Defining the Future – The Imperative of Fossil Energy Research

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NETL is...

...the only U.S. National Laboratory devoted to Fossil Energy Technology Discovery, Development and Deployment.
NETL’s Mission

To discover, integrate, and mature technology solutions to enhance the Nation’s energy foundation and protect the environment for future generations

**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
The World and U.S. Energy Future

≥80% Fossil Energy Today AND Tomorrow

Dominated by Global Growth

50% growth in world energy use 2012–2040
Fossil Energy
Share of World Energy Demand

- Gas
- Oil
- Coal

2014

2050

6 Degree Stabilization
4 Degree Stabilization
2 Degree Stabilization
The Imperative of Fossil Energy Research

• R&D will define the future of coal and gas use
• Without innovative fossil energy R&D, global energy needs will not be met
• Fossil energy R&D leads to sustainable solutions
R&D Success is Foundation of Current Fossil Energy Demand

Advanced Emissions Controls for Acid Gases and Mercury

Hydraulic-Fracturing and Horizontal Drilling
We must continuously fill the pipeline with innovative technology
We must take on large investments as R&D moves forward
We must accelerate maturation of technologies
Filling the Pipeline

- **Discovery**: Concept identified/proven at laboratory-scale
- **Development**: Technology component validated/integrated
- **System Testing**: System performance confirmed at pilot-scale
- **Deployment**: System demonstrated in operational environment
- **Commercialization**: Technology available for wide-scale market use

- **Scale**
- **Technology Confidence**
- **Investment**
- **Private Sector Cost Share**

**Technology Maturation**

**Fundamental Studies**
Accelerate Maturation of Technologies

• Modeling and simulation is critical to all NETL research, development and deployment
  - Accelerating development continuum

• Current thrusts
  - Code development spanning and linking orders of magnitude (from angstroms to meters)
  - Uncertainty quantification, data technology (i.e., informatics, AI)

Reduced time for designing devices and systems at various scales, including trouble-shooting and reduced technical and financial risk in commercializing large, multi-phase, reacting systems
NETL R&D Thrusts Are Defining the Future

• In West Virginia:
  • Marcellus Shale Energy and Environment Laboratory (MSEEL)
  • Camp Dawson
  • NETL Supercomputer
  • Rare Earth Elements
  • Chemical Looping

West Virginia Army National Guard, Camp Dawson, WV
Marcellus Shale Energy and Environment Laboratory (MSEEL) Project

**Purpose:** Provide a long-term “living laboratory” experimental station for testing and monitoring Marcellus shale gas production.

**Technical Objectives:**
- Improve recovery efficiency
- Minimize environmental implications
- Develop and validate new technologies
Purpose: Evaluate and deploy advanced energy technologies and systems at National Guard facility.

Technical Objectives:
• Integrate shale gas and geothermal energy resources.
• Demonstrate water and energy independent military site.
• Develop and deploy advanced energy technologies and systems.
• Identify ways to integrate fossil and renewable resources.
Joule – One of the world’s fastest, most energy-efficient supercomputers

Helps energy researchers on NETL projects working around the U.S. to discover new materials, optimize designs and better predict operational characteristics
NETL’s pilot-scale Chemical Looping Reactor (CLR) is conducting key research to support chemical looping technology development.

Chemical looping systems provide oxygen necessary for the combustion process without the high capital, operating and energy costs of generating oxygen via an air separation unit.
NETL Rare Earth Element Sampling Program

Extensive sampling in WV

WV participants include:

- Communication Satellites
- Catalysts
- Permanent Magnets
- Lasers
- Glass Additives
- Hybrid Electric Vehicles
- Phosphors
- Turbines

States From Which Samples Were Obtained

- Alabama
- Alaska
- Colorado
- Illinois
- Indiana
- Kentucky
- Louisiana
- Mississippi
- Missouri
- Montana
- New Mexico
- North Dakota
- Ohio
- Pennsylvania
- South Carolina
- Texas
- Utah
- Virginia
- West Virginia
- Wyoming
West Virginia

- Tight Oil/Shale Gas Plays
- Coal Fields
- Coal Power Plants
West Virginia

- Tight Oil/Shale Gas Plays
- Coal Fields
- Coal Power Plants
- Natural Gas Power Plants
- Nuclear Power Plants
West Virginia

- Tight Oil/Shale Gas Plays
- Coal Fields
- Coal Power Plants
- Natural Gas Power Plants
- Nuclear Power Plants
- Renewable Power Generation
West Virginia

At the epicenter of the driving force for energy research

- Tight Oil/Shale Gas Plays
- Coal Fields
- Coal Power Plants
- Natural Gas Power Plants
- Nuclear Power Plants
- Renewable Power Generation
- Energy Transmission
  - Natural Gas, Crude Oil, HGL, & Electric Lines
- Academia
Solutions for Today
Options for Tomorrow

For More Information, Contact NETL
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