



the **ENERGY** lab

R&D FACTS

RESEARCH & INNOVATION CENTER

Research and Innovation Center

The National Energy Technology Laboratory (NETL), one of the Department of Energy's (DOE) 17 national laboratories, is leading research, development, and demonstration programs to resolve the environmental, supply, and reliability constraints of using fossil fuels, including coal, natural gas and oil. In support of this goal, NETL's Research and Innovation Center (RIC) provides the DOE Fossil Energy Research & Development (R&D) Program an onsite "corporate laboratory," where researchers perform fundamental and applied fossil energy R&D.



Through research, NETL is:

- Advancing scientific understanding of key fossil energy technologies
- Generating new ideas and directions for future programs
- Collaborating with regional and national universities
- Helping to develop our nation's future scientific and energy engineering experts



NETL attracts world-class researchers who are addressing diverse energy and environmental needs including:

- Secure and reliable energy supplies
- Future roles for hydrogen
- Clean power generation from coal
- Global climate change research
- Critical infrastructure assurance

While pursuing knowledge, science, and technology, NETL also has received numerous licensable patents. NETL's researchers use state-of-the-art capabilities and unique facilities in Albany, OR; Morgantown, WV; and Pittsburgh, PA. A core group of approximately 150 Federal scientists and engineers conduct the R&D program with support contractors, academic and industrial partners. NETL provides an impartial evaluation of new concepts and materials with expert authoritative reviews of external R&D proposals. NETL also provides a venue for other Federal agencies (e.g., Department of Defense [DOD] and NASA) and research organizations for collaborations.

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In addition, NETL conducts R&D with external academic and industry partners—efforts designed to help overcome barriers to the commercialization of advanced power systems, fuels, and environmental and waste management technologies. NETL's onsite research facilities are an important benefit of this collaboration, eliminating the need for outside groups to build separate test platforms for each research concept.

Five Research Directorates

Research is conducted in five focused areas that build upon R&D competencies at NETL and address long-range issues central to continuing fossil fuel use in an environmentally and cost-effective manner.

Computational Science and Engineering provides the capabilities in high-performance computing and data analytics, which enable this directorate to generate information and understanding beyond the reach of experiments alone, by integrating experimental information with computational sciences and engineering across time and length scales. This research directorate comprises four research teams devoted to Hardware & Network Systems, Data Analysis & Visualization, Software & Automation, and Information Access & Infrastructure.

Energy Conversion Engineering specializes in innovative energy conversion processes and transformational technologies for utilization of fossil fuels. Although not limited, the focus is predominately on specific devices/processes and their integration into cohesive systems. The directorate's competency is based on research teams with expertise in Multiphase Flow Science, Thermal Sciences, Innovative Energy & Water Processes, and Reaction Engineering, which allows for process level R&D, evaluation, integration and control, and validation of scalable performance models. This competency is strategically positioned to be complementary with the other core RIC directorates for diligent and successful conceptualization, evaluation, development and demonstration of advanced Fossil Energy technologies.

Materials Engineering and Manufacturing supports NETL's ability to design, develop, and deploy advanced materials for use in extreme service environments to enable advanced energy systems. This directorate provides NETL a deep understanding of materials and their performance at condition, and specializes in the design, development, and deployment of advanced functional and structural materials. This research accelerates the development of material solutions through an integrated R&D approach leveraging multi-scale, multi-disciplinary computational, experimental techniques, and systems analysis; which encompasses the materials development continuum ranging from atomic-level design through translating lab-scale materials concepts to affordable industrial practice utilizing advanced manufacturing methodologies. This approach uses advanced tools, unique facilities, and broad expertise across a variety of materials classes found in advanced energy systems.

All materials solutions are scaled-up and tested at in situ conditions for proof of concept in advanced fossil energy systems. The research teams, which make up this directorate, are Computational Materials Engineering, Functional Materials, Structural Materials, and Materials Characterization.

Geological and Environmental Systems leverages expertise in research team areas: Geology & Geospatial Analysis, Geochemistry and Water, Geophysics, and Field Monitoring. NETL conducts science and engineering research of natural systems to develop the knowledge and technologies that can enable safe, sustainable production and utilization of domestic energy resources. The directorate includes development of numerical modeling with attributes that are unique to subsurface applications. Current NETL subsurface research efforts focus on CO₂ storage, unconventional tight gas resources, hydrates, offshore oil and gas, and geothermal systems.

Systems Engineering and Analysis supports NETL's mission through analysis of its existing research portfolio and potential of new technology ideas, identification of new innovative energy concepts, and analysis of interactions between energy systems at plant, regional, national, and global scales. This directorate conceives, plans, manages, and conducts research in the research team areas: Energy Process Analysis, Process Systems Engineering Research, Energy Systems Analysis, and Energy Markets Analysis. The directorate's activities range from analysis of single energy processes (such as a power plant integrated with carbon capture and compression) to interacting energy systems (such as the grid and the environment) to modeling and analysis of economy-wide markets. In addition, this directorate conducts research focused on the development and utilization of advanced models coupled with optimization and uncertainty quantification to support decision-making and process innovation.

Collaborative Research

RIC actively looks for opportunities to work in close collaboration with university and industry partners. NETL research expertise combined with broad capabilities of nationally recognized universities, technology manufacturers, and end users, enables RIC to effectively expand the critical research that supports the Department of Energy mission. These partnerships provide additional impetus to discover and develop sustainable energy systems of the future, introduce new technology, boost economic development, and enhance national security.

