Not your everyday fish story

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Research Highlights . . .

DOE Pulse

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Art and science push 3-D fuel cell modeling

The art and science of computer simulation are making important contributions to the development of lower-cost, higher-efficiency, solid-state fuel cell systems, and those contributions are expected to grow rapidly as more accurate and robust models are developed. In support of the Solid State Energy Conversion Alliance, and building on previous work with one-dimensional codes, researchers at DOE's National Energy Technology Laboratory are developing tools for full 3-D analysis of complex solid-state fuel cell geometries. Unlike simpler tools, the FLUENT-based 3-D analysis tools provide designers with performance predictions, thermal stress distributions and the ability to explore complex design options in a rapid, cost-effective manner.

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NREL launches fuel research lab in Denver

DOE's National Renewable Energy Laboratory dedicated a research facility in Denver July 19 that develops cleaner fuels for trucks and buses. At the Renewable Fuels and Lubricants (ReFUEL) Research Laboratory, researchers will develop pathways to increase the use of renewable and synthetic motor fuels and lubricants, and to work with industry to improve the formulation, quality and utilization of these products. "The ReFUEL Research Laboratory will go a long way towards improving our environment and helping to meet national goals for reducing our reliance on foreign energy sources," said Barbara Goodman, director of NREL's Center for Transportation Technologies and Systems.

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Climate monitoring goes mobile

Scientists now have the capability to document atmospheric and climate change at locations nearly anywhere in the world, thanks to a new mobile atmospheric monitoring system—the Pacific Northwest National Laboratory Atmospheric Remote Sensing Laboratory, or PARSL, developed at DOE's PNNL. PARSL is a complete climate-measuring system that can be transported to nearly any site on the planet quickly and easily, and be fully operational within 48 hours of arrival. Its suite of instruments allows researchers to closely focus on key elements that contribute to climate change. In particular, scientists are interested in the amount of solar energy collected at the earth's surface and the atmospheric conditions that influence that change.

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Climate computer models double resolution

Climate studies just doubled in resolution thanks to a new computer model developed by researchers at the National Center for Atmospheric Research and DOE's Oak Ridge National Laboratory. The model runs on ORNL's IBM supercomputer, nicknamed Cheetah. Cheetah has 4.5 teraflops (4.5 trillion calculations per second) of computing power and was recently listed No. 8 in the Top500 list of fastest computers in the world. NCAR and ORNL researchers configured a new climate model optimized for Cheetah that improves resolution from 2.8 degrees to 1.4 degrees. The model solves mathematical equations representing the complex and still only partially understood interactions that determine weather and climate.

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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).

25 Years of Research Excellence

At the foot of a rocky mesa on the outskirts of Golden, Colo., a small group of scientists and engineers launched the Department of Energy's Solar Energy Research Institute, a federal facility dedicated to harnessing power from the sun. They had high hopes and a pioneering spirit—but little inkling of where their ambitious venture would lead.

This year, some of those same pioneers are celebrating the 25th anniversary of their ambitious endeavor, today known as DOE's National Renewable Energy Laboratory, or NREL.

A quarter-century of research at the lab has helped renewable energy press forward on many fronts. Consider that

- The cost of wind energy has declined from 40 cents per kilowatt-hour when the lab was founded, to five cents or less today.
- Lower costs have helped wind energy become the fastest growing source of new electricity in the nation.
- The cost of electricity from photovoltaic panels that covert sunlight directly into power has dropped from several dollars per kilowatt-hour, to 20-25-cents a kilowatt-hour today.
- Improved efficiencies have helped sustain an annual growth rate for the PV industry of 20 to 30 percent a year.
- The cost of ethanol made from biomass has plummeted from more than $4 per gallon to $1.20 today, with a resulting rise in ethanol production and use.

Other renewable technologies have shown similar gains, and in each case, research by NREL, at the Colorado labs and around the country by its partner universities and corporations, is recognized as a substantial factor.

Among the lab's nearly 50 areas of scientific investigation are wind energy, solar photovoltaics, solar buildings, biomass power, biofuels, geothermal energy, hydrogen, superconductivity, distributed power, hybrid vehicles, fuels utilization, building energy technology, federal energy management and advanced industrial technologies. The lab also maintains a leadership role in basic energy science. Other efforts like NREL's Energy Analysis, International, Energy Resource Assessment, Education and Technology Transfer programs fulfill critical objectives as well.

As the only federal lab dedicated solely to renewable energy, NREL is at work nurturing technologies that benefit our environment, our economy and our national security. And the benefits of renewable energy research have never been more critical to our nation.

In the U.S. today, energy is the lifeblood of our economy, essential to our modern, daily lives. It is at the heart of our national security. How will we meet our energy demand in the years to come?

NREL is helping to answer this question. NREL Director Richard Truly believes that the United States will require new energy options that are affordable, reliable and efficient—in both production and use. These energy options should be secure from disruptions from acts of nature, and also terrorist threats. They must additionally be safe and environmentally sustainable.

Over the last 25 years the lab has provided Americans with many beneficial energy solutions. But its work is not done. Today, the National Renewable Energy Laboratory stands ready to meet the energy challenges of the nation's future.

Submitted by DOE's National Renewable Energy Laboratory

Not your everyday fish story

Richard Setlow

Richard Setlow spends a lot of time with fish. That may sound normal for a long-time resident of Long Island, where fishing is a common pastime, but Setlow's fish are more than a hobby. They're the backbone of his work. The biophysicist at DOE's Brookhaven Lab uses fish to stand in for sunbathers and astronauts to learn how solar radiation and cosmic rays affect DNA, the genetic material of living cells. His work has led to a new understanding of how radiation and chemical agents trigger cancer.

Almost forty years ago, Setlow and his colleagues discovered that certain DNA defects caused by ultraviolet light lead to biological damage. He also showed that, in normal bacterial cells, cellular enzymes repair these defects. When the repair mechanisms fail, the result can be cancer.

At Brookhaven in the early 1990s, Setlow and his colleagues began using tropical fish to investigate the role of certain genes in causing malignant melanomas, the most serious form of skin cancer. These fish, like humans, develop melanoma from exposure to sunlight. The scientists found that malignant melanoma is induced by *all* wavelengths of the sun's ultraviolet rays. This discovery contradicted the long-held belief that only short-wavelength UV rays were harmful.

Setlow is currently studying the potential for mutations in the sperm cells of astronauts, who are exposed to high-energy cosmic rays in outer space. In this study, the scientists expose male medaka fish to energetic nuclei from Brookhaven's Alternating Gradient Synchrotron. The male fish are then mated with unexposed females. Mutations in the sperm result in color changes in fertilized embryos that are easily observed because the embryos are transparent.

"Through these studies, we will gain a better understanding of how radiation causes mutations and cancer," says Setlow, who is hooked on using fish to help solve human problems.

Submitted by DOE's Brookhaven National Laboratory