

## CAES launches new energy efficiency research program

By Kortny Rolston, CAES Communications

The Center for Advanced Energy Studies is spearheading a new statewide research program to help make buildings, homes and industrial systems more energy efficient.

The CAES-led Energy Efficiency Research Initiative (CEERI, pronounced “cheery”) will evaluate energy-saving technologies currently on the market to see how well they work and study consumer behavior to determine which technologies they like best and what motivates them to conserve. CEERI also will train architects, engineers and technicians to incorporate energy efficiency into buildings and industrial systems.

The research program involves the CAES partners – Boise State University, Idaho National Laboratory, Idaho State University and University of Idaho – as well as Idaho Power, Micron Technology, the J.R. Simplot Company, the Boise Metro Area Chamber of Commerce, the Idaho Office of Energy Resources, the Natural Resources Defense Council and others.

“Our goal is to take a research-based approach to energy efficiency,” said John Gardner, a Boise State University professor and sustainability expert who is leading the CAES effort. “Technology has come a long way and we think we can do better in terms of improving energy efficiency.”

### Did you know?

The International Energy Agency projects that making buildings, industrial processes and transportation more efficient could cut world energy consumption in 2050 by one-third.

CAES has long planned to delve into energy efficiency research since all four of its partner institutions have expertise in this area.

Director Harold Blackman said improved efficiency goes hand in hand with the work CAES scientists and engineers are already doing in carbon management, nuclear science and engineering, bioenergy and other energy-related fields.

“The cheapest energy is that which you don’t use and if we can better understand how to use less energy to power homes, buildings and industry, it’s a savings to consumers across the board,” Blackman said. “Improving energy efficiency is an integral part of developing sustainable energy solutions and that’s what CAES is about.”

The formation of the CEERI is timely, especially for utilities like Idaho Power that are faced with supplying consumers with electricity.

The more its customers embrace energy efficiency and incorporate it into their homes or businesses, the less power Idaho Power has to generate or purchase on the open market, which can be costly. Improving energy efficiency also reduces the amount of greenhouse gases a utility emits.

“Energy efficiency is our first resource choice,” said Ric Gale, Idaho Power’s vice president for corporate responsibility. “When you look at the gamut of energy generation options, there are negatives with every one of them – either cost, siting issues or carbon emissions. We don’t have these same negatives associated with cost-effective energy efficiency.”

Though Idaho Power has implemented several energy-saving programs and technologies over the past decade, Gale



said more work is needed to improve efficiency and educate the public.

“The best energy appliances and best programs don’t work if consumers aren’t willing to engage,” he said. “We’ve got to get consumers on board.”

Gale also believes CAES is the best choice to lead the energy efficiency research program.

“The Idaho universities and INL are already partners in CAES,” he said. “CAES is able to bring in all the players and get them to work together.”

## University of Idaho/CAES students win paper and presentation awards

By Kortny Rolston, CAES Communications

Two University of Idaho graduate students conducting research at CAES took top honors at the 2010 American Institute of Chemical Engineers conference in Salt Lake City.

Michael Shaltry won first place in the nuclear engineering division for his paper titled "Kinetic Study of Ion Exchange Between Multivalent Cations and Zeolite-4A in Molten Salt."

Ammon Williams won first place in the nuclear engineering division for his presentation "Modeling of Zone Freezing for Pyrochemical Process Waste Minimization."

Shaltry received a \$500 scholarship and the opportunity to have his paper published in a peer-reviewed journal. Williams received a \$500 scholarship.

Both are studying under Dr. Supathorn Phongikaroon, an Idaho Falls-based University of Idaho professor and CAES researcher.

"I'm very happy for Michael and Ammon," he said. "There was a lot of competition this year and they both won first place. This is a good reflection on our university and CAES community."

This is the second consecutive year a University of Idaho student has won best paper in the institute's nuclear engineering division. Robert Hoover, who also studied under Phongikaroon at CAES, won in 2009.

Shaltry, who graduates this semester, is excited to have his first paper published.

"I wrote a lot of drafts before the final paper was ready. It was a lot of work, but it was worth it," he said. "I'm ready to do it again."



## A Minute With Jatu Burns

By Kortny Rolston, CAES Communications

Jatu Burns is a research associate for Boise State University in Idaho Falls.

She received her master's degree in materials science and engineering in 2010 from Boise State University and her bachelor's degree in chemical engineering in 1998 from Prince of Songkla University in Thailand.

At Boise State, she studied high-temperature fatigue crack growth and microstructural evolution in nickel-based alloy using electron backscatter diffraction (EBSD).

Before that, Burns worked in the electroplating and electronics industries.

### **How long have you worked at CAES?**

For about seven months.

### **Which research projects are you involved with at CAES?**

I am currently working on characterizing the microstructure of sintering oxide dispersion strengthened (ODS) alloys using EBSD. I also help other researchers who want to use the scanning electron microscope, focused ion beam and other instruments in the CAES Microscopy and Characterization Suite (MaCS).

### **What do you like best about working at/with CAES?**

Good people, good environment, advanced instruments.

### **Has CAES led to any new research projects or collaborations for you?**

Yes, the research we are working is in collaboration with other institutions.

### **What do you in your free time?**

I like camping, photography, spending time with my kids.

### **What is your favorite movie?**

I rarely go to movies. My favorite is probably "It's a Wonderful Life" from 1946.

### **Favorite book?**

"The Little Prince" by Antoine de Saint-Exupéry.

### **If you were a superhero, what would your superpower be?**

Never want to be a hero. But if I could I would like to be a witch and cast spells over some people to be nice, kind, generous, love other humans, love animals and love nature. And also I could fly and I could see the beauty of the earth and feel free like a bird.

# CAES Research Updates

By Kortny Rolston, CAES Communications

CAES' research focuses on nuclear science and engineering, advanced materials, carbon management/geosciences, bioenergy, energy policy, modeling and simulation and energy efficiency.

Here is the latest news from our research initiatives:

## Nuclear Science and Engineering

- The safety review for the installation of crystal growth hardware has begun at CAES. The equipment will support the research Dr. Eric Burgett, an Idaho State University professor, is conducting to better understand the separate effects of radiation and thermal conditions on fuel performance on the atomistic and macro scale. This ongoing effort will provide the world's largest crystals of uranium dioxide, as well as engineered crystalline structures for various U.S. Department of Energy Office of Nuclear Energy missions.

## Advanced Materials

- Dr. Rick Ubic, a Boise State University materials science professor, has been named director of the CAES Microscopy and Characterization Suite (MaCS). The new research suite includes a high-end local electrode atom probe (LEAP), a scanning electron microscope (SEM) and a nano indenter atomic force microscope.

## Carbon Management/Geosciences

- CAES is sponsoring a geothermal energy workshop April 21-23 in Idaho Falls. CAES is hoping to build competitive teams made up of scientists, engineers and students from its partner institutions - Idaho National Laboratory, Boise State University, Idaho State University and University of Idaho - to conduct research and development that will develop Idaho and the region's geothermal energy resources. For more information, contact [Robert.Podgorney@inl.gov](mailto:Robert.Podgorney@inl.gov), [jfairley@uidaho.edu](mailto:jfairley@uidaho.edu), [mccumich@isu.edu](mailto:mccumich@isu.edu), or [cjnorth@boisestate.edu](mailto:cjnorth@boisestate.edu).

## Bioenergy

- CAES bioenergy researchers and the Energy Policy Institute are planning to host a roundtable discussion in Twin Falls in April on some of the policy and regulation issues surrounding community anaerobic digesters.

## Energy Policy

- David Solan, director of CAES' Energy Policy Institute, and Steven Peterson, a University of Idaho professor and CAES researcher, recently presented a report titled Economic and Employment Impacts of Small Modular Nuclear Reactors at the Center for Strategic and International Studies in Washington, D.C. More than 100 people attended the presentation, including representatives from the U.S. Department of Energy, the State Department, the U.S. Department of Defense and several foreign embassies. The report's research team included faculty and graduate students from Boise State University, Idaho State University, University of Idaho and the University of New Mexico.
- Solan also presented a research paper on options to improve electricity transmission siting on public lands to the Western Interstate Energy Board on January 11. The research was funded through an \$11,000 grant from the Western Governors' Association.

## Modeling and Simulation

- Boise State University was recently designated as a CUDA Research Center by NVIDIA, an international company that focuses on visual computing. (NVIDIA invented the graphics processing unit (GPU) in 1999.) CUDA is NVIDIA's parallel computing architecture that, according to the company's Web site, enables dramatic increases in computing performance by harnessing the power of the GPU.

NVIDIA's CUDA Research Center Program fosters collaboration at institu-

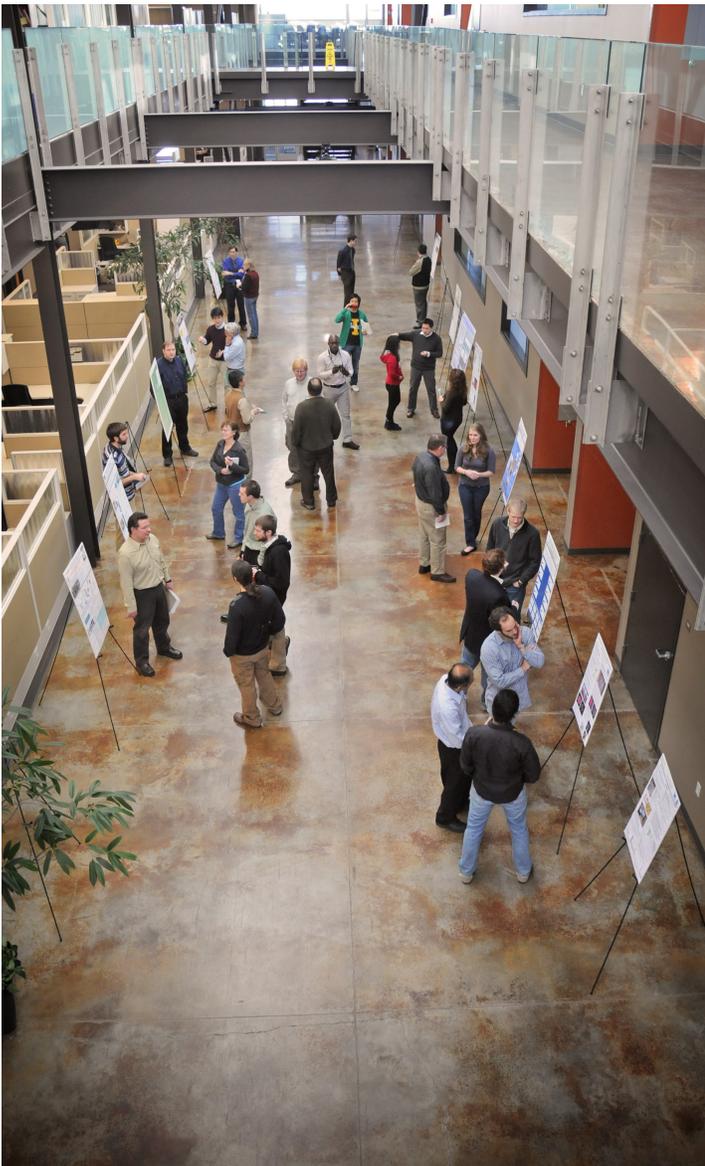
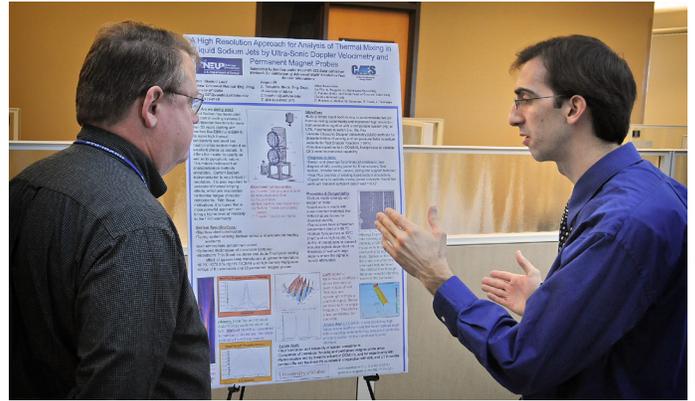
tions that are expanding the frontier of massively parallel computing.

## Energy Efficiency

- University of Idaho professor Kevin Van Den Wymelenberg recently led a group of Idaho Power executives on a visit to the Pacific Energy Center, a Pacific Gas & Electric outreach and education facility in San Francisco. The CAES Energy Efficiency Research Initiative is taking the lead on developing a similar center to serve Idaho and the surrounding region.
- Boise State University professor John Gardner submitted a National Science Foundation curriculum development grant on behalf of seven regional institutions. The goal is to develop Internet-delivered engineering courses focused on energy and sustainability that can be shared among the partner institutions.
- Gardner and Van Den Wymelenberg are working with the National Energy Leadership Corporation (NELC), a non-profit organization associated with the G-PIC energy efficiency hub at Pennsylvania State University, to submit a proposal to the U.S. Department of Energy's Building America program. The NELC is dedicated to education, outreach and research in the area of residential energy efficiency.

## Shop talk

University of Idaho and Idaho State University nuclear science and engineering students gathered at CAES in December to present their research during a "Talk Shop/Eat Pizza" event. Some students displayed their research during a morning poster session while others presented during an afternoon session in the CAES auditorium.



## CAES/University of Idaho researcher explores neural networks

By Kortny Rolston, CAES Communications

In the Hollywood movies *I, Robot* and *Terminator*, highly intelligent computers that can learn, reason and make decisions try to take over the world.

That seems farfetched to most people. Not to Milos Manic, a University of Idaho professor and a Center for Advanced Energy Studies researcher who specializes in neural networks – algorithms that help computers learn by mimicking human intelligence and reasoning.

The only part he views as outlandish is the bit about taking over the world.

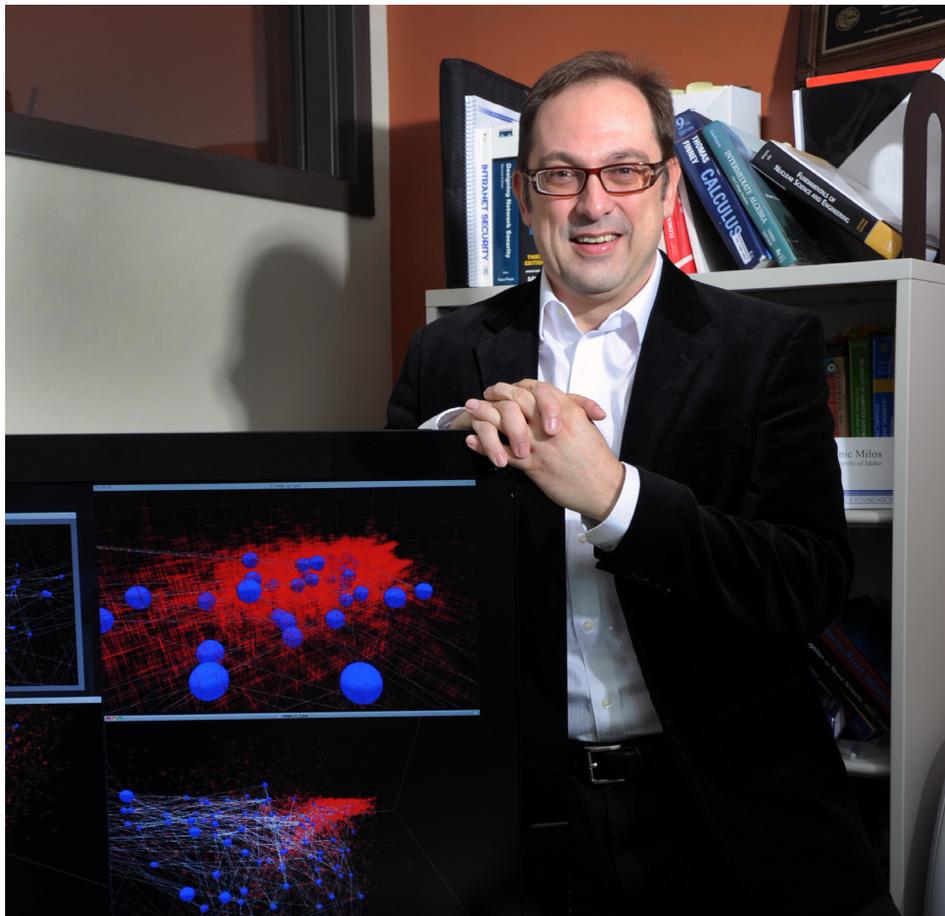
“Neural networks are based on the human mind and are able to learn,” Manic said. “Just like we use our human minds to do lots of things so can we use the artificial mind to do a lot of things.”

Manic’s research focuses primarily on creating neural networks and combining them with something called “fuzzy math” to build self organizing maps of data. The maps examine data for similarities and interdependencies then group them in clusters, which researchers can evaluate.

The maps are loaded into a computer assisted virtual environment – or CAVE – at CAES so researchers can view the data in 3D. Manic and his students have used self organizing maps to sort wind turbine data that is collected at CAES.

“It is difficult for humans to view and analyze 12 to 15 sets of data and group them,” Manic said. “We’re just not set up for it. With self organizing maps, a computer is able to sort it for us. It can extract knowledge from data and help researchers find correlations they might not have been able to otherwise see.”

Manic started delving into neural networks in 2005 during his PhD studies at the University of Idaho. He had studied math while attending college in his native Serbia and thought to continue in Idaho. However, his professor informed him that fuzzy math was for graduate students and he needed to move on to neural networks.



“I did not like neural networks at first,” Manic said. “They can be chaotic and creating them is as much art as it is science. You have to figure out how to combine the right algorithms. Sometimes they don’t work as you think they would and you have to play around until you get it right. It can be frustrating because there’s not one definite way to do it.”

Manic eventually embraced them and now has built his career around using them to help researchers evaluate complex sets of data.

For example, one research project he is currently working on involves improving sensors that detect intrusions into industrial control systems. By using neural networks and fuzzy math, he and others

are able to help the sensor analyze different factors, information and anomalies that signal an intrusion could occur. The sensor mines the data it is able to collect and learn from it.

This is important because most sensors are set up to detect signals based on past intrusions, not new and different attacks that might be dreamed up in the future.

Manic acknowledges his field can seem scary and straight out of a Hollywood movie, but says the potential for researchers in all disciplines is huge.

“All of this allows researchers to see data in new ways and pick out patterns and explain scientifically why something is occurring,” he said. “They are powerful tools.”

To submit story ideas, calendar items or other information for upcoming CAES newsletters, please send an e-mail to [Kortny.Rolston@inl.gov](mailto:Kortny.Rolston@inl.gov).