

# Energy & Environmental Sciences Quarterly

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## Vehicle charging goes unplugged; project receives \$8 million from DOE

ORNL researchers are dropping the cord in battery charging for electric vehicles and plug-in hybrid models in favor of wireless power transfer (WPT) technology that has proven to be safer, more convenient, and more efficient.

Using a proprietary design created at ORNL's National Transportation Research Center, John M. Miller, principal investigator with the lab's Power Electronics Group, and his team have developed a hands-free, magnetized coil system that wirelessly transfers electricity to a vehicle with an onboard battery pack while it's parked over a floor-embedded charging sensor.

The project's multi-phase approach includes testing stationary charging of multiple vehicles in real-world situations, such as cars and buses in parking lots and garages, and a longer-term objective of further developing dynamic in-motion charging in which the vehicle's battery pack is replenished as it is driven over sensors installed along roadways.

"This is the ultimate in convenience. Without having to use a cord to plug in the charger to the vehicle, wireless

technology takes the charging burden completely off the driver, making it autonomous and safer for people to use," John said.

Test results from the lab show that using ORNL's wireless coils as a charging source can bring an EV's battery pack to fully charged with 90% efficiency, which is comparable to the current plug-in method and is the highest charge rate among competing wireless power transfer technologies for EVs.

The ORNL project team's impressive gains in wireless charging research, coupled with a strong focus on user safety, led to an \$8 million award from the US Department of Energy to fund further development and demonstration of the grid-connected, ground-based coil units. With DOE's support, ORNL plans to install its latest wireless charging coil design at an existing EV charging station as part of the lab's Sustainable Campus Initiative. It will be tested with a Toyota Prius parked over an 18- to 20-inch square of charging coils that emits between 7 and 10 kilowatts of electrical charge.

*Continued on page 4.*



*Researcher Steven Campbell demonstrates an electric vehicle being wirelessly charged using ORNL technology.*

## BESC celebrates first 5 years

To ensure a secure energy supply, the United States needs to develop a mix of fuels from various sources—preferably available domestically or from friendly countries. One of DOE's strategies for doing so is to replace at least 20% of US gasoline consumption with affordable, sustainable, domestically produced liquid biofuels.

ORNL's Bioenergy Science Center is one of three bioenergy research centers that DOE established in 2007 to conduct basic and use-inspired scientific research designed to accelerate progress toward a viable biofuels market based on lignocellulosic feedstocks as the fuel source. BESC recently succeeded in securing a recommendation for another 5 years of funding for its research.

*Continued on page 5.*



*Group shot of attendees at annual BESC retreat in July.*

# In the Spotlight

Energy and Transportation Science Division's Joshua New began his career at ORNL as an intern from UT, helping develop general tools for analyzing and visualizing large scientific data sets from



many diverse application domains.

After completing a Ph.D. in computer science, he returned as a research staff member in the Building Technologies Research and Integration Center and applied his expertise to develop tools for analyzing and visualizing data on energy use in buildings.

He is a primary contributor to the DOE Roof Savings Calculator website, a web-based simulator for calculating how much energy/money can be saved with available roof or attic choices for commercial or residential buildings. The RSC combines the DOE-2.1E tool for building energy simulation with AtticSim for modeling modern attic and cool roofing technologies. It calculates hour-by-hour roof performance for a set of building properties input by the user, based on

Joshua New

weather data from a nearby location, and reports annual energy savings for heating and cooling loads. Since it was posted in early 2010, the RSC has averaged 79 visitors per day.

Joshua currently applies advanced computer science techniques to automatically create accurate models of buildings from sensor data. This effort involves 269 channels of 15-minute data from ORNL's energy-efficient ZEBAlliance robotically emulated-occupancy home (now for sale!), OLCF's Jaguar/Titan supercomputer and other HPC resources for running 110 compute-years of building simulation ensembles, a suite of machine learning algorithms for data mining, and plans for a public 270 TB database with 26.9 trillion data points of virtual building energy data (partially available now at <http://autotune.roofcalc.com>).

## Roof-and-attic system delivers year-round efficiency

A new kind of roof-and-attic system field-tested at ORNL keeps homes cool in summer and prevents heat loss in winter, a multi-seasonal efficiency uncommon in roof and attic design. The system improves efficiency using controls for radiation, convection, and insulation, including a passive ventilation system that pulls air from the underbelly of the attic into an inclined air space above the roof.

"Heat that would have gone into the house is carried up and out," said Energy and Transportation Science Division's Bill Miller of ORNL's Building Envelope Group. "And with a passive ventilation scheme, there are no moving parts, so it's guaranteed to work."

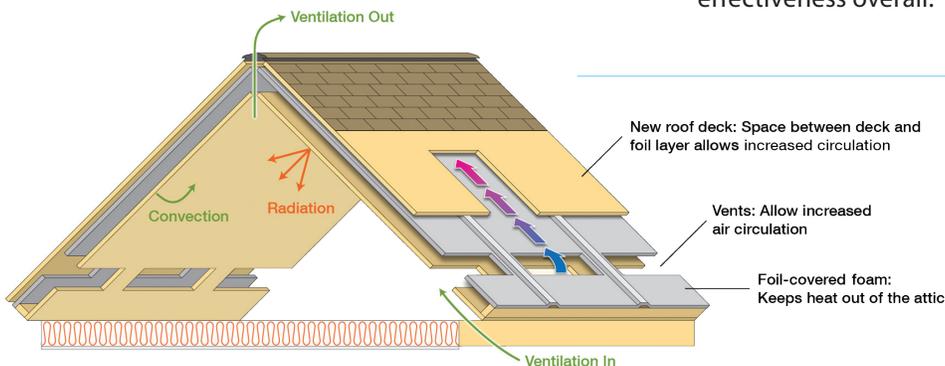
The new roof system design can be retrofitted with almost all roofing products. The heart of the design is a foil

covered polystyrene insulation that fits over and between rafters in new construction or can be attached on top of an existing shingle roof system. Homeowners don't have to remove old shingles, which saves money.

Poorly sealed HVAC ducts leak conditioned air into an attic, which typically costs homeowners \$100 to \$300 per year based on ORNL computer simulations.

To address the problem, some homeowners pay \$8,000 to seal the attic with spray foam, which can save upward of \$460 a year. For less initial cost and the same number of pay-back years, homeowners can retrofit the attic with the new design for about \$2,000 and save \$100 a year.

Looking to the future, Bill and colleagues are working on designs with lower initial installation costs, and greater cost-effectiveness overall.



*A new roof system field-tested at ORNL improves efficiency using controls for radiation, convection, and insulation, including a passive ventilation system that pulls air from the underbelly of the attic into an inclined air space above the roof.*

## ORNL researchers improve soil carbon cycling models

A more robust model of the soil carbon cycle developed at ORNL improves understanding of carbon residence time in soils and enables scientists to make more accurate climate predictions.

The model does a better job than previous models of accounting for how microbes in the soil break down carbon-rich materials and release carbon dioxide. "Soil is a big reservoir of carbon," said co-author Melanie Mayes of the Environmental Sciences Division and the Climate Change Science Institute. "Most soil carbon cycling models in use are so simplified that they ignore the fact that decomposition is actually performed by microbes."

The ability to accurately predict future climate conditions depends on understanding how CO<sub>2</sub> is cycled in four main reservoirs: atmosphere, oceans, soil, and biosphere. The ORNL model, Microbial-Enzyme-Mediated Decomposition, represents mechanisms of carbon decomposition in soil more accurately because it accounts for how different forms or "pools" of carbon in the soil are degraded by microbial action.

MEND simulates the chain of events that occur as plant or animal material decays and releases carbon into the soil. Enzymes released by microbes in the soil degrade the organic matter, releasing carbon molecules, which the microbes absorb as food. Eventually, the microbes release CO<sub>2</sub>.

In addition to accounting for most of the relevant processes in carbon degradation, MEND accounts for how temperature affects the ability of microbes to emit CO<sub>2</sub>. The researchers hypothesize that higher temperatures will alter the physiology of the microbes and their ability to digest carbon and release CO<sub>2</sub> into the atmosphere, Mayes said.

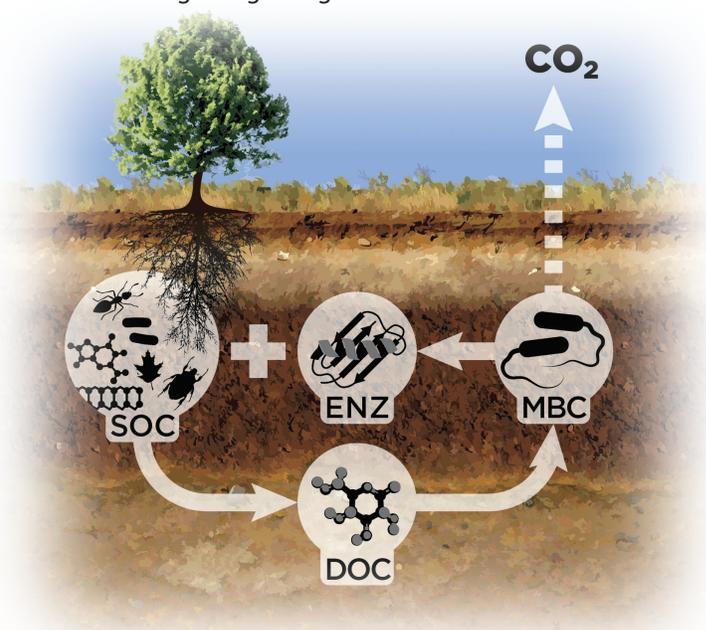
## Testing for a smarter grid

Modernization of the nation's electrical power grid involves the deployment of an Advanced Metering Infrastructure (AMI) that integrates many technologies with existing utility operations and asset management processes to provide intelligent connections between consumers and system operators. Protecting the privacy of AMI-related data and securing the computing and communication networks will be central to the performance, reliability, and security of the future electric power infrastructure.

Assigned by DOE and led by Energy and Transportation Science Division's Isabelle Snyder and Computational Sciences and Engineering Division's Nathanael Paul and Teja Kuruganti, an ORNL team is evaluating the functional and security requirements described in the AMI Smart Meter Upgradeability Test Framework (DRAFT NISTIR 7823). The purpose is to validate the suitability of the proposed framework for testing conformance to the National Electric

The ORNL team will conduct lab-scale experiments for several months to ensure the accuracy of the model. Eventually they hope to incorporate it into the Community Land Model, a module used in the Community Earth System Model for predicting climate change.

In addition to Melanie, authors of the paper include ESD's and CCSI's Gangsheng Wang and Mac Post.



*ORNL's new carbon cycling model could help scientists understand the role of soil microbes (MBC) in climate change by tracking extracellular enzymes (ENZ) that break down carbon-rich soil materials (SOC) into forms that microbes can respire (DOC).*

cal Manufacturers Association requirements for Smart Meter Upgradeability standard (SG-AMI-2009).

Within a controlled environment, ORNL has implemented on the ORNL campus an AMI system that includes smart meters, cell relay, and a collection engine and data management system by Itron, a global technology company that helps utilities measure, monitor, and manage energy and water. With the help of collaborators including Itron, Enernex, Electrosoft, NIST, and DOE, ORNL will develop and implement appropriate test plans to validate the functional and security requirements as described in the DRAFT NISTIR 7823. The team will analyze the test procedures as well as the system performance to assess whether the test framework provides a suitable platform to validate conformance to each of the functional and security requirements for smart grid firmware upgradeability.

Continued from page 1...

## Vehicle charging goes unplugged; project receives \$8 million from DOE

John explained that during the next 3 years, his team will continue development of the static charging functionality of the wireless charging system; take the technology into the production intent phase as it moves toward commercialization; and present the wireless charging system to DOE for further testing, data collection, and validation.

ORNL has focused on WPT for onboard vehicle battery charging since 2008. During the last year, the lab has made significant strides in modified coil technology to effectively and efficiently handle in-motion charging.

In the future, said John, moving from stationary to in-motion wireless charging of onboard vehicle batteries may require installation of in-ground direct current cabling along American highways. Setting up EV charging stations, which could resemble and function like toll roads, could be done in tandem with scheduled road construction and repair. EV owners could use the equivalent of an electronic "fast pass" system to pay for wireless charging as they drive over embedded sensors.

The ORNL-led team includes Evatran, General Motors, Toyota, and Clemson University.

*Researchers including Chester Coomer worked with various designs to optimize performance of the coil units.*



## Lab R.A.T.S. explore learning with LEGO®

After successfully mentoring several high school teams participating in the 2012 FIRST® Robotics Competition, ORNL is building new interest in science, technology, engineering, and math—one LEGO® brick at a time.

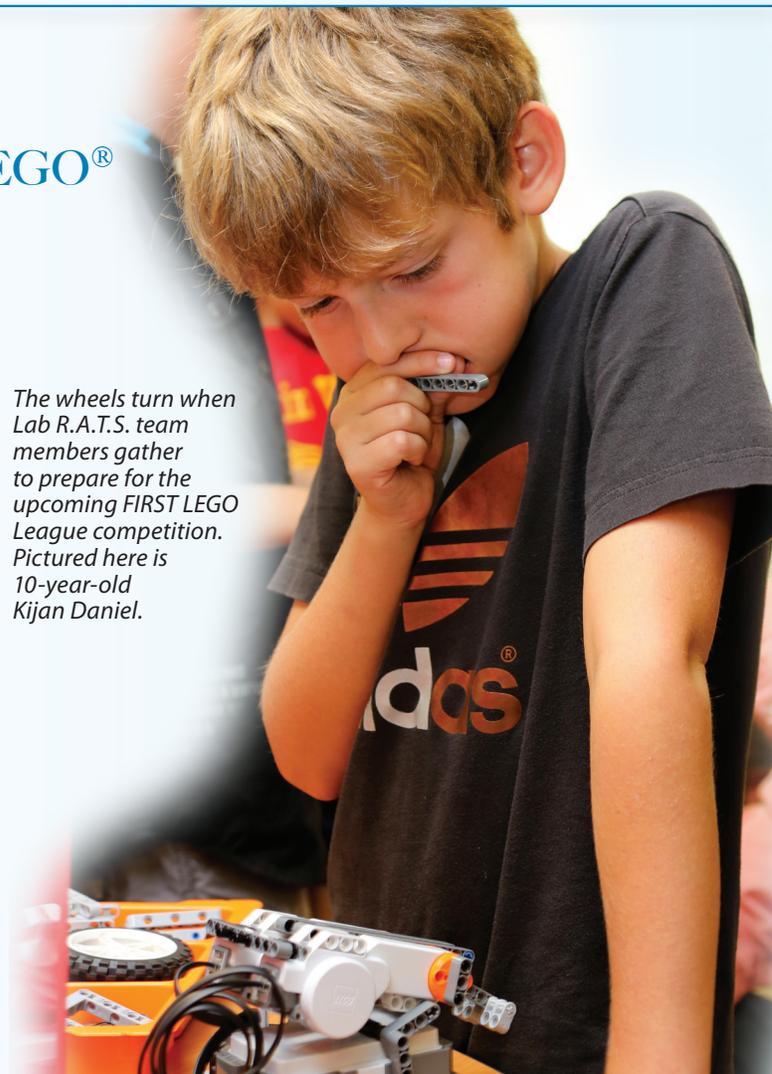
FIRST®LEGO® League targets kids 10 to 14 years of age. Twice a week, seven local students are meeting with ORNL mentors and members of the Hardin Valley Academy FIRST Robotics team at the National Transportation Research Center/Manufacturing Demonstration Facility off Hardin Valley Road to prepare for the 2012 Senior Solutions Challenge.

Self-proclaimed the Lab R.A.T.S. (Robots Are Technology in Service), the young team members are brainstorming ideas to help solve problems faced by today's senior population

and building a LEGO robot to autonomously solve challenges around this topic on a robot game field. With the help of their mentors and additional funds received from Hardin Valley Academy, Coldwell Banker Real Estate, and William Keller Realty, the Lab R.A.T.S. should be ready for the state competition in Cookeville on December 8.



*The wheels turn when Lab R.A.T.S. team members gather to prepare for the upcoming FIRST LEGO League competition. Pictured here is 10-year-old Kijan Daniel.*



Continued from page 1...

## BESC celebrates first 5 years

BESC's goal is to enable revolutionary breakthroughs in overcoming biomass recalcitrance—the resistance of plant walls to releasing their sugars for conversion to alcohol. The aim is to enable the use of lignocellulosic biomass—wood and grass, mainly—to produce transportation fuels. Ethanol is easily produced from corn, but corn isn't considered a practical fuel source: aside from concerns about using a food crop for fuel, growing and harvesting corn requires almost as much energy as it produces. Lignocellulosic biomass is an attractive option because it is abundant and renewable; comes from non-food sources, including agricultural and wood waste; and can be grown on semi-agricultural lands less amenable to food crop production.

Paul Gilna is BESC director and Brian Davison is science coordinator; both are members of ORNL's Biosciences Division. The research staff includes around 300 scientists and engineers from 18 different research institutions and private companies who make up the BESC collaboration.

Brian is excited by the progress of BESC: "In five years, BESC has moved recalcitrance from an operationally-defined phenotype into an understandable phenomenon in terms of pathways and interactions in both cell-wall formation and bioconversion based on chemistry, structure, and biochemistry."

The center's research focuses on three areas: biomass formation and modification—"making better plants"; biomass deconstruction and conversion—"making better bugs"; and the enabling technologies of characterization and modeling. The BESC approach involves (1) genetically designing plants, or discovering naturally occurring plants, with cell walls that can be deconstructed rapidly and easily and (2) engineering improvements in enzymes and microbes that can convert plant biomass to biofuels in a single step.

Examples of accomplishments in BESC's first 5 years include a modified switchgrass with an improved biofuel yield that has now reached field trials with a commercial partner, and a genetically improved yeast that has the ability to digest sugars from plant cellulose, alongside the native ability to ferment the sugar into biofuel.

BESC's ability to design, conduct, and analyze wide-ranging experiments such as genotyping and high-throughput recalcitrance phenotyping studies of large-scale plant feedstocks has been key to its success in overcoming the biological and technical barrier of biomass recalcitrance.

"With well over 400 publications under our belt along with over 100 invention disclosures, some of which have already been licensed, we believe we have redefined the boundaries of recalcitrance research and in so doing have

accelerated the rate of discoveries and developments that will serve to enhance the emergent cellulosic biofuels enterprise," said Paul.

New insights into plant genetics, cell wall composition, and cellulose conversion are emerging from laboratory experiments, characterization techniques such as neutron scattering and microscopy, computer simulation, and expanded genetic databases. The new knowledge is used to build better understanding and models of lignocellulose destruction, which will lead to better processes for releasing sugars for biofuel production.



*Populus transgenic lines grown in greenhouse.*

## DataONE portal helps researchers comb through online data

New software released by DataONE (Data Observation Network for Earth) will help researchers exploring data-intensive environmental topics such as climate change or infectious diseases find the information they need in massive online datasets.

The overwhelming volume of data available in diverse forms—from old field notes to current satellite readings—makes it hard for researchers to find the information they need to address complex environmental questions. Sponsored by the National Science Foundation, DataONE is a collaboration of research institutions addressing the need to organize and make available “vast amounts of highly diverse and interrelated but often incompatible scientific data.”

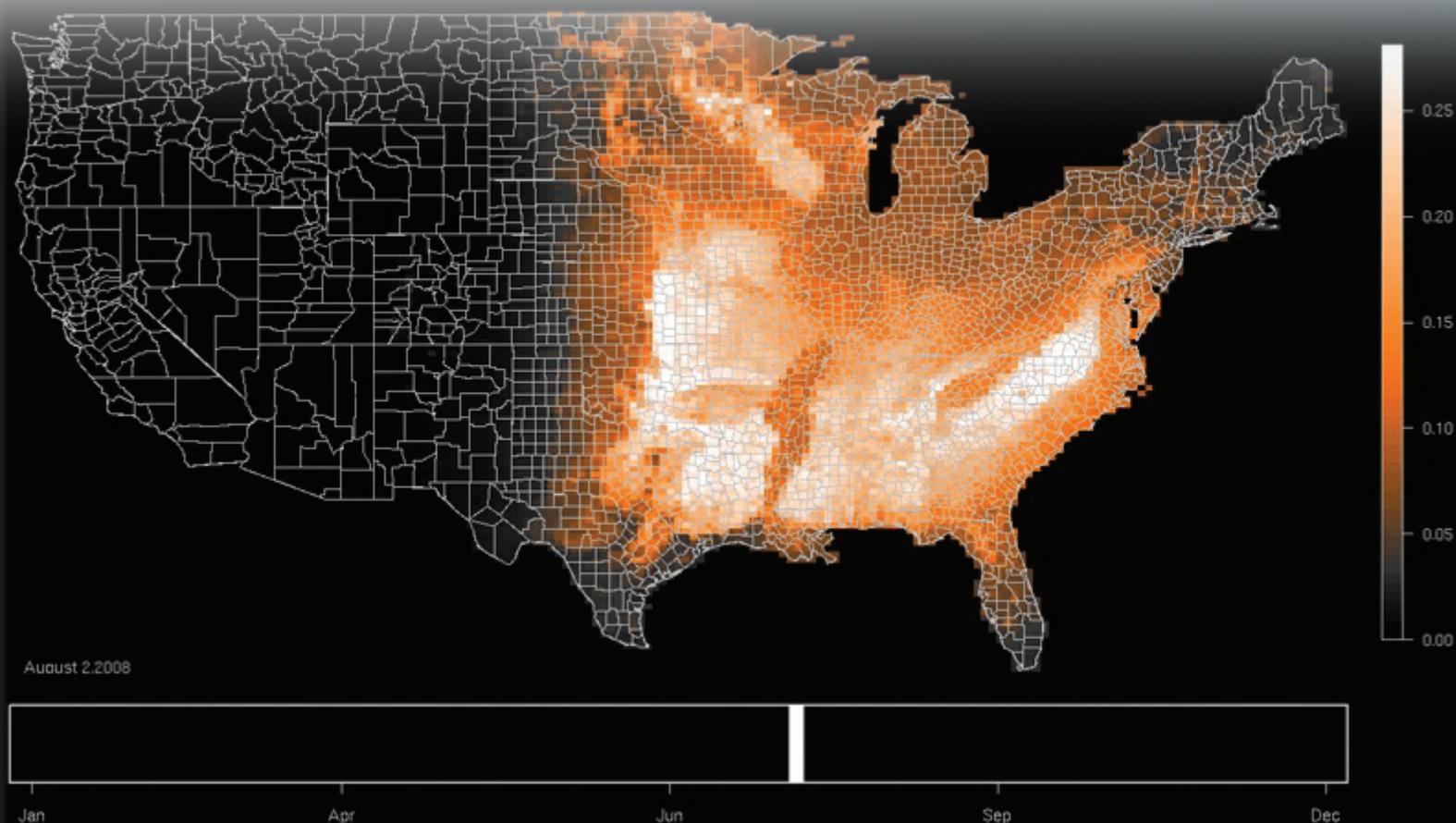
DataONE offers a one-stop search engine called “One-Mercury” that queries data collections worldwide for relevant information on earth science topics. Environmental Sciences Division’s Robert Cook and Giri Palanisamy and Computer Science and Mathematics Division’s John Cobb and Line Pouchard are part of the team that developed the new tools; it also includes researchers from the University of Tennessee School of Information Sciences and other partners. A key part of the new software is an advanced search engine developed by ORNL team members.

“This search system enables researchers to discover, access, and explore data that exist at many different repositories around the Internet,” Robert said. Previously there was no “federation” of the various data centers that would allow a user to search all the resources from one point, he said.

A valuable feature of the DataONE search tool is that it allows users to easily integrate information from previously incompatible data sets. A DataONE working group, for example, combined a database of amateur bird sightings with layers of environmental data for land use, weather, and vegetation to refine predictions about bird migration patterns.

“The whole process of making data available, and making the data so it could be readily integrated, really benefited the bird ecologists,” Cobb said. The tool is freely available to the public at <https://cn.dataone.org/onemercury/>.

*Easier access to data through a new search software from DataONE promises to aid data-intensive research projects such as eBird, which combined multiple data layers to make predictions about bird migration patterns. The map shows the predicted occurrence of the eastern bluebird in August 2008. Additional animated maps are available at <http://ebird.org/content/ebird/about/occurrence-maps/>.*

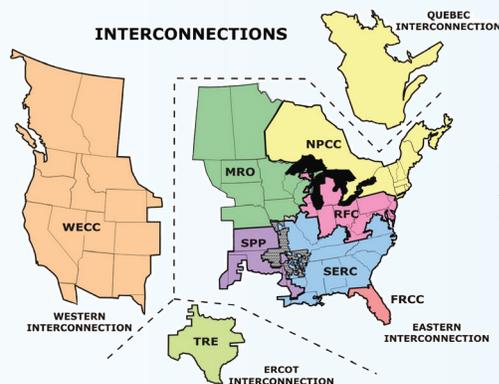


## Supporting the grid's Eastern Interconnection

Arguably the most complex “machine” in the world, the Eastern Interconnection of the North American electrical grid contains thousands of power plants, hundreds of thousands of miles of power lines, and millions of endpoints in everyone’s homes, stores, offices, and factories. Extending from Upper Canada to Florida and New Mexico to Nova Scotia, EI is owned by thousands of organizations from small utility districts to giant investor-owned utilities to federal authorities.

While planning for the EI had traditionally been managed by individual utilities and regions within it, major utilities banded together in 2009 to create the Eastern Interconnection Planning Collaborative. The Department of Energy extended support, providing stimulus funds for EIPC to initiate transmission studies that involve all of the stakeholders in the EI, including power providers, transmission owners, end-users, environmental organizations, consumer groups, and the 39 states and regulatory bodies within the EI. DOE also provided stimulus funds to those states so they could create the Eastern Interconnection States’ Planning Council, whose mission includes guidance of the EIPC, creation of tools to define Clean Energy Zones, and other studies.

Since their inception, ORNL has provided support to EIPC and EISPC in a variety of ways. Energy and Transportation Science Division’s Stan Hadley helped the EIPC in its initial proposal to DOE, provided training on transmission planning to the EISPC, and has been a technical advisor throughout the phases of the study. Stan also helped provide forecasts of demand, demand response, energy efficiency, wind power, solar generation, and power plant costs for use in the long-term planning models being



*Image source: North American Reliability Corporation.*

used, and created the visual tools used to convert model outputs into understandable form.

In addition to Stan, ETSD’s John Stovall has been a key EISPC representative on the transmission options task force that plans out potential transmission connections to meet the future scenarios. ORNL has also worked on the EISPC’s Clean Energy Zone tool; a cross-directorate team has provided information on different clean energy resources, including nuclear, clean coal, hydro, and storage. Their information is fed into a GIS tool that will allow end-users to select criteria and see what areas of the country are most suitable for development.

Besides direct support to the EIPC and EISPC, DOE has funded ORNL to study the potential for energy efficiency and demand response in the EI. Personnel from ESTD and ESD have studied demand response, while Georgia Tech was subcontracted to conduct a similar study on energy efficiency. The work was used to supply information to the studies above, and reports on their results will be issued this fall.

## Enhancing sustainable mobility through education

While school was not in session and many grade school students enjoyed a relaxing summer vacation, others began building their futures by attending one of the annual Oak Ridge Associated Universities’ week-long science academies. Approximately 60 middle school students from Tennessee, throughout the Appalachian Region, and Florida participated in the academies.

Activities included visits to the National Transportation Research Center and the opportunity to learn more about ORNL fuels and engines research and the effects of various fuels on the environment. At NTRC, Energy and Transportation Science Division’s Scott Curran welcomed the students, explained the types of research done at the NTRC, and led the students on a tour to better understand biodiesel and other various fuel types being researched at the facility.

ORNL intern Mary Eibl discussed her work with students, while Emily Wise and Katelynn Routh, members of the University of Tennessee’s EcoCAR 2 advanced vehicle design team, gave short presentations on sustainable transporta-

tion and the benefits of participating in this type of competition. Each presentation highlighted the advantages of becoming involved in these educational opportunities, and the three presenters expressed their enthusiasm for the students’ interest in learning, especially during summer vacation.

“I believe this is a really good program,” said Emily. “The students are able to learn about something they show interest in, while also finding ways to advance their education in preparation for college and a future career. This type of camp will allow students to recognize the opportunity for achievement and success.”

— Article submitted by Katelynn Routh, UT Student and EcoCAR 2 team member



# Clean Energy Highlights

## Nuclear

A team led by ORNL's Environmental Sciences Division with representatives from several national labs joined staff from the Nuclear Regulatory Commission, the US Army Corps of Engineers, and various federal and state agencies in conducting an environmental site audit for an Early Site Permit application submitted by Public Service Enterprise Group for a site located adjacent to two existing PSEG nuclear power plants in Salem County, New Jersey. The proposed permit would allow PSEG to "bank" the site for developing one or two new reactors within 20 years of ESP issuance. The team is expected to publish its findings in 2013 in a draft environmental impact statement evaluating the potential environmental impacts of constructing and operating a new unit(s) at the proposed site. The final EIS is scheduled for 2014.

## Biosciences

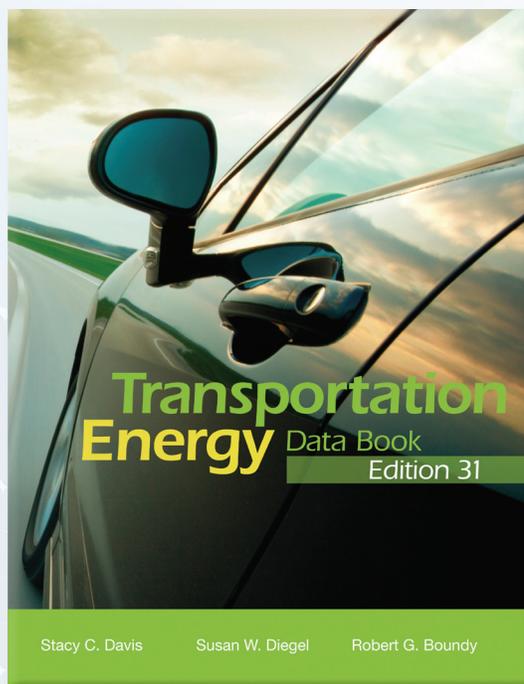
This summer, Biosciences Division's Chris Schadt, Jerry Tuskan, Nancy Engle, Wellington Muchero, and Jessy Labbé and Chemical Sciences Division's Karuna Chourey logged over 600 hours taking samples from more than 200 trees at experimental *Populus trichocarpa* plantations in Oregon for the Plant-Microbe Interfaces SFA project. As part of an ongoing collaboration led by Chris and Jerry, almost 550 samples were processed for microbial community ribosomal sequence analysis and more limited metagenomic sequencing by the Joint Genome Institute through the Community Sequencing User Program. From the samples, BSD's Dale Pelletier and his group have isolated more than 1700 bacterial colonies, and Duke University's Rytas Vilgalys and Greg Bonito have verified a novel ectomycorrhizal fungal species of the genus *Tuber* (true truffles). Further results should be forthcoming from these efforts late this year.

## Sustainability

ORNL-developed socioeconomic sustainability indicators were the centerpiece for the DOE Social Aspects of Bioenergy Sustainability workshop and subsequent webinar earlier this year. The workshop identified knowledge gaps and implementation challenges, as well as research and development recommendations for the suite of proposed indicators. In the webinar, Environmental Sciences Division's Virginia Dale reviewed the proposed indicators: social well-being (employment, work lost due to injury, household income, and food security), social acceptability (public opinion, transparency, effective stakeholder participation, and risk of catastrophe), and trade (energy security premium, fuel supply stability, terms of trade, trade volume). ESD's Rebecca Efrogmson presented a summary of recommendations of the social acceptability subgroup at the workshop and webinar.

## Transportation

The latest *Transportation Energy Data Book*, produced by the Center for Transportation Analysis for DOE's Office of Energy Efficiency and Renewable Energy, is now available on the Web. The TEDB is a compendium of data on transportation with an emphasis on energy. Designed for use as a desktop reference, the TEDB was first published in 1976 and has continued to the 31st edition. The TEDB's most current electronic version is available in Excel and PDF formats. Hard copies of the book are available by emailing Stacy Davis at [davissc@ornl.gov](mailto:davissc@ornl.gov).



## ITER

Measurement Science and System Engineering Division researchers Stephen Killough, Alan Barker, Chuck Schaich, Robin Rumbolt, and Carl Dukes are working with the US ITER Office and Fusion Energy Division on instrumentation and controls (I&C) for the ORNL ITER electron cyclotron heating (ECH) test facility located in Building 7625. With ECH one of three methods planned for use by ITER to heat plasma for the fusion tokamak, MSSSED staff members are addressing several I&C tasks, including development of a 1 MW power supply control and monitoring system for a 140 GHz gyrotron and eventually a new 170 GHz gyrotron. Experimental tests have been conducted to study vacuum pump down curves for various waveguide configurations to gauge the impact of initial assembly and maintenance on large amounts of wave-

guide. The researchers are also developing a water-cooling test stand to study the thermal time constant of waveguides and durability over accelerated lifecycle testing. This allows simulation of heating and cooling a waveguide section thousands of times to test the integrity of the fastening materials, such as epoxy.

## Electricity

CURRENT is a National Science Foundation engineering research center focused on wide-area visualization and controls of the electric grid. Jointly supported by NSF and the Department of Energy, the Center is led by the University of Tennessee. During the last year, ORNL has supported CURRENT

research and development projects, creating enhanced funding opportunities for both organizations and accelerating the research agenda. The two institutions have partnered on multiple significant proposals involving advanced computing and modeling, mathematical modeling, and plug and play photovoltaics. ORNL and UTK, along with the industry partner National Rural Electric Cooperative Association, also have been deploying fault disturbance recorders across the country for higher-resolution monitoring of the grid. *Rural Electric Magazine* featured the FNET wide-area-measurement system created and used by researchers at CURRENT, UT, and ORNL. Entitled "FNET: Taking the Grid's Temperature," the article discusses the potential for more affordable methods of monitoring the nation's electric power grid.

## 2012 ORNL Awards Night EES Honorees

*UT-Battelle, LLC, is pleased to announce the annual Awards Night honors for outstanding employees. The awards will be presented on November 16 at the annual Awards Night celebration. Below is the list of honorees representing the Energy and Environmental Sciences Directorate.*

### Science & Technology—Early Career Award for Engineering Accomplishment

Measurement Science and Systems Engineering Division's Chris Boehnen is being recognized for growth of a high-quality biometrics program in his first 3 years of service at ORNL. It is producing results that will alter systems containing iris recognition capabilities for many applications, improve police capabilities for data analysis, and significantly impact classified applications in this area.

### R&D Leadership, Group Level

Environmental Sciences Division's Liyuan Liang is being honored for her leadership in aligning subsurface science in ESD with DOE priorities; creating an environment that promotes staff hiring, development, and high-impact publication; and providing strategic direction that has resulted in programmatic growth and cross-division collaboration.

### Excellence in Technology Transfer

MSSD's John Simpson and Scott Hunter are members of the team being honored for development and licensing of diatomaceous earth-based superhydrophobic materials, a revolutionary new coating technology for protecting a wide range of products and materials.

### Engineering Research & Development

EESD's Ray Boeman and Craig Blue are among the team members being recognized for exceptional R&D engineering accomplishments resulting in the establishment of unique capabilities for demonstrating and facilitating implementation of alternative carbon fiber production technologies that will save energy and promote economic development.

### Exceptional Community Engagement by an Individual

MSSD's Gary Alley is being recognized for sustained leadership and service to students in Roane County.

### Science Communicator

Energy and Transportation Science Division's Brian West is being recognized for a sustained commitment to sharing his research expertise and for his passion for educating the general and non-automotive technical communities on the details of transportation energy use, especially with respect to the potential impact of biofuels.

## Employee Excellence



Paul Hanson

Environmental Sciences Division's Paul Hanson has been named a UT-Battelle Corporate Fellow. Paul is a distinguished research and development staff member and group leader with more than 25 years of experience conducting environmental effects research related to energy technologies and their use. His work focuses predominately on the impacts of climate change on the physiology, growth, and biogeochemical cycles of North American forest ecosystems.

Congratulations to Biosciences Division's Wellington Muchero and Jay Chen, in collaboration with scientists at the National Renewable Energy Laboratory, who were awarded beam time by the Lawrence Berkeley National Laboratory's Advanced Light Source user facility to conduct experiments under a proposal titled "Imaging mass spectroscopy of tissue-specific plant cell wall composition using laser desorption and vacuum ultraviolet (VUV) photoionization."

Biosciences Division's Abhijeet Borole has been awarded a US Patent for the new invention Microbial Fuel Cell Treatment of Ethanol Fermentation Process Water. Abhijeet also received an "Excellence in Review Award" from the journal *Environmental Science & Technology*, in June 2012.

Energy and Transportation Science Division's Jim Parks and Bill Partridge have been awarded a patent for developing an approach to rapidly measure the concentration of oxygen in fluids. The technology is applicable for enabling the development of high-efficiency engine systems.



Bill Partridge



Jim Parks

The journal *WIREs Nanomedicine and Nanobiotechnology* has released its list of top ten cited journal articles. The article "Atomic force microscopy of biological samples," co-authors including Biosciences Division's David Allison, Ninell Mortensen, and Mitch Doktycz, appears on the list. The original article is available at <http://onlinelibrary.wiley.com/doi/10.1002/wnan.104/full>.



ORNL researchers have received ten R&D 100 awards. The awards, presented by *R&D Magazine*, recognize the top 100 innovations of 2012 and are sometimes referred to as the "Academy Awards of Science." The ten awards bring ORNL's total of R&D 100 awards to 174.

# Making Connections

Global Security Directorate's Rich Stouder and Biosciences Division's Bob Cottingham organized the Oak Ridge National Laboratory Biosurveillance Symposium that was held in conjunction with the annual Biodetection Technologies 2012 Conference in Washington in June. Bob Cottingham gave the talk "Introduction to the Biosurveillance Initiative."

In July, ORNL participated in a DOE Advanced Manufacturing Office-sponsored Technology Deployment Workshop associated with the Better Buildings Better Plants Program. Alcoa, Navistar, Bridgestone, Eastman, St. Gobain, and Cummins were in attendance. Industrial partners presented their challenges and success stories associated with energy management and technology deployment. ORNL researchers presented new and emerging technologies that could have near-term impact for these industrial partners.



Energy and Transportation Science Division's Robert Wagner and Paul Chambon traveled to Tianjin, China, where they delivered invited presentations and served as moderators at the 2012 SAE Summer Technology Week. Robert, pictured above, served as lead organizer and chairman of the four-day event.



**MDF**  
Manufacturing Demonstration Facility

In August, White House National Economic Council Director Gene Sperling, Acting US Commerce Secretary Rebecca Blank, Assistant Secretary of Energy for Energy Efficiency and Renewable Energy David Danielson, and other senior administration officials visited M7 Technologies in Youngstown, Ohio. They toured the facility and announced a National Network for Manufacturing Innovation initiative to spur manufacturing innovation and lay the groundwork for job creation. During the event, ORNL researchers showcased the Hardin Valley Academy FIRST Robotics entry, a product of science, technology, engineering, and mathematics outreach activities led by ORNL's Manufacturing Demonstration Facility.

A Lawrence Berkeley National Laboratory-led team including ORNL was competitively selected for the US-India Partnership to Advance Clean Energy Research under the building energy efficiency topic area. Energy and Transportation Science Division researchers from the Building Technologies and Research Integration Center will host team leaders from India this fall and travel to India to participate in several partnership-related events.

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## Impacting Industry

*ORNL embraces industry partnerships to advance commercialization of clean energy technologies. Featured here are a few recent collaborative updates.*

- UT-Battelle, LLC, and Shell Global Solutions (US) signed a CRADA to develop and demonstrate oil-soluble ionic liquids as engine oil additives to improve the mechanical efficiency of internal combustion engines. The CRADA is in support of a Broad Agency Announcement award through the Vehicle Technologies Program's fuels and lubricants research area.



*Synthetic polyalphaolefin base oil (left) and 0W10 racing lubricant containing 3% ionic liquid.*

- A new research partnership between ORNL and Arcam AB was officially launched in September with a CRADA kickoff meeting. Arcam is the sole provider of electron beam melting powderbed additive manufacturing equipment, expanding an emerging field of manufacturing technology that will benefit the US industrial base and its workforce.
- Congratulations to Energy and Transportation Science Division's Ed Vineyard and team for executing a new CRADA with Trane covering two R&D initiatives—development of next-generation rooftop heating, ventilation, and air-conditioning units and next-generation variable-speed water source heat pump units.
- Congratulations to Energy and Transportation Science Division researchers involved in the development of the ClimateMaster Trilogy™ 40 Q-Mode™ geothermal heat pump. Developed under a CRADA with ORNL, the technology is winner of the *Air-Conditioning, Heating and Refrigeration News'* ninth annual Dealer Design Gold Award, the top honor in the HVAC High-Efficiency Residential Equipment category.
- Energy and Transportation Science Division researchers and two major automotive manufacturers have secured access to ORNL high performance computing resources via the Industrial HPC Partnership Program. The automotive manufacturers will be working with ETSD and Computer Science and Mathematics Division researchers to investigate the stability limits of advanced combustion strategies and injector design optimization for next-generation, high-efficiency engines.