

# NETL RESEARCH

## OUR MISSION

*Discover, integrate, and mature technology solutions to enhance the nation's energy foundation and protect the environment for future generations*

## ENDURING MISSION ELEMENTS

### EFFECTIVE RESOURCE DEVELOPMENT

Developing technologies that improve the effectiveness and economics of producing our fossil energy resources

### EFFICIENT ENERGY CONVERSION

Discovering cleaner, cheaper, and more efficient energy conversion technologies for the production of high-value energy commodities

### ENVIRONMENTAL SUSTAINABILITY

Accelerating the development of transformative and enabling solutions to protect our air, land, and water for future generations

# NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

## WHO WE ARE

The National Energy Technology Laboratory (NETL) facilitates the responsible and effective use of our nation's extensive fossil resources. NETL is one of 17 partner organizations in the U.S. Department of Energy's National Laboratory System and the only national lab organization dedicated to fossil energy optimization research. For more than a century, NETL and its predecessor labs have been at the forefront of technology development, consistently creating safe and environmentally sound technical solutions that satisfy the world's demand for affordable, abundant energy.

## ACCELERATING DEVELOPMENT OF EMERGING TECHNOLOGIES

NETL is committed to utilizing and creating the most current and efficient technology to implement practices and policies that address the energy industry's most demanding and complex challenges. To this end, NETL is working with our partners to achieve a carbon pollution-free power sector by 2035. We will accomplish this through integration of critical clean energy technologies, to include: battery storage; negative emissions technologies; carbon capture and storage; renewable hydrogen; safe nuclear energy; and extraction of highly efficient methane gas.

## CLEAN TECHNOLOGY R&D

NETL has been at the center of technology development for more than a century, consistently leading and partnering to create safe, affordable, and environmentally sound technical solutions that increase efficiency, reduce emissions, and diminish energy costs. Advanced technologies will: synthesize the clean, reliable, and affordable energy needed to increase domestic manufacturing and associated workforce; invest in improving our nation's energy infrastructure; improve electrical grid reliability and resilience; expand domestic energy production; educate America's future scientists and engineers; and support U.S. energy and national security goals.

## APPLIED R&D SUPPORTING COMMERCIALIZATION

The NETL Carbon Capture Program is creating technological solutions for carbon capture from natural gas or pulverized coal power plants, as well as emerging applications such as: hydrogen production from steam methane reforming; industrial point sources such as cement and steel production; and direct air capture.

Additionally, NETL research is accelerating the development of efficient, cost-effective fossil fuel conversion systems that meet the short-term goal of capturing 90 percent of the CO<sub>2</sub> produced by a pulverized coal power plant. This effort ranges from the discovery of innovative materials through evaluation in real systems.

In 2016, NETL formed the Institute for Design of Advanced Energy Systems (IDAES) to improve the efficiency and reliability of existing coal-fired power plants and to accelerate development of advanced fossil energy systems.

For more information, please visit: <https://idaes.org/>

## DISCOVERY-COMMERCIALIZATION

NETL's integrated science, engineering and technology competencies address today's energy challenges while aggressively planning and seeking solutions for the challenges of tomorrow. NETL pursues its technology development mission by engaging partners in federal agencies and laboratories, in the private sector, and at some of the Nation's most prestigious research universities. NETL is committed to a strong science and technology enterprise enabling a fully integrated energy research portfolio that spans the discovery-development-deployment continuum to meet the Nation's economic, environmental and energy security challenges of the 21st Century.

### COMMERCIALIZATION

Technology available for wide-scale market use

### DEPLOYMENT

System demonstration in operational environment

### SYSTEM TESTING

System performance confirmed at pilot-scale

### DEVELOPMENT

Technology component validated/integrated

### DISCOVERY

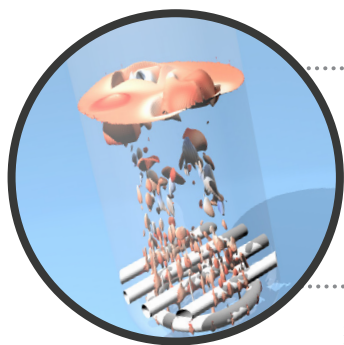
Concept identified/proven at laboratory-scale

TECHNOLOGY MATURATION

## CORE COMPETENCIES

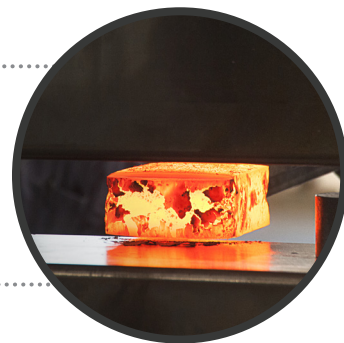
Executing an energy research portfolio of national importance that discovers, matures, and deploys innovative technologies requires NETL to maintain cutting edge and enduring core competencies. NETL's integrated science, engineering and technology competencies address today's energy challenges while aggressively planning and seeking solutions for tomorrow. Furthermore, maintaining these core competencies is critical to ensuring the Laboratory can continue to provide technology options to meet the Nation's needs in times of crisis.

NETL continues to place critical value upon the people that ultimately own the success. Consequently, significant effort is devoted to cultivating a well-trained, dynamic workforce capable of accelerating the technology advancements that attain the energy, economic and environmental goals pursued by the Laboratory.



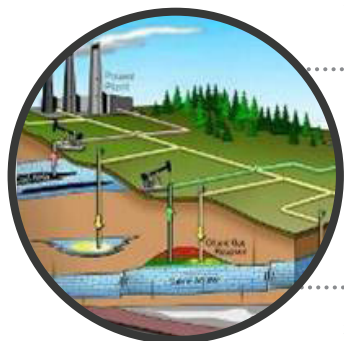
### COMPUTATIONAL SCIENCE & ENGINEERING

High Performance Computing  
Data Analytics



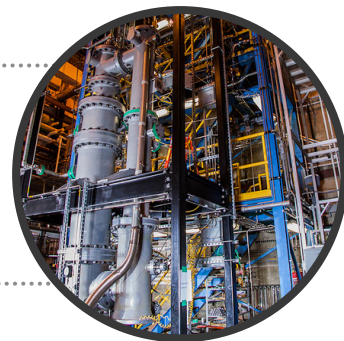
### MATERIALS ENGINEERING & MANUFACTURING

Structural & Functional Materials  
Design, Synthesis, Manufacturing & Performance



### GEOLOGICAL & ENVIRONMENTAL SYSTEMS

Air, Water & Geology  
Understanding & Mitigation



### ENERGY CONVERSION ENGINEERING

Component & Device  
Design & Validation



### SYSTEMS ENGINEERING & ANALYSIS

Process & System  
Optimization, Validation & Economics

In 2019, NETL executed an extensive competency assessment to identify paths for growth of the lab's capabilities, which culminated in the establishment of four Key Lab Initiatives. These laboratory initiatives were crafted to align with the strategic goals of DOE, Fossil Energy (FE), and NETL. They are intended to meet these strategic goals while exercising and enhancing NETL's technical competencies.



## INTEGRATED ENERGY SYSTEMS

We are innovating fossil-fuel power plants that feature flexible operations to improve efficiency and reduce emissions, provide resilient power to Americans, and decrease carbon footprints while transforming how fossil technologies are designed and integrated with the nation's energy grid.



## SCIENCE-BASED ARTIFICIAL INTELLIGENCE/MACHINE LEARNING INSTITUTE (SAMI)

Pairing AI/ML with NETL's world-class capabilities in science-based modeling and high-performance computing, SAMI will address FE research priorities in areas such as: enabling efficient operation of power plants under load-following conditions; improving the performance, reliability, and efficiency of the existing coal-fired fleet; enhancing oil and gas production to optimize the recovery of oil and gas resources and carbon storage; and accelerating the discovery and maturation of innovative material solutions in carbon capture to reduce the cost and risk of Carbon Capture and Utilization Storage (CCUS).



For more information on CCUS, see: [www.energy.gov/carbon-capture-utilization-storage](http://www.energy.gov/carbon-capture-utilization-storage)



## MANUFACTURING HIGH-VALUE CARBON PRODUCTS

NETL is cultivating additional value streams throughout the fossil energy life cycle and developing the capability to generate high-value carbon-based products, such as nanomaterials and carbon fiber, from carbon-based feedstocks.

For more information, see: <https://netl.doe.gov/node/9241>



## NATURAL GAS UTILIZATION CENTER OF EXCELLENCE

We are committed to the development of innovative, game-changing technologies to maximize the value creation of domestic natural gas resources to take full economic advantage of these abundant resources and optimized utilization of CO<sub>2</sub>, while developing technologies associated with military fuels, petrochemicals, and novel carbon materials. In the near-term, the center will focus on fulfilling capability gaps in material synthesis and reactor testing while providing the full suite of capabilities to advance technologies in the three product streams.

For more information, see: <https://netl.doe.gov/node/10380>

### Contacts

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