in Brown Hall 208 entitled "Modeling and Control of Efficient Solar Energy Converters".

DR. GBENGA A. OLARINOYE, visiting Fulbright Scholar, CESR, presented a seminar Wednesday, May 28, 2014 in Brown Hall 208 at 10:00 a.m. entitled "High Performance Drives for Single Phase Induction Machines". Dr. Olarinoye received the Fulbright Scholarship award from the U.S. Department of State, Bureau of Educational and Cultural Affairs in 2013. He is a member of IEEE and has just concluded his academic program as a visiting scholar under the Fulbright Foreign Student Program for 2013-2014.

DR. RANJAN K. BEHERA presented a second seminar Tuesday, August 5, 2014 at 11:00 a.m. in Brown Hall 208 entitled "Modeling and Control of Dual Active Bridge Converter for All Solar Micro Grid Application".

VADIM ZHEGLOV, a former CESR Masters student (Power Systems Consultant at EnerNex, Knoxville), and Dr. Jens Schoene (Director of Research Studies at EnerNex) presented a seminar Thursday, March 2014 at 3:00 p.m. in Brown Hall 320 entitled "Integration of PVs in Power Systems".

DR. A.N. SIGAPPI, Associate Professor, Department of Computer Science and Engineering, Annamalai University and Exchange Visitor, presented a seminar on "Image Processing – Basics and Research Applications" on Feb. 18, 2014 at 3:00 p.m. in Bruner Hall 207.

DR. MOHAMED T. ANSARI, The Electrical and Computer Engineering Graduate Students Association (ECEGSA) of TTU organized a seminar by Dr. P.K. Rajan, Interim Director CESR, on February 11, 2014 at 11:00 a.m. in Brown Hall 208. Dr. Rajan presented a seminar on the topic "Design of Fuzzy Logic Controllers".

DR. S. GANAPATHY, (Exchange Visitor) Professor of Electrical Engineering, Annamalai University, India presented a seminar Wednesday, November 20, 2013 in Brown Hall 303 entitled "Load Frequency Control Strategies in Power Systems".

SUBBU MEIYAPPAN, Co-Founder and Vice President Engineering, NextVav, LLC presented a seminar Thursday, September 19, 2013 in Brown Hall 208 entitled "Positioning Technologies for GPS Challenged Locations".

MASTERS

BHANU NAGA ANGIREKULA
Modeling, Analysis and Control of Renewable Energy Resources Based Single Phase DC-AC Multi-Level Converters
May 2014
Dr. Joseph Ojo
Electrical and Computer Engineering

ADENIYI BABALOLA
Implementation of Multi-Agent Systems Algorithms for Distributed Restoration and Cascading Failure Blackout Prevention in a Smart Grid System
May 2014
Dr. Rabie Belkacemi
Electrical and Computer Engineering

BRANDON BARTROM
Impact of Shear Rating Factors for Reinforced Concrete Culverts and Enhancement of TDOT Culvert Rating Aids
May 2014
Dr. Sharon Huo
Civil Engineering

DEREK GAW
Geometrically Nonlinear Analysis of Isotropic And Laminated Composite Plates Subjected to Thermal Loading using Groebner Bases
December 2013
Dr. Jane Liu
Civil Engineering

HEATH KAUFMAN
Analysis and Rating of Reinforced Concrete Box Culverts Under Various Loading and Modeling Methods
May 2014
Dr. Sharon Huo
Civil Engineering

SHANE PAULSON
A Parametric Study of Linear And Nonlinear Models for Moisture Diffusion In Composite Sandwich Structures
December 2013
Dr. Jane Liu
Civil Engineering

BHARADWAJ SRINIVASAN
Pressure Drop Testing of Corrugated Stainless Steel Pliable Gas Tubing (PLT)
May 2014
Dr. Stephen Idem
Mechanical Engineering

STEVEN STRATZ
Propogation of Anthropogenic Variations in Hydroclimate Statistics for Dynamic Modeling of Probable Maximum Precipitation
May 2014
Dr. Faisal Hossain
Civil Engineering

PhD

KENNEDY AGANAH
On-Grid Doubly-Fed Induction Generator Wind Turbine with Nine-Switch Converter as Grid Side Converter for Low Voltage Ride-Through
August 2013
Dr. Joseph Ojo
Electrical and Computer Engineering

MEHRIAR AGHAZADEH TABRIZI
Participation of Non-Conventional Energy Resources in Power System Frequency Control
December 2013
Dr. Ghadir Radman
Electrical and Computer Engineering

PREEJITH AMBUKEN
The Influence of Polymer Charring and Crystallization on Nanoparticle Dispersion for Rubbery Polymer Nanocomposites
December 2013
Dr. Holly Stretz
Chemical Engineering

RAMI AMIRI
Conception, Synthesis, and Integration: Custom-State Machine TCP/IP Offload Engine and Cryptosystem for Isomorphic Transformation and Elliptic Curve Cryptography on an FPGA Chip
May 2014
Dr. Omar Elkeelany
Electrical and Computer Engineering

MANOHAR GOTTAPU
Investigation of Recent C3s Hydration Inferences Using A Multi-Constrained Multi-Ionic Single Particle Modeling Strategy
December 2013
Dr. Joseph Biernacki
Chemical Engineering

ARASH JAMEHBOZORG
Enhancement of Power Systems Dynamics in Presence of Renewable Energy Sources Using Smart Storage Units
August 2013
Dr. Ghadir Radman
Electrical and Computer Engineering

GRADUATE STUDENT SUPPORT SM-10

MS STUDENTS

Name	Dept.	Source of Support	Graduation Date	Advisor
Angirekula, Bhanu Naga	ECE	CESR	Spring 2014	Dr. Ojo
Babalola, Adeniyi	ECE	CESR	Spring 2014	Dr. Belkacemi
Bartrom, Brandon	CEE	TDOT	Spring 2014	Dr. Huo
Cruz Rangel, Dario	CHE	CESR	Fall 2014 (exp.)	Dr. Biernacki
Drane, Benjamin	CEE	CESR, CEE	Fall 2014 (exp.)	Dr. Liu
France-Mensah, Jojo	CEE	NSF	Summer 2014 (exp.)	Dr. Mohr
Gaw, Derek	CEE	CESR, CEE	Fall 2013	Dr. Liu
Hale, John	CSC	CESR	Spring 2014	Dr. Ghafoor
Kaufman, Heath	CEE	TDOT, CESR	Spring 2014	Dr. Huo
Maswood, Mehedi	CEE	CESR	Left TTU	Dr. Hossain
Paulson, Shane	CEE	CESR, CEE	Fall 2013	Dr. Liu
Qualls, Joshua	ME	NSF, TTU Research Office	Spring 2015 (exp.)	Dr. Canfield
Rogers, Christopher Lee	CEE	TDOT	Spring 2014	Dr. Crouch

GRADUATE STUDENT SUPPORT SM-10

PHD STUDENTS

Name	Dept.	Source of Support	Graduation Date	Advisor
Amiri, Rami	ECE	CESR	May 2014	Dr. Elkeelany
Chaudhari, Ojas	CHE	CESR, NSF	Spring 2016 (exp.)	Dr. Biernacki
Crowley, Aaron	CEE	TDOT	Spring 2015 (exp.)	Dr. Crouch
Dillon, Sarah	CEE	CESR, CEE	Spring 2015 (exp.)	Dr. Crouch
Ford, Vitaly	CSC	CESR	Spring 2016 (exp.)	Dr. Siraj
Ghosh, Arnab	ECE	CESR	Spring 2017 (exp.)	Dr. Johnson
Khalil, Alamgir	CEE	NASA	Left the University	Dr. Hossain
Khayamy, Mehdy	ECE	CESR	Spring 2015 (exp.)	Dr. Ojo
Marshall, Ryan	CSC	CESR	Spring 2017 (exp.)	Dr. Ghafoor
Ramezani, Mehdi	ECE	CESR	Summer 2015 (exp.)	Dr. Ojo
Sota, Eseme	ECE	CESR	Fall 2015 (exp.)	Dr. Ojo
Thomas, Adam J.	ECE	CESR	Fall 2014 (exp.)	Dr. Mahajan
Zafarani, Mohsen	ECE	CESR	Left the University	Dr. Ojo
Zarrabian, Sina	ECE	CESR, ECE	Spring 2018 (exp.)	Dr. Belkacemi
Yigzaw, Wondmagegn	CEE	NASA	Summer 2015 (exp.)	Dr. Hossain/ Dr. Huddleston

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)
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-11

GRADUATE/UNDERGRADUATE STUDENTS	DEGREE AND MAJOR
Rami Amiri	Ph.D. ECE
Bhanu Angirekula	M.S. ECE
Oluwaseun Joseph Arbido	M.S. ECE
Adeniyi Babalola	M.S. ECE
David B. Bailey	B.S. GEOSCIENCES
David T. Bailey	B.S. ECE
Brandon Bartrom	M.S. CEE
Charles Batson	B.S. CEE
Christina Bechard	B.S. ME
Jacob Brooks	B.S. CEE
Chelsea Burton	B.S. CEE
William Caruthers	B.S. CHE
Ojas Chaudhari	Ph.D. CHE
Traci Cooper	B.S. CEE
Kayla Cornett	B.S. CEE
Aaron Crowley	Ph.D. CE
Dario A. Cruz Rangel	M.S. CHE
Sarah Dillon	Ph.D. CEE
Rebekah Dorris	B.S. CEE
Benjamin Drane	M.S. CEE
Tigstu Dullo	Ph.D. CEE
Blakeslee Eagan	B.S. CEE
Tanner Elliott	B.S. COMP ENGR
Vitaly Ford	Ph.D. CSC
Jojo France-Mensah	M.S. CEE
Derek Gaw	M.S. CEE
Arnab Ghosh	Ph.D. ECE
Manohar Gottapu	Ph.D. CHE
John Hale	M.S. CSC
Jackson Hardin	B.S. ME
Scott Hill	B.S. ME
Md T. Islam	M.S. CSC
Eric James	M.S. CEE
Heath Kaufman	M.S. CEE
Mehdy Khayamy	Ph.D. ECE
James Locum	B.S. CEE
Rowan Lumb	B.S. PHYSICS
Ryan Marshall	Ph.D. CSC
Mariah Martinez	B.S. CHE
Benjamin McComb	B.S. CHE
Bradley Montgomery	B.S. CEE

HOURLY STUDENT PERSONNEL SM-11

GRADUATE/UNDERGRADUATE STUDENTS	DEGREE AND MAJOR
Andrew Murray	B.S. PSYCHOLOGY
Shane Paulson	M.S. CEE
Joshua Qualls	M.S. ME
Parisa Radman	B.S. ECE
Mehdi Ramezani	Ph.D. ECE
Maruthi Reddy	M.S. ME
Jesse Roberts	M.S. ECE
Christopher Rogers	M.S. CEE
Stephen Salaman	M.S. CEE
Wyatt Sherry	B.S. CE
Natalia Shlonimskaya	M.S. CHE
Caleb Smith	B.S. CE
Eseme Sota	M.S. ECE
Bharadwaj Srinivasan	M.S. ME
Adam Stegemann	B.S. EE
Peter Talley	B.S. CE
Joseph Tatarczuk	M.S. CSC
Adam Thomas	Ph.D. EE
Jared Thompson	M.S. CE
Michael Whittenburg	B.S. CE
Wondmagegn Yigzaw	Ph.D. CEE
Sina Zarrabian	Ph.D. ECE

WORK STUDY/WORK SCHOLARSHIP

Demanuel Boyd	B.S. MET
Derek Bush	B.S. ME
Marshall Hunt	B.S. COMP ENGR
Austin Jenkins	B.S. ME
Jonathan McBrien	B.S. CHE
Jessika Samples	B.S. CEE

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 2013-14 Actual			FY 2014-15 Proposed			FY 2015-16 Requested		
	Matching	Appropr.	Total	Matching	Appropr.	Total	Matching	Appropr.	Total
Expenditures	1,373,220	847,909	**2,221,129**	490,155	1,749,751	**2,239,906**	471,713	943,425	**1,415,138**
Salaries									
Faculty	153,645	24,376	**178,021**	103,298	223,612	**326,910**	97,649	30,000	**127,649**
Other Professional	32,270	242,893	**275,163**	10,000	327,566	**337,566**	10,000	288,691	**298,691**
Clerical/Supporting	6,811	76,106	**82,917**	1,250	167,054	**168,304**	1,950	118,259	**120,209**
Assistantships	142,177	201,119	**343,296**	129,300	200,000	**329,300**	109,400	145,000	**254,400**
Total Salaries	**334,903**	**544,494**	**879,397**	**243,848**	**918,232**	**1,162,080**	**218,999**	**581,950**	**800,949**
Fringe Benefits	141,228	238,919	**380,147**	83,924	467,571	**551,495**	89,147	289,134	**378,281**
Total Personnel	**476,131**	**783,413**	**1,259,544**	**327,772**	**1,385,803**	**1,713,575**	**308,146**	**871,084**	**1,179,230**
Non-Personnel									
Travel	44,177	11,271	**55,448**	33,393	25,000	**58,393**	32,172	21,000	**53,172**
Software	600	3,887	**4,487**	1,000	3,146	**4,146**	1,000	2,500	**3,500**
Books & Journals	670	54	**724**	200	200	**400**	200	200	**400**
Other Supplies	248,334	30,102	**278,436**	28,108	164,135	**192,243**	48,445	43,641	**92,086**
Equipment	462,625	14,629	**477,254**	55,082	163,167	**218,249**	0	5,000	**5,000**
Maintenance		0	**0**			**0**			**0**
Scholarships	0	0	**0**			**0**			**0**
Consultants	140,183	1,950	**142,133**	12,000	1,500	**13,500**	17,000		**17,000**
Renovation	0	0	**0**		6,800	**6,800**			**0**
Other (Advertising)		2,603	**2,603**			**0**			**0**
Other (Participant Support)	500	0	**500**	32,600		**32,600**	64,750		**64,750**
			0			**0**			**0**
			0			**0**			**0**
Total Non-Personnel	**897,089**	**64,496**	**961,585**	**162,383**	**363,948**	**526,331**	**163,567**	**72,341**	**235,908**
GRAND TOTAL	**1,373,220**	**847,909**	**2,221,129**	**490,155**	**1,749,751**	**2,239,906**	**471,713**	**943,425**	**1,415,138**
Revenue									
New State Appropriation	0	919,300	**919,300**		898,500	**898,500**		943,425	**943,425**
Carryover State Appropriation	0	779,860	**779,860**		851,251	**851,251**		0	**0**
New Matching Funds	1,024,195		**1,024,195**	449,250		**449,250**	471,713		**471,713**
Carryover from Previous Matching Funds	389,930		**389,930**	40,905		**40,905**	0		**0**
Total Revenue	**1,414,125**	**1,699,160**	**3,113,285**	**490,155**	**1,749,751**	**2,239,906**	**471,713**	**943,425**	**1,415,138**

SCHEDULE 13A — ACTUAL PERSONNEL

TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
ACTUAL, 2013-2014

Tennessee Technological University | Center for Energy Systems Research | June 30, 2014

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
Indranil Bhattacharya, Assistant Professor	Electrical and Computer Engineering	30
Steve Canfield, Professor	Mechanical Engineering	25
L. K. Crouch, Professor	Civil and Environmental Engineering	45
Sheikh Ghafoor, Associate Professor	Computer Science	25
Stephen Idem, Professor	Mechanical Engineering	25
Y. Jane Liu, Professor	Civil and Environmental Engineering	30
Benjamin Mohr, Associate Professor	Civil and Environmental Engineering	40
Joseph Ojo, Professor	Electrical and Computer Engineering	40
Matthew Yarnold, Assistant Professor	Civil and Environmental Engineering	50

*NOTE 1: Center faculty members. **Number 10** **FTE 3.50**

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

		Number	FTE
a.	Faculty	22	1.87
b.	Other Professionals	3	2.90
c.	Clerical/Supporting	2	2.00
d.	Assistantships	27	14.94
e.	Hourly Students	63	5.00
TOTAL, all categories		**127**	**30.21**

SCHEDULE 13B PROPOSED PERSONNEL

TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
PROPOSED, 2014-2015

Tennessee Technological University | Center for Energy Systems Research | June 30, 2014

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, Assistant Professor	Electrical and Computer Engineering	30
L. K. Crouch, Professor	Civil and Environmental Engineering	40
Sheikh Ghafoor, Associate Professor	Computer Science	25
Stephen Idem, Professor	Mechanical Engineering	35
Alfred Kalyanapu, Assistant Professor	Civil and Environmental Engineering	25
Y. Jane Liu, Professor	Civil and Environmental Engineering	30
Benjamin Mohr, Associate Professor	Civil and Environmental Engineering	40
Joseph Ojo, Professor	Electrical and Computer Engineering	40
Ambareen Siraj, Associate Professor	Computer Science	25
Matthew Yarnold, Assistant Professor	Civil and Environmental Engineering	50

*NOTE 1: Center faculty members. **Number 11 FTE 3.80**

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

		Number	FTE
a.	Faculty	17	1.95
b.	Other Professionals	3	3.00
c.	Clerical/Supporting	2	2.00
d.	Assistantships	22	13.40
e.	Hourly Students	40	3.00
TOTAL, all categories		**95**	**27.15**

SCHEDULE 13C REQUESTED PERSONNEL

TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
REQUESTED, 2015-2016

Tennessee Technological University | Center for Energy Systems Research | June 30, 2014

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	30
L. K. Crouch, Professor	Civil and Environmental Engineering	40
Sheikh Ghafoor, Associate Professor	Computer Science	25
Stephen Idem, Professor	Mechanical Engineering	35
Alfred Kalyanapu, Assistant Professor	Civil and Environmental Engineering	25
Y. Jane Liu, Professor	Civil and Environmental Engineering	30
Benjamin Mohr, Associate Professor	Civil and Environmental Engineering	40
Joseph Ojo, Professor	Electrical and Computer Engineering	40
Ambareen Siraj, Associate Professor	Computer Science	25
Matthew Yarnold, Assistant Professor	Civil and Environmental Engineering	50

*NOTE 1: Center faculty members. **Number 11** **FTE 3.80**

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

		Number	FTE
a.	Faculty	17	1.95
b.	Other Professionals	3	3.00
c.	Clerical/Supporting	2	2.00
d.	Assistantships	25	20.00
e.	Hourly Students	50	4.00
TOTAL, all categories		**108**	**34.75**

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

INSTITUTION: Tennessee Technological University **DATE: June 30, 2014**
CENTER OF EXCELLENCE: Energy Systems Research

State Appropriations

Description	Number	Unit Cost	Total
Fast Response HC Gas Analyzer (Funding also provided by the Office of Research $14,999.98; College of Engineering $12,500.01; Center for Manufacturing Research $6,885.01)	1	$ 5,000.00	$ 5,000.00
Pouch Cell Battery Production Line (Funding also provided by the College of Engineering $49,831.80; Electrical and Computer Engineering Department $39,445.72) Encumbered for 2014-2015 from the Center for Energy Systems Research is $13,334.63 and from the Electrical and Computer Engineering Department is $5,555.28	1	$ 9,629.27	$ 9,629.27
Subtotal, State Appropriations			**$14,629.27**

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

INSTITUTION: Tennessee Technological University **DATE: June 30, 2014**
CENTER OF EXCELLENCE: Energy Systems Research

	Matching		
Description	**Number**	**Unit Cost**	**Total**
Temperature and Humidity Stability Chamber, Refrigerated (National Science Foundation Index 531234)	1	$10,590.00	$ 10,590.00
Integrated Power Systems Equipment (Office of Naval Research Index 532343) Encumbrance of $40,304.55	1	$452,035.00	$452,035.00
Subtotal, Matching			**$462,625.00**
GRAND TOTAL			**$477,254.27**

Grand Total	**Matching**	**Appropriation**
$477,254.27	**$462,625.00**	**$14,629.27**

SCHEDULE 14B **PROPOSED EQUIPMENT**

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

INSTITUTION: Tennessee Technological University **DATE: June 30, 2014**
CENTER OF EXCELLENCE: Energy Systems Research

State Appropriations

Description	Number	Unit Cost	Total
Research Equipment	1	$79,832	$ 79,832
Resilient Infrastructure Equipment	1	$70,000	$ 70,000
Smart Grid Research Equipment	1	$13,335	$ 13,335
Subtotal, State Appropriations			**$163,167**

Matching

Description	Number	Unit Cost	Total
Resilient Infrastructure Equipment	1	$14,777	$ 14,777
Subtotal, Matching			**$ 14,777**
GRAND TOTAL			**$177,944**

Grand Total	Matching	Appropriation
$177,944	$14,777	$163,167

SCHEDULE 14C **REQUESTED EQUIPMENT**

TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
REQUESTED EQUIPMENT, 2015-2016

INSTITUTION: Tennessee Technological University **DATE: June 30, 2014**
CENTER OF EXCELLENCE: Energy Systems Research

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

BASE SUPPORT AND NON-EQUIPMENT MATCHING ACTUAL 2013-2014		
		2013-2014
Budget Account Numbers		**Actual Expenditures**
2-10406, 2-10407, 2-10409, 2-10436, 2-10437, 2-10438, 2-10411, 2-10412, 2-10413,		11,692,372
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		
TOTAL BASE SUPPORT		**11,692,372**
Non-Equipment Matching **Restricted Accounts** **(No equipment or indirect costs included)**		
Account		
Number	**Project Title and Sponsor**	**Amount**
531652	CAREER: Wind Power -- Multi-Level Control, Intelligent Grid Integration and Real Time Digital Simulation (Year 5 of 5), National Science Foundation	80,000
532343	More Electric Integrated Power Systems with Multiphase Motors and Generators, Office of Naval Research	40,353
539341	Design and Development of Wireless Low Cost Power Data Loggers, Oak Ridge National Laboratory	10,000
539284	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (Federal) Year 3, Tennessee Department of Transportation	6,957
539285	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (State) Year 3, Tennessee Department of Transportation	1,739
539281	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (Federal), Tennessee Department of Transportation	3,479
539282	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (State), Tennessee Department of Transportation	869
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, National Aeronautics and Space Administration	27,600

SCHEDULE 15A BASE SUPPORT AND NON-EQUIPMENT MATCHING

Non-Equipment Matching Restricted Accounts (No equipment or indirect costs included)		
Account Number	**Project Title and Sponsor**	**Amount**
539290	Developing Determining Concrete Chloride Permeability Rapidly and Effectively, Tennessee Department of Transportation	166,957
539291	Developing Determining Concrete Chloride Permeability Rapidly and Effectively, Tennessee Department of Transportation	41,739
531234	REU Supplement: PFI: AIR Technology Translation-Computationally Designed Shrinkage Reducing Admixtures for Concrete, National Science Foundation	5,500
531234	PFI: AIR Technology Translation-Computationally Designed Shrinkage Reducing Admixtures for Concrete, National Science Foundation	81,305
539292	Enhance and Improve Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts (Federal), Tennessee Department of Transportation	93,913
539293	Enhance and Improve Rating Aids for the Evaluation of Existing Concrete Box/Slab Culverts (State), Tennessee Department of Transportation	23,478
536231	Biaxial Material Model of Semi-Brittle Polymers, United Launch Alliance	10,896
531218	NSF I-Corps: Shrinkage Reducing Admixture Business Development, National Science Foundation	46,385
539347	Development of Tennessee Travel Demand Model Users' Group, University of Tennessee-Knoxville, Tennessee Department of Transportation	8,956
539286	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification (Federal), Tennessee Department of Transportation	41,739
539287	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification (State), Tennessee Department of Transportation	10,436
536325	Structural Health Monitoring of the Tacony-Palmyra Bridge Arch Span, Intelligent Infrastructure Systems	14,337

SCHEDULE 15A BASE SUPPORT AND NON-EQUIPMENT MATCHING

Non-Equipment Matching Restricted Accounts (No equipment or indirect costs included)		
Account Number	**Project Title**	**Amount**
539513	Enabling Families, Infants, and Toddlers Through Technology: Merging EIME Project (School Age)	6,481
539514	Enabling Families, Infants, and Toddlers Through Technology: Merging EIME Project (Preschool)	6,481
531258	NSF I-Corps Supplement to Enhancing the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences: Type II Proposal	35,841
533122	TBR Course Revitalization Initiative for CEE 3110: Mechanics of Materials for Fall 2014-Spring 2015	13,500
533123	TBR Course Revitalization Initiative for CEE 2110: Engineering Mechanics-Statics for Fall 2014-Spring 2015	13,500
538597	Power-Test-Service Account	3,850
	Subtotal, Restricted Accounts	**796,291**

Unrestricted Matching (No equipment or indirect costs included)		
Account Number		**Amount**
229501	CESR Smart Grid Lab Facility	150,000
	Subtotal, Unrestricted Accounts	**150,000**

Other Matching (Gifts and other non-equipment support not having account numbers)	
1. Carryover Match, Operations, 2012-2013	389,930
Subtotal, Other Matching	**389,930**
TOTAL, NON-EQUIPMENT MATCHING	**1,336,221**

SCHEDULE 15B PROPOSED BASE SUPPORT AND NON-EQUIPMENT MATCHING

BASE SUPPORT AND NON-EQUIPMENT MATCHING PROPOSED, 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		12,276,990
TOTAL BASE SUPPORT		**12,276,990**
	Non-Equipment Matching Restricted Accounts (No equipment or indirect costs included)	
1.	Embry-Riddle University (ASHRAE)	33,432
2.	National Aeronautics and Space Administration (NASA	27,600
3.	National Science Foundation (NSF)	295,349
4.	Tennessee Department of Transportation (TDOT)	13,565
5.	Tennessee State Department of Education	12,962
6.	Industry Sponsors	66,342
	Subtotal, Restricted Accounts	**449,250**
	Unrestricted Accounts	
Account Number		**Amount**
2-29342	TTU Research Indirect Costs	-
	Subtotal, Unrestricted Accounts	**-**
	TOTAL, NON-EQUIPMENT MATCHING	**449,250**

SCHEDULE 15C BASE SUPPORT AND NON-EQUIPMENT MATCHING

BASE SUPPORT AND NON-EQUIPMENT MATCHING		
REQUESTED, 2015-2016		
		2015-2016
		Proposed Expenditures
Budget Account Numbers		
2-10406, 2-10407, 2-10409, 2-10436, 2-10437, 2-10438,		12,890,840
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		
TOTAL BASE SUPPORT		**12,890,840**
Non-Equipment Matching		
Restricted Accounts		
(No equipment or indirect costs included)		
1	National Science Foundation (NSF)	377,345
2	State Department of Education	12,962
3	Tennessee Department of Transportation (TDOT)	77,406
4	Industry Sponsors	4,000
	Subtotal, Restricted Accounts	**471,713**
Unrestricted Accounts		
Account		
Number		**Amount**
2-29342	TTU Research Indirect Costs	-
	Subtotal, Unrestricted Accounts	**-**
	TOTAL, NON-EQUIPMENT MATCHING	**471,713**