PROGRAM facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Power Systems Advanced Research

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DOE-WRI BASE PROGRAM FOR FUNDAMENTAL ADVANCES IN ENERGY SCIENCE AND TECHNOLOGY

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Description

For over two decades, the University of Wyoming Research Corporation — doing business as the Western Research Institute (WRI) — has been supporting the U.S. Department of Energy (DOE) Office of Fossil Energy (FE) and its mission of developing fossil energy and related environmental technologies. The funding for these research efforts has generally been provided through congressionally mandated cooperative agreements, with the DOE's National Energy Technology Laboratory (NETL) overseeing program efforts. For this purpose, there are two current types of cooperative agreements: the Base Program, which is fully funded by federal money, and the Jointly Sponsored Research (JSR) Program, which requires at least 50 percent cost-sharing by non-federal sources.

Under the Base Program, WRI performs research to provide fundamental new insights for developing future fossil energy technologies. Base Program projects develop ideas to a level promising enough to attract commercial co-sponsors for further development and commercialization under the JSR Program. In many instances, a potential JSR co-sponsor has been identified, but additional laboratory or bench-scale data are necessary to assess the utility of the technology prior to co-sponsor investment.

WRI is a not-for-profit research and technology development organization. WRI is developing the coal technologies of the future, including coal conversion; providing support to the coal and utility industries in Wyoming; and delivering research and technology services for the oil and gas industry, including coal bed methane. WRI is the University of Wyoming's School of Energy Resources public outreach partner.

Advanced Research — To support coal and power systems development, NETL's Advanced Research Program conducts a range of pre-competitive research focused on breakthroughs in materials and processes, coal utilization science, sensors and controls, computational energy science, and bioprocessing — opening new avenues to gains in power plant efficiency, reliability, and environmental quality. NETL also sponsors cooperative educational initiatives in University Coal Research, Historically Black Colleges and Universities, and Other Minority Institutions.

PROJECT DURATION

Start Date
04/10/98
End Date
04/09/08

COST

Total Project Value
$11,134,000
DOE/Non-DOE Share
$11,134,000 / $0

Base Program Goals

The goals of the Base Program support those of the JSR Program, and are designed to:

- Increase the production of U.S. and western energy resources, particularly low-sulfur coal, natural gas, oil, and renewable energy resources
- Enhance the competitiveness of U.S. and western energy technologies in international markets, and assist in technology transfer
- Reduce the nation's dependence on foreign energy supplies and strengthen both the U.S. and regional economies
- Minimize the environmental impacts of energy production and utilization

The WRI main headquarters facility houses analytical laboratories that offer non-routine, specialized analyses not available elsewhere. The building originally housed the U.S. Department of the Interior, Bureau of Mines, Petroleum and Oil Shale Experiment Station.

Major Technology Areas

The goals of the Base and JSR programs are accomplished by focusing RD&D and commercialization in three major technology areas:

- *The Energy Program* emphasizes increased production and utilization of domestic energy resources, and includes improved oil and gas recovery, coal beneficiation and upgrading, coal bed methane recovery, and renewable energy resources.
- *The Environmental Program* attempts to minimize adverse effects of energy production and utilization activities by providing technologies to clean underground oily wastes, remediate and recover oil from tank bottom wastes, mitigate acid mine drainage, and demonstrate uses for solid wastes from clean coal technologies.
- *The Technology Enhancement Program* encompasses resource characterization, development or improvement of environmental monitors and sensors, and development of predictive techniques.

Interactions between the Base and JSR programs are dynamic and continuous, since commercialization of promising new technologies is the driving force for both. The Base Program explores innovative concepts that will attract industrial co-sponsors for continued development under the JSR Program. It is intended that Base projects move to the JSR stage, where the objective is to develop and demonstrate the technology sufficiently for sound and prudent commercialization decisions to be made.

Technology development is crucial to the preservation and growth of the American economy and standard of living. Much of this technology and growth will come from companies that were small or nonexistent just a decade ago. Unlike large, multinational companies with internal R&D facilities, these companies must rely on creative and innovative contractors such as WRI to assist with their process and product development activities. Activities such as the WRI cooperative agreement programs meet this crucial national need.

At WRI's Advanced Technology Center, NETL scientists take a first-hand look at projects being developed under the cooperative agreement with DOE

Current Active Projects

Over the life of the Base Program, WRI has initiated some 67 tasks valued at over $12 million. DOE-supported projects under way at WRI include innovative technologies for upgrading heavy crude oil and waste oils, removing mercury from coal, managing produced water from coal bed methane development, and producing transportation-grade fuels using a proprietary catalyst to convert natural gas or biomass. Current active Base Program projects include:

Energy Program

- *Heavy Oil Process Monitor* — The overall objective is to develop and commercialize improved, efficient monitoring technologies for refining process and/or heavy oil upgrading. The ongoing work falls under the heavy oil/petroleum thrust area of WRI, and would improve scientific and technical understanding of converting heavy crude oil and residua, and increase the yield of premium quality transportation fuels from lesser quality feeds.
- *Advanced Processing of Coal* — The overall objectives are to support the design, construction, and operation of a CTF, which is a pilot-scale pulverized coal combustion facility replicating a coal-fired utility boiler. The CTF is able to accommodate varied feedstocks and demonstrate its applicability to area utilities, pollution control vendors, advanced system development, and sequestration-ready systems.

Additional information about Advanced Research may be found on the Department of Energy's Office of Fossil Energy Web site at:

http://www.fossil.energy.gov/programs/powersystems/advresearch/index.html

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- *Development of Plasma-Based Retrofit for NO_x Reduction from Diesel Engines* — The purpose of this task is determine the number of ion generators and voltage requirements for exhaust after-treatment devices to sufficiently reduce NO_x in bench-scale test streams simulated for various diesel engine exhausts.

Environmental Program

- *Improvements in Fischer-Tropsch (F-T) Synthesis* — Overall objectives are to develop a heterogeneous F-T catalyst system that will have improved yield and separability of the mixed alcohols produced from synthesis gas (syngas); characterize and evaluate catalysts in the temperature programmed reactor; scale up in a pilot-scale reactor; and optimize both catalyst and alcohol synthesis processes. For a homogeneous catalytic system for F-T synthesis, ionic liquid catalysts also will be studied.
- *Application of Layered Double Hydroxides in Removing Oxyanions from Refining and Coal Mining Wastewater* — The overall objective is to develop an innovative filtration device/process based on a layered double hydroxide (LDH) that will effectively remove arsenic, selenium, and biological contaminants commonly found in groundwater contaminated with waste streams from coal mining, coal bed methane production, refining, and pharmaceutical manufacturing.
- *Potential Mercury Problems in Oil Shales* — The overall objective is to determine mercury distribution in oil shale, its emission during processing, and its removal or containment from oil shale process streams.
- *Synergistic Combination of Petroleum Hydrocarbon Biodegradation and Microbial Fuel Cell (MFC)* — The objectives are to quantify hydrocarbon degradation rates in MFCs and to design and deploy a prototype for enhanced bioremediation in the field.
- *Sorbent Test Facility for Power Plant Emission Control* — The objectives of this multi-year effort are to develop and test unique, low-cost formulations of non-carbon-based sorbents that would capture multi-pollutants (i.e., As, Hg, Se) at high temperatures (about 500 °F) in both oxidizing and reducing environments.

Technology Enhancement Program

- *Integrated Freezer System with Phase Change Liquids* — The objective is to develop a freezer system based on phase-change liquid, to ship environmental samples. The freezer system should maintain temperatures at 7 °C to 20 °C for at least 48 hours. Prior work led the laboratory to develop an integrated system for shipping frozen samples. The current emphasis is to perform tests and field evaluations that will help commercialize the integrated freezer system.
- *Technical Assistance to the Subbituminous Coal Producers and Users* — The goal is to provide the subbituminous coal industry an opportunity to collaborate in developing joint technical solutions to meet emission control regulations. The specific objectives are to provide forums for the industry to share information, provide a database of coal quality and emission data, and to develop joint plans for the industry.