

Defining the Future – The Imperative of Fossil Energy Research

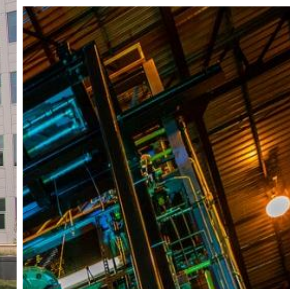
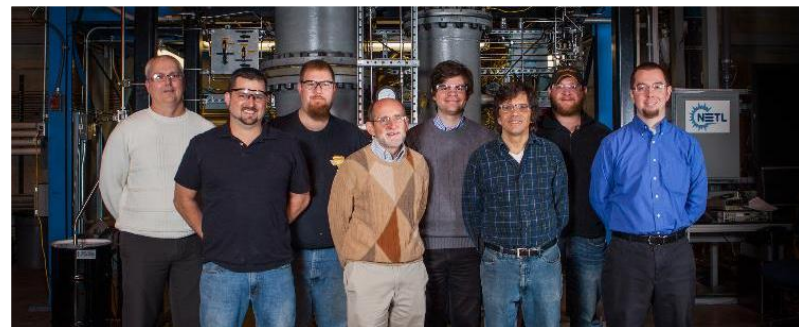
Sean I. Plasynski, Ph.D., Acting Deputy Director & COO



Solutions for Today | Options for Tomorrow

NETL is...

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

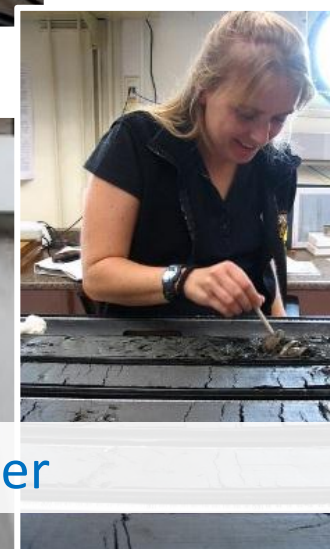


Responsible Steward

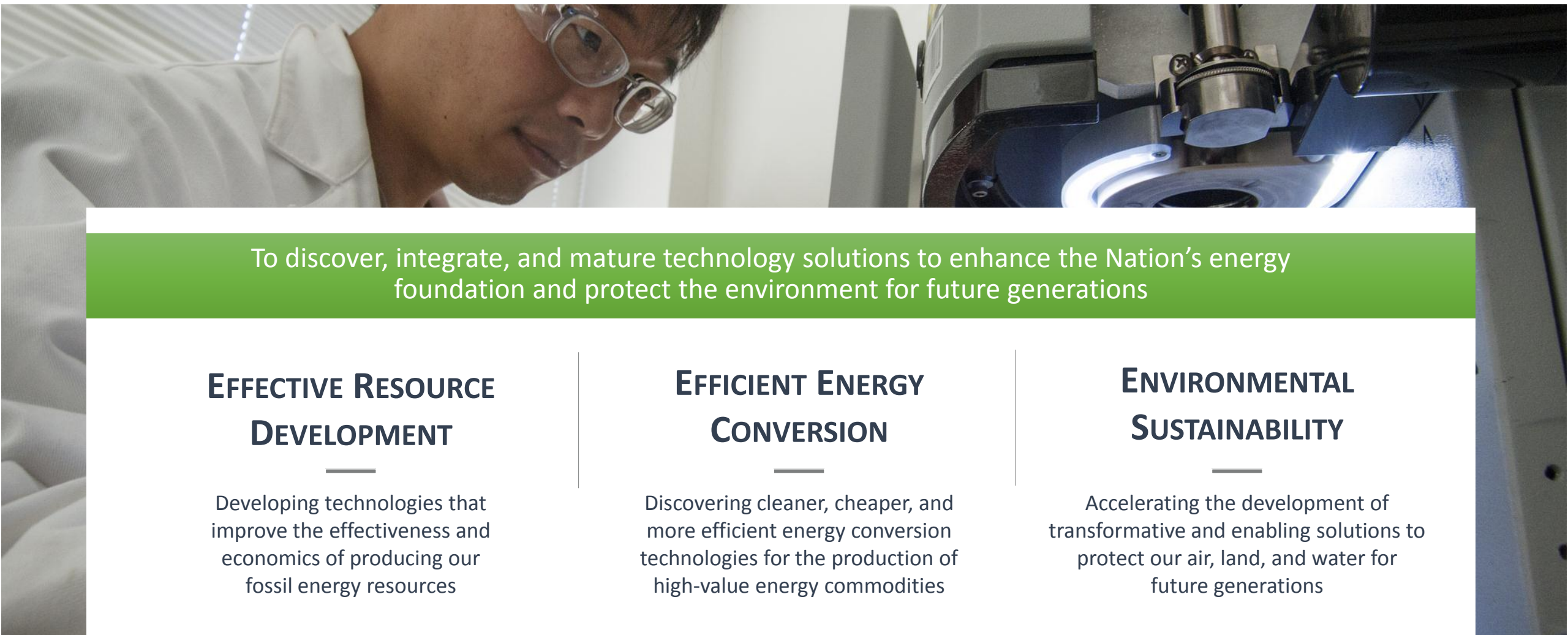
Knowledge and Technology Generation Center



Technology Convener



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

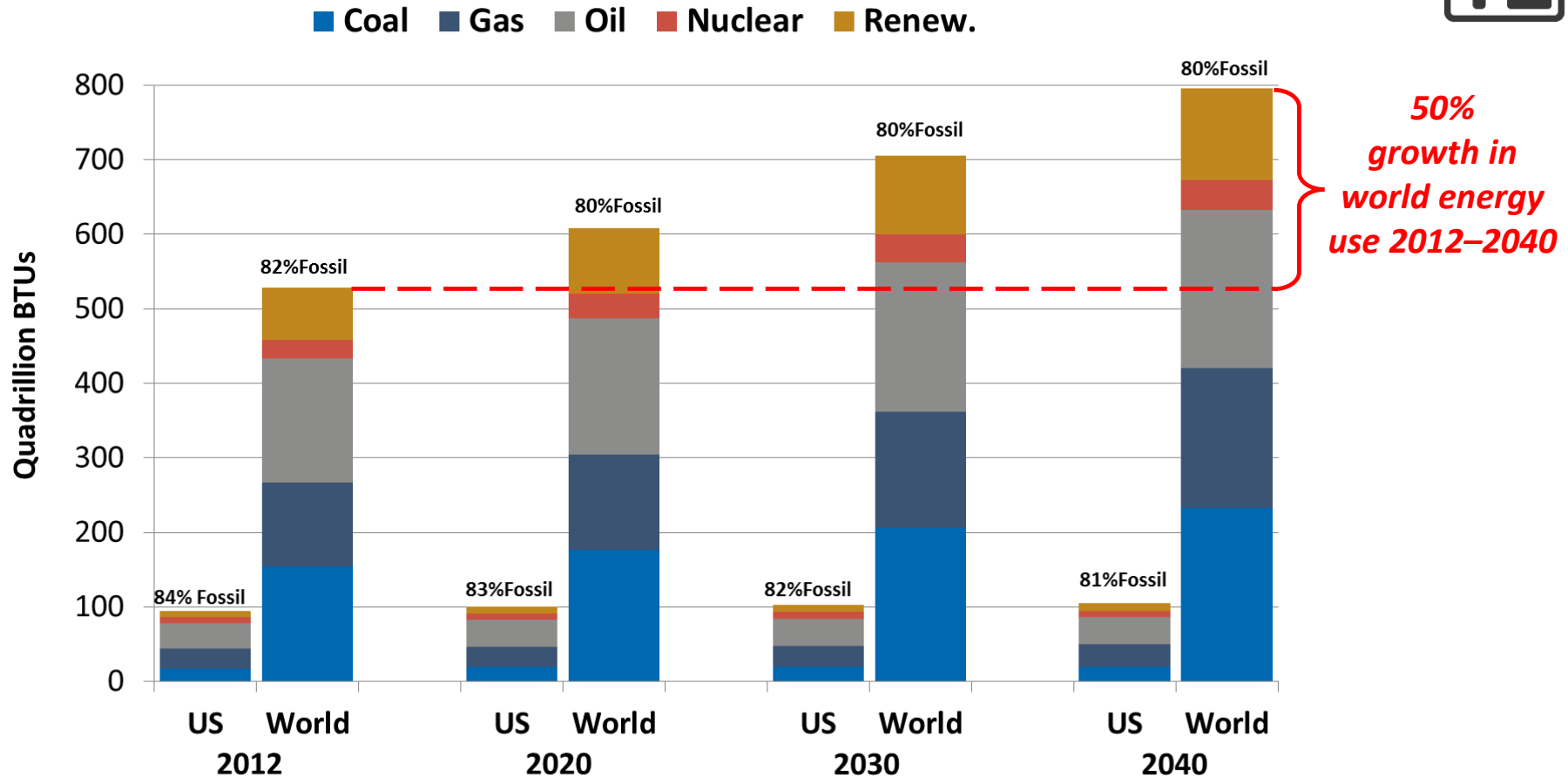
EFFICIENT ENERGY CONVERSION

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

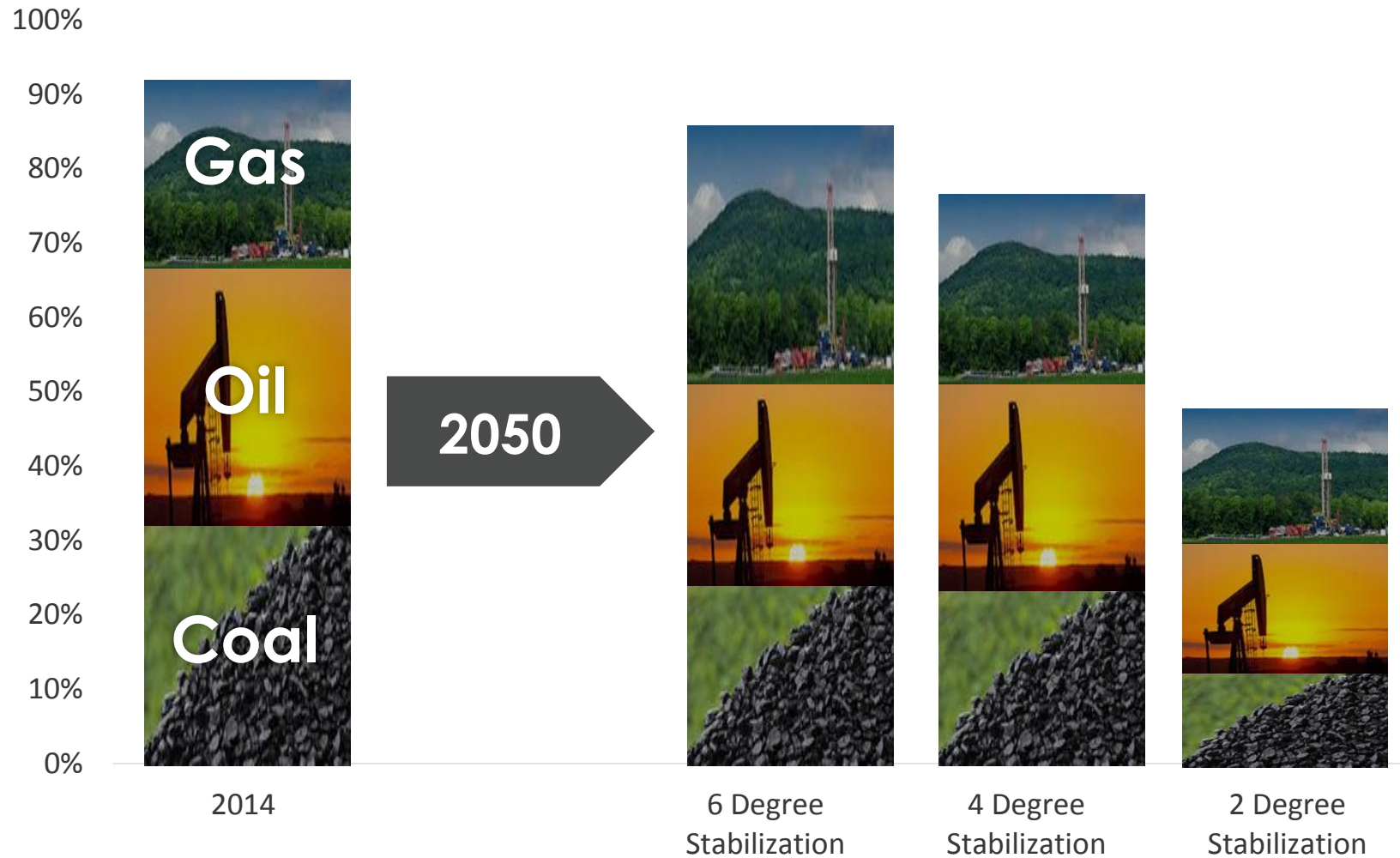
The World and U.S. Energy Future



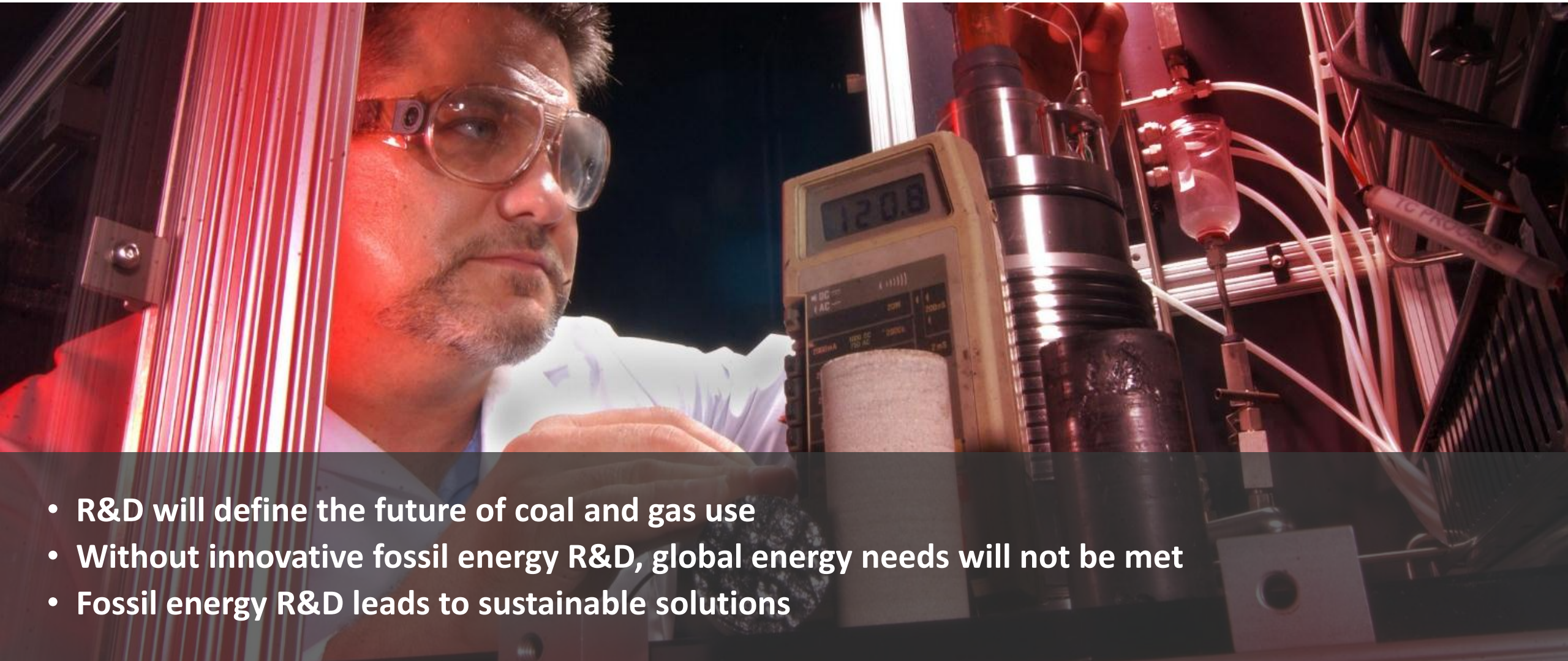
*≥80% Fossil Energy Today AND Tomorrow
Dominated by Global Growth*

Fossil Energy

Share of World Energy Demand



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

Continued Success Requires Vision, Courage and Perseverance



- 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

COMMERCIALIZATION

*Technology available
for wide-scale market use*

DEPLOYMENT

*System demonstrated
in operational environment*

SYSTEM TESTING

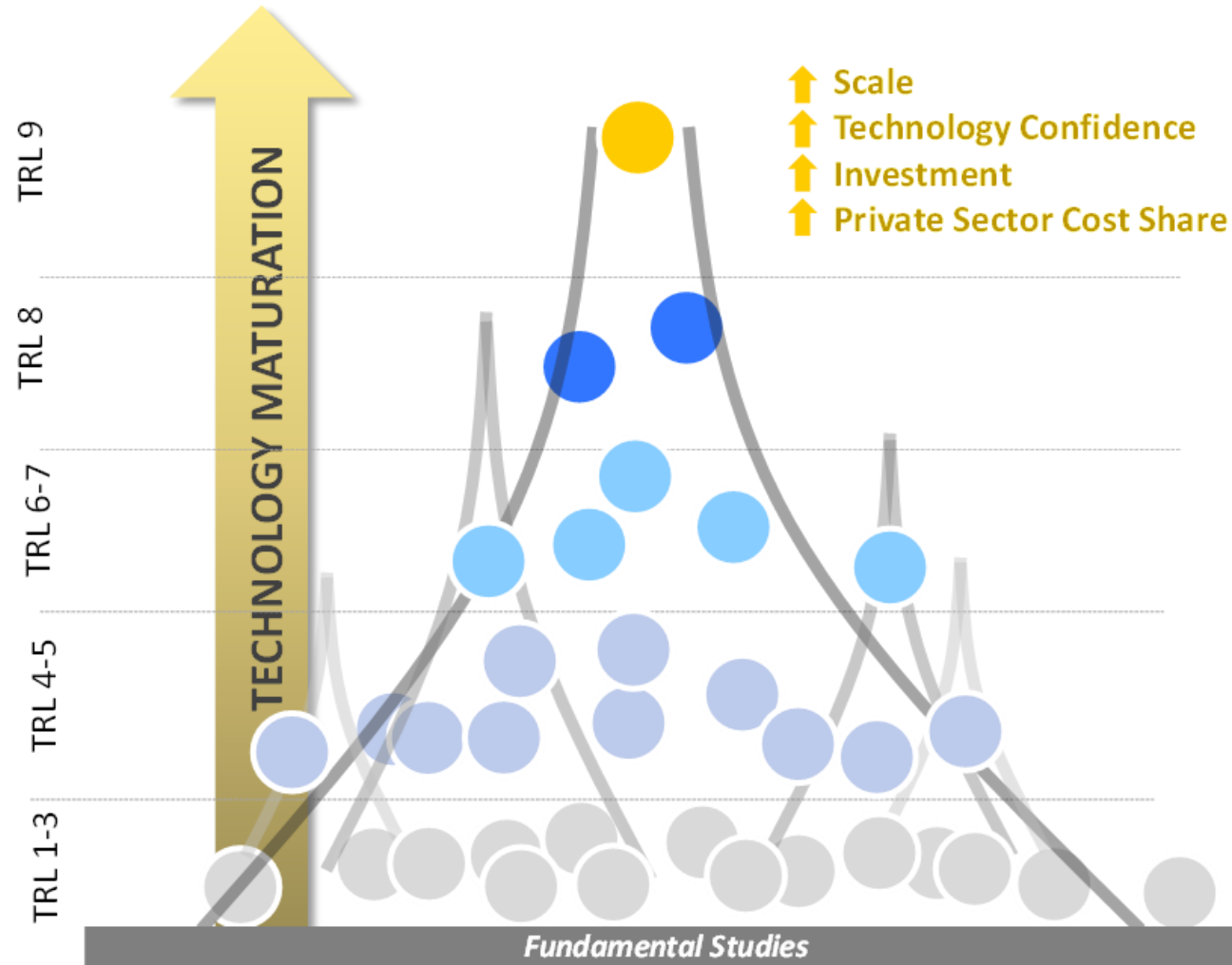
*System performance
confirmed at pilot-scale*

DEVELOPMENT

*Technology component
validated/integrated*

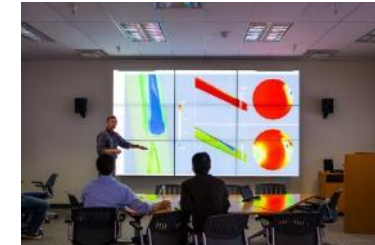
DISCOVERY

*Concept identified/proven at
laboratory-scale*



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

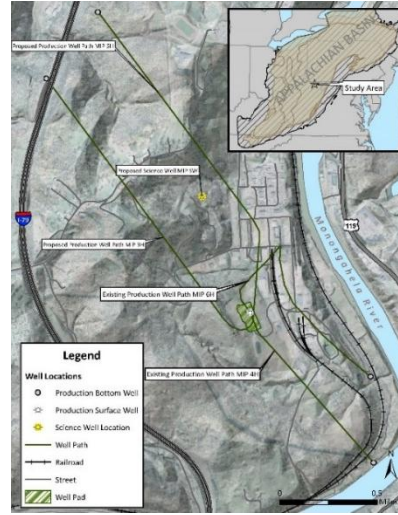


- **In West Virginia:**

- Marcellus Shale Energy and Environment Laboratory (MSEEL)
- Camp Dawson
- NETL Supercomputer
- Rare Earth Elements
- Chemical Looping

*West Virginia Army
National Guard,
Camp Dawson ,WV*

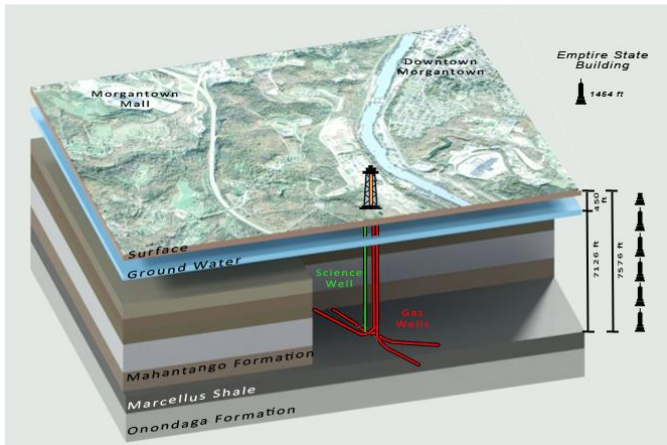
Marcellus Shale Energy and Environment Laboratory (MSEEL) Project



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



NETL Initiative in West Virginia

Camp Dawson

West Virginia Army National Guard and NETL



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.



NETL Initiative in West Virginia

NETL Supercomputer – Morgantown, WV

Joule – One of the world's fastest,
most energy-efficient supercomputers

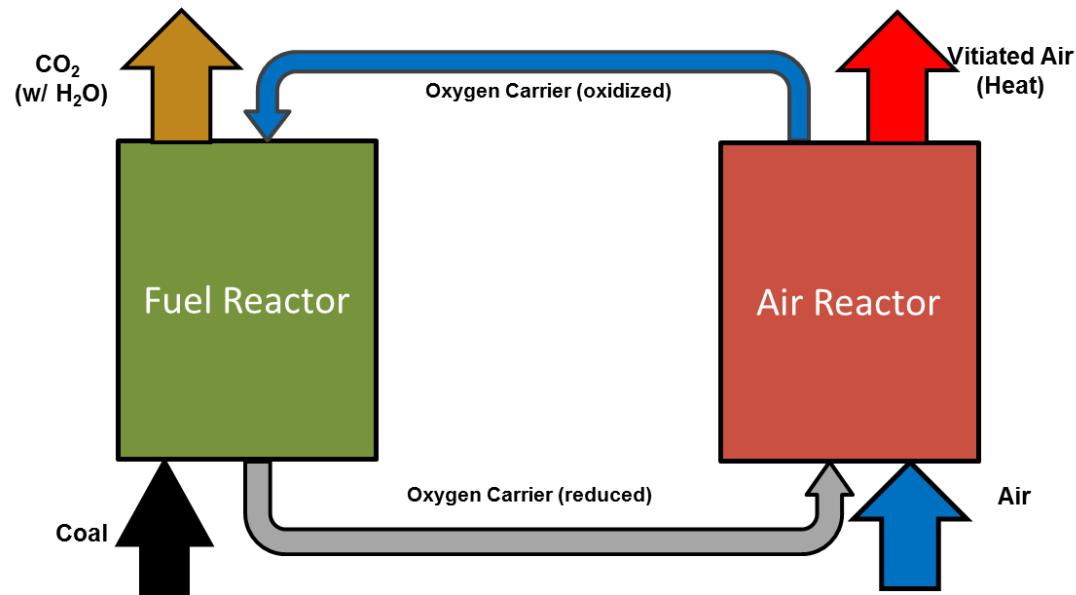
Helps energy researchers on NETL
projects working around the U.S. to
discover new materials, optimize
designs and better predict operational
characteristics



Chemical Looping Research

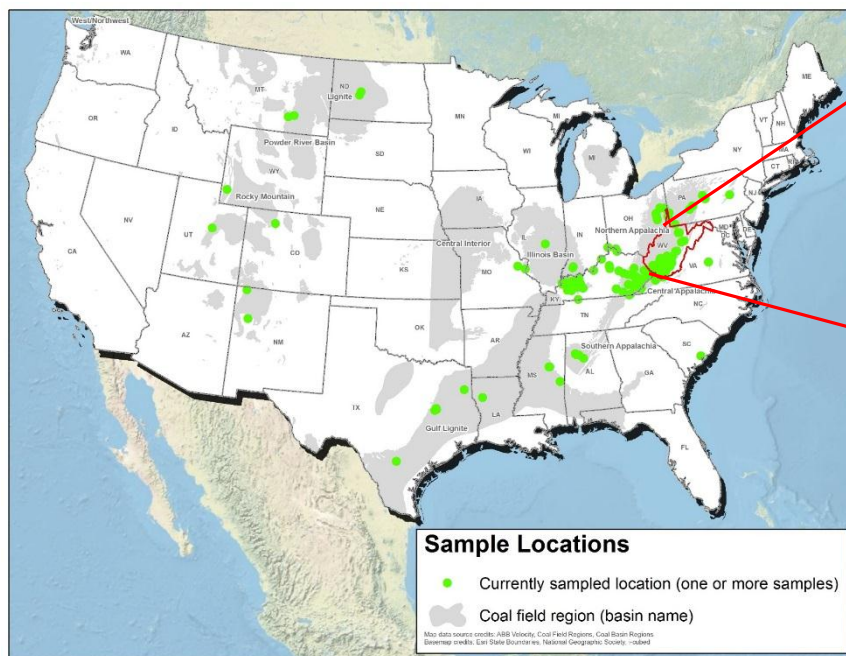
NETL's pilot-scale **Chemical Looping Reactor (CLR)** is conducting key research to support chemical looping technology development.

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

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

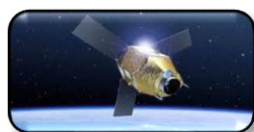


Extensive sampling in WV

WV participants include:



west virginia department of environmental protection



Communication
Satellites



Catalysts



Permanent
Magnets



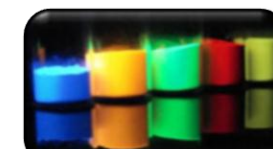
Lasers



Glass Additives



Hybrid Electric
Vehicles



Phosphors



Turbines

West Virginia



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ENERGY

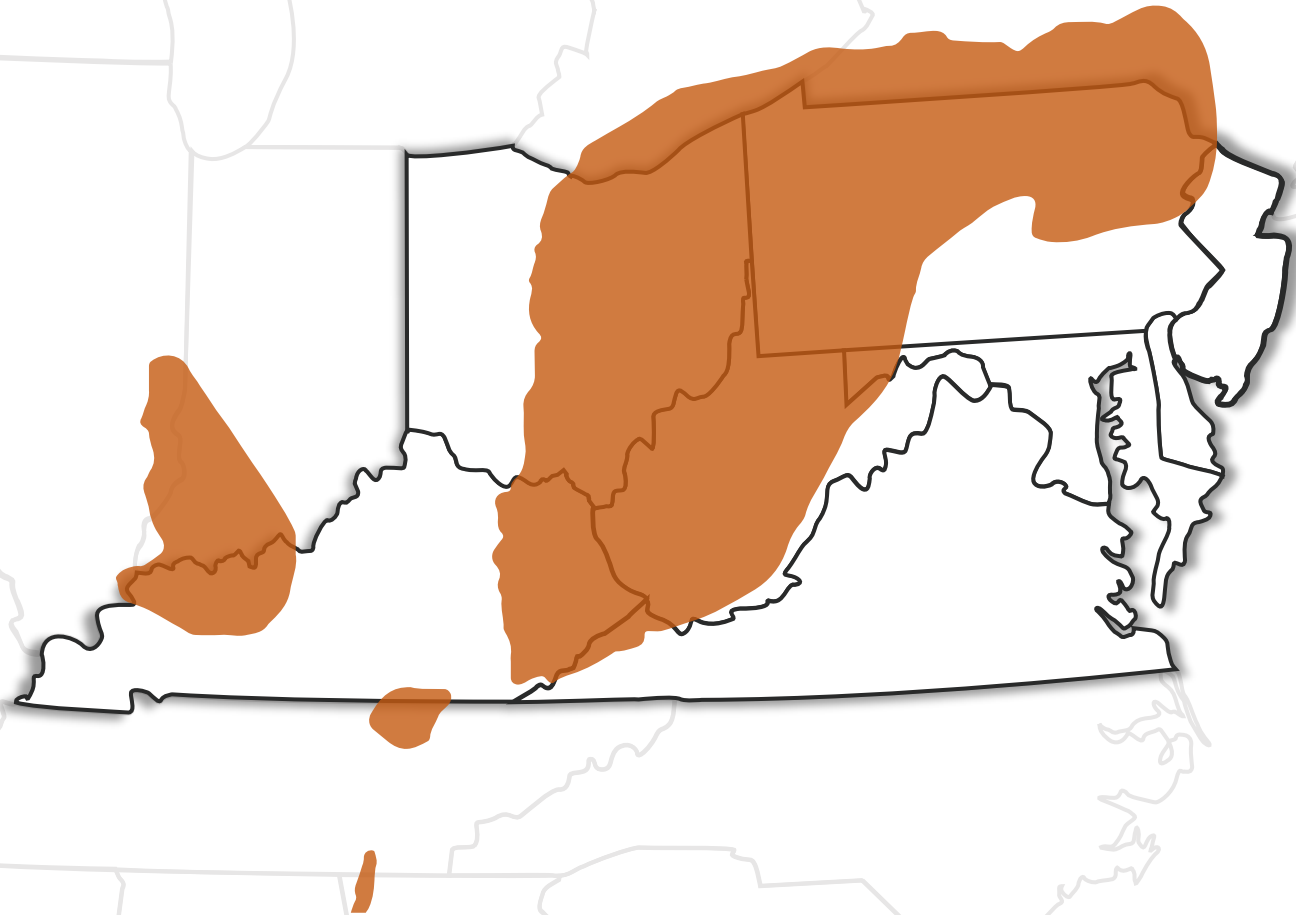
West Virginia



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ENERGY

West Virginia

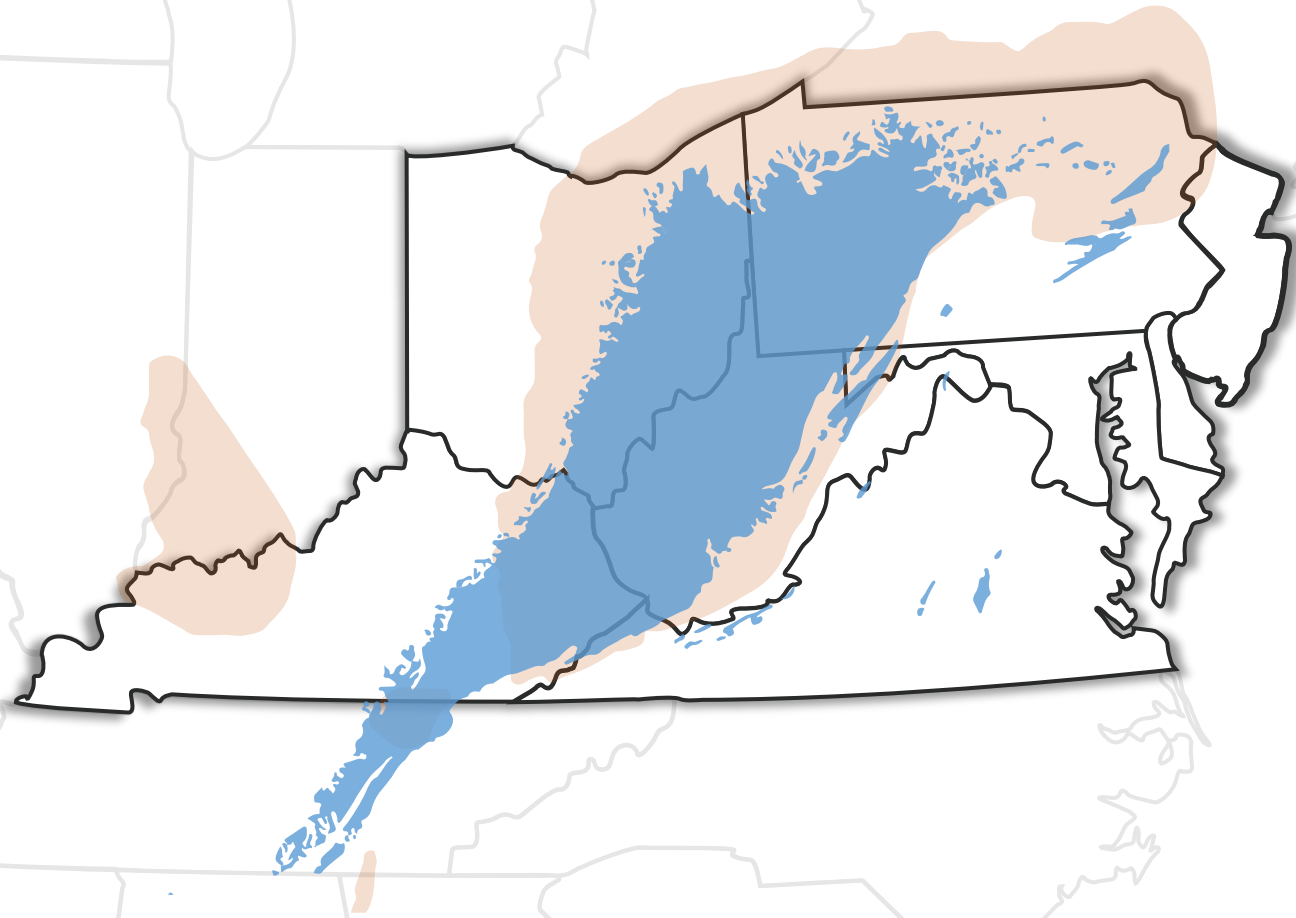
● Tight Oil/Shale Gas Plays



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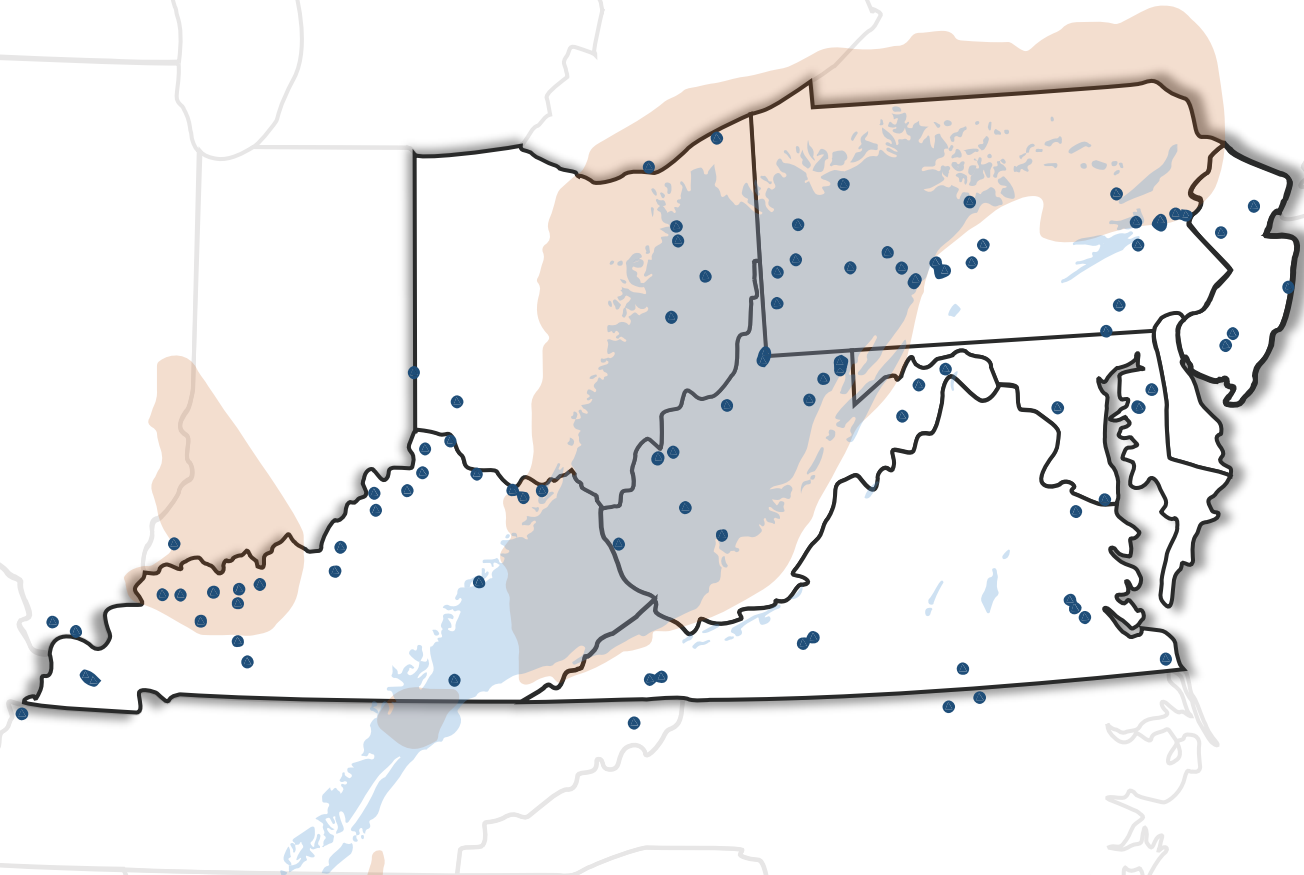
West Virginia

- Tight Oil/Shale Gas Plays
- Coal Fields



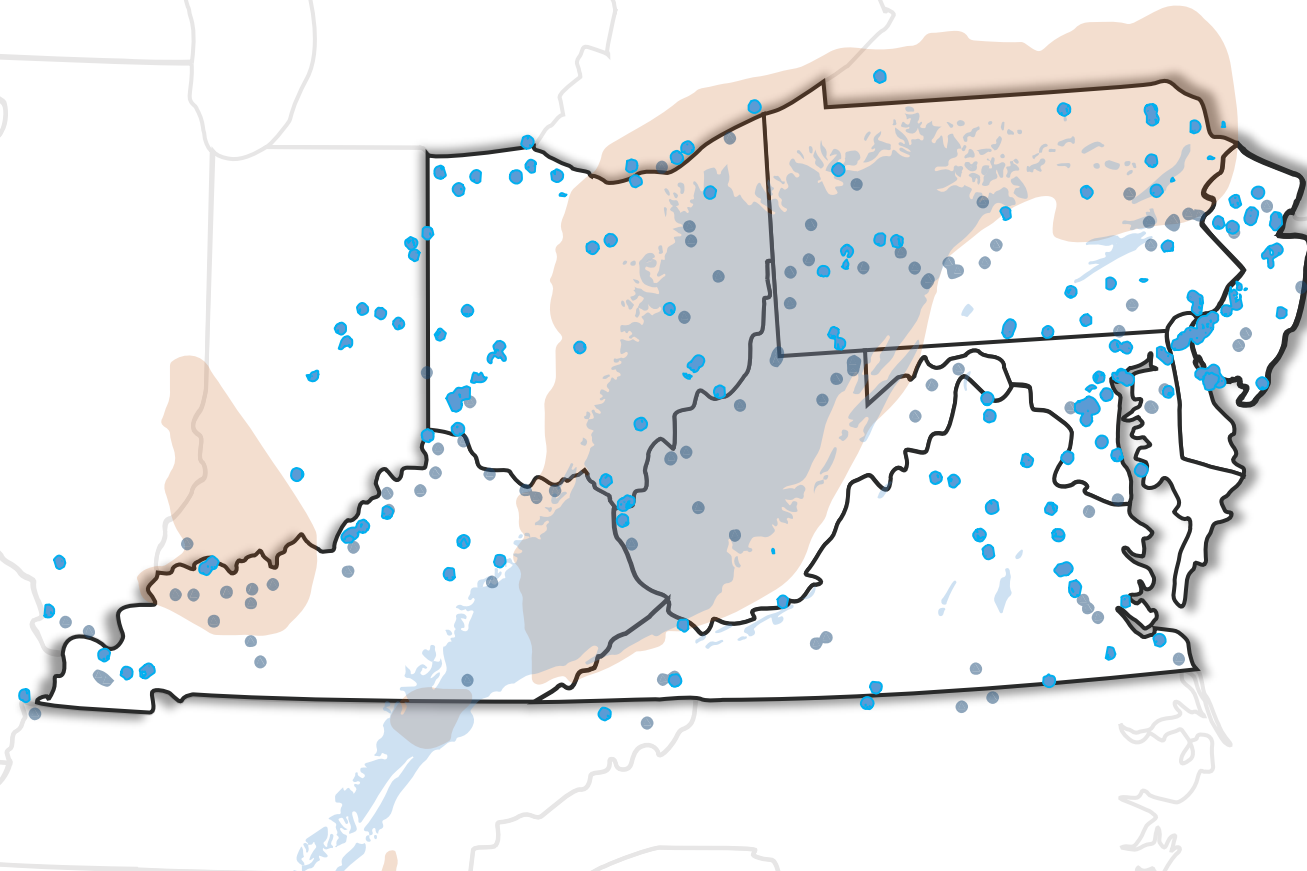
West Virginia

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



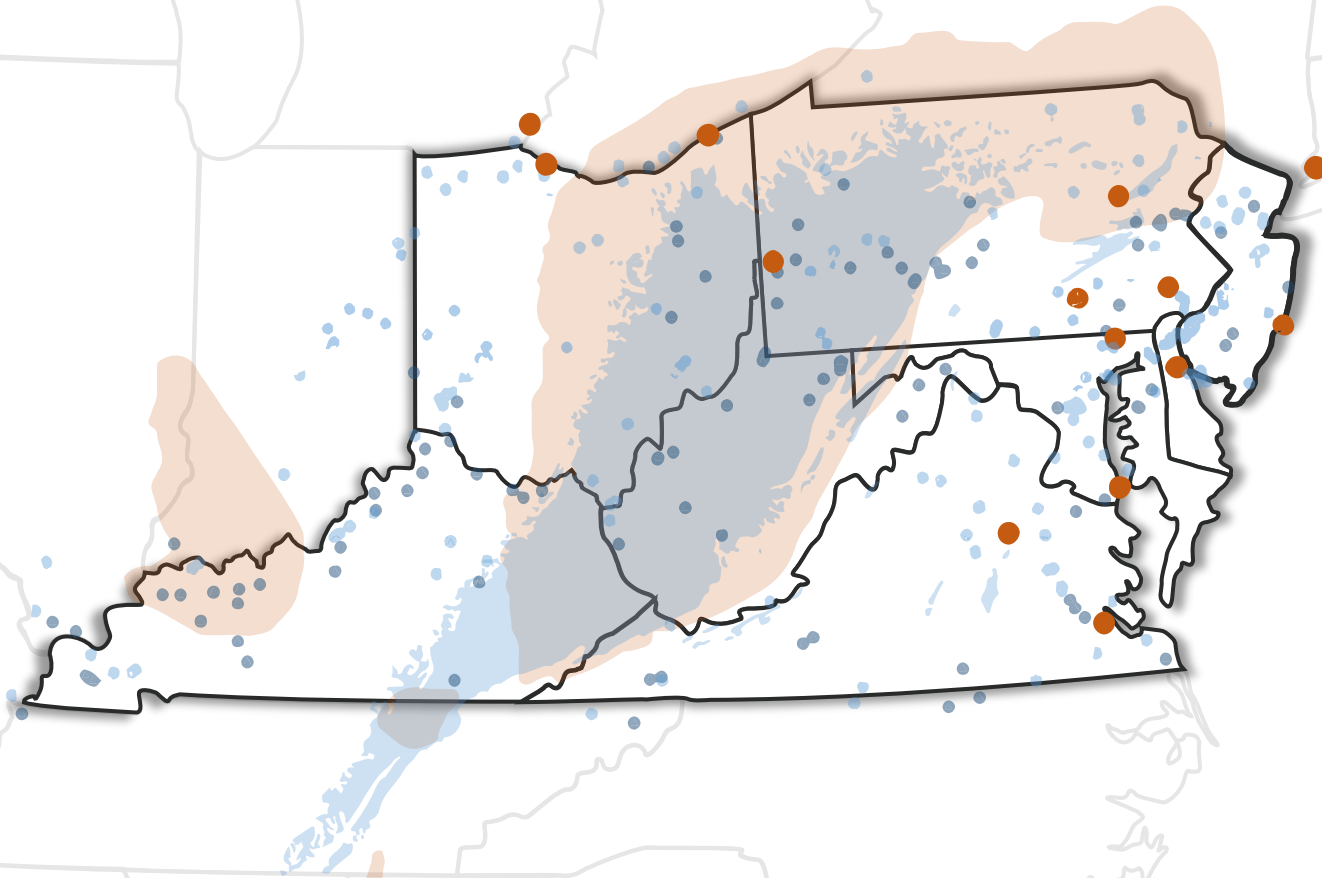
West Virginia

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



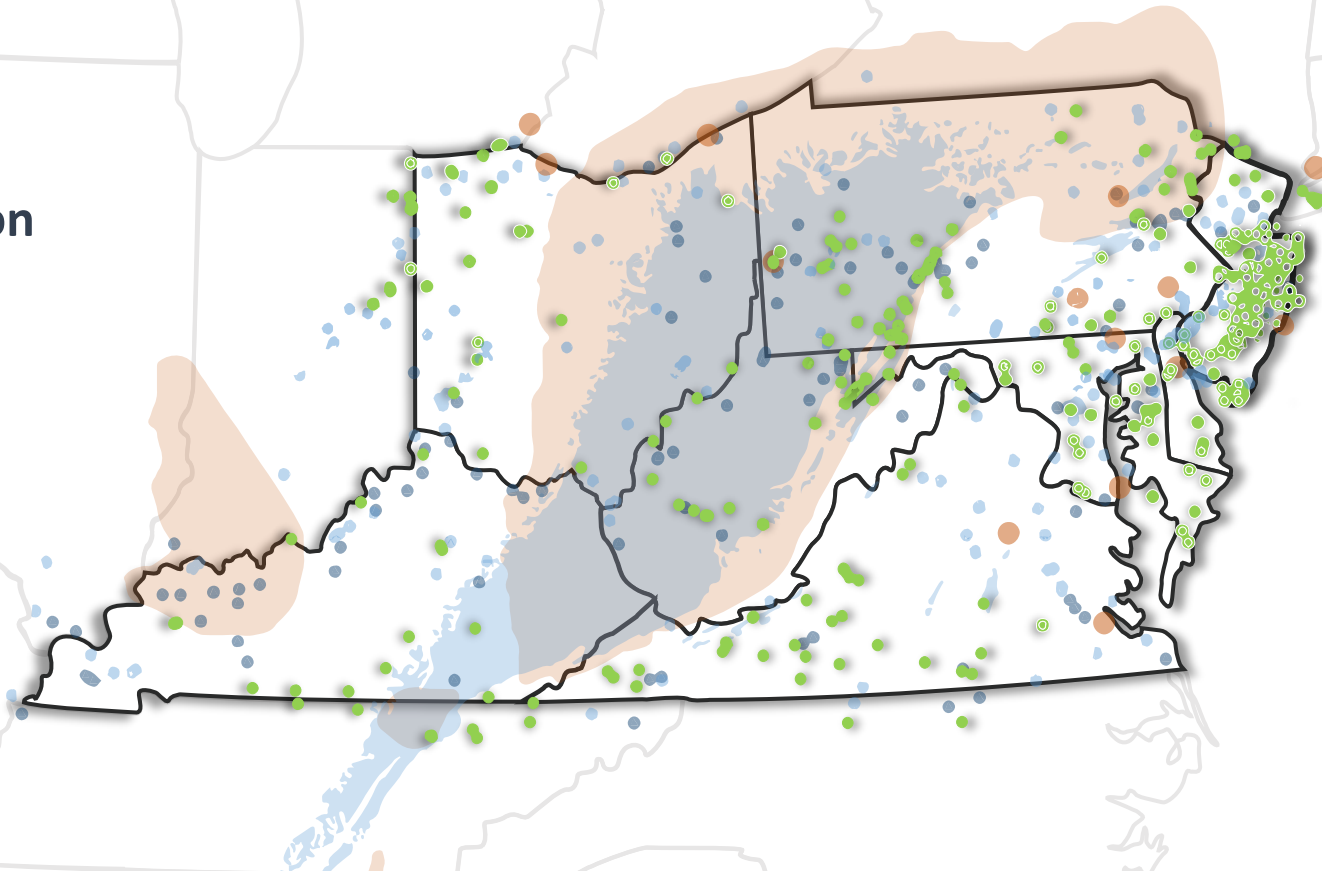
West Virginia

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



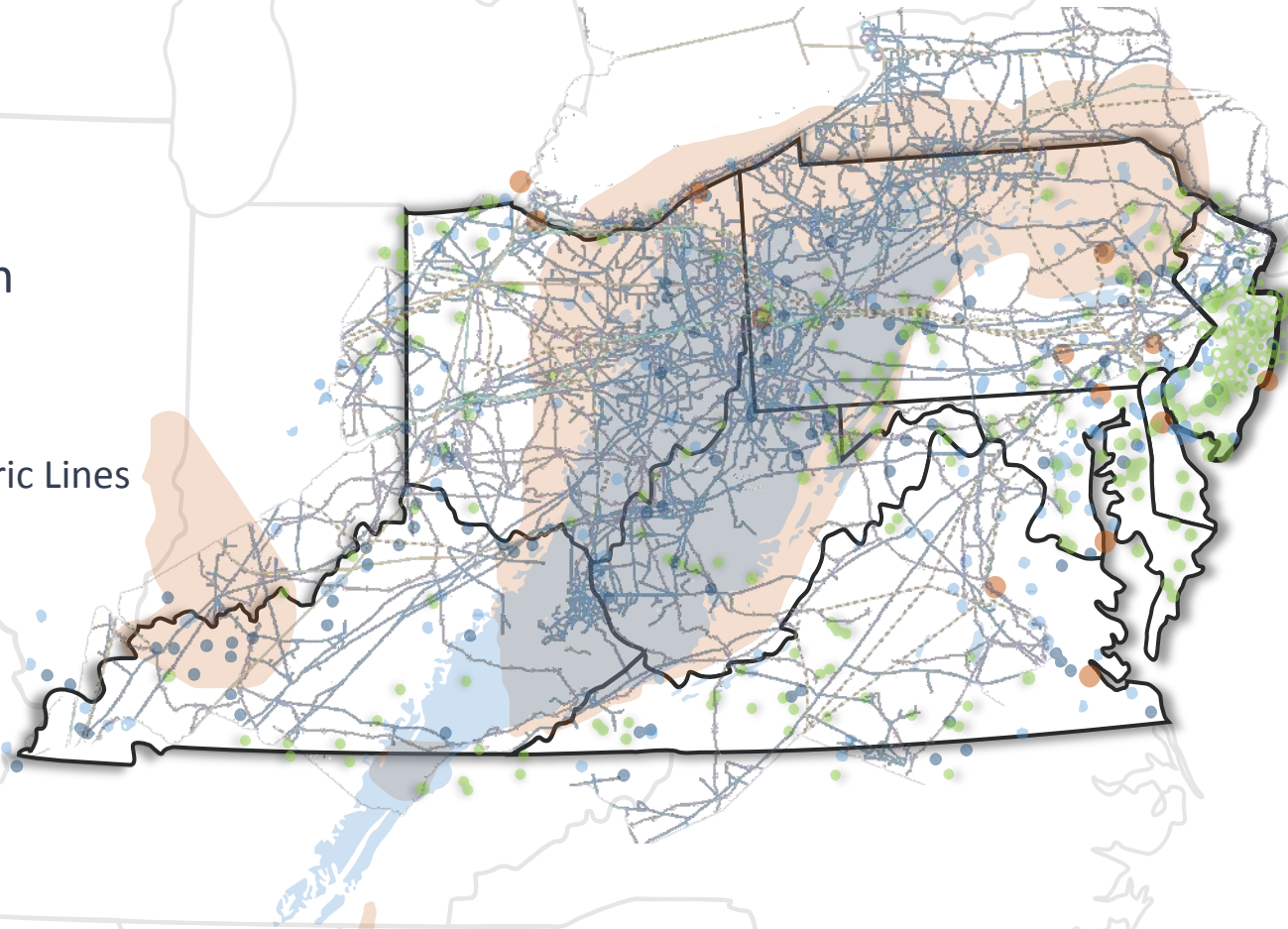
West Virginia

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



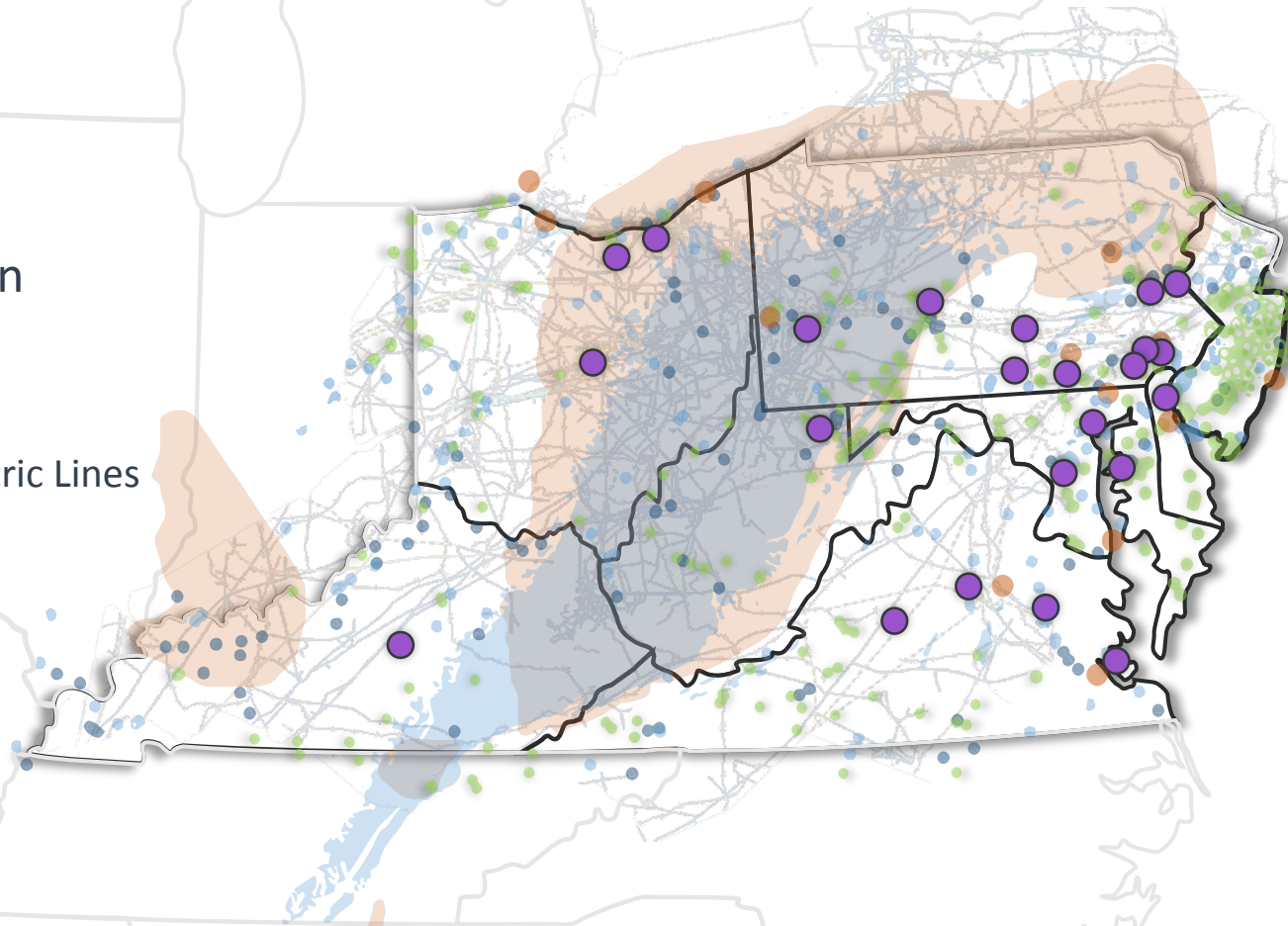
West Virginia

- 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



West Virginia

- 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



West Virginia

● Tight Oil/Shale Gas Plays

● Coal Fields

● Coal Power Plants

● Natural Gas Power Plants

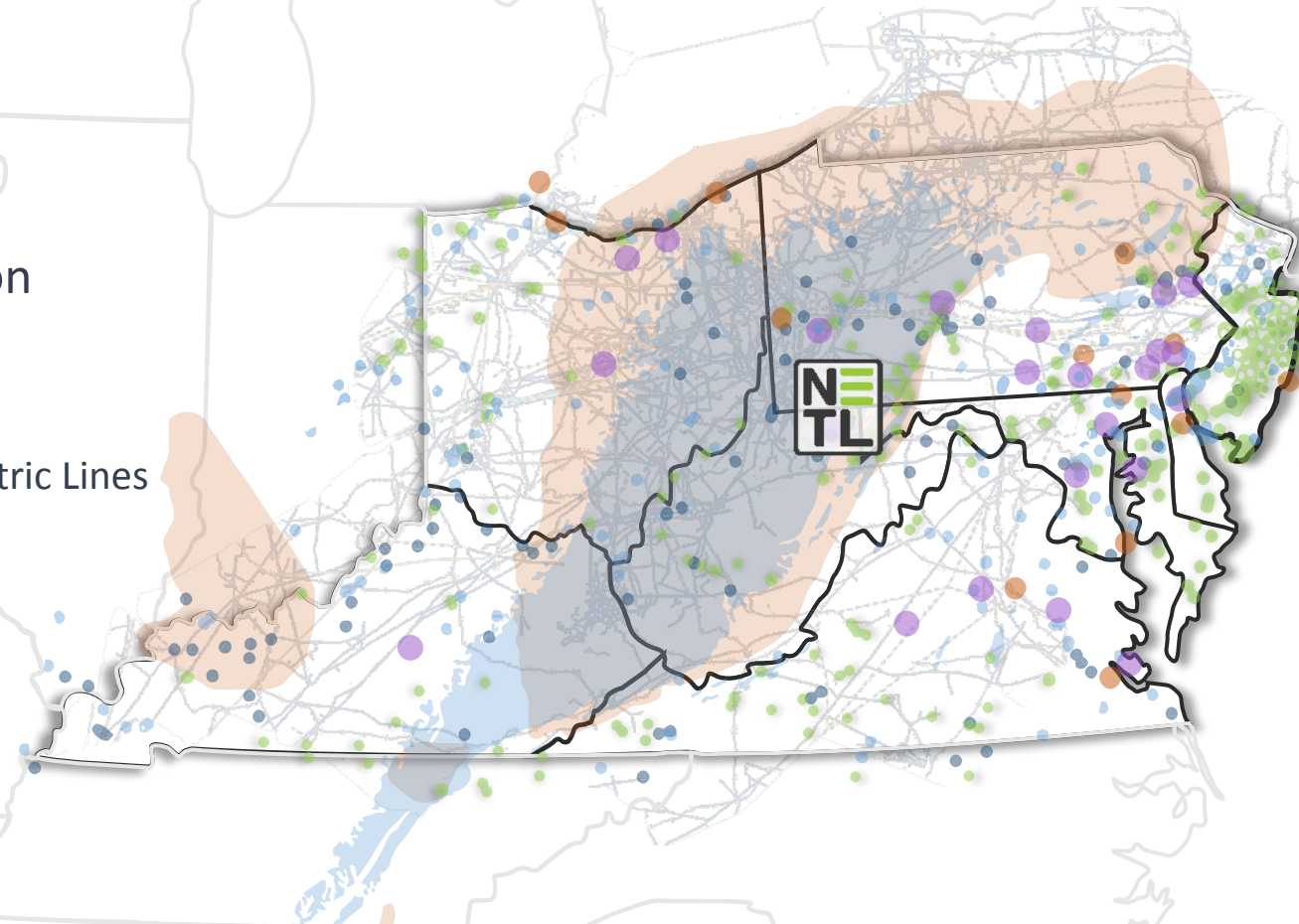
● Nuclear Power Plants

● Renewable Power Generation

● Energy Transmission
Natural Gas, Crude Oil, HGL, & Electric Lines

● Academia

● **NETL**
NATIONAL ENERGY TECHNOLOGY LABORATORY



U.S. DEPARTMENT OF
ENERGY

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

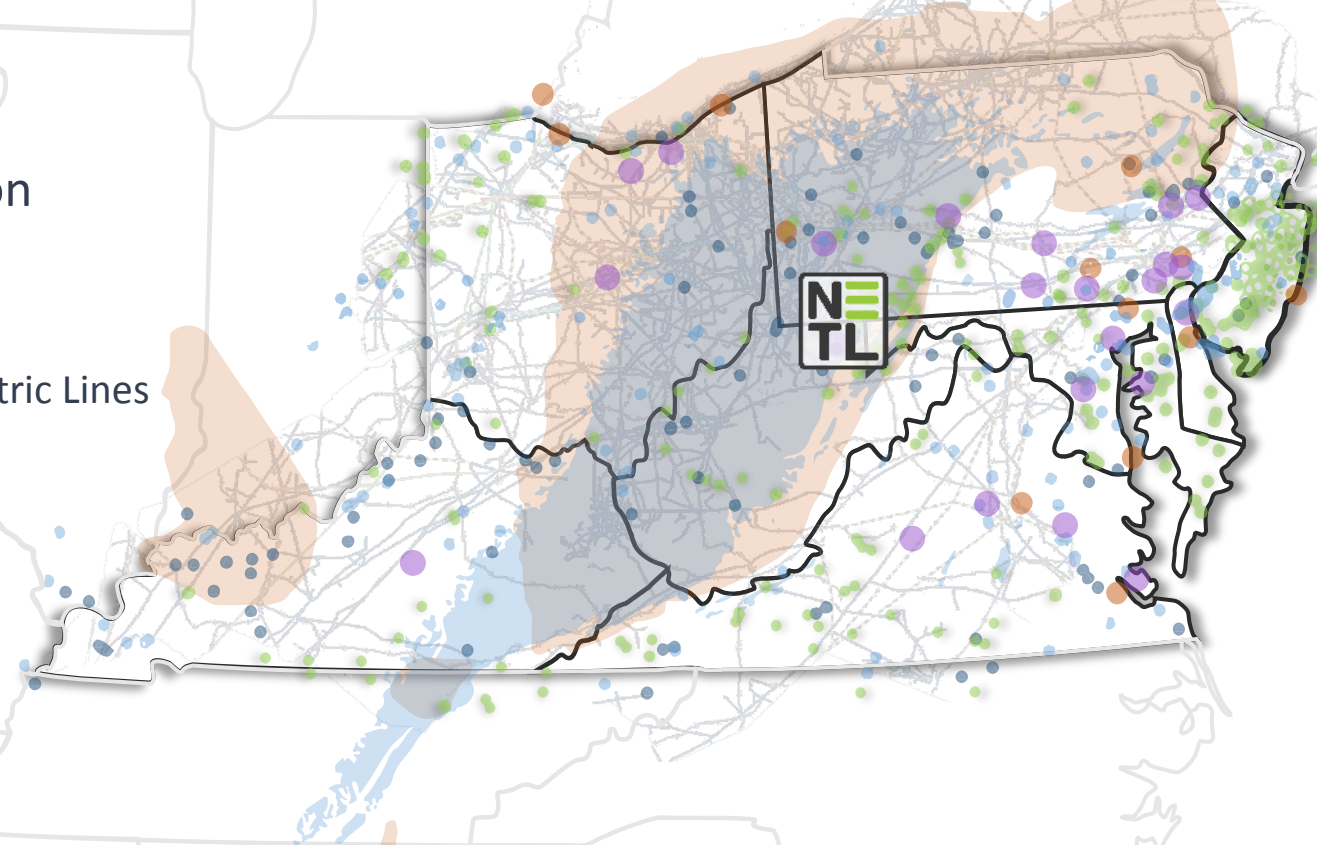
● Nuclear Power Plants

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Natural Gas, Crude Oil, HGL, & Electric Lines

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ENERGY

Solutions for Today Options for Tomorrow

For More Information, Contact NETL
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