As the nation's premier laboratory for renewable energy research, SERI is expanding America's energy horizons...
Expanding Energy Horizons

... to help ensure our nation's energy independence, meet its growing energy needs, and strengthen its competitiveness.

SERI develops renewable energy technologies to heat and cool buildings; run industries; light homes and offices; grow and cook food; power cars and trucks; produce plastics, clothing, drugs, and chemicals; clean our water; destroy toxic wastes; and absorb carbon dioxide from the atmosphere.

We have about 450 full-time professionals. The expertise of our 275-person technical staff is augmented by approximately 30 visiting scientists from around the world; 45 postdoctoral researchers, graduate students, and undergraduate students; and scores of scientists and engineers from universities and industries that conduct cooperative or subcontracted research.

Our research activities span five scientific and technical areas, encompassing nearly 50 specific disciplines. In materials sciences our investigations run from biobased materials and ceramics to superconductors, solid-state physics, and beyond. In biosciences we study biocatalysis, biochemistry, genetic engineering, microbiology, and more. Our optics research includes lasers, optoelectronics, and solar concentrators. We have engineering disciplines in acoustics, structural dynamics, heat and mass transfer, aerodynamics, and chemical processing. In photon interaction research we explore the role sunlight plays in biological, catalytic, chemical, and photosynthetic processes.

We maintain two support areas. In resource assessment we measure and appraise the available renewable resource — sunlight, wind, water, and biomass. Our analysis and measurements specialists characterize the crystallographic, electrical, optical, surface, interface, and thermal properties of materials. And we have experts in...
energy and environmental analysis who assess environmental impacts of energy supply, conversion, and consumption and who evaluate energy markets, the implications of energy policy options, and the economics of energy systems.

With more than 60 world-class laboratories, our capabilities extend from making sophisticated photovoltaic cells, to analyzing molecular structures, to genetically engineering enzymes. We have outdoor sites for testing wind systems and photovoltaic arrays. And we have a solar furnace to help us investigate the ability of concentrated solar energy to fashion space-age materials and to destroy toxic wastes.

We are moving toward the 21st century by constructing a state-of-the-art laboratory and headquarters on our 300-acre site in Golden, Colorado. We have already built 20 temporary structures and a modern, permanent laboratory building that houses the biosciences, photon interaction research, and some of the materials sciences. To accommodate the remaining basic and applied sciences and the research support areas, we are currently designing the second permanent structure of the three-phase project.

Before the turn of the century, this completed world-class facility will strengthen SERI's ability to help America build toward a stable energy future.
Renewing America's Future

America is moving into a new energy era, in which renewable energy technologies will help ease us from a fossil-fuel-based economy into an economy encompassing a variety of energy resources.

Since 1970, America has nearly doubled its use of renewable energy to where we now consume almost 7 quads annually, an amount equal to the energy in 1.2 billion barrels of oil. Of this, about 3 quads come from hydropower, 3 quads from wood combustion, and less than 1 quad from new technologies. But the contribution of the new technologies is expanding rapidly.

A decade ago, for example, there were virtually no markets for wind electricity, solar thermal systems, or photovoltaics. Now, wind machines in California have generated more than 10 billion kilowatt-hours of electricity. Solar thermal systems in the Mojave Desert use concentrated sunlight to produce enough electric power to supply the residential needs of a half-million people. And photovoltaic systems power tens of thousands of applications throughout the nation.

Thanks to SERI's research, America will have the option of using trees, grasses, shrubs, energy crops, and wastes to make low-pollution fuels like ethanol and methanol for tomorrow's cars.
Because of these and a host of other emerging technologies, a study done as part of the development of the U.S. Department of Energy's (DOE's) National Energy Strategy suggests that America could derive a third of its energy from renewable sources by 2030.

This is good news for America's future.

Good for energy security. Large domestic supplies of renewable energy will cushion us from the interruptions in supplies, the economic shocks, and the international politics associated with foreign oil.

Good for prosperity. Dozens of new technologies will meet every kind of energy need, create millions of new jobs, and produce billions of dollars of exports. Energy will become cheaper and our industries will become more efficient and more competitive. And we will cut projected oil imports.

Good for the environment. Renewable energy technologies will help reduce acid rain and smog because they produce little or no carbon monoxide, hydrocarbons, and nitrogen or sulfur compounds. They will help slow or reverse the buildup of carbon dioxide, a major contributor to global warming. They will enable us to turn our garbage into energy. And they will help us destroy toxic wastes and purify our drinking water.

This could be just the beginning. We are not limited by the available resource. The energy in one day of sunshine falling on the United States, for example, is more than double the amount of energy America consumes in a year. This, and the wealth of energy in wind, biomass, flowing water, and the oceans wait only upon technological progress for harvesting.

In the Mojave Desert, rows of parabolic troughs use the heat of concentrated solar energy to provide 354 million watts of electric power generating capacity.

*If we are successful in developing advanced storage technologies, the contribution of renewable resources could be even greater.
Meeting America’s Needs

America’s charge to the DOE: fashion strategies and perform energy R&D to ensure our security, keep us competitive, and maintain our quality of life.

As the only national laboratory devoted primarily to renewable energy, SERI supports the DOE commitment by performing R&D on technologies for every sector of energy use: electricity, transportation, buildings, and industry.

Electricity. To meet America’s growing demand for electricity, SERI investigates new technologies in several fields. In biomass power we explore new concepts for efficiently converting wood, wastes, and energy crops to electricity. We examine wind technology, exploiting the kinetic energy of wind to produce electricity. With photovoltaics, we develop solid-state technology for turning sunlight into electricity. And with solar thermal systems, we use concentrated sunlight to heat fluids to run generators.

Transportation. In biofuels we develop technologies that convert trees, grasses, crops, wastes, oil seeds, and microalgae into ethanol, methanol, gasoline, and diesel fuel. We study the gasification of biomass and the solar electrolysis of water to produce renewable hydrogen fuels for transportation. We manage programs that foster the use of alternative transportation fuels in conventional and advanced engines and that encourage the production of vehicles designed to run on alternative fuels. We have established an Alternative Fuels Data Center to collect and analyze data on fuel economy, engine performance, and emissions. And our work in photovoltaics enhances the development of electric vehicles.

Buildings. With proper building design, the sun can heat large portions of a building comfortably. There are systems that use solar energy to heat water and living and working spaces. With atriums, skylights, light shelves, and other components and techniques, sunshine can light the interior of buildings and reduce the lighting and cooling loads. SERI is developing building materials that absorb daytime solar heat to release it at night. We are designing windows as resistant to heat loss as a solid wall and windows that darken or lighten as desired. And, we are exploring ways to cool buildings with desiccant dehumidifiers driven with heat from solar collectors.

Industry. SERI is investigating solar thermal systems that can provide electricity or heat for industrial processes, decontaminate water, detoxify hazardous solid waste, produce fuels and chemicals,
transform and harden metal surfaces, and deposit thin films with special properties. We are applying our expertise in biotechnology and chemical conversion to find solutions to problems with existing waste-to-energy plants; explore alternative ways to produce energy from municipal solid waste; develop methods to turn waste wood into plastics and adhesives; and investigate lightweight, biobased materials that promise to perform as well as today's metals or plastics.

Etc. Some of our work is applicable to several sectors of energy use. Our research in superconductivity and renewable sources of hydrogen, for example, can provide the nation with fuels, electricity, and new technologies for energy storage and transmission. And our analytical studies and resource assessment activities are relevant to all the renewable energy technologies.

The solar resource, which is immense and ubiquitous, does not differ at any point in the contiguous 48 states by more than 25% from that in Kansas City, Missouri.
Building American Business

America runs on energy and American business runs on innovation. Energy stokes the fires of industry and commerce while innovation keeps us ahead of the competition. With a mission to transfer energy technology to industry, SERI sits at the confluence of energy research and innovation that brightens the horizons of American business.

This mission has been made much easier with CRADAs (Cooperative Research and Development Agreements) established by the National Competitiveness Technology Transfer Act of 1989. CRADAs, in which industry cost-shares R&D projects with SERI, are simple, fast, and beneficial to industry:

Simple. Each CRADA contract is streamlined, short, and easy to understand.

Fast. From start to finish, a CRADA contract should take less than 4 months to complete.

Beneficial. Industrial partners can retain or easily license exclusive rights to intellectual property generated by the research. All information generated by the project is proprietary and protected for up to 5 years.

Of course, there are other ways in which we transfer technology, including research sponsored by industry and done at SERI. This avenue is especially useful for those who want to take advantage of SERI’s unique expertise or facilities. The sponsor retains the rights to intellectual property arising from this research.

With subcontracted research, SERI manages DOE-funded research performed by industry, universities, or other institutes. This is often the preferred route for universities, small businesses, and nonprofit institutes. Not only can they take advantage of SERI’s expertise, they also retain rights to the intellectual property.

Also, industry or universities may use SERI’s specialized laboratories or test facilities, often with no fee charged to the user.

What’s more, cooperative efforts at SERI often lead beyond renewable energy to applications in medicine, electronics, agriculture, communications, and more. In these and a myriad of diverse ways, SERI is joining with others to build a brighter tomorrow for America.

SERI-invented compact vacuum insulation, with insulation values of up to R-100 per inch, could save space and energy and displace harmful chlorofluorocarbons.

An industrial consortium is working to refine and commercialize a SERI-invented process that turns wood waste into complex oils which can be formulated inexpensively into adhesives for wood industry products or into molding compounds for plastic components.