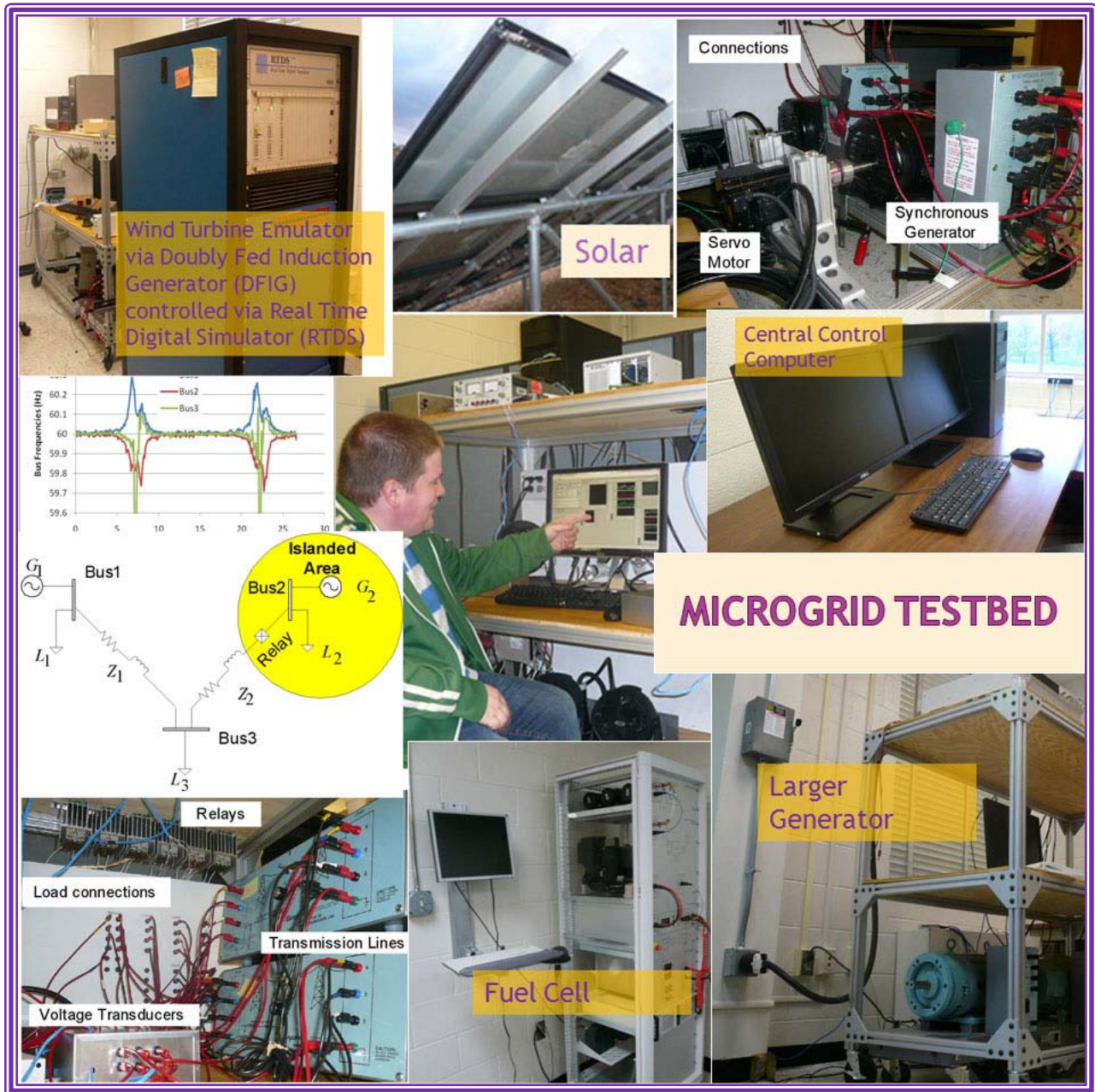


CENTER FOR ENERGY SYSTEMS RESEARCH

TENNESSEE TECH UNIVERSITY

ANNUAL REPORT FOR FISCAL YEAR 2011 — 2012



Center for
Energy
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Research

"Where research is put into practice."

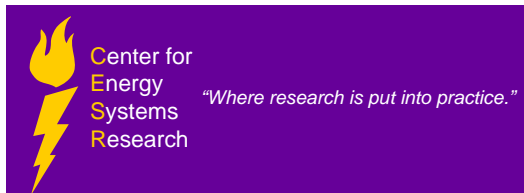
TU TENNESSEE TECH
UNIVERSITY

Annual Report for Fiscal Year

JULY 1, 2011 – JUNE 30, 2012

Subramaniam Deivanayagam, Interim Director

www.tntech.edu/cesr



Center for Energy Systems Research

1020 Stadium Drive

Prescott Hall 414

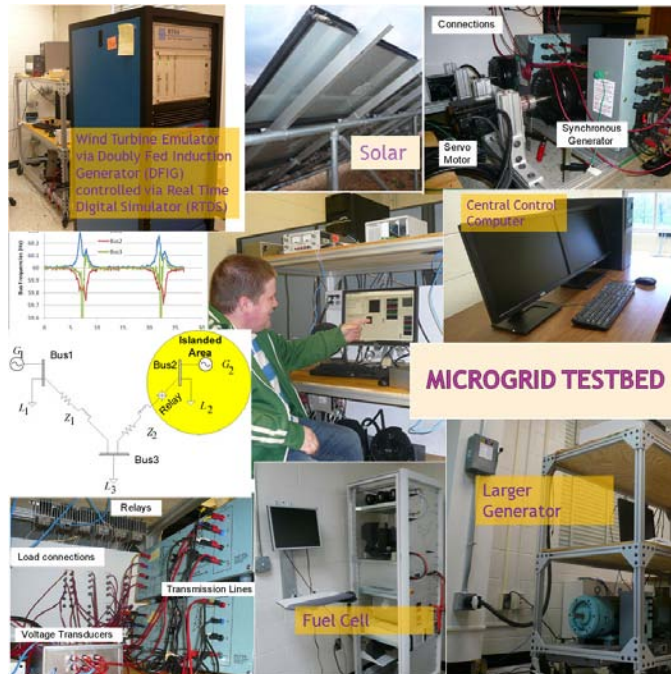
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Cover Description: A Laboratory sized power Grid (LabGrid) Microgrid Test bed Undergraduate student Steven Corum running LabGrid's LabView control program.

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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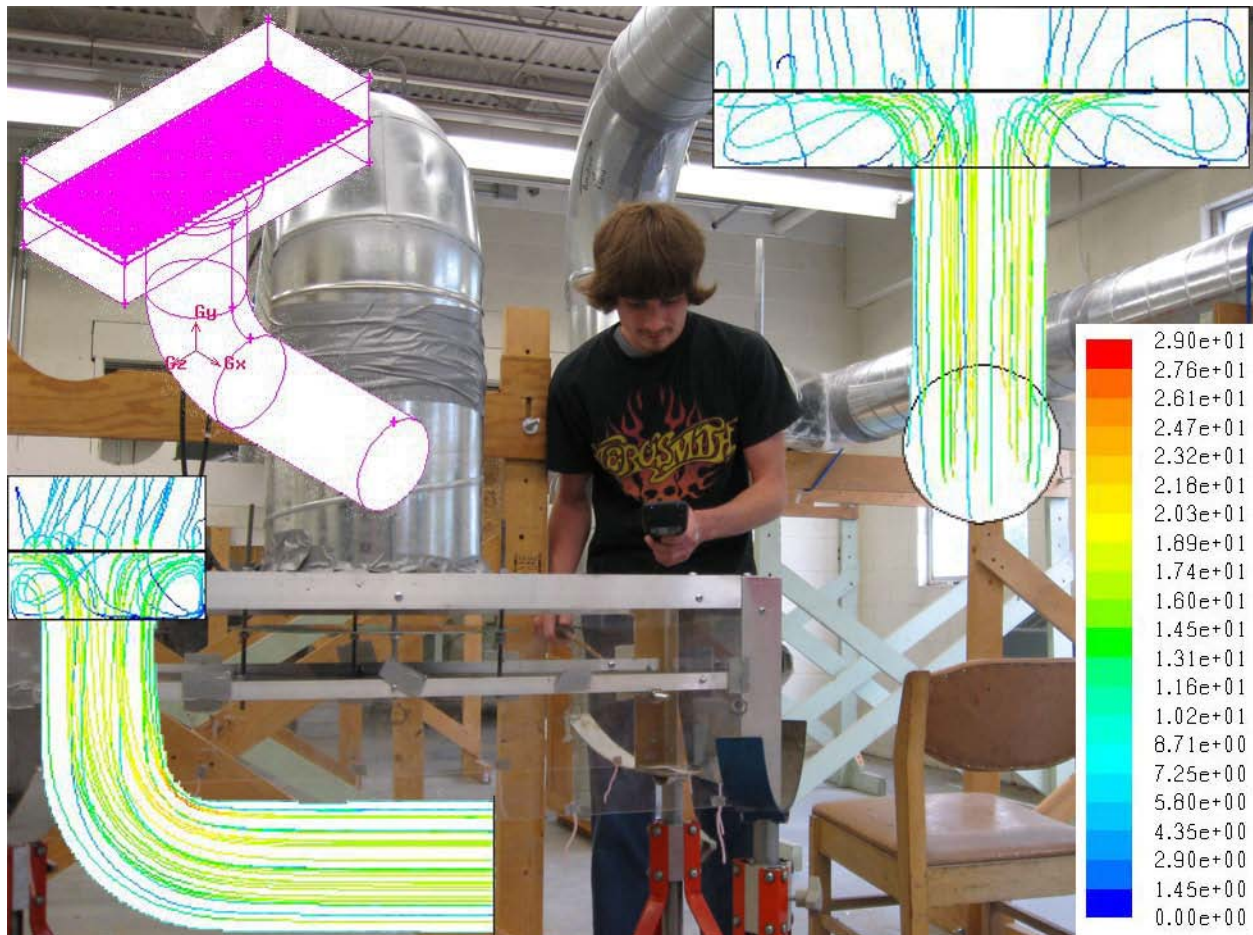
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PROGRAMMATIC REPORT



The Center has a long history of scale model testing for industry with corresponding CFD analysis. Graduate student Tyler Hughes makes flow measurements on a scale model to verify computer analysis of a flow problem for an air plenum of a fluidized bed furnace.

CESR 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's vision is to pursue advanced and applied research to enhance knowledge in currently needed and emerging technical areas of energy systems. The Center also has major interests in dissemination of knowledge and enhancing education in energy systems.

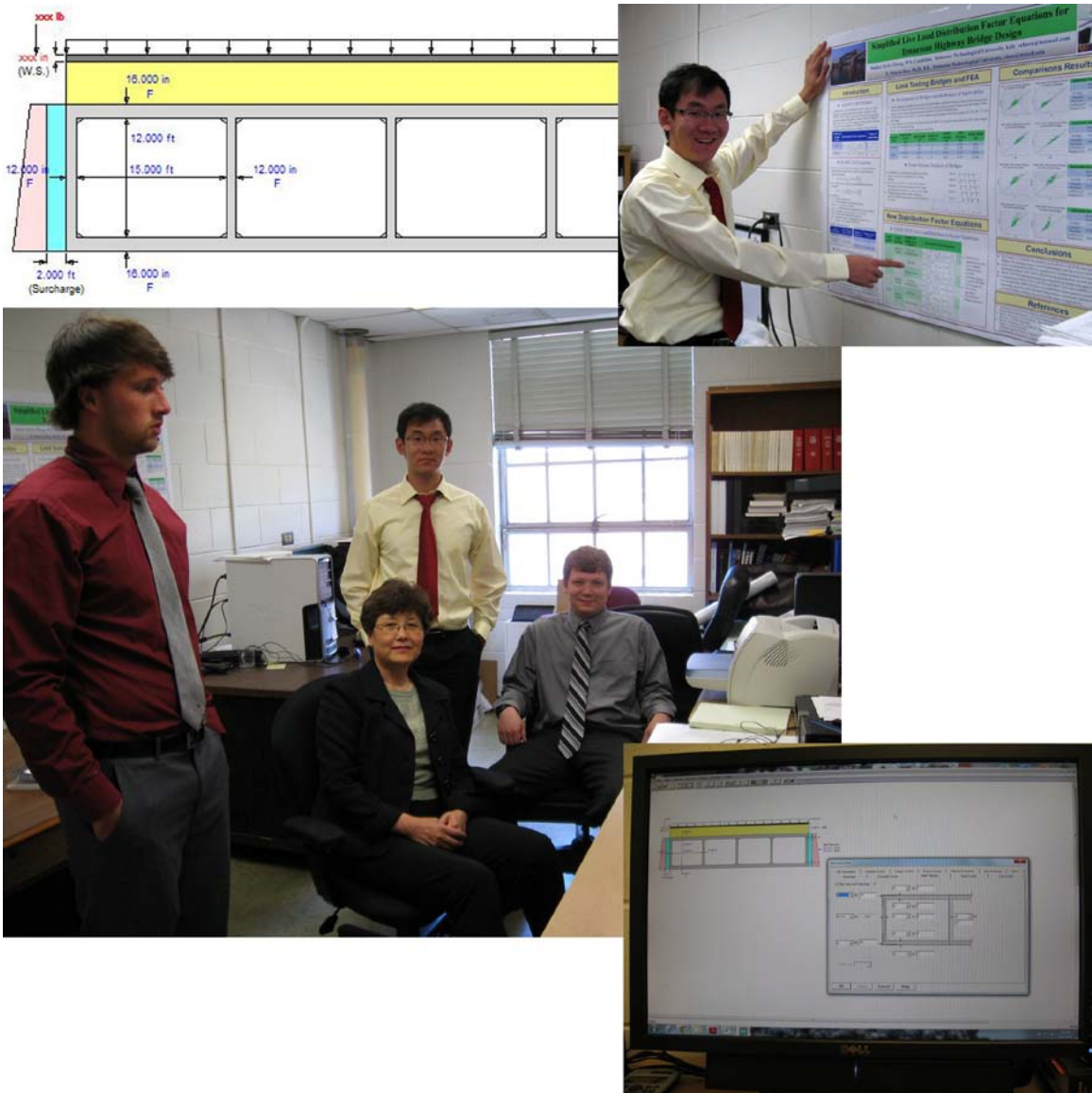
The Center draws upon the expertise from the faculty in the College of Engineering as well as from other faculty on campus. Participating faculty and faculty associates represent Chemical Engineering, Civil and Environmental Engineering, Computer Science, Electrical and Computer Engineering, Mathematics,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

HISTORY

The Center for Electric Power was established in 1985 in the College of Engineering at Tennessee Technological University by the State of Tennessee. The name of the Center has now been changed to Center for Energy Systems Research in order to reflect the broadening of activities. Over the years several funding agencies have sponsored projects. These include 20 major electric utilities, EPRI and federal agencies such as DOE, NASA, NSF, and ONR and state agencies such as TDOT and State Department of Education—Division of Special Education. In addition, several other industries have sponsored research projects.

CESR operates within the TTU System. Support in the form of travel money and graduate student support is provided to faculty members to encourage them to submit research proposals to external agencies through the Center. Where needed, support for marketing research concepts is also provided.

In addition, CESR provides services of an R&D Engineer, Visiting Scholars, Network Manager, Financial Analyst, and Secretary in support of the various research activities performed by faculty and students.



Dr. Sharon Huo, Professor of Civil Engineering, and her research team work on a research project sponsored by the Tennessee Department of Transportation. The objective of the research is to develop appropriate rating aids for the evaluation of existing concrete box culverts in Tennessee. From the left to right in the larger photo: Graduate Research Assistant Caleb Jones, Dr. Sharon Huo, Graduate Research Assistants Kyle Zhang and Michael Bednarcyk.

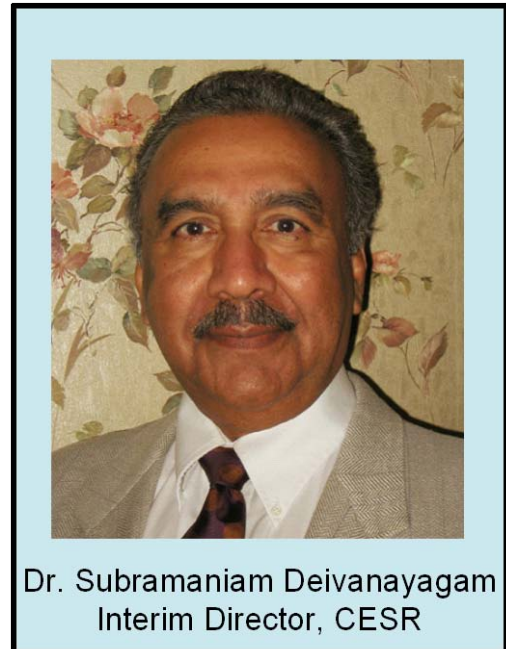
PROGRAMMATIC REPORT

MESSAGE FROM THE CENTER

YEAR IN REVIEW

The academic year 2011-2012 has been a very busy year for the Center for Energy Systems Research personnel. Dr. Subramaniam Deivanayagam, Associate Dean of Research and Graduate Studies, served as the Interim Director of CESR on additional responsibility. On his retirement from July 1, 2012 Dr. Periasamy Rajan has been appointed Interim Associate Dean of Research and Interim CESR Director for 2012-13.

The Center for Energy Research Systems (CESR) in conjunction with the TTU Energy Savings Plan developed the initial communications system for the first smart meter installations on campus. The initial placement in Brown and Prescott Halls reflected requests from electrical engineering professors for real use data on campus. Saving energy begins with measuring how much is being used. An existing National Instruments command and control computer in the Microgrid Test Bed being developed in CESR was utilized to gather data from the meters and store the data in the historian. Noting that the visible vertical spikes in power usage correlated to use of the elevators, a MatLab program was written to filter out the elevator events and total up the elevator power usage for a day. This program and data have been submitted to the Basic Engineering program for possible inclusion in a future project or homework assignment in their MatLab course.



The Smart Grid Research Project funded by the Department of Energy (DOE) has been successfully completed by the team of researchers headed by Dr. Sastry Munukutla. The objective was to conduct state-of-the-art research in Smart Grid implementations in electric power systems. Smart grid research and development deals with solar, wind and battery power and interconnection with existing grid, smart grid security, FNET application for power system performance predictions and improvement, Microgrid Technology.

As a part of its commitment to smart grid research, the Center has been developing a microgrid test bed. The microgrid test bed consists of multiple generators and loads spread out over three different laboratories in Prescott Hall connected electrically as a stand-alone power grid. A central control computer communicates with all the local grid computers and serves as a central data historian. Creating this laboratory permits researchers to conduct a variety of experiments in power electronics, power grid control, fault detection and mitigation, communication, and a variety of other research fields important to the smart grid. The latest addition to the CESR Microgrid Test Bed is a wind turbine emulator developed by graduate student Richa Gokhale. The Center's Real-Time Digital Simulator (RTDS) has been programmed to accept values for a simulated wind and control an actual induction generator to behave much as a real wind turbine would behave with the benefit of real power being added to the microgrid test bed to study grid effects due to changing wind. Note that as the wind power generation increases, the power provided by the other two generators reduces to just meet the load requirements at any given time. When the wind becomes too high and would damage the wind turbine it must be shut off and the other generators must be available to quickly meet the demands of the various loads. This highlights the problems our country is trying to address as it attempts to employ more and more renewable energy.

Dr. Stephen Canfield and Dr. Sheikh Ghafoor continue working on a three year research project "Enhancing the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences" from the National Science Foundation (NSF) to refine and extend a model in

MESSAGE FROM THE CENTER (CONTINUED)

which students begin learning programming in an environment that matches their notions and allows them to design systems that control the world around them.

Dr. Canfield and Dr. Hwan-Sik Yoon are working on year three of a three year EIME project with the Tennessee State Department of Education-Division of Special Education. Dr. Canfield also has a project with Robotic Technologies of Tennessee (RTT) to develop a remote climbing robot for automating welding process on the shipbuilding industry.

Dr. L. K. Crouch is working on the final year of a two-year contract with The Tennessee Department of Transportation (TDOT) for TDOT Class D Portland Cement Concrete and the final year of a two year contract to research higher volume Fly Ash PCC for Sustainability and Performance. Dr. Xiaoming Sharon Huo continues to progress on the final year of a TDOT two year research project to study Tennessee Highway Bridge Design.

Dr. Daniel Badoe completed the second year of a 2.5 year research project from the University of Tennessee-Knoxville (Funded by TDOT) for the Development of Tennessee Travel Demand Model Users' Model Group to improve on the travel demand forecasting capabilities of transportation planning agencies within the state of Tennessee.

Dr. Sabine Le Borne is serving a two-year appointment that began September 2011 as the Program Director for the Computational Mathematics Program, Division of Mathematical Sciences, and Directorate for Mathematical and Physical Sciences at the National Science Foundation.

Dr. Benjamin Mohr has completed the first year of a three year project from the National Science Foundation to investigate the nano-and micro-scale mechanisms of late age ettringite formation and how these mechanisms relate to macro-scale expansion in concrete materials. Dr. Mohr began serving as the Interim Chair for the Department of Civil and Environmental Engineering here at Tennessee Tech on July 1, 2012.

Dr. Glenn Cunningham and Dr. Joseph Ojo have completed their third year of a three year appointment as TVA Chairs. The endowed chair positions were created to support teaching and research in electrical engineering and mechanical engineering.

PROGRAMMATIC REPORT

RESEARCH AREAS

Research contract and grant awards activated from July 1, 2011 thru June 30, 2012 total \$1,032,667. The distribution among the Center for Energy Systems Research (CESR) areas of research is shown in the following table.

<u>Research Area</u>	<u>Activated Amount</u>
Power Systems Performance Improvement	\$130,000
Environmental Issues and Energy Conservation	\$27,500
Advanced Technologies	\$697,962
Infrastructure Materials	\$130,000
Testing and Service Contracts	\$16,525
Miscellaneous Contracts	\$30,680
Total Activated Amount	\$1,032,667

CESR continues to enjoy a broad base of support. The funding categories for 1985 thru 2012 as illustrated in Figure 1 are: in-state utilities, 13.65 percent; out-of-state utilities 7.64 percent; state and local agencies, 11.18 percent; federal government, 52.99 percent; other, 14.54 percent. The "other" category includes a variety of national and international industries, universities and professional societies. Through June 2012, the cumulative research funding of the Center is \$24,357,632. 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 27-year match of about \$24.4 million represents 101.5 percent of the state appropriations of \$24 million. Indirect costs of approximately \$4.41 million have also been received. The 2011-2012 match is \$854,190 and the state appropriation is \$866,000. A list of the projects conducted under the major research areas is given in SM-3 in this report.

CESR RESEARCH FUNDING 1985 THRU 2012

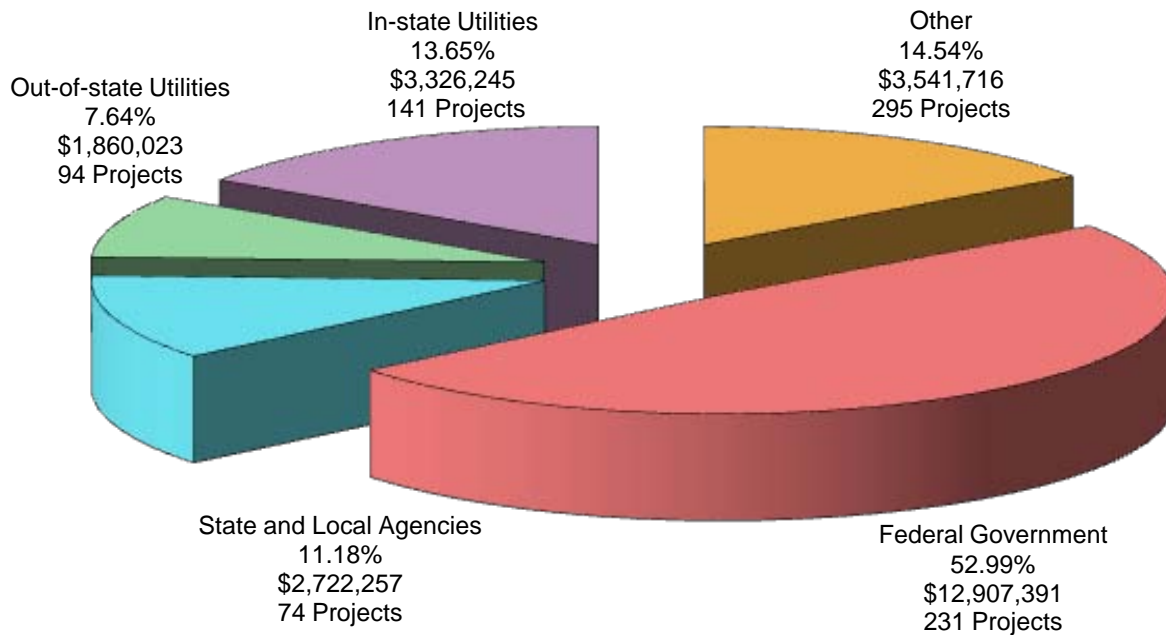


Figure 1: Types of Research Funding (Total \$24,357,632)

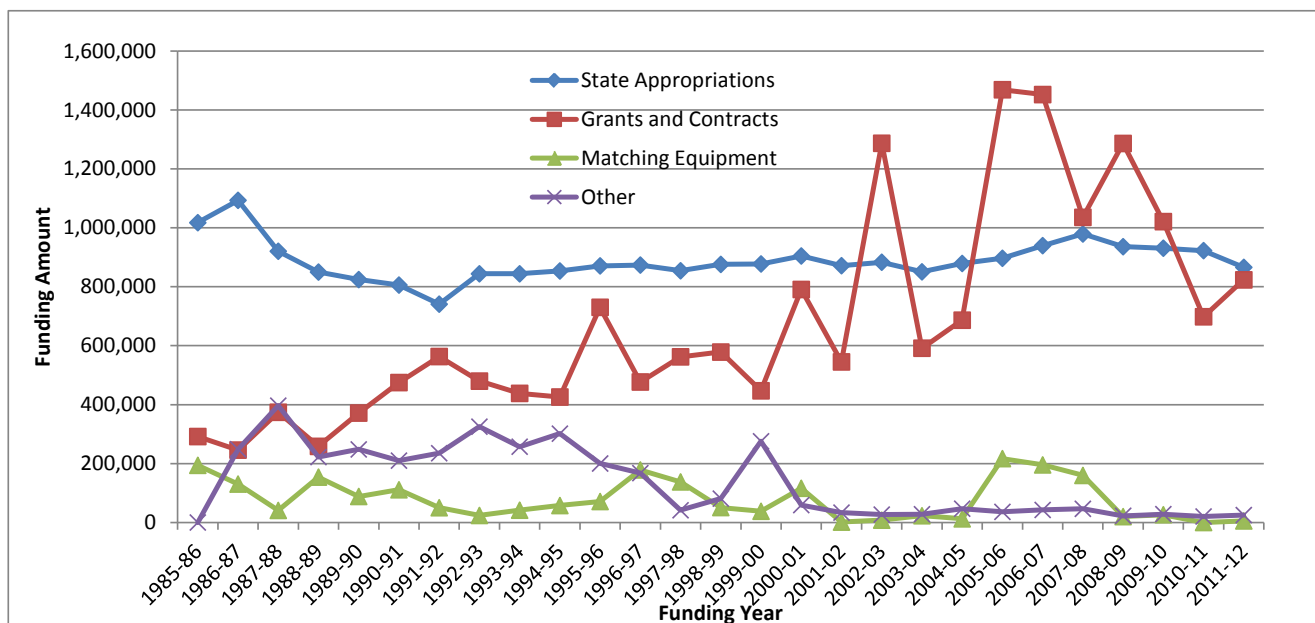
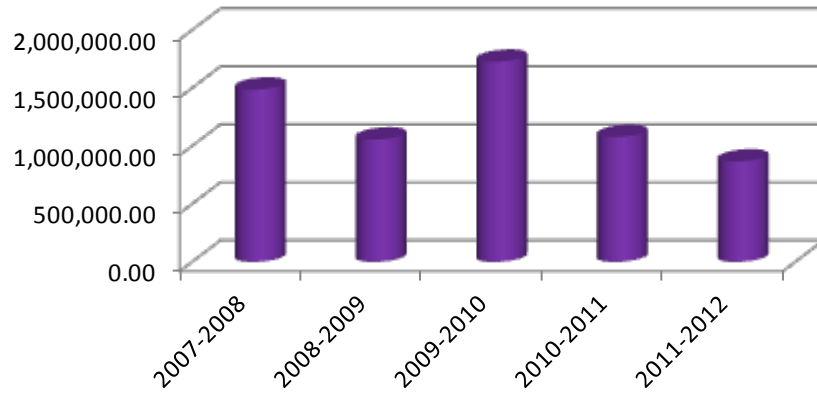
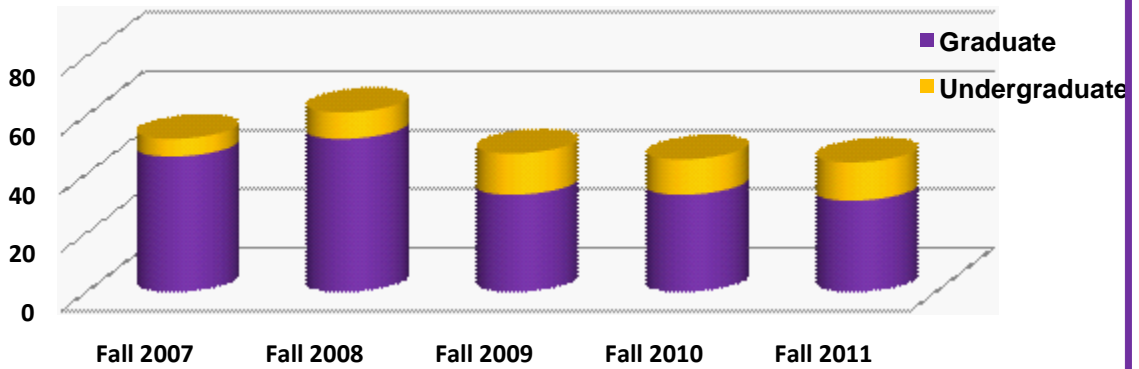


Figure 2: Historical State Appropriations and Matching

Center for Energy Systems Research Activations in dollars



Center for Energy Systems Research Fall (Number of Students Supported Financially)



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.

NEW RESEARCH INITIATIVES

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.

The TTU "Smart Grid Group" is one such group of researchers who have banded together to build a microgrid "test bed". 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.

CONTINUING OR COMPLETED PROJECTS

DR. SABINE LE BORNE

Algebraic hierarchical matrix preconditioners for two- and three-dimensional saddle point problems – National Science Foundation, DMS-0913017 – \$137,149 / July 1, 2009- June 30, 2012

In this project year, hierarchical matrix preconditioners have been extended to linear systems of equations arising from higher order finite element discretizations. These systems typically have worse condition numbers, making them harder to solve iteratively. Discretizations for up to fourth order finite elements have been implemented into the HLib library. In order to develop hierarchical matrix preconditioners for higher order finite elements beyond polynomial degree four, an interface has been implemented between the HLib Library and the DEAL package.

DR. L. K. CROUCH

TDOT Aggregate-Lime-Fly Ash Stabilized Base Modifications – Dr. L. K. Crouch has been principal investigator on four multi-year Tennessee Department of Transportation funded projects. The projects were investigations of the effect of air and/or supplementary cementing materials (including fly ash) on the durability of concrete for TDOT applications. The multi-year combined value of the project was \$585,000.00. He has also been pursuing future funding through a CESR funded study of the beneficial use of substandard fly ash.



CESR MS student Sarah Dillon is compacting TDOT lime-fly-ash aggregate base as part of her MS research on using substandard fly ash.



From left: Undergraduate assistant Josh Hogancamp, CESR MS student Aaron Crowley, CESR MS student Samantha Jeffries are making higher volume fly ash concrete for testing as part of the MS research of Crowley and Jeffries.

DR. X. SHARON HUO

Simplified Live Load Distribution Factor Equations for Tennessee Highway Bridge Design

September 2010 to September 2012

Objectives: The main objective of the proposed research is to evaluate and simplify the NCHRP 12-62 distribution factor equations and to propose new TDOT distribution factors equations while maintaining the accuracy of the calculations.

Accomplishments this year: The research team at Tennessee Tech has developed a new set of simplified distribution factor equations (TDOT 2010 Equations), completed the statistical analysis of comparison between TDOT 2010 Equations and analytical results, and developed 14 design examples using the new equations. Currently, the research team is working on the final project report. Shuhai Zhang, a graduate student working on this project, presented a poster presentation entitled "Simplified Live load Distribution Factor Equations for Moment and Shear of Highway Bridge Girders," at the *2012 ASCE Structures Congress*, March 29-31, 2012, Chicago, IL.

Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee

Objectives: The objective of the proposed research is to develop appropriate rating aids including rating charts and tables for the evaluation of existing concrete box culverts in Tennessee.

Accomplishments this year: The research team has conducted literature review, acquired standard drawings of concrete box culverts, performed verifications of BRASS Culvert program, and modeled and analyzed culvert structures using the BRASS Culvert rating program.

DR. STEVEN CLICK, PE

Tennessee Department of Transportation (TDOT)

\$200,000 / 3-Year Project

The purpose of this research is to field-test one traditional and two innovative traffic signal treatments designed to improve vehicular capacity at narrow (2-lane) over- and underpasses associated with interstate interchanges. The potential benefits include postponement of expensive construction projects to widen or replace existing facilities which are structurally sound.

WORK ACCOMPLISHED SO FAR: Work continued on the TDOT sponsored project "Field Evaluation of Traffic Signal Based Interchange Treatments," The project is to provide TDOT with input on design options for traffic signal operations at interchanges, especially those with closely spaced intersections.

DR. DANIEL BADOE, PI ON SUBCONTRACT TO TTU

Tennessee Model Users Group (TNMUG), Tennessee Department of Transportation

\$27,750 / Duration: 3 years (Project ends December 31, 2012)

Objective: To improve on travel demand forecasting capabilities of transportation planning agencies within the state of Tennessee through limited research on modeling issues of interest to the group, software training workshops, and technical presentations

Work accomplished so far:

The project involves the undertaking of limited research on travel demand modeling issues for Tennessee Department of Transportation and the Metropolitan Planning Organizations within the state; the organizing of workshops on the use of travel demand modeling software and transportation planning data collected by federal agencies; and the organizing of quarterly technical meetings that address current issues in the modeling of travel demand and the collection of transportation data.

DR. BEN MOHR, PI

TRANSPORT KINETICS OF INTERNAL CURING WATER IN HIGH PERFORMANCE CONCRETES –National Science Foundation CMMI-00556015

The research conducted over the past year has been a multi-faceted approach to investigating the durability of cement-based materials. One aspect of this has been to determine the transport kinetics of internally cured high performance 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. JOSEPH BIERNACKI

LEACHING OF HEAVY METALS FROM LIME-FLY ASH CEMENTS

The lime stabilization of fly ash is one potential method to convert coal combustion by-products into useful construction materials. This research presents results for heavy metals leaching potential of lime-fly ash cements for one low loss on ignition (LLOI) and one high loss on ignition ash (HLOI). Leaching was studied using three different test methods: (1) a standard shaken (stirred) extraction test; (2) a modified shaken extraction test; and (3) a modified EP-TOX test. Novel hydration time-based test sequence was used to explore the relationship between formation of hydration product and sequestration potential. As-receive fly ashes and lime-fly ash samples were cured for 0, 7, 28 and 84 d at 40°C. The curing results suggested that curing time sequences can be used to study the rate of sequestration by the hydration product relative to the rate of leaching from the ash. X-ray diffraction (XRD) was used to characterize hydration reaction products of the lime-fly ash cements. In addition, the rate of hydration reaction was compared using isothermal calorimetry at 25°C and 40°C. The leaching results suggested that some of the tested heavy metals are greatly dependent on leachant pH and test method. Additionally, formation of hydration products during leaching does appear to partially sequester some tested heavy metals. X-ray diffraction peaks indicated that ettringite and an unidentified calcium aluminosilicate hydrate (CASH) phase are major hydration products, however, depend upon the fly ash source. Furthermore, isothermal calorimetry results suggest that hydration of LLOI fly ash is measureable at 40°C but slow at 25°C, while HLOI fly ash hydrates with much slower yet detectable rates.

This project is now complete. One MS student in Chemical Engineering, Ojas Chaudhari has graduated and one paper has been submitted and is in review. In addition, three presentations have been made or are presently accepted.

DR. JOSEPH BIERNACKI

GEOPOLYMER CEMENT FEASIBILITY STUDY

Geopolymer cement is an inorganic polymeric binder with a three-dimensional (3D) framework structure having superior mechanical and physical properties. The main application of geopolymeric cement is as a replacement for ordinary Portland cement in the production of concrete.

Geopolymeric cement, however, has many other applications and can be used not only as a green infrastructure material but also to produce low temperature reaction bonded ceramics and fire resistant fiber-reinforced composites. Geopolymer cement is considered to be an environmentally friendly substitute to ordinary Portland cement since it drastically reduces green house gas emissions produced as a result of Portland cement production. The process for geopolymer production includes mixing an aluminosilicate material with an alkaline solution such as sodium or potassium hydroxide. Additionally, large volumes of industrial waste by-products such as fly ash or blast furnace slag can be used as potential sources for aluminosilicate materials, required in geopolymer production. This review presents the work carried out on geopolymer cement concrete production and technological developments in the United States. Coverage includes preparation of geopolymer concrete from various raw materials, raw material availability and cost analysis in the United States. A comparison of green house gas emissions for geopolymeric cement and ordinary Portland cement is also given. Finally, a US-based geopolymer industry scenario is discussed including the feasibility of geopolymer mass production and current geopolymer products available in the market.

This project is nearing completion and a rough draft final report is available. One poster presentation has been made on this topic thus far. Chaudhari, O. and Biernacki, J., "Geopolymer cement feasibility study," Annual Research Day, Tennessee Tech University, Cookeville, TN, 04/2012.

DR. SATISH MAHAJAN

DEVELOPMENT OF A WIRE CORE TRANSFORMER

Superior performance (efficiency, shielding, etc.) at reduced cost of a wire core distribution transformer will have the potential benefits in lowering overall energy consumption thereby reducing greenhouse gases. The concept of using a wire core in place of a laminated core and placing it outside rather than inside the winding is truly novel. Once committed to this concept, the technology coming out of it will change landscape for the manufacturers of distribution transformers.

It is proposed to perform an electromagnetic and thermal modeling of the wire core 10kVA rated designs. Laboratory tests will then be performed to validate these models so that hot spot temperature (HST) and top oil temperature (TOT) could be determined. Comparison with a conventionally designed transformer having identical rating can then be made. Conformance to existing IEEE standards for transformer loading and allowable temperature rise in the insulation can also be validated.

This report summarizes developmental work by the Buswell Team over an extended period from 1997-2011 wherein an innovative distribution transformer containing a wire wound magnetic core is analyzed and compared to a present vintage conventional transformer containing a sheet wound magnetic core. The attraction to wire-wound core technology is the inherent exceptionally low eddy current loss that can be achieved as well as the high producibility through modular core construction. Present conventional design distribution transformers have always struggled with the limitation that automation of the magnetic core has been difficult to achieve. This report provides multiple comparisons of design aspects between the Buswell wire wound core and conventional designs. The report describes the several important aspects of the design and provides experimental and analytical backup to demonstrate the validity of the design.

This project was completed in August 2011 and a final report is available.

DR. JOSEPH O. OJO

Multiphase, Multi-Level Induction Motor Drives — Office of Naval Research (ONR), \$537,405 / July 1, 2008 – September 30, 2011

OBJECTIVE: (1) The research is to develop new multi-level converters for electric motor drives with many phases. Multiphase motor drives ensures fault-tolerant and high reliability operation in critical applications.

WORK ACCOMPLISHED SO FAR: (1) Developed the theory of the multiphase induction motor drives. (2) Designed, built and tested a three-level five phase converter with an innovative modulation scheme. (3) Designed and simulated the control of motor drive under vector control.

Dr. Ojo's three year research project from the Office of Naval Research to develop new multi-level converters for electric motor drives with many phases will be completed at the end of September. Some of the research accomplished includes the following: (1) Developed the theory of the multiphase induction motor drives; (2) Designed, built and tested a three-level five phase converter with an innovative modulation scheme; (3) Designed and simulated the control of motor drive under vector control.

DR. STEPHEN IDEM

ASHRAE – Laboratory Testing of Flexible Duct It is proposed to measure static pressure loss as a function of air volume flow rate for various diameters of wire-wound flexible duct. All aspects of the test procedures and data reduction will strictly adhere to ANSI/ASHRAE Standard 120-2008. The results will be presented in terms of Moody diagrams, where the measured friction factors will be plotted as a function of the Reynolds numbers. The goal will be to determine the relative duct roughness.

Pressure Drop Testing of Corrugated Stainless Steel Pliable Gas Tubing (PLT) – It is proposed to measure pressure drop as a function of air volume flow rate for corrugated stainless steel flexible gas tubing (PLT) and fittings manufactured by Gastite of Portland, TN. All aspects of the test procedures and data reduction will strictly adhere to I.S. EN 15266:2007. The pressure loss data will be presented on a dimensional basis, in terms of measured pressure loss over a prescribed length of tubing as a function of flow rate.

DR. STEPHEN IDEM & DR. SASTRY MUNUKUTLA

Jacksonville Electric Authority (JEA) – Northside Units 1 & 2 Primary Air System Flow Straightener Design and Optimization – The primary air supply piping system for the Circulating Fluidized Bed (CFB) Boiler of the Northside Generating Station(NGS) of Jacksonville Electric Authority (JEA) consists of a main pipe line joined by a secondary pipe line at an angle. Just before the secondary pipe joins the main pipe, flow measurement equipment known as an Annubar is installed. The Annubar location immediately follows a pipe bend in the secondary line. The measurement location thus has both upstream and downstream disturbances. Due to this the flow measurement accuracy is questionable. The purpose of this research is to correct the problem. The solution is sought via laboratory scale model study.

CFD and Scale Model Study of Primary Air Diffuser for JEA NGS Unit – Conduct CFD and scale model study to help Jacksonville Electric Authority take a decision on reinstalling the diffusers that were there originally at the entrance to the plenum of the CFB boiler.

FACULTY AWARDS AND ACCOMPLISHMENTS

2011–2012



Dr. Joseph Biernacki –received the University Distinguished Faculty Fellow Award. He was also a member of the team received that the Leighton E. Sissom Innovation and Creativity award for the implementation of the MoLE-SI, module learning.

Dr. Stephen Canfield -- received the Partners and Leadership Award from the Tennessee Department of Health for his dedication to the Early Intervention and Mechanical Engineering (EIME) program working with Children's Special Services (CSS) to provide innovative, engineered products, free of charge, to children with special needs. More than 300 TTU engineering students have completed projects through the program, which typically serves at least three families each semester. CSS recommends the families and individuals who need assistance.



Dr. Sabine Le Borne – is serving a two-year appointment that began September 2011 as the Program Director for the Computational Mathematics Program, Division of Mathematical Sciences, and Directorate for Mathematical and Physical Sciences at the National Science Foundation

Dr. Benjamin Mohr – was awarded the 2011 Kinslow Award for Best Paper for his extensive research in concrete durability. The Kinslow Award is given annually for the best research paper written by a TTU engineering faculty member and published in a refereed professional journal. Dr. Mohr was awarded Outstanding Engineering Educator, the ASCE Tennessee Section Peter G. Hoadley Award.

Dr. Mohr also received NSF support to research concrete durability of concrete at a nano-scale level and study the mechanisms of degradation that make it crack.

Dr. Mohr has been appointed Interim Chair for the Department of Civil and Environmental Engineering.



Dr. Sastry Munukutla – received the Brown Henderson Award from the College of Engineering in February 2012. The award honors outstanding performance in teaching and research or service and carries the names of TTU's College of Engineering Dean Emeritus James Seay Brown and James Henderson, the college's first dean.

Dr. Munukutla was also selected as a recipient of the 2012 Outstanding Faculty Award for Teaching. This award was presented by the University for his Exceptional teaching, mentoring, and service. Dr. Munukutla will retire on July 31, 2012.

FACULTY AWARDS AND ACCOMPLISHMENTS

2011–2012 (CONTINUED)

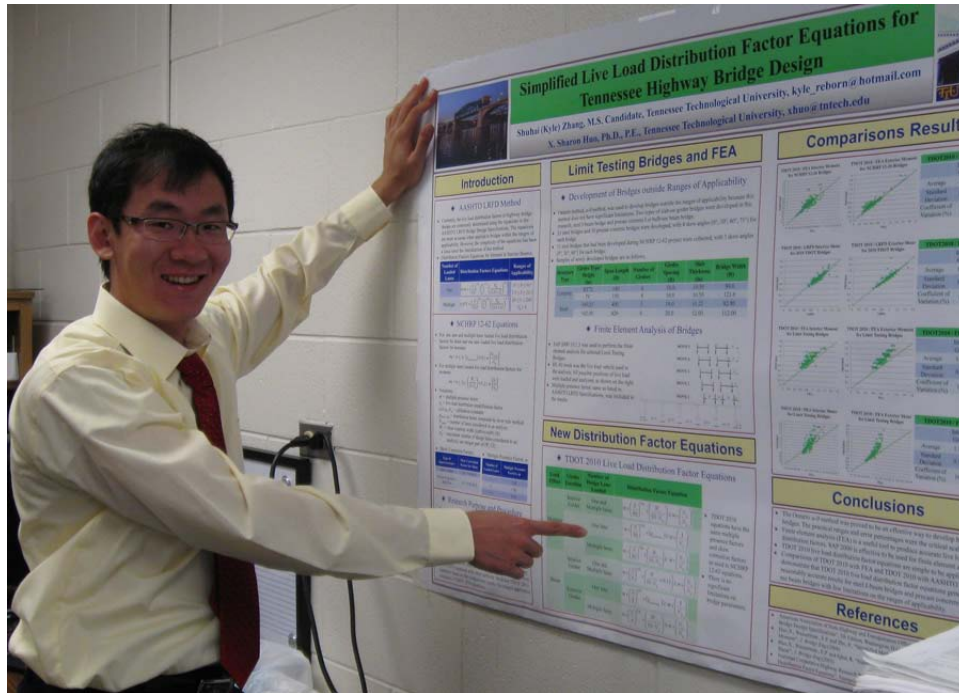


Dr. Joseph O. Ojo –was named an IEEE Fellow in 2011. IEEE Fellow is a distinction reserved for select IEEE members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious grade elevation. He has been serving as TVA Chair in Electrical and Computer Engineering for the past three years. He has been serving as Associate Educator.

STUDENT ACCOMPLISHMENTS AND AWARDS

2011–2012

Student Research Day at Tennessee Technological University is an event designed to showcase in a poster format the research of students. Several CESR students showcased their research posters in April 2012. Each participant received a certificate of appreciation and a bronze medallion.



Civil and Environmental Engineering student Shuhai (Kyle) Zhang displayed his poster at TTU's 2012 Student Research Day. (Photo courtesy of CESR)

STUDENT TRAVEL TO CONFERENCES

Manohar Gottapu (Joseph Biernacki, Advisor) presented paper, “Exploring Very Early Age Hydration Using a Solution-Phase Continuum Model,” at the 3rd Advances in Cement-based Materials Conference, at the University of Texas in Austin, TX, June 2012.

Daniel Keaton, (Benjamin Mohr, Advisor) presented paper “Nanoscale Pore Structure Analysis of Mortars Undergoing Delayed Ettringite Formation,” at the 3rd Advances in Cement-based Materials Conference, at the University of Texas in Austin, TX, June 2012.

Natalia Shlonimskaya, (Joseph Biernacki, Advisor) presented paper at the 3rd Advances in Cement-based Materials Conference, at the University of Texas in Austin, TX, June 2012.

Arash Jamehbozorg, (Ghadir Radman, Advisor) presented paper at the IEEE Energy Tech 2012 at Case Western in Cleveland, OH, May 2012.

Aditya Jayanthi (John Peddieson, Advisor) presented paper “Development of Discrete Population Balance Mixture Atomization Model,” at the ILASS Americas Conference in San Antonio, TX, May 2012.

Amin Najafabadi (Ali Alouani, Advisor) presented paper “Real Time Estimation of Sensitive Parameters of Composite Power System Load Model,” at the IEEE PES Transmission and Distribution Conference and Exposition, in Orlando, FL, May, 2012.

Shuhai (Kyle) Zhang (David Huddleston, Advisor) presented paper “Simplified Live Load Distribution Factor Equations for Moment and Shear of Highway Bridge Girders”, at the ASCEE 2012 Structures Congress in Chicago, IL, March 2012.

Ojas Chaudhari (Joseph Biernacki, Advisor) presented paper “Leaching Behavior of Hazardous Heavy Metals from Lime Fly Ash Cements”, at the AIChE Annual Conference, in Minneapolis, MN, October 2011.

Manohar Gottapu (Joseph Biernacki, Advisor) presented paper “Multi-Component Continuum-Based Single Particle Model for Tri—Calcium Silicate Hydration”, at the AIChE Annual Meeting in Minneapolis, MN, October 2011.

Joshua Ojo (Benjamin Mohr, Advisor) presented paper “Multi-Component Continuum-Based Single Particle Model for Tri—Calcium Silicate Hydration”, at the AIChE Annual Meeting in Minneapolis, MN, October 2011.

CONFERENCES ATTENDED BY FACULTY AND SUPPORT STAFF

Daniel Badoe

Presentation at the Tennessee Model Users' Group Meeting in connection with the TDOT project, Mt. Juliet, TN, March 2012.

Joseph Biernacki

Presentation at the AIChE Annual Meeting, October 2011.

Presentation at the 2nd Advances in Cement-based Materials: Characterization, Processing, Modeling and Sensing, July 2011.

Stephen Canfield

Invited presentation to NSRP day at NAVSEA, Presented robotics research to Assistant Secretary of the Navy ASN Sean Stackley, at NAVSEA, Washington, DC, September, 2011.

Steven Click

Attended the Transportation Research Board Annual Meeting in Washington, DC, January 2012.

Attended the Tennessee Department of Transportation Project Meeting, Nashville, TN, July 2011.

L.K. Crouch

Presentation to the Tennessee Department of Transportation concerning research with the TDOT, Nashville, TN, May 2012.

Presentation to the Tennessee Department of Transportation concerning research with the TDOT, Nashville, TN, January 2012.

Omar Elkeelany

Attended a Teaching and Professional Development Workshop at TTU, "Orientation to Teaching Connections of Engineering and Technology," August 2011.

Xiaoming (Sharon) Huo

Presentation to the Tennessee Department of Transportation on the TDOT Culverts Project, Nashville, May 2012.

Presentation of Distribution Factor Project at the Tennessee Department of Transportation, Nashville, TN, July 2011.

Benjamin Mohr

Presentation at the American Ceramics Society, Cements Division, 3rd Advances in Cement-Based Materials: Characterization, Processing, Modeling and Sensing, Austin, TX, June 2012.

Presentation at the American Concrete Institute Multi-Type Durability Attack in Cincinnati, OH, October 2011.

Poster presentation at the Expansive Reactions in Cement-Based Materials: Characterization, Processing, Modeling and Sensing, at Oregon State University, Corvallis, OR, July 2011.

Presentation at the American Ceramic Society, Cements Division, 2nd Advances in Cement-Based Materials: Characterization, Processing, Modeling and Sensing, Nashville, TN, July 2011.

CONFERENCES ATTENDED BY FACULTY AND SUPPORT STAFF (CONTINUED)

Joseph O. Ojo

Presentation at the Workshop Proceedings on Power Electronics in Industrial Applications and Renewable Energy, in Doha, Qatar, November 2011.

Presentation at the Renewable Power Generation Conference, in Edinburgh, UK, September 2011.

Presentation at the IEEE Energy Conversion Congress and Exposition (ECCE), September 2011.

Presentation at the Conference Record of the International Conference on Innovations in Engineering and Technology, IET 2011, University of Lagos, Nigeria, August 2011.

Ghadir Radman

Presentation at the 2011 IEEE Power & Energy Society General Meeting at the Renaissance Center in Detroit, MI, July 2011.

Holly Stretz

Presentation of research results at the Fire and Polymers Symposium, San Diego, CA, March 2012.

FUTURE PLANS



Dr. L.K. Crouch's Masters 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 2012-2013

The Center for Energy Systems Research (CESR) will continue to create interdisciplinary research teams to meet the needs of the Center's sponsors. New and established engineering faculty and faculty associates from outside the College of Engineering will continue to participate in research. Also, collaboration with other universities will be continued. In addition, education and research throughout the world in the area of electric power will be enhanced by involving graduate students from the United States and abroad.

CESR Goals

To contribute to ongoing research related to energy systems and be recognized as a national leader.

To contribute to ongoing university instructional and research activities and educational outreach activities at the highest level possible.

To contribute to technology transfer and thereby improve the quality of life of citizens of Tennessee and the U.S.A.

To increase externally funded research through the Center for Energy Systems Research.

To stimulate activities that increase external funding and efficiency/cost saving through individual and unit incentives.

New Research Initiatives

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.

The TTU "Smart Grid Group" is one such group of researchers who have banded together to build a microgrid "test bed". 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.

Another focus area for the center's research effort is "Infrastructure Materials". Faculty members interested in materials and energy use are working on developing energy efficient use of materials for infrastructure in conjunction with the Tennessee Department of Transportation (TDOT) and the National Science Foundation (NSF).

Electric Power

The emphasis of CESR in the area of electric power is still of primary importance. The DOE sponsored initiative for studying disturbances in the electric grid through a distributed array of frequency disturbance recorders has spawned the development of a Laboratory sized power grid (Labgrid), which will be incorporated into the new Smart Grid Group microgrid test bed.

Electromagnetic Transients: Most power system outages are caused by lightning. Studies are being conducted to mitigate the effects of lightning by reducing ground resistance.

Power Transfer Capability Improvement: Studies are being conducted on transmission capacity evaluation of existing lines using commercially available software. Studies have been done to improve power transfer capability by optimizing conductor configuration.

Power Plant Performance Improvement: Work is ongoing in the area of real-time performance monitoring. Advanced control algorithms for improved control of power plant components are being studied.

Application of Neural Networks for understanding the effects of various parameters on plant performance is being implemented.

Robotics Application for Boiler Tube Inspection: Robots have been developed for inspecting boiler tubes using non-destructive evaluation (NDE) equipment. Special robots have been developed for inspecting storage tanks and penstocks in hydroelectric stations.

Power Systems Performance Improvement

Smart grid research and development (solar, wind and battery power and interconnection with existing grid, smart grid security, FNET application for power system performance predictions and improvement, Microgrid Technology)

Coal-fired power plant performance monitoring in real-time

Environmental Issues and Energy Conservation

High volume fly ash utilization for highway and building construction

Traffic engineering

Improved thermal insulation technologies

Performance improvement of HVAC systems

Reuse of industrial solid waste material

Advanced Technologies

CFD and solid mechanics modeling application to industrial problems

Robotics application to power and other industries

Multi-phase open winding motors and permanent magnet machines actuated with dual multi-phase, multi-level converters

Modeling of electro-chemical systems

Combustion research

Nanotechnology application to material science

Research goals for 2011-2012 in the above-mentioned areas follow.

Smart grid research and development (solar, wind and battery power and interconnection with existing grid, smart grid security, FNET application for power system performance predictions and improvement, Microgrid Technology)

Coal-fired power plant performance monitoring in real-time

Utilize the full potential of the state-of-the-art Real-Time Digital Simulator (RTDS) and incorporate it into various research activities in the area of power systems performance improvement. Utilize the recently acquired current transformer laboratory facilities to study other types of transformers. Develop an intelligent load shedding scheme to improve power system stability by using FNET data. Extend research activities into the area of renewable energy. Continue working on modeling of batteries and extend the techniques to model fuel cells. Increase external funding above the two million dollar mark.

Investment in the Future

Develop a laboratory to study the effects on frequency in power systems

Develop fluid mechanics laboratory to include advanced flow measuring systems

Increase computational power by acquiring high-end work stations

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 2011-2012

Center Director: **Dr. Subramaniam Deivanayagam** Interim Director CESR

CESR Staff:	Robert Craven	R&D Engineer
	Anthony Greenway	Information Technology Associate 9
	Linda Lee	Administrative Associate 3
	Sharon Robinson	Administrative Associate 3
	Etter Staggs	Financial Analyst
	Michael Kelley	Information Technology Associate 5
	Will Mefford	Academic Support Associate 7, Research Technician II, Laboratory Technician

In addition to center faculty, the following faculty members participated in center activities during 2011-2012. 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.

ENGINEERING ADMINISTRATION

Joseph Rencis, Dean
Subramaniam Deivanayagam,
Associate Dean of Graduate
Studies and Research

ELECTRICAL & COMPUTER ENGINEERING

P. K. Rajan, Interim Chairperson
Ali Alouani
Rabie Belkacemi
Omar Elkeelany
Syed Hasan
Satish Mahajan
Joseph Ojo
Ghadir Radman

CIVIL & ENVIRONMENTAL ENGINEERING

David H. Huddleston, Chairperson
Daniel A. Badoe
Steven Click
Lewis K. Crouch
Y. Jane Liu
Benjamin Mohr

MECHANICAL ENGINEERING

Darrell E. P. Hoy, Chairperson
Stephen Canfield
Jie Cui
Glenn Cunningham
Corinne M. Darvennes
Stephen A. Idem
Sastry Munukutla
John Peddieson
Hwan-Sik Yoon

CHEMICAL ENGINEERING

Pedro Arce, Chairperson
Joseph Biernacki
Holly Stretz

MANUFACTURING & INDUSTRIAL TECHNOLOGY

Ahmed H. ElSawy, Chairperson
Ismail Fidan
Ahmed Kamal

COMPUTER SCIENCE

Doug Talbert, Chairperson
Sheikh Ghafoor
Martha Kosa
Ambareen Siraj

ACADEMIC AFFAIRS

Mark Stephens, Provost and Vice President
X. Sharon Huo, Interim Associate Provost

MATHEMATICS

Allan Mills, Chairperson
Sabine LeBorne
David Smith

CURRICULUM AND INSTRUCTION

Susan Gore, Chairperson
Holly Anthony

CENTER FOR MANUFACTURING RESEARCH

Kenneth Currie Mills, Chairperson
Robert Qiu

FACULTY EXPERTISE

CHEMICAL ENGINEERING

Pedro Arce: Electrokinetics-Soil Clean up – High Oxidation Cold Plasma Methods-Water Pollution Control – Gel Electrophoresis – Drug Delivery Materials – Modeling of Transport Process in Porous Media with Reactions

Joe Biernacki: Chemical reaction phenomena – Kinetics - Thermochemistry of reactions and reaction mechanisms - High temperature processing, synthesis and production of electronic and structural ceramic materials - Chemistry and physics of cement-based materials - Process micronization and micro-fluidics - Assessment – Interdisciplinary - Inquiry and team-based educational approaches in engineering education

Holly Stretz: Polymer processing – Surfactants – Composite Modeling – Nanoparticle Deposition – High temperature Composite Stability – Biodiesel Reaction Kinetics – Nanocomposites - Ablation

CIVIL AND ENVIRONMENTAL ENGINEERING

Daniel Badoe: Transportation Demand Analysis – Transferability of Demand Models – Transport Systems Analysis – Discrete Choice Models Applied to Travel Demand – Travel Surveys

Steven Click: Traffic signal operations – Traffic signal system operations – Urban arterial operations – Traffic signal controller functions – Traffic signal master controller functions – Non-traditional intersection and arterial designs

L.K. Crouch: Aggregates – Portland Cement Concrete – Controlled Low-strength Materials – Hot-mix Asphalt – Construction Materials Testing

R. Craig Henderson: Masonry Design – Seismic Design – Earthquake Engineering – Structural Codes – Infilled Frames

X. Sharon Huo: Structural Analysis – Pre-stressed Concrete Analysis and Design – Bridge Analysis and Design – Reinforced Concrete Analysis and Design – Structural Steel Analysis and Design

Y. Jane Liu: Applied Mechanics – Finite Element Analysis – Advanced Computational Mechanics – Composite Materials – Plates and Shells Analysis

Benjamin Mohr: Nano/microstructure – Chemistry – Durability of cement-based materials – Fiber-reinforced cementitious composites – Early-age behavior of cement and concrete – Novel material characterization/analytical techniques

Guillermo Ramirez: Computational and Theoretical Mechanics – Laminated Plates and Shells – Piezo and Magneto Elastic Solids – Smart Structures

COMPUTER SCIENCE

Sheikh Ghafoor: Parallel and distributed computing - High Performance Computing - Autonomic resource management for high performance computing environment - Programming model for parallel adaptive applications - Fault tolerant computing

Ambareen Siraj: Network security, security in smart grid and security education - Information Assurance - *Sensor alert fusion with alert correlation and alert clustering, security metrics* - Software Engineering- Artificial Intelligence

FACULTY EXPERTISE (CONTINUED)

ELECTRICAL AND COMPUTER ENGINEERING

Ali Alouani: Intelligent Systems Design – Sensor Data Fusion – Automatic Control Systems – Stochastic Systems – Applied Signal Analysis – Artificial Neural Networks and Fuzzy Systems – Power Systems Stability & Control

Rabie Belkacemi: Power and Energy Systems

Satish Mahajan: Lasers – LEDs – Solar Cells – Optical Fibers – High Power Switchgear – Power Systems

Joseph Ojo: Electric Machine Analysis and Design – Adjustable-Speed Motor Drives – Power Electronic Converters – Control Theory Applied to Power Electronics and Power Systems – Power Systems Economics and Deregulation Issues

Ghadir Radman: Modeling / Analysis / Control of Power Systems – Optimal Power Flow – Reactive Power Compensation / Voltage Stability, Study of issues related to Power Systems Integration with Renewable Sources

P.K. Rajan: Circuits and Signals – Digital Signal Processing – Independent Component Analysis – Digital Image Processing, Pattern Recognition

MECHANICAL ENGINEERING

Steve Canfield: Robotics – Dynamic Modeling – Compliant Mechanisms – Smart Actuators – Mechatronics

Jie Cui: Computational Fluid Dynamics – Turbulence Modeling – Large Eddy Simulation – Numerical Heat Transfer – Thermal Fluids

Glenn Cunningham: Remaining Life Analysis – Fatigue, Creep and Fracture Analysis – Thermal Sciences – Energy Conservation and Management – Heating, Ventilation, and Air Conditioning (HVAC)

Corrine Darvennes: Acoustics – Noise Control – Ultrasonics – Nondestructive Evaluation

Stephen Idem: Scale Model Testing – Fluid Flow Measurement – Thermal Modeling – Fluid Mechanics– Heat Transfer

John Peddieson: Multiphase Flow – Friction Stir Welding – Tether Dynamics – Fluid Mechanics – Solid Mechanics

MANUFACTURING AND INDUSTRIAL TECHNOLOGY

Ahmed ElSawy: Development of Manufacturing Processes – Welding Engineering and Metallurgy – Recycling and Reuse of Industrial Solid Waste Materials – Web-based Distance Learning – Computer Applications in Technology

Ismail Fidan: Manufacturing Processes – Electronics Manufacturing – Knowledge-based Systems – Web-based Distance Learning – Rapid Prototyping

Ahmed Kamal: Embedded Control System – Sensor and Biosensor – Digital Signal Processing – Biomedical System – System Identification

MATHEMATICS

Sabine Le Borne: Computational Fluid Dynamics – Multi-Grid Methods – Hierarchical Matrices

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

POWER SYSTEMS PERFORMANCE IMPROVEMENT

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
536238	Northside Units 1 & 2 Primary Air System Flow Straightener Design and Optimization (Dr. Sastry Munukutla, Dr. Stephen Idem)	Jacksonville Electric Authority	8/1/11-7/31/12	32,000	31,974
536239	CFD and Scale Model Study of Primary Air Diffuser for JEA NGS Unit (Dr. Sastry Munukutla, Dr. Stephen Idem, Dr. John Peddieson, Dr. Y. Jane Liu, Dr. Jie Cui)	Jacksonville Electric Authority	10/1/11-9/30/12	18,000	11,089
531652	CAREER: Wind Power -- Multi-Level Control, Intelligent Grid Integration and Real Time Digital Simulation (Year 3 of 5) (Dr. Wenzhong David Gao, Dr. Jie Cui)	National Science Foundation	9/1/11-8/4/12	80,000	95,034
SUB - TOTAL				130,000	
POWER SYSTEMS PERFORMANCE IMPROVEMENT					138,097

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

ENVIRONMENTAL ISSUES AND ENERGY CONSERVATION

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
539322	Development of Tennessee Travel Demand Model Users' Group (Year 3 of 3) (Dr. Daniel Badoe)	University of Tennessee-Knoxville (Funded by the Tennessee Department of Transportation)	6/1/12-12/31/12	9,500	8,868
535255	Laboratory Testing of Flexible Duct (Dr. Stephen Idem)	Thermaflex, Inc.	7/1/11-12/31/11	18,000	17,998
SUB - TOTAL ENVIRONMENTAL ISSUES AND ENERGY CONSERVATION				27,500	26,866

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

ADVANCED TECHNOLOGIES

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
531216	Nanoscale Characterization of Expansion Due to Delayed Ettringite Formation (Year 2 of 3) (Dr. Benjamin Mohr)	National Science Foundation (CMMI)	9/1/11-8/31/12	110,707	107,577
539274	Optimum Air Content Range (Plastic and Hardened) for TDOT Class D Portland Cement Concrete (PCC) - Federal (Year 3 of 3) (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe, Dr. Y. Jane Liu)	Tennessee Department of Transportation	9/15/11-9/14/12	16,000	29,429
539277	Optimum Air Content Range (Plastic and Hardened) for TDOT Class D Portland Cement Concrete (PCC) - State (Year 3 of 3) (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe, Dr. Y. Jane Liu)	Tennessee Department of Transportation	9/15/11-9/14/12	4,000	7,445
531651	Algebraic Hierarchical Matrix Preconditioners for Two- and Three-Dimensional Saddle Point Problems (Year 3 of 3) (Dr. Sabine LeBorne, Dr. Alan Mills)	National Science Foundation (CCLI)	7/1/11-6/30/12	51,909	5,119

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012

ADVANCED TECHNOLOGIES (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
535258	Pressure Drop Testing of Corrugated Stainless Steel Pliable Gas Tubing (PLT) (Dr. Stephen Idem)	Gastite	5/7/12-7/15/12	27,706	20,354
539510	Enabling Children with Disabilities and Their Families in Tennessee through Technology EIME Project (Preschool) (Dr. Stephen Canfield, Dr. Hwan-Sik Yoon)	State Department of Education -- Division of Special Education	7/1/11-6/30/12	28,000	27,469
539511	Enabling Children with Disabilities and Their Families in Tennessee through Technology EIME Project (School Age) (Dr. Stephen Canfield, Dr. Hwan-Sik Yoon)	State Department of Education -- Division of Special Education	7/1/11-6/30/12	7,000	6,869
533216	Field Evaluation of Traffic Signal Based Interchange Treatments -- State (Year 3 of 3) (Dr. Steven Click)	Tennessee Department of Transportation	1/1/12-12/31/12	13,200	821
539278	Field Evaluation of Traffic Signal Based Interchange Treatments -- Federal (Year 3 of 3) (Dr. Steven Click)	Tennessee Department of Transportation	1/1/12-12/31/12	52,800	23,634

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

ADVANCED TECHNOLOGIES (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
539279	Higher Volume Fly Ash PCC for Sustainability and Performance - Federal (Year 2 of 2) (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe)	Tennessee Department of Transportation	7/15/11-7/14/12	52,000	65,166
539280	Higher Volume Fly Ash PCC for Sustainability and Performance - State (Year 2 of 2) (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe)	Tennessee Department of Transportation	7/15/11-7/14/12	13,000	17,328
531258	Enhancing the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences: Phase II (Dr. Stephen Canfield, Dr. Hwan-Sik Yoon)	National Science Foundation	9/15/11-9/14/12	232,629	173,344
539286	Development of a TDOT Class S-Lower Heat Portland Cement Concrete (S-LH PCC) - Federal (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe)	Tennessee Department of Transportation	1/1/12-12/31/12	52,000	11,038

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

ADVANCED TECHNOLOGIES (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
539287	Development of a TDOT Class S-Lower Heat Portland Cement Concrete (S-LH PCC) - State (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe)	Tennessee Department of Transportation	1/1/12-12/31/12	13,000	996
539235	Expanding the Range of Applications for the MRMS: a Mobile Robotic Manufacturing System for Mechanizing Manufacturing Processes (Dr. Ahmed Elsayy)	Advanced Technology International (ATI) DBA SCRA Applied R&D (Funded by NSRP ASE)	12/16/11-12/15/11	24,011	8,973
SUB - TOTAL				697,962	
ADVANCED TECHNOLOGIES					505,562

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

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) (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe)	Tennessee Department of Transportation	8/1/11-7/31/12	48,000	16,225
539285	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (State) (Dr. L. K. Crouch, Dr. Benjamin Mohr, Dr. Daniel Badoe)	Tennessee Department of Transportation	8/1/11-7/31/12	12,000	5,711
539281	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee - Federal (Dr. X. Sharon Huo)	Tennessee Department of Transportation	8/1/11-7/31/12	56,000	35,329
539282	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee - State (Dr. X. Sharon Huo)	Tennessee Department of Transportation	8/1/11-7/31/12	14,000	8,610
SUB - TOTAL				130,000	
INFRASTRUCTURE MATERIALS					65,875

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

POWER-TEST-SERVICE ACCOUNT

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
538597	Power-Test-Service Account (Funds Carried Over from 2010-2011)				30,352
	Laboratory Testing of a Fabric Air Dispersion System (Dr. Stephen Idem)	Duct Sox	5/1/11-6/30/11	5,000	5,000
	Cylinder Testing (Dr. L. K. Crouch)	ECE Services	3/28/11-5/12/11	1,335	1,335
	Pervious Concrete Permeability Testing (Dr. L. K. Crouch)	Tennessee Concrete Association	5/6/11-6/24/11	400	400
	Aggregate Tests for Pervious Concrete (Dr. L. K. Crouch)	Tennessee Concrete Association	8/15/11-12/20/11	300	300
	Engineering Services (Dr. Steven Click)	Mekuria Engineering	10/1/11-10/31/11	935	935
	Engineering Services -- Project US 15-501 Coordination Timing in Chapel Hill, NC (Dr. Steven Click)	Mekuria Engineering	8/1/11-9/30/11	6,120	2,905
	Engineering Services -- Advanced Synchro Programming (Dr. Steven Click)	Mekuria Engineering	11/1/11-11/30/11	255	0

**CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012**

POWER-TEST-SERVICE ACCOUNT (continued)

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
	Testing of Four Transformers for Thermal and Other Characteristics (Dr. Satish Mahajan)	Buswell Energy	9/1/11-5/31/12	900	810
	Testing on Flowable Fill Cylinders (Dr. L. K. Crouch)	Foundation Systems Engineering, P.C.	9/1/11-10/25/11	459	459
	Pervious Concrete Testing for Baxter, TN Driveway (Dr. L. K. Crouch)	Tennessee Concrete Association	3/20/12-4/23/12	821	821
SUB - TOTAL				16,525	43,317
POWER-TEST-SERVICE ACCOUNT					

CONTRACT AND GRANT AWARDS
Activated Between July 1, 2011 and June 30, 2012

MISCELLANEOUS

Contract Number	Title	Source	Project Dates	Total Amount	Estimated Expendit.
229342	TTU Research (\$490 was carried over from 2010-2011)		7/1/11-6/30/12	19,800	20,290
229660	IC Faculty Energy Systems Munukutla (\$3,630 was carried over		7/1/11-6/30/12	5,580	9,089
	Gifts		7/1/11-6/30/12	5,300	0
SUB - TOTAL MISCELLANEOUS				30,680	29,379
TOTAL CONTRACTS AND GRANTS: 2011 - 2012				1,032,667	809,096

**STATUS OF PROPOSALS
Submitted Between July 1, 2011 and June 30, 2012**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
1.	REU Site: Biomedical Engineering Summer Research Experience for Undergraduates	Ahmed Kamal, Ali Alouani, Omar Elkeelany, Hwan-Sik Yoon	NSF REU	330,000	Unfunded
2.	Northside Units 1 & 2 Primary Air System Flow Straightener Design and Optimization	Sastry Munukutla, Stephen Idem	Jacksonville Electric Authority	32,000	Funded
3.	CFD and Scale Model Study of Primary Air Diffuser for JEA NGS Unit	Sastry Munukutla, Stephen Idem, Jie Cui, John Peddieson, Jane Liu	Jacksonville Electric Authority	18,000	Funded
4.	Enabling Families, Infants, and Toddlers Through Technology: Merging Early Intervention and Mechanical Engineering (EIME)	Stephen Canfield, Hwan-Sik Yoon	Tennessee State Department of Education -- Division of Special Education	35,000	Funded at \$14,000 for 2012-2013
5.	CFD and Experimental Study to Determine Loss Coefficients of Close-Coupled Round Five-Gore Elbows	Stephen Idem	University of North Carolina at Charlotte	43,610	Pending
6.	Multiscale Modeling of Shock Propagation in Granular High Explosives	Jane Liu, John Peddieson	U. S. Department of Energy, National Nuclear Security Administration (NNSA)	699,740	Pending
SUBTOTAL, PROPOSALS FOR 2011-2012				1,158,350	

**STATUS OF PROPOSALS
Submitted Between July 1, 2011 and June 30, 2012**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
7.	Expanding the Range of Applications for the MRMS: a Mobile Robotic Manufacturing System for Mechanizing Manufacturing Processes	Ahmed Elsayy	Advanced Technology International DBA SCRA Applied R&D (Funded by NSRP ASE)	24,011	Funded
8.	Computing for Teaching (C4T): Professional Development in Computing to Enhance STEM Skills	Sheikh Ghafoor, Susan Gore, Martha Kosa, Ambareen Siraj, Eric Brown	Tennessee Higher Education Commission	199,981	Unfunded
9.	Pressure Drop Testing of Corrugated Stainless Steel Pliable Gas Tubing (PLT)	Stephen Idem	Gastite	27,706	Funded
10.	Real Time Multi-Agent Control Architecture for Smart Grid Operation	Rabie Belkacemi	Southeastern Center for Electrical Engineering Education (SCEEE)	19,000	Pending
11.	Integrating Theory and Practice in the American Industrial Workplace	Ahmed Kamal	National Science Foundation, TUES Program	250,000	Pending
SUBTOTAL, PROPOSALS FOR 2011-2012				520,698	
TOTAL, PROPOSALS FOR 2011-2012				1,679,048	

STATUS OF PROPOSALS – PENDING AND UNFUNDED

Submitted Between July 1, 2010 and June 30, 2011

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
1.	CAREER: Nanoparticle Barrier Layers: Strengthening the Network	Dr. Holly A. Stretz	National Science Foundation	409,470	Unfunded
2.	Development of Tennessee Travel Demand Model Users' Group	Dr. Daniel A. Badoe	University of Tennessee-- Knoxville (Funded by the Tennessee Department of Transportation)	27,750	Funded
3.	Fault-Tolerant Water Current Turbine Power Generation for the Grid	Dr. Joseph Ojo	National Science Foundation	330,454	Unfunded
4.	Evaluation of Low-Cost Digital Image Correlation for Strength Tests	Dr. Jane Liu, Dr. John Peddieson	United Launch Alliance	20,100	Funded
5.	Enabling Children with Disabilities and Their Families in Tennessee through Technology EIME Project	Dr. Stephen L. Canfield, Dr. Hwan-Sik Yoon	State Department of Education -- Division of Special Education	35,000	Funded
6.	Using Solar Power for Chevy Volts Commuters: Feasibility Study	Dr. Ali Alouani	Merritt Island Holdings, LLC	16,302	Funded
SUBTOTAL, PROPOSALS FOR 2010-2011				839,076	

**STATUS OF PROPOSALS
Submitted Between July 1, 2010 and June 30, 2011**

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
7.	MRI: Acquisition of Research and Education Equipment for Smart Grid	Dr. Robert Qiu, Dr. Ghadir Radman, Dr. Ali Alouani, Dr. Omar Elkeelany, Dr. Ambareen Siraj	National Science Foundation	242,880	Unfunded
8.	Design of a Slug Drop and Conveyor System	Dr. Ali Alouani	ABC Group Fuel Systems, Inc.	67,416	Unfunded
9.	CAREER: Wind Power - Multilevel Control, Intelligent Grid Integration and Real Time Digital Simulation (Supplement)	Dr. Jie Cui	National Science Foundation	99,404	Unfunded
10.	Large Strain Behavior of Rohacell	Dr. Jane Liu, Dr. John Peddieson	United Launch Alliance	20,000	Funded
11.	Laboratory Testing of Flat Oval Transitions to Determine Loss Coefficients	Dr. Stephen Idem	ASHRAE, Inc.	79,996	Unfunded
12.	Laboratory Testing of Flexible Duct Note: Submitted at \$36,000 Revised to \$18,000	Dr. Stephen Idem	Thermafex, Inc.	36,000	Funded at \$18,000
SUBTOTAL, PROPOSALS FOR 2010-2011				545,696	

STATUS OF PROPOSALS
Submitted Between July 1, 2010 and June 30, 2011

	TITLE	INVESTIGATORS	SOURCE	AMOUNT	STATUS
13.	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture	Dr. L. K. Crouch, Dr. Benjamin Mohr	Tennessee Department of Transportation	125,000	Funded
14.	Developing a TDOT Class S-LH (Lower Heat) PCC Mixture Specification	Dr. L. K. Crouch	Tennessee Department of Transportation	200,000	Funded
15.	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee	Dr. Xiaoming Sharon Huo	Tennessee Department of Transportation	118,000	Funded
16.	Innovation in Integrating Theory and Practice in Teaching the Industrial Electronics Course	Dr. Ahmed Kamal	National Science Foundation	178,718	Unfunded
	SUBTOTAL, PROPOSALS FOR 2010-2011			621,718	
	TOTAL, PROPOSALS FOR 2010-2011			2,006,490	

ALOUANI, ALI

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A. T. Alouani and U. Sulayman, "Smart grid monitoring using local area sensor network. Real-time data acquisition, analysis and management," IEEE 2011 Southeastcon, Nashville, TN, March 2011.

BADDOE, DANIEL

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BIERNACKI, JOSEPH

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J. J. Biernacki, J. Thomas, J. W. Bullard, S. Bishnoi, J. S. Dolado, G. W. Scherer and A. Luttge, *Modeling and Simulation of Cement Hydration Kinetics and Microstructure Development*, Cem. Concr. Res., 41(12), 1257-1278, 2011.

J. J. Biernacki, *International Summit on Cement Hydration Kinetics and Modeling*, Invited editorial to 40th Anniversary Issue, Cem. Concr. Res., 41(1), 1206-1207, 2011.

CANFIELD, STEPHEN

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Canfield, S. L., S. Ghafoor, 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.

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Canfield, S. L., A. Shibakov, and J. Richardson, "Design Space Analysis of Distributed Compliance in Segmented Beam Templates of Compliant Mechanisms," submitted to the *ASME Journal of Mechanical Design*, 2011.

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CLICK, STEVEN

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

CROUCH, L.K.

Crouch, L. K., D. Badoe, and Cameron Williams, "Help for Pervious PCC Producers Part 3: Fine Aggregate for Pervious PCC," *Tennessee Concrete Magazine*, Vol. 25, No. 2, Summer/Fall 2011.

CUI, JIE

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CUNNINGHAM, GLENN

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ELKEELANY, OMAR

Elkeelany, O., and V. Todakar, "Data Archival to SD Card Via Hardware Description Language," *IEEE Embedded Systems Letters*, Vol. 3, No. 4, pp. 105-108, December 2011.

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GHAFOOR, SHEIKH

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GHAFOOR, SHEIKH (CONTINUED)

Ghafoor, S., S. Canfield, M. Kelley, and T. Hill, "Assessment of Student Attitudes and its Impact in a Hands-On Programming Model for the Introductory Programming Course", American Society for Engineering Education Middle Atlantic Section Fall Conference, Philadelphia, PA, 2011.

HUO, X. SHARON

Huo, X. S., J. A. Puckett, M. Jablin, and D. R. Mertz, "Framework for Simplified Live Load Distribution-Factor Computations," *ASCE Journal Bridge Engineering*, Vol. 16, No. 6, pp. 777-791, 2011.

IDEM, STEPHEN

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PEDDIESON, JOHN

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"Simulation of Beam Plastic Forming with Variable Bending Moments", with A. Natarajan, *International Journal of Non-Linear Mechanics*, 46, pp. 14-22, 2011.

STRETZ, HOLLY

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Draft. Stretz, H. A., V. L. Pallem, M. J. M Wells, X. Ma, and D. Bouchard, "Mechanism of Disaggregation of Humic Acid in the Presence of Gold Nanoparticles", for *Water Research*.

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STRETZ, HOLLY

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YOON, HWAN-SIK

Yoon, Hwan-Sik, and T. Sweafford, "Co-Simulation of Dynamic Systems in Parallel and Series Configurations", *Submitted to International Journal of Modelling and Simulation*, 2012.

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BIERNACKI, J. J.

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Biernacki, J. J., J. Murillo, and C. P. Bagley, "Multi-Scale Study on the Pyrolysis of Sustainable Biomass Feedstock", *AIChE Annual Meeting*, October 2011.

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Biernacki, J. J., and M. Gottapu, "Multi-Component Continuum-Based Single Particle Model for Tri-Calcium Silicate Hydration", *AIChE Annual Meeting*, October 2011.

Biernacki, J. J., and P. E. Arce, "Introduction to Chemical and Biological Engineering Analysis – An Initial Condition for Teaching Transfer Science and Reaction Engineering", *AIChE Annual Meeting*, October 2011.

OJO, JOSEPH O.

Sosthenes Karugaba, Amrit Gautam, Olorunfemi Ojo, "Full order Modeling and Simulation of nine-Phase Interior Permanent Magnet Machine", accepted for presentation at the 2011 IEEE Energy Conversion Congress and Exposition (ECCE2011) to be held in Phoenix, Arizona, USA in September 17-22, 2011.

Sosthenes Karugaba, Amrit Gautam, Olorunfemi Ojo, "Full Order Modeling and Simulation of a Nine-Phase Interior Permanent Magnet Machine," accepted for presentation at the 2011 IEEE Energy Conversion Congress and Exposition (ECCE2011) to be held in Phoenix, Arizona, USA in September 17-22, 2011.

Sosthenes Karugaba and Olorunfemi Ojo, "Carrier Based PWM Scheme for a Three-level Diode-Clamped Five-Phase Voltage Source Inverter Ensuring Capacitor Voltage Balancing," in the Conference Record of the 26th Annual IEEE Applied Power Electronics Conference & Exposition (APEC2011), Fort Worth, Texas, March 6-10, 2011.

STRETZ, HOLLY A.

Stretz, H. A., P. V. Ambuken, J. Koo, J. Lee, and R. Trejo, "High Temperature Mechanical Properties of Thermoplastic Polyurethane Nano composites", *ACS Annual Conference, PMSE*, 03-2012.

Stretz, H. A., J. W. Thompson, J. A. Pascal, M. Oyanader, and P. E. Arce, "Effect of Morphology on Optimal Separation Times in Nanocomposite Polymer Gel Electrophoresis: Diverging Annual Pore Morphology", *AIChE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., J. W. Thompson, P. E. Arce, H. J. Ploehn, and H. Gao, "Electrophoresis of Proteins in Polyacrylamide/Montmorillonite Hydrogel Composites", *17th Symposium on Separation Science and Technology for Energy Applications*, Gatlinburg, TN, 10-24-2011.

Stretz, H. A., J. J. Simhadri, M. Oyanader, and P. E. Arce, "Analysis of Channel Morphology for Electrophoresis of Bio-molecules: Effect of Axial and Orthogonal Fields", *AIChE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., P. Ambuken, H. Patel, and D. Cannon, "A Simple Mechanical Evaluation of Polymer Encapsulant Toughness", *AIChE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

STRETZ, HOLLY A. (CONTINUED)

Stretz, H. A., J. A. Pascal, M. Oyanader, and P. E. Arce, "Effect of Morphology on Optimal Separation Times in Nanocomposite Polymer Gel Electrophoresis: Diverging Annular Pore Morphology", *AICHE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., P. Ambuken, J. H. Koo, and J. C. Lee, "Char Layer Mechanical Properties for Thermoplastic Polyurethane Elastomer Nanocomposites", *AICHE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., J. J. Simhadri, M. Oyanader, and P. E. Arce, "Role of Material Morphology on Electrophoresis of Bio-molecules: Effect of Poiseuille Flow", *AICHE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., J. W. Thompson, and P. E. Arce, "Impact of Material Morphology on Bioseparations in Nanocomposite Hydrogels: a Modeling Approach in an Annular Channel", *AICHE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., P. Golbayani, K. T. Seale, R. Sanders, and P. E. Arce, "Morphological Effects on the Electrostatic Potential in a Divergent and Convergent Channel for Microfluidic Applications", *AICHE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

Stretz, H. A., J. W. Thompson, H. J. Ploehn, H. Gao, and P. E. Arce, "Effect of Nanoparticle Alignment in PAM-MMT Nanocomposite Hydrogels on Protein Electrophoretic Separations", *AICHE Annual Proceedings*, Minneapolis, MN, 10-16-2011.

ELKEELANY, OMAR

Elkeelany, O., and M. Abdallah, "Towards Affordable Home Health Care Devices Using Reconfigurable System-on-Chip Technology," Book chapter 7, *Applied Biomedical Engineering*, INTECHWEB.ORG Publisher, ISBN: 978-953-307-256-2, pp. 141-166, 2011.

STRETZ, HOLLY A.

Draft. Stretz, H. A., P. Ambuken, G. Kumar, M. Rabbani and S. Bietto, "Regulatory and Environmental Issues of Nanotechnology Safety", chapter for multi-author text edited by C. Ibeh, Pittsburgh State University, for *CRC Press* due January 2012.

Stretz, H. A., M. Tant, and P. Ambuken, "Polymer Composites: Heat Transfer", Encyclopedia of Composites, Wiley & Sons, online 09-2011, print 01-2012.

PRESENTATIONS**IDEM, STEPHEN**

Speaker in seminar: "Laboratory Testing of Saddle Tap Tees to Determine Loss Coefficients," SPIDA Meeting-AHR Expo, Las Vegas, NV, 2011.

STRETZ, HOLLY

Stretz, H. A., "Nanoparticle Patterning in Hydrogels and Other Nanomagic", East Tennessee State University, Department of Physics and Astronomy, Johnson City, TN, 11-15-2011.

Stretz, H. A., P. Arce, J. Thompson, and R. Sanders, "Polyacrylamide/MMT Nanocomposite Hydrogels: Novel Protein Separations in Electrophoresis", Vanderbilt University, Department of Biomedical Engineering, Nashville, TN, 07-21-2011.

Alouani, Ali T.

Member:

IEEE Control Systems Society
Optical Engineering

Reviewer:

IEEE Transactions on Automatic Control
IEEE Conference on Decision and Control
American Control Conference
Automatica
SPIE
International Journal of Control
International Journal of Microcomputer Applications
International Symposium on Circuits and Systems

Arce, Pedro

Member:

American Institute of Chemical Engineering (AIChE), Senior Member (since 2004)
CAST, Chemical Reaction Engineering Divisions
American Chemical Society (ACS)
American Society of Engineering Education (ASEE)
Society of Industrial and Applied Mathematics (SIAM),
Sigma Xi

Badoe, Daniel A.

Member:

Assoc. Member, American Society of Civil Engineers
Member, Institution of Transportation Engineers
Member, 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
Proposal Reviewer for National Science Foundation
Paper Reviewer for National Science Foundation, Graduate Research Fellowship Program, European
Journal of Operations Research, Journal of the Korean Society of Civil Engineers, Journal of the
Transportation Research Board, Growth and Change, Transportation Research Part B: Methodological,
and Environment and Planning

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)
American Society of Heating, Refrigeration, Airconditioning Engineers (ASHRAE)

Darvennes, Corinne

Member:

Acoustical Society of America (ASA)
American Society of Mechanical Engineers (ASME)

Elkeelany, Omar

Member:

American Society of Engineering Education (ASEE)
Association of Computing Machinery (ACM)
Institute of Electrical and Electronics Engineers (IEEE)
IEEE Consumer Electronics Society
International Academy of Science & Technology (IAST)
International Society for Computers & their Applications (ISCA)

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

Member:

Institute of Electrical and Electronic Engineers
Lasers and Electro-Optics Society
Power Engineering Society
Electron Devices Society
Sigma Xi
Tau Beta Pi
Eta Kappa Nu

Mohr, Benjamin

Member:

American Concrete Institute (ACI)
International Union of Laboratories & Experts in Construction Materials, Systems & Structures (RILEM)
American Ceramic Society, Cements Division (ACerS)
Chair-Elect, 2011-2012
Secretary, 2010-2011
American Society of Civil Engineers (ASCE)
American Society of Engineering Education (ASEE)

Honors/Awards:

ASCE Tennessee Section Peter G. Hoadley Award for Outstanding Engineering Educator, 2011
TTU Kinslow Award, 2011, "Influence of Bleed Water Reabsorption on Cement Paste Autogenous Deformation," *Cement and Concrete Research*, 2010; 40(2):220-225
ACI Outstanding University, 2011

Munukutla, Sastry

Member:

Associate Fellow, American Institute of Aeronautics and Astronautics (AIAA)
Fellow, American Society of Mechanical Engineers (ASME)

Honors/Awards:

2012 Outstanding Faculty Award for Teaching for his exceptional teaching, mentoring, and service

Ojo, Joseph O.

Senior Member:

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
Editorial Board Member, IET (UK) Proceedings on Power Electronics
Chair of the Industry Drive Committee of the IEEE Industry Applications Society
Chair for Transactions Paper Review 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)

Rajan, P.K.

Member:

Institute of Electrical and Electronics Engineers (IEEE)
IEEE Acoustics, Speech, and Signal Processing Society
IEEE Circuits and Systems Society
IEEE Education Society
American Society for Engineering Education (ASEE)
Tennessee Academy of Science
Sigma Xi
The Society for Scientific Research

Siraj, Ambareen

Committees:

IT Curriculum Committee, Department of Computer Science, TTU.
Information Assurance and Security Programs Committee, Department of Computer Science, TTU.
Software Engineering Committee, Department of Computer Science, TTU.
Mary Patterson Committee, Department of Computer Science, TTU.
CESR Search Committee, 2011-2012
ECE Search Committee, 2011-2012

Services:

Program Committee for the 26th International Conference on Computers and Their Applications (CATA-2011)
Reviewer for the 26th International Conference on Computers and Their Applications (CATA-2011)

Stretz, Holly

Member:

American Chemical Society
American Institute of Chemical Engineers
Sigma Xi
Society of Plastics Engineers
Society of Women Engineers
American Society of Engineering Educators (ASEE)

Yoon, Hwan-Sik

Member:

American Society of Mechanical Engineers (ASME)
Society of Automotive Engineers (SAE)

Diana Tudor
Kathi Rowe

Tennessee Department of Education
Tennessee Department of Education

April 3, 2012
April 3, 2012

IDEM, STEPHEN

Speaker in seminar: "Laboratory Testing of Saddle Tap Tees to Determine Loss Coefficients," SPIDA Meeting-AHR Expo, Las Vegas, NV, 2011. (The 2011 ASHRAE Winter Conference addressed the efficient use of energy, the greening of the industrial base, the real cost of zero-energy design and other topics related to design, standards, codes and professional skills.).

GRADUATE THESIS/DISSERTATIONS AND OTHER STUDENT PUBLICATIONS**MASTERS****ONYINYECHUKWU A. AHIKWO**

Design and Implementation of a Computer-Based Automatic Voltage Regulator for a Synchronous Machine
May 2012
Dr. Ali Alouani

MUHAMMAD NAYEEM AHSAN

Improvements of Real-Time Traffic Signal Delay Estimation using State-of-the-Practice Detection Technology
December 2011
Dr. Steven Click

LINDSAY B. BRYANT

Expansion of Cementitious Mortars Due to Delayed Ettringite Formation
December 2011
Dr. Benjamin Mohr

OJAS A. CHAUDHARI

Leaching Behavior of Hazardous Heavy Metals from Lime Fly Ash Cements
December 2011
Dr. Joseph Biernacki

AARON MARTIN CROWLEY

High Volume Fly Ash in Portland Cement Concrete for Bridge Decks
May 2012
Dr. L. K. Crouch

SARAH ANN DILLON

Utilizing a Substandard Fly Ash for a TDOT Aggregate-Lime-Fly Ash Stabilized Base Course
May 2012
Dr. L. K. Crouch

PADMANABHAN KUMAR

Modeling and Development of a Tool to Aid in the Design of Tracked Mobile Climbing Robots on Curved Surfaces
May 2012
Dr. Stephen Canfield

TRAVIS ANTHONY LLOYD

The Applicability of Bluetooth Recorders to Obtain Real-Time Traffic Data in a Rural City
December 2011
Dr. Stephen Click

DIVYA MAHABAL

Dynamic Analysis of Combined Photovoltaic Source and Synchronous Generator Connected to Power Grid
May 2012
Dr. Ghadir Radman

JOSEPH LAYTON MCDANIEL

Security Analysis of the Frequency Monitoring Network System and Protection Mechanisms Applicable to General Wide Area Monitoring System Environments
December 2011
Dr. Ambareen Siraj

GRADUATE THESIS/DISSERTATIONS AND OTHER STUDENT PUBLICATIONS**MASTERS****MELAKU MENGISTU MIHRET**

Modeling, Stability Analysis and Control of a Direct AC/AC Matrix Converter Based Systems
December 2011
Dr. Joseph Ojo

ANANTH NAG NALLA

Pressure Loss Testing of Saddle Tap Tees and a Fabric Air Duct
December 2011
Dr. Stephen Idem

BIJAYA POKHAREL

Modeling, Control and Analysis of a Doubly Fed Induction Generator Based Wind Turbine System
With Voltage Regulation
December 2011
Dr. Joseph Ojo

CHAYANON SONTIDPANYA

Use of a Laboratory-Sized Power Grid (Labgrid) for Detection of Unfavorable Conditions and
Demonstration of Intentional Islanding
December 2011
Dr. Ghadir Radman

SHARATH CHANDRA VAVILALA

Inclusion of Quadrature Boosters (QBs) in Power Flow Analysis
December 2011
Dr. Ghadir Radman

SHUHAI ZHANG

Simplified Live Load Distribution Factor Equations for Tennessee Highway Bridge Design
May 2012
Dr. X. Sharon Huo

GRADUATE THESIS/DISSERTATIONS AND OTHER STUDENT PUBLICATIONS**PhD****AHMED RIDA ABOUNASSIF**

Simulations of Atomizing Flows in 2D and 3D Combustion Chambers using an Eulerian Multiphase Model
May 2012
Dr. Jie Cui and Dr. John Peddieson

UWAKWE CHRISTIAN CHUKWU

Assessment of the Impact of V2G on the Electric Distribution Network
December 2011
Dr. Satish Mahajan

SEYED NASSER KESHMIRI

Probabilistic Economic Dispatch of Generation Units Considering Environmental Aspects
December 2011
Dr. Ghadir Radman

DEVENDRA KULKARNI

Measurement of Loss Coefficients in Divided Flow Fittings, and CFD Studies of Developing Turbulent Flows for Various Entrance Geometries
December 2011
Dr. Stephen Idem and Dr. Jie Cui

GANAPATHY KUMAR

Enhancement in Verdet Constant of an E-Field Oriented Polymer Nanocomposite
May 2012
Dr. Satish Mahajan

JOSHUA OJO

Transportation Kinetics of Internal Curing Water in Cement-Based Materials using Broadband Dielectric Spectroscopy
May 2012
Dr. Benjamin Mohr

JENNIFER ANNE PASCAL

Up-Scaling Electrical Based Separations by Electrokinetic Hydrodynamics (EKHD) and the Role of Scaling in Learning Transport Phenomena Concepts
December 2011
Dr. Pedro Arce

LAZARUS OKECHUKWU UZOECHI

Evaluation of Available Transfer Capability using Transient Stability Constraints Based on Line Flows
December 2011
Dr. Satish Mahajan

Name	Dept.	MS STUDENTS Source of Support	Graduation Date	Advisor
Angirekula, Bhanu Naga	ECE	CESR	Summer 2013	Dr. Ojo
Bednarczyk, Michael	CEE	TDOT Culverts	Summer 2012	Dr. Huo
Bule, Mehari	ECE	CESR	Spring 2013	Dr. Ojo
Chaudhari, Ojas	CHE	CESR	Fall 2011	Dr. Biernacki
Crowley, Aaron	CEE	TDOT HVFA	Spring 2012	Dr. Crouch
Dillon, Sarah	CEE	CESR	Spring 2012	Dr. Crouch
Gautam, Amrit	ECE	CESR	Fall 2012	Dr. Ojo
Halbrooks, David	ME	CESR	Summer 2012	Dr. Cui
Hale, John	CSC	NSF CCLI/TUES, CSC	Spring 2014	Dr. Ghafoor
Hawkins, Sarah	CEE	CESR, CEE	Summer 2012	Dr. Liu
Hill, Tristan	ME	CESR, NSF CCLI/TUES	Summer 2012	Dr. Canfield
Hughes, Tyler	ME	CESR, Thermaflex	Fall 2012	Dr. Idem
Islam, MD	CSC	NSF CCLI/TUES, CSC	Spring 2013	Dr. Ghafoor
Jeffries, Samantha	CEE	TDOT HVFA	Fall 2012	Dr. Crouch
Jones, Caleb	CEE	TDOT Culverts, CESR Match	Fall 2012	Dr. Huo
Keaton, Daniel	CEE	NSF Ettringite	Summer 2012	Dr. Mohr
Kelley, Michael	CSC	NSF CCLI/TUES	Fall 2013	Dr. Canfield
Kumar, Padmanabhan	ME	EIME Tennessee Department of Education, ME	Spring 2012	Dr. Canfield
Longanecker, Landon	ECE	CESR, ECE	Fall 2012	Dr. Alouani
Mahdieh Najafabadi, Amin	ECE	CESR	Fall 2012	Dr. Alouani
Mefford, Will T.	ECE	CESR, NSF CCLI/TUES	Left the University	Dr. Ojo
Thompson, Jared	CEE	NSF Ettringite	Spring 2013	Dr. Mohr
Wanjoeh, Samuel	ECE	CESR, ECE	Fall 2012	Dr. Radman
Zhang, Shuhai	CEE	TDOT Bridge Design, CESR Match	Spring 2012	Dr. Huo

Name	Dept.	PHD STUDENTS		Graduation Date	Advisor
			Source of Support		
Abounassif, Ahmed	ME	CESR		Spring 2012	Dr. Cui/ Dr. Peddieson
Aganah, Kennedy	ECE	CESR		Fall 2012	Dr. Ojo
Chaudhari, Ojas	CHE	CESR		Fall 2015	Dr. Biernacki
Jamehbozorg, Arash	ECE	CESR		Fall 2012	Dr. Radman
Jayanthi, Aditya	ME	CESR, ME		Fall 2012	Dr. Peddieson/ Dr. Cui
Karimi-Davijani, Hossein	ECE	CESR, ECE		Fall 2012	Dr. Ojo
Ojo, Joshua	CEE	NSF Ettringite		Spring 2012	Dr. Mohr
Oyekanmi, Waheed	ECE	CESR		Fall 2015	Dr. Ojo
Thomas, Adam J.	ECE	CESR		Fall 2012	Dr. Mahajan

CEE – Civil and Environmental Engineering (Tennessee Technological University)
 CESR – Center for Energy Systems Research (Tennessee Technological University)
 CHE – Department of Chemical Engineering (Tennessee Technological University)
 CSC – Department of Computer Science (Tennessee Technological University)
 ECE – Department of Electrical and Computer Engineering (Tennessee Technological University)
 EIME -- Early Intervention and Mechanical Engineering (Tennessee State Department of Education)
 ME – Department of Mechanical Engineering (Tennessee Technological University)
 NSF -- National Science Foundation
 ONR -- Office of Naval Research
 ORNL/DOE -- Oak Ridge National Laboratory/Department of Energy
 RTT -- Robotic Technologies of Tennessee
 TDOT -- Tennessee Department of Transportation

HOURLY STUDENT PERSONNEL

SM-13

GRADUATE/UNDERGRADUATE STUDENTS

	MAJOR
Ahmed Abounassif	ME
Kennedy Aganah	EE
Rami Amiri	EE
Viraj Anagal	EE
Bhanu Angirekula	EE
Srinath Balasubramanian	EE
Michael L. Bednarczyk	CE
Lindsay Smith Bryant	CE
Mehari Bule	EE
Ryan Carter	ME
Stephan G. Charles II	CE
Ojas A. Chaudhari	CHE
Uwakwe Chukwu	EE
William Tyler Clark	ME
Jordan Cleek	CE
William N. Craig III	PSY/SOC
Aaron Crowley	CE
John Deaton	EE
Sarah Dillon	CE
Amrit Gautam	EE
Derek Gaw	CE
Matthew E. Glass	ME
Richa Gokhale	EE
David Halbrooks	ME
John Hale	CSC
Paige Harris	CE
Sarah Hawkins	CE
Tristan Hill	ME
Joshua Hogancamp	CE
Tyler Hughes	ME
MD Islam	CSC
Arash Jamehbozorg	EE
Aditya Jayanthi	ME
Samantha Jeffries	CE
Caleb Jones	CE
Hossein Karimi-Davijani	EE
Sosthenes Karugaba	EE
Christopher Katko	ME
Daniel Keaton	CE
Michael Kelley	CSC
Kayla M. Kelly	CE
Sumalatha Kesavareddy	CE

HOURLY STUDENT PERSONNEL

SM-13

GRADUATE/UNDERGRADUATE STUDENTS

	MAJOR
Devendra Kulkarni	ME
Daniel Langley	ME
Landon Longanecker	ECE
Joseph McDaniel	CSC
Richard McMahan	ME
Amin Mahdieh Najafabadi	ECE
Emanuel Matee	ECE
Will Mefford	ECE
Melaku Mihret	ECE
David Nuckolls	CEE
Joshua Ojo	CEE
Waheed Oyekanmi	ECE
Shane Paulson	CEE
Bijaya Pokharel	ECE
Mehdi Ramezani	ECE
Amy E. Rauch	CEE
Christopher L. Rogers	CEE
Benjamin Rose	EEE
Kurt Smith	ME
Chayanon Sontidpanya	ECE
Bharadwaj Srinivasan	ME
Svjetlana Stekovic	ME
Amarnath Tamersi	ECE
Adam Thomas	ECE
Jared Thompson	CEE
Lazarus Uzoechi	ECE
Samuel Wanjoeh	ECE
Erika N. Wood	ME
Shuhai Zhang	CEE

Work Study/Work Scholarship

Brendan Brewer
Caleb Leavell
Jordan Middlebrooks
Jacob Wright

BUDGET MATERIALS



Students conducting power electronics research into 3, 5 and, 7 phase generators and wind turbine emulators in Dr. Ojo's Power Laboratory (Photo courtesy CESR)

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 2011-12 Actual			FY 2012-13 Proposed			FY 2013-14 Requested		
	Matching	Appopr.	Total	Matching	Appopr.	Total	Matching	Appopr.	Total
Expenditures	789,603	736,826	1,526,429	724,790	1,449,579	2,174,369	453,560	907,120	1,360,680
Salaries									
Faculty	158,252	8,000	166,252	186,369	127,000	313,369	88,796	90,660	179,456
Other Professional	10,710	185,308	196,018	8,338	305,725	314,063	0	254,690	254,690
Clerical/Supporting	6,220	62,321	68,541	3,481	159,332	162,813	2,700	115,100	117,800
Assistantships	161,223	175,430	336,653	182,346	244,989	427,335	129,680	125,000	254,680
Total Salaries	336,405	431,059	767,464	380,534	837,046	1,217,580	221,176	585,450	806,626
Fringe Benefits	40,220	81,220	121,440	40,921	208,794	249,715	22,214	168,700	190,914
Total Personnel	376,625	512,279	888,904	421,455	1,045,840	1,467,295	243,390	754,150	997,540
Non-Personnel									
Travel	25,290	5,281	30,571	21,845	49,719	71,564	13,101	25,000	38,101
Software		11,282	11,282	2,000	5,000	7,000	1,500	2,000	3,500
Books & Journals		0	0	100	200	300	250	300	550
Other Supplies	98,285	73,352	171,637	56,353	104,730	161,083	48,309	37,670	85,979
Equipment	23,330	37,418	60,748	0	100,000	100,000	0	5,000	5,000
Maintenance		2,990	2,990	0	3,000	3,000	0	3,000	3,000
Scholarships	93,409	94,224	187,633	100,096	136,590	236,686	67,010	80,000	147,010
Consultants	172,664	0	172,664	122,941		122,941	80,000	0	80,000
Renovation	0	0	0	0		0	0	0	0
Other (Advertising)	0	0	0	0	4,500	4,500	0	0	0
			0			0			0
			0			0			0
			0			0			0
Total Non-Personnel	412,978	224,547	637,525	303,335	403,739	707,074	210,170	152,970	363,140
GRAND TOTAL	789,603	736,826	1,526,429	724,790	1,449,579	2,174,369	453,560	907,120	1,360,680
Revenue									
New State Appropriation	0	866,000	866,000	0	880,700	880,700	0	907,120	907,120
Carryover State Appropriation		439,705	439,705		568,879	568,879		0	0
New Matching Funds	854,190		854,190	440,350		440,350	453,560		453,560
Carryover from Previous Matching Funds	219,853		219,853	284,440	0	284,440			0
Total Revenue	1,074,043	1,305,705	2,379,748	724,790	1,449,579	2,174,369	453,560	907,120	1,360,680

SCHEDULE 13A

ACTUAL PERSONNEL

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
ACTUAL, 2011-2012**

Tennessee Technological University Center for Energy Systems Research June 30, 2012

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
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	33
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
Sastry Munukutla, Professor	Mechanical Engineering	25
Joseph Ojo, Professor	Electrical and Computer Engineering	40
John Peddieson, Professor	Mechanical Engineering	30
Ghadir Radman, Professor	Electrical and Computer Engineering	25

***NOTE 1: Center faculty members Number 12 FTE 3.88**

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

	Number	FTE
a. Faculty	12	1.45
b. Other Professionals	6	2.84
c. Clerical/Supporting	5	2.43
d. Assistantships	34	23.10
e. Hourly Students	67	6.31
TOTAL, all categories	136	40.01

SCHEDULE 13B

PROPOSED PERSONNEL

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

Tennessee Technological University Center for Energy Systems Research June 30, 2012

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
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	33
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	30
Ghadir Radman, Professor	Electrical and Computer Engineering	25

***NOTE 1: Center faculty members. Number 11 FTE 3.63**

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

	Number	FTE
a. Faculty	10	1.25
b. Other Professionals	3	2.35
c. Clerical/Supporting	3	3.00
d. Assistantships	23	20.00
e. Hourly Students	40	3.00
TOTAL, all categories	90	33.23

SCHEDULE 13C

REQUESTED PERSONNEL

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

Tennessee Technological University Center for Energy Systems Research June 30, 2012

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
Steve Canfield, Professor	Mechanical Engineering	25
L. K. Crouch, Professor	Civil and Environmental Engineering	40
Sheikh Ghafoor, Associate Professor	Computer Science	25
Stephen Idem, Professor	Mechanical Engineering	33
Y. Jane Liu, Professor	Civil and Environmental	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

***NOTE 1: Center faculty members. Number 11 FTE 3.58**

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

	Number	FTE
a. Faculty	10	1.25
b. Other Professionals	3	3.00
c. Clerical/Supporting	3	3.00
d. Assistantships	25	23.00
e. Hourly Students	50	3.50
TOTAL, all categories	102	37.33

SCHEDULE 14A

2011-2012 PURCHASED EQUIPMENT

**TENNESSEE HIGHER EDUCATION COMMISSION
CENTERS OF EXCELLENCE
PURCHASED EQUIPMENT, 2011-2012**

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

DATE: June 30, 2012

State Appropriations

Description	Number	Unit Cost	Total
Dell PowerEdge R515 and Power Vault 124T LT05 (CESR Index 533392)	1	12,417.59	12,417.59
PCB Fabrication Station (CESR Index 533392) Cost shared with CMR Index 533390 and ECE Index 210460) Total Cost is \$75,490.	1	25,000.00	25,000.00
Subtotal, State Appropriations			\$37,417.59

Matching

Description	Number	Unit Cost	Total
RTDS GTAI Card (TTU Research 229342)	1	5,425.00	5,425.00
Custom Portable Traffic Data Collection System (PTDCS) (CEE Index 210460 \$20,000; TDOT Traffic Signal Interchange Index 539278 \$15,000; Power-Test-Service Index 538597 \$2,905) Total cost of \$37,905 is Encumbered as of 6/30/2012. The \$17,905 is carryforward 2010-2011.	1	17,905.00	17,905.00
Subtotal, Matching			\$23,330.00

GRAND TOTAL **\$60,747.59**

Grand Total	Matching	Appropriations
\$60,747.59	\$23,330.00	\$37,417.59

SCHEDULE 14B

PROPOSED EQUIPMENT

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

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

DATE: June 30, 2012

State Appropriations

Description	Number	Unit Cost	Total
Research Laboratory Equipment Smart Grid Research, Power Systems Research, Renewal Energy Research, Transportation Research (\$5,000 from 2012-2013 State Appropriations; \$95,000 from Carryforward from 2011-2012)	1	\$100,000	\$100,000
Subtotal, State Appropriations			\$100,000

Matching

Description	Number Total	Unit	Cost
Subtotal, Matching			\$0
GRAND TOTAL			\$100,000
Grand Total	Matching		Appropriations
\$100,000	\$0		\$100,000

SCHEDULE 14C

REQUESTED EQUIPMENT

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

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

DATE: June 30, 2012

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			\$0.00

GRAND TOTAL **\$5,000**

Grand Total	Matching	Appropriations
\$5,000	\$0.00	\$5,000

SCHEDULE 15A
BASE SUPPORT AND NON-EQUIPMENT MATCHING

ACTUAL 2011-2012

Budget Account Numbers	2011-2012 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	10,441,294
TOTAL BASE SUPPORT	10,441,294

**Non-Equipment Matching
 Restricted Accounts
 (No equipment or indirect costs included)**

Account Number	Project Title and Sponsor	Amount
536238	Northside Units 1 & 2 Primary Air System Flow Straightener Design and Optimization (Jacksonville Electric Authority)	22,939
531216	Nanoscale Characterization of Expansion Due to Delayed Ettringite Formation (National Science Foundation)	79,360
539510	Enabling Children with Disabilities and Their Families in Tennessee through Technology EIME Project (Preschool) (State Department of Education -- Division of Special Education)	25,926
539511	Enabling Children with Disabilities and Their Families in Tennessee through Technology EIME Project (School Age) (State Department of Education -- Division of Special Education)	6,481
539279	Higher Volume Fly Ash PCC for Sustainability and Performance (Federal) (Tennessee Department of Transportation)	45,218
539280	Higher Volume Fly Ash PCC for Sustainability and Performance (State) (Tennessee Department of Transportation)	11,304
531651	Algebraic Hierarchical Matrix Preconditioners for Two- and Three-Dimensional Saddle Point Problems (National Science Foundation)	37,211
535255	Laboratory Testing of Flexible Duct (Thermaflex, Inc.)	12,904
539284	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (Federal) (Tennessee Department of Transportation)	41,739

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
539285	Development of a TDOT Class D-LP (Lower Permeability) Concrete Mixture (State) (Tennessee Department of Transportation)	10,435
539274	Optimum Air Content Range (Plastic and Hardened) for TDOT Class D Portland Cement Concrete (PCC) (Federal) (Tennessee Department of Transportation)	13,913
539277	Optimum Air Content Range (Plastic and Hardened) for TDOT Class D Portland Cement Concrete (PCC) (State) (Tennessee Department of Transportation)	3,479
539286	Development of a TDOT Class S-Lower Heat Portland Cement Concrete (S-LH PCC) (Federal) (Tennessee Department of Transportation)	45,217
539287	Development of a TDOT Class S-Lower Heat Portland Cement Concrete (S-LH PCC) (State) (Tennessee Department of Transportation)	11,304
536239	CFD and Scale Model Study of Primary Air Diffuser for JEA NGS Unit (Jacksonville Electric Authority)	12,903
539281	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (Federal) (Tennessee Department of Transportation)	48,696
539282	Developing Rating Aids for the Evaluation of Existing Concrete Box Culverts in Tennessee (State) (Tennessee Department of Transportation)	12,174
531652	CAREER: Wind Power -- Multi-Level Control, Intelligent Grid Integration and Real Time Digital Simulation (National Science Foundation)	80,000
539235	Expanding the Range of Applications for the MRMS: a Mobile Robotic Manufacturing System for Mechanizing Manufacturing Processes (Advanced Technology International)	17,212
531258	Enhancing the Programming Experience for Engineering Students through Hands-On Integrated Computer Experiences: Phase II (National Science Foundation)	183,057

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
533216	Field Evaluation of Traffic Signal Based Interchange Treatments (State) (Tennessee Department of Transportation)	11,478
539278	Field Evaluation of Traffic Signal Based Interchange Treatments (State) (Tennessee Department of Transportation)	45,913
539322	Development of Tennessee Travel Demand Model Users' Group (University of Tennessee--Knoxville, Funded by the Tennessee Department of Transportation)	8,261
535258	Pressure Drop Testing of Corrugated Stainless Steel Pliable Gas Tubing (PLT)	19,861
538597	Power-Test-Service Account	16,525
Subtotal, Restricted Accounts		823,510

Unrestricted Matching
(No equipment or indirect costs included)

Account Number		Amount
229342	TTU Research	14,375
229660	Munukutla IC Faculty Energy Systems Research	5,580
Subtotal, Unrestricted Accounts		19,955

Other Matching
(Gifts and other non-equipment support not having account numbers)

1.	Gift from John Morris Bryant	300
2.	Gift from E. I. Dupont de Nemours	5,000
3.	Carryover Match, Operations, 2010-2011	219,853
Subtotal, Other Matching		225,153
TOTAL, NON-EQUIPMENT MATCHING		1,068,618

SCHEDULE 15B
PROPOSED BASE SUPPORT AND NON-EQUIPMENT MATCHING

BASE SUPPORT AND NON-EQUIPMENT MATCHING
PROPOSED, 2012-2013

2012-2013
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	10,754,533
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TOTAL BASE SUPPORT	10,754,533
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Non-Equipment Matching

Restricted Accounts

(No equipment or indirect costs included)

1. National Science Foundation (NSF)	269,352
2. Tennessee Department of Transportation	132,174
3. Tennessee State Department of Education	12,964
4. Power-Test-Service Account	25,750

Subtotal, Restricted Accounts	440,240
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Unrestricted Accounts

Account Number	Amount
2-29342 TTU Research	110
Subtotal, Unrestricted Accounts	110
TOTAL, NON-EQUIPMENT MATCHING	440,350

SCHEDULE 15C
BASE SUPPORT AND NON-EQUIPMENT MATCHING

BASE SUPPORT AND NON-EQUIPMENT MATCHING
REQUESTED, 2013-2014

Budget Account Numbers	2013-2014 Proposed 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	11,077,169
TOTAL BASE SUPPORT	11,077,169

Non-Equipment Matching
Restricted Accounts
 (No equipment or indirect costs included)

1. National Science Foundation	165,372
2. Tennessee Department of Transportation	155,110
3. State Department of Education	12,964
4. Office of Naval Research	85,372
5. Industry Sponsors	24,687
6. Power-Test-Service Account	10,055
Subtotal, Restricted Accounts	453,560

Unrestricted Accounts

Account Number	Amount
2-29342 TTU Research	-
Subtotal, Unrestricted Accounts	-
TOTAL, NON-EQUIPMENT MATCHING	453,560

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August 2012

Tennessee Tech University

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