Berkeley's Margaret Torn: A steppe at a time.

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Research Highlights . . .

DOE Pulse

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Coal ash becomes a dwelling

A new construction material using recycled flyash from coal-fired power plants is being tested at DOE's Oak Ridge National Laboratory. The material will be used in the walls of a Habitat for Humanity home; its performance will then be compared with data from other, previously built Habitat homes. The project represents a double benefit: converting a waste-stream from coal burning into an energy-efficient construction material. The Tennessee Valley Authority and Babb International of Ringgold, Ga., are participating in the project with ORNL's Buildings Technology Center.

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DREAM-y technology advances proteomics

While people may rely on counting sheep to fall asleep and then dream, scientists at DOE's Pacific Northwest National Laboratory are putting DREAMS before measurements with a powerful new mass spectrometry technique. This method, called DREAMS for Dynamic Range Enhancement Applied to Mass Spectrometry, analyzes more proteins in less time and with greater accuracy than current methods, thereby providing a more thorough understanding of an organism. PNNL scientists designed DREAMS to automatically filter out signals from proteins that exist in large numbers from those proteins that appear in fewer numbers. Such low-level proteins often hold clues to important cellular processes, such as disease development. Globally studying proteins has become a major challenge and now is possible because of the near completion of the mapping of the human genome.

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NETL works both ends of technology development

DOE's National Energy Technology Laboratory is developing a mathematical model that can ultimately be used to improve the iron-removal rates of semi-passive technologies applied to watersheds polluted with acid mine drainage. The model would also predict the outcome of adding a treatment method to an existing technology.

The overall goal is to demonstrate the effectiveness of water-powered technologies as a cost-cutting alternative to fossil-fuel-operated devices used today. Because iron kills insects that are part of a watershed's food chain, it threatens an entire ecosystem. In addition to providing the science behind improved technology design, the lab will design, construct and field test large-scale, in-stream systems.

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Research projects advance renewable energy

DOE's National Renewable Energy Laboratory will perform three research projects as part of an Xcel Energy program to advance renewable energy. One project is to develop a filter that can remove potential pollutants from systems that produce energy from biomass. In addition, NREL researchers will work on a new solid state Titania solar cell based on mesoporous Titanium Dioxide Film. One main objective of this project is to make the cell practical for the marketplace by developing a solid-state version of the cell. A third project involves the development of new electrocatalysts for proton exchange membrane fuel cells. This research could lead to the development of a direct methanol or ethanol fuel cell or to a more robust hydrogen powered system.

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DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

Analysis tool benefits from close partnership

ADVISOR, a systems analysis tool designed and maintained by researchers at DOE's National Renewable Energy Laboratory addresses multiple questions about specific component and vehicle designs for hybrid electric vehicles. Thanks to recent collaborations with Oak Ridge National Laboratory and the purchase of a damaged Toyota Prius, ADVISOR has been gaining additional engine and emissions data.

"We've had a long, successful history of working with ORNL," said Keith Wipke, team leader for the Vehicle Systems Analysis Team.

Whereas NREL does no in-house engine research, ORNL has provided key information on several engines such as the Mercedes 1.7L diesel engine and a Volkswagen 1.9L turbo diesel engine.

ORNL and NREL are also working hand in hand with TECAT Engineering on implementing an advanced engine scaling routine for inclusion in ADVISOR. That routine scales engine performance and emissions in response to changes in engine bore (diameter of the cylinder through which a piston travels) and stroke (the length the piston travels in the cylinder).

Dent-'n-scratch Prius

"ADVISOR is a tool that requires data input," said ORNL's Fuels, Engines and Emissions Research Center team member Scott Sluder. "Through ADVISOR, NREL provides us with a big picture tool that allows users to utilize data from different engines, emissions control systems and scaling algorithms. This way, we're able to provide different types of engine and emissions control data for people to use."

ADVISOR is being used successfully by more than 800 organizations and over 4000 people worldwide and is fed new component test data through users in industry, academia and efforts of other national labs such as ORNL and ANL.

In November, NREL's Battery Thermal Management Team purchased a damaged Prius for $3,000 from Jefferson County in Colorado. The Prius was involved in an accident and had sustained some structural damage. NREL's battery thermal management team removed the Panasonic NiMH battery pack and battery controller to evaluate ways to effectively heat the battery in extremely cold temperatures and to verify battery pack models developed for ADVISOR simulations. The Battery Thermal Management team collaborated with the Vehicle System Analysis team by providing them validated models for various battery chemistries.

"Neither the battery pack nor engine was damaged during the accident so it was an excellent investment," said Ahmad Pesaran, NREL's Battery Thermal Management team leader.

Wipke contacted Sluder and asked him if the engine or electric motor would be of any use.

"I received a call from Keith who wanted to know if the engine from the damaged Prius would be useful to ORNL," said Sluder. "I think this is a good example of how well our two organizations work well together."

Submitted by DOE's National Renewable Energy Laboratory

Margaret Torn digs up a century of carbon data in Russia

Margaret Torn

"Because of carbon respiration and storage, soils could be a key determinant of how and when the global climate changes," says Margaret Torn of the Earth Sciences Division at DOE's Berkeley Lab. "Yet soils are one of the aspects of the terrestrial carbon cycle we know least about."

Terrestrial ecosystems can't be studied from an armchair. "You may have a great theory, but when you test it in the field, you often find you are wrong." Torn's travels have ranged from Hawaiian volcanoes to Alaskan tundra, from the Rocky Mountains to the Russian steppes.

In the 1890s the pioneering soil scientist R. V. Rizpolozhensky collected "monoliths"—slabs of soil, some of them more than a meter deep—from nearly 50 locations across Russia. Historic soil data is often inaccurate, and sampling sites have been lost. But using Rizpolozhensky's careful notes, plus computer-aided comparisons between new and old maps, Torn and Russian scientist Andrei Lapenis, now at the State University of New York, relocated many of his original sites.

In some places, they found, land use hadn't changed since Rizpolozhensky's time; at one site, pristine steppe has been preserved. In five widely separated locations the scientists dug new pits and compared the soils directly with the historic monoliths. While acid rain from power plant emissions and wind-blown phosphates from agricultural fertilizers had caused many striking changes, Torn's radiocarbon measurements showed that the amount of carbon in the soils has changed very little.

"The central question," says Torn, "is whether soils like these will buffer the atmosphere against the massive injections of carbon from fossil fuels and other human activity—or do the opposite, by releasing carbon and greatly amplifying human impacts." The challenge is to learn how long the resilience of soils can last, and how to detect ominous changes early.

Submitted by DOE's Lawrence Berkeley National Laboratory