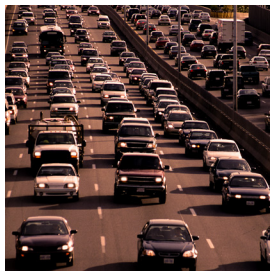


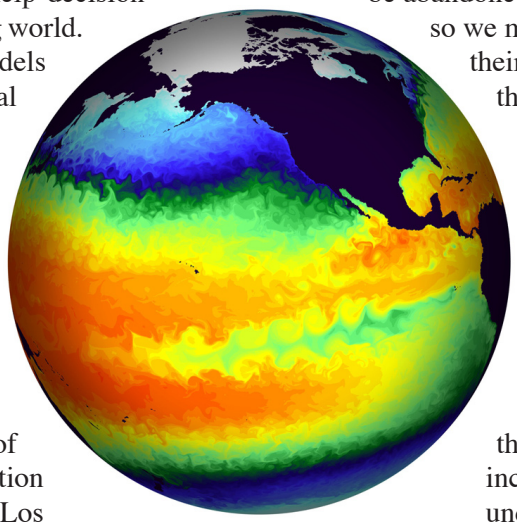
We are applying our unique scientific capabilities to the challenges of global climate change and energy security.

Energy Security Overview

For more than six decades, the United States has trusted Los Alamos National Laboratory with its most formidable national security challenges. Perhaps the greatest threats facing the nation today are climate change and the related challenge of securing a sustainable energy future. The nation's investment in the Laboratory's defense mission has fostered a host of unique scientific and technical capabilities that are also used to predict and mitigate the impacts of climate change, clean up conventional energy sources, and develop renewable sources and the energy storage technologies needed to make them viable.

Predicting the Effects of Climate Change

The Laboratory's science-based prediction expertise, which grew out of a national need to predict the effects of nuclear weapons, is now used to help decision makers respond to our rapidly changing world. Los Alamos' ocean and sea ice models are used throughout the international climate modeling community and were an integral part of the Intergovernmental Panel on Climate Change Assessment that won the 2007 Nobel Peace Prize. For two decades, the Laboratory has also modeled energy, water, economics, and other elements of our national infrastructure with a focus on their complex interdependencies. As part of the National Infrastructure Simulation and Analysis Center, or "NISAC," Los Alamos is now combining its climate and infrastructure models to provide the detailed, accurate information needed to prepare our nation's critical systems for the future. These computational prediction tools have already been used to understand and mitigate the effects of hurricanes and predict the impacts of climate change on energy demand and delivery in California.



Ocean surface temperatures modeled with Los Alamos' Parallel Ocean Program (POP).

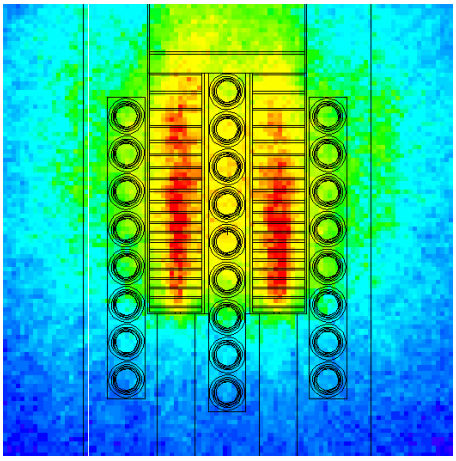
Our predictive models are also used in another area in which we can expect climate-related changes—human health. Changing weather patterns are already altering the distribution of infectious diseases. Los Alamos computer models predict the spread of illnesses, such as avian flu, and show the effects of various intervention strategies. Such simulations enable rapid public safety decisions and guide precious resources to where they will have the greatest effect.

Cleaning Up Conventional Fuels

As we adapt to these impacts, we must also slow the advance of climate change with innovations in how we use conventional energy sources. Seventy percent of our nation's electricity comes from fossil fuels which cannot be abandoned without crippling our economy, so we must make them cleaner by keeping their greenhouse gas emissions out of the atmosphere. One solution, carbon capture and storage, entails capturing CO_2 at coal power plants and injecting it deep underground into geologic formations. Capturing CO_2 without greatly increasing electricity prices poses a significant technical challenge, but Los Alamos is developing several approaches, including a novel separation membrane that removes CO_2 with a minimal price increase because it works efficiently under the extreme conditions in power plants. To understand the potential risks of storing billions of tons of CO_2 underground, Los Alamos has joined with industry and is combining data from field studies and laboratory experiments to create a computer prediction tool that ensures optimal site selection and safe containment for decades or even centuries. With its long history in underground testing, waste repository science,

and geothermal energy, Los Alamos is uniquely qualified in the geosciences required to monitor and understand the long-term fate of injected CO_2.

Nuclear power supplies 20% of U.S. electricity and does not emit greenhouse gases. It could be part of the solution to climate change if we develop new ways to manage its waste and reduce proliferation risks. Los Alamos has a long history of applying its expertise in all things nuclear to the development of nuclear energy. The Laboratory's computer codes, such as the Monte Carlo Neutron Particle (MCNP) code and the Transient Reactor Analysis Code (TRAC) are gold standards in nuclear modeling and underpin systems used by the International Atomic Energy Agency and the Nuclear Regulatory Agency to evaluate reactor safety and track nuclear fuel worldwide. These codes and the Laboratory's unique nuclear materials capabilities are crucial to developing advanced reactors and new fuels that will be proliferation-resistant and produce minimal amounts of shorter-lived waste.



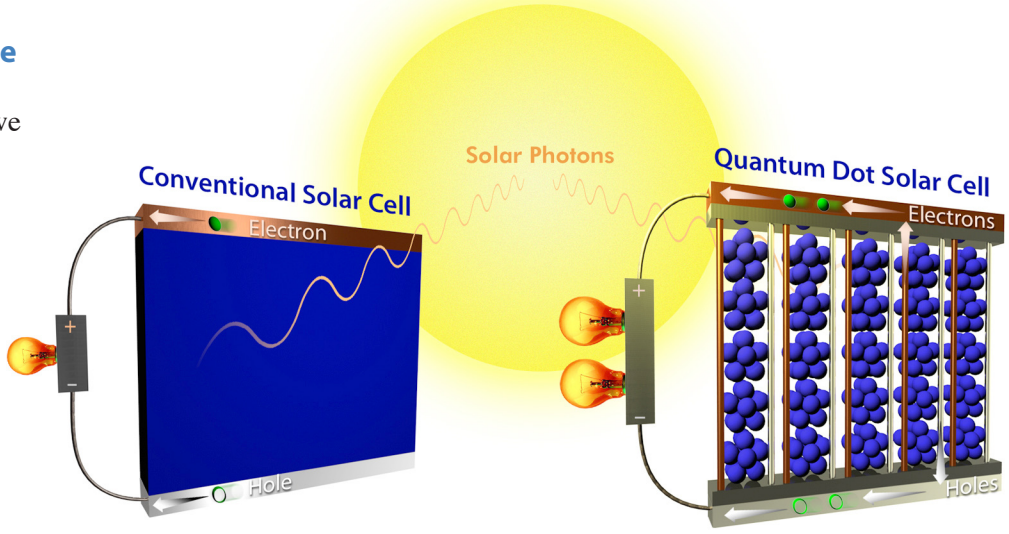
Monte Carlo Neutron Particle (MCNP) simulation of new nuclear fuels undergoing performance tests at Los Alamos' Materials Test Station.

Renewables and Energy Storage

As we clean up conventional fuels, we must also phase in renewable energy sources, like wind and solar, which now provide less than 3% of U.S. electricity. Photovoltaic panels that convert sunlight into electricity have been inefficient, but Los Alamos scientists have made a breakthrough, called "carrier multiplication," that may lead to a 30% jump in efficiency. But the sun and wind provide energy intermittently and cannot replace current fuels without a revolution in energy storage technologies. A panel of experts assembled by DOE's Office of Science concluded that these revolutionary advances will require crosscutting science that combines advanced characterization, nano-materials, electrolyte innovations, and theory, modeling, and simulation. No institution brings these crosscutting capabilities together better than Los Alamos National Laboratory. The Laboratory has applied these capabilities for decades in developing fuel cells and storing hydrogen to power them. Los Alamos' breakthroughs in cost reduction, durability, and reliability have enabled the fuel cell industry. Transportation poses an energy storage challenge as well. To replace CO_2-emitting internal combustion engines with fuel cells, we must invent ways to store sufficient hydrogen on board vehicles. Los Alamos scientists are developing a promising chemical hydrogen storage system by engineering the hydrogen-rich compound ammonia-borane and designing catalysts to promote hydrogen release on demand.

The Intergovernmental Panel on Climate Change concluded that "no single area of research will secure a reliable future supply of energy," and that "cross-disciplinary collaborations" are needed to sustain human growth while protecting the environment. Cross-disciplinary research is the very essence of Los Alamos National Laboratory, and its scientists are working across a broad spectrum of future energy possibilities.

Conventional solar cells generate only one electron/hole pair (called an "exciton") for each photon of sunlight, but solar cells based on nano-sized "quantum dots" can generate multiple excitons per photon, greatly increasing electrical output.



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