When the lights flicker, we barely notice. Our homes stay warm. Our laptops switch to battery backup. Maybe an old clock radio needs a reset, but otherwise life goes on uninterrupted.

In the world of distributed energy production, however, even a momentary disruption in power can be a big deal. Whether it’s something as small as a voltage fluctuation (think: a squirrel in a transformer or a tree falling on a power line) or something as significant as a cyber attack on the power grid, knowing how the next generation of energy will respond to these disruptions is vitally important.

That’s where Curtiss Fox of the Clemson University Restoration Institute (CURI) comes in. The work he’s doing today at the University’s Energy Innovation Center (EIC) on its Grid Simulator will change the way we power our nation, and even our world, tomorrow.

Fox landed his stint at CURI in early May 2010, shortly after he’d finished up Ph.D. coursework on the University’s main campus. The Department of Energy had just awarded a grant to the drivetrain facility so that it could conduct mechanical testing of wind turbines by constructing two wind turbine dynamometers: one 7.5 megawatts, one 15 megawatts.

About the time the grant was awarded, Fox’s Clemson adviser, Randy Collins, associate dean of the College of Engineering and Science and professor of electrical and computer engineering, attended a presentation about the then-proposed wind turbine drivetrain testing facility. Collins spoke with EIC facility director and senior scientist, Nick Rigas, and learned about an electrical diagram of the proposed facility. On that diagram, there was a box. But no one quite knew what type of equipment was going to go into the box.

After joining CURI as a grad assistant, Fox’s main objective was to figure out what kind of electrical equipment went into the box. He also was charged with designing power-flow studies and studying the transient response of the electrical equipment within the facility.

The box had a name, if not a specific function: LVRT Equipment. It turns out it was actually an addition to the wind turbine facility’s electrical system. It wasn’t until after the grant was awarded that the Department of Energy came back to Clemson and asked if the University could also look at working an electrical test into what was otherwise mechanical testing of the wind turbine drivetrains.

The answer, thanks to Fox, was “yes.” That box was right in his wheelhouse. Low Voltage Ride-Through, or LVRT, is the ability of electrical equipment to keep working even when there are brief disturbances in the power system — something like lightning strikes, fallen trees or even animals on the power lines. When the lights flicker or short out, it’s because the flow of electricity has been disrupted. Fox had been pursuing a thesis on the subject, and now he had an opportunity to give it real-world application.

So, Fox developed a 15MW Hardware-In-the-Loop (HIL) grid simulator to troubleshoot these kinds of power interruptions and reduce the risks that those in the energy industry worry as they try to integrate new technologies into the electrical grid.

Since then, Fox’s work to bring HIL capability to the Energy Innovation Center has introduced a world-class, advanced testing platform capable of modeling grid conditions anywhere in the world. The grid simulator is a center for innovation, where energy efficiency, energy storage and smart-grid technologies can be developed, tested and certified before they are rolled out for the mass marketplace. All the while, the project has been an opportunity to educate industry about power systems engineering and to show them how it could impact their future workforces.

“As a student, I have been allowed to collaborate directly with industry,” Fox explains. That collaboration bodes well for the future of the electrical grid: “These projects are only a stepping stone for the research and innovation that will be needed for the grid of the future,” he says. “I hope to continue to contribute to those efforts.”
The Holcombe Department of Electrical and Computer Engineering is pleased to announce the addition of new faculty members to the department during the Fall 2013 semester.

Dr. Hai Xiao joined Clemson University as the Samuel Lewis Bell Distinguished Professor of Electrical and Computer Engineering, jointly affiliated with COMSET. Previously, he was a Professor of Electrical Engineering at the Missouri University of Science and Technology where he served as the founding director of the Photonics Technology Laboratory. Dr. Xiao received his Ph.D. degree in electrical engineering from Virginia Tech in 2000.

Dr. Xiao’s research interests mainly focus on photonic and microwave sensors and instrumentation for applications in energy, intelligent infrastructure, clean-environment, biomedical sensing/imaging, and national security.

Dr. Apoorva Kapadia joined Clemson as a lecturer, teaching courses in General Engineering and Electrical and Computer Engineering. He received his Ph.D. degree in Electrical Engineering from Clemson in 2013.

Kapadia’s research interests include modeling, design, and control of continuum robotic manipulators; the design of nonlinear controllers for electromechanical and embedded systems; real-time electromechanical systems; and hardware-in-the-loop testing.

Bill Delaney joined the ECE department as manager of the Micro-Photonics Fabrication Facility at AMRL. Before joining Clemson, Bill worked in private industry in various process engineering roles in the fabrication of refractive & diffractive Micro-Photonic devices.

Most recently, Bill was part of a 4 person team that procured, installed, qualified & developed all lithography processes on a TEL ACT 8 coat develop track & ASML 5500-1150C 193nm optical scanner capable of 90nm lithography, and recently achieved Six Sigma Green Belt certification.

ECE CAREER AWARD WINNERS

A CAREER award is the National Science Foundation’s most prestigious in support of early career development activities, providing a financial stipend to support research activity for a period of five years. The most recent CAREER grants awarded at Clemson represent a broad spectrum of interests and applications. For more information on Clemson’s CAREER award winners, visit http://features.clemson.edu/ces/2013/08/28/the-start-of-something-good/

Haiying (Helen) Shen

A new efficient and cooperative large-scale distributed data sharing system

Data sharing is the answer to a wide array of information technology woes, which is why millions of dollars are spent on commercial servers to deliver data. Haiying (Helen) Shen, associate professor of electrical and computer engineering, whose work is at the forefront of computing design, is working to improve these types of data sharing systems. Shen’s CAREER project seeks to make use of information obtained from something most everyone is familiar with these days: social networks. She is investigating how information from social networks may be used to create efficient and cooperative large-scale distributed data sharing systems — systems that support many social, commercial and cultural activities.

Melissa Smith

Harnessing hybrid computing resources in PetaScale computing and beyond

The world’s fastest computers process so quickly, their calculations are measured in something called petaflops: One petaflop is a thousand trillion calculations per second. But big computers require huge memories and equally massive amounts of storage. That means they also require big performance solutions. That’s where Melissa Smith comes in. The associate professor of electrical and computer engineering has received a CAREER grant to research heterogeneous supercomputing systems and new approaches that are essential for the efficient use of this raw computing power “to develop, deploy and optimize large-scale applications.” The grant will support a “rigorous study of hybrid computing systems to formulate a modeling framework useful for managing and optimizing large-scale applications running on heterogeneous, multi-paradigm systems.”
New Lab Advances Study of Electric Power Grid Technology

Clemson University will be in a position to better prepare the electrical power industry workforce of the future. The new lab is part of the Holcombe Department of Electrical and Computer Engineering within Clemson's College of Engineering and Science.

Under the direction of G. Kumar Venayagamoorthy, Duke Energy Distinguished Professor of Electrical and Computer Engineering, the RTPIS is a world-class research, education, and innovation-ecosystem laboratory for smart grid technologies. Electrical and computer engineering scholars and researchers can now conduct realistic, real-time investigations of the effects of integrating new kinds of generation such as wind and solar power, distributed generation, plug-in electric vehicles and energy storage, and disturbances on power systems.

Funded by the National Science Foundation and the Department of Energy, along with industry partners like Duke Energy, NEC Labs America, and several others, the RTPIS Lab creates an opportunity for academic institutions to collaborate with other stakeholders to expand their graduate and undergraduate engineering curricula in electric grid dynamics and operations, system of systems, modeling and simulation, control, and smart grid data analytics and visualizations.

Smart grid research being conducted in the RTPIS Lab includes, but is not limited to: adaptive devices and intelligent circuits and systems, big data analytics and visualization, computational methods and high performance computing platforms, cyber-physical systems and cyber-security, distributed generation and renewable energy, hardware/software-in-the-loop simulation, micro-grids and nano-grids, plug-in electric and hybrid vehicles, power electronics, and power system computations.

“We are fortunate indeed to have Dr. Venayagamoorthy leading this effort here at Clemson,” says College of Engineering and Science Dean, Anand Gramopadhye. “With his expertise and this advanced lab, our students will have the opportunity to make real contributions to smart grid technologies.”

ECE Alumni Honored at Annual College Banquet

At the 18th annual engineering and science banquet, the Thomas Green Clemson Academy of Engineers and Scientists welcomed Bryant G. Barnes to its distinguished ranks. Barnes graduated from Clemson University in 1976 with a bachelor’s degree in electrical and computer engineering. Three years later he earned a master’s degree in business administration from the University of South Carolina.

Barnes had begun working for the Rock Hill Telephone Company in his teens – sweeping floors, cleaning equipment and recycling telephones. In 1979 he began his professional career with the company, which today is known as Comporium. He was elected president in 2002, and a year later, he assumed the additional role of chief executive officer. Barnes was instrumental in helping establish the Optoelectronics Research Center of Economic Excellence in Clemson’s Holcombe Department of Electrical and Computer Engineering. He is currently a member of the Clemson University Foundation Board of Directors, and is a tireless ambassador for the College of Engineering and Science, keeping other constituents informed about the progress and needs of the academic departments.

During the banquet, the college also honored ECE Alumni Thomas G. Macdonald with its Outstanding Young Alumni Award. Macdonald received two Clemson degrees, the M.S. and Ph.D. degrees in electrical engineering in 1998 and 2001, respectively. As a graduate student, he excelled both as a researcher and as a leader among campus peers. Recognition of his excellence in research included the only Armed Forces Communications and Electronics Association (AFCEA) Fellowship awarded anywhere in the country in 1998. While conducting outstanding research, he was also a leader in the affairs of the campus.

Today, Macdonald leads the Advanced SATCOM Systems and Operations Group in the Communications Systems and Cyber Security Division at the MIT Lincoln Laboratory. The group plays a significant role in the synthesis, design, development and testing of the nation’s protected satellite systems. His expertise is widely sought in both technical and policy forums. He is a longtime contributor to the IEEE and, in particular, has been very active in the IEEE Military Communications Conference.
2013 ECE Student Awards

Riggs Most Outstanding Senior in Electrical Engineering
- Miller G. Byrd

Riggs Most Outstanding Senior in Computer Engineering
- Edward L. Sullivan

Rhodes Most Outstanding Junior in Electrical Engineering
- Ross C. Beppler

Rhodes Most Outstanding Junior in Computer Engineering
- Benjamin E. Ujcich

Rhodes Most Outstanding Sophomore in Electrical Engineering
- Matthew J. Byrd

Rhodes Most Outstanding Sophomore in Computer Engineering
- Justin P. Ford

Piedmont IEEE Student Paper Award
- John S. Bohannon

Piedmont IEEE Award – Electrical Engineering
- Jesse C. Santiago

Piedmont IEEE Award – Computer Engineering
- John S. Bohannon

Clemson engineering students recognized by Tau Beta Pi

Several students in Clemson’s SC Alpha chapter of Tau Beta Pi have won national awards presented this year by the honor society. The following students were awarded undergraduate scholarships for 2013-2014:

- Turner Cotterman (Electrical Engineering)
- R. Jordan Hall (Bioengineering)
- Sara Albritton (Civil Engineering)
- Melanie Payne (Civil Engineering)

There were 210 scholarships awarded nationwide. This is the sixth year in a row that a member of SC Alpha has been awarded a scholarship, and the last four years in a row we have had multiple winners.

The Tau Beta Pi Association was founded at Lehigh University in 1885 by Edward Higginson Williams, Jr., to mark in a fitting manner those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as students in engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in engineering colleges.

ECE students win IEEE PES scholarships

Five Clemson undergraduates have won IEEE Power & Energy Society Scholarships, which not only provide financial assistance, but career experience as well. Qualified U.S. students receive scholarship funds for up to 3 years as well as opportunities for internships and co-ops within the power and energy industry. Clemson’s IEEE PES Scholarship winners include:

- Ross Beppler- Johns Creek, GA
- Turner Cotterman- Greenville, SC
- Joseph Lavalliere- Londonderry, NH
- Jennifer Little- Aiken, SC
- Thomas Ryan- Alpharetta, GA

Over the next 5 years, half of the engineers in the power and energy industry will retire or leave the workforce. As that happens, industry demand for creative, visionary and hands-on problem solvers will continue to increase to meet the escalating need for electricity and to overcome new concerns about the environment and inadequate infrastructure.

Advancement of innovative technologies like electric vehicles, wind and solar generation and the Smart Grid require skilled workers to meet these demands and inspire solutions to tomorrow’s challenges. Clemson’s IEEE PES Scholarship awardees will meet those challenges.