



January 8, 2015

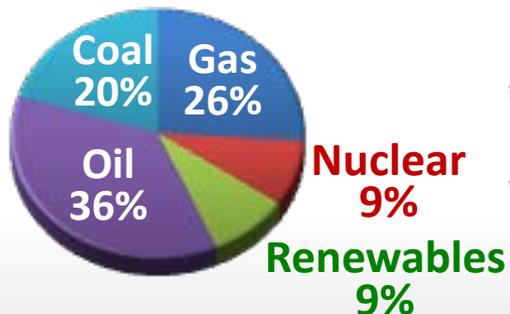
NETL Overview



the ENERGY lab

Energy Demand 2011

97 QBtu / Year
83% Fossil Energy



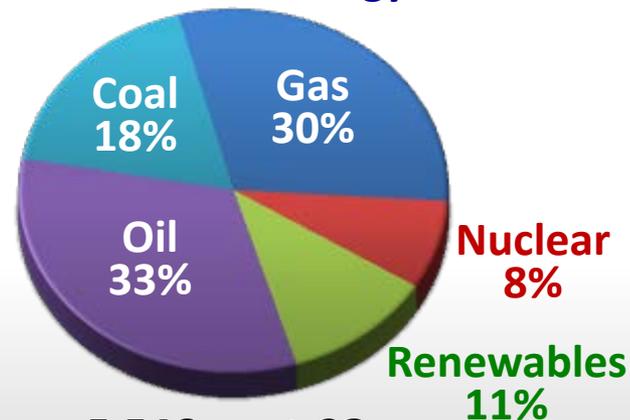
5,498 mmt CO₂

+ 7%

United States

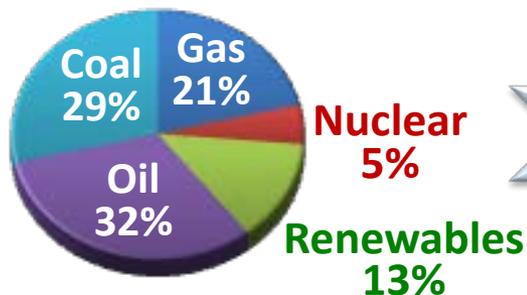
Energy Demand 2035

104 QBtu / Year
81% Fossil Energy



5,546 mmt CO₂

519 QBtu / Year
82% Fossil Energy

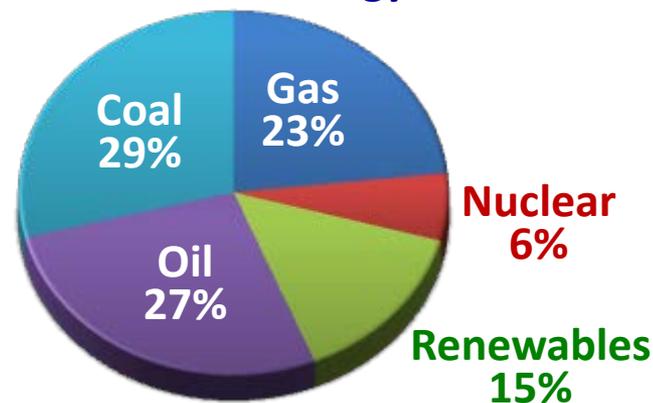


31,162 mmt CO₂

+ 43%

World

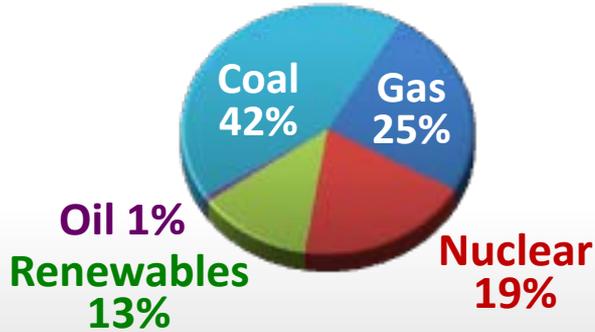
740 QBtu / Year
80% Fossil Energy



43,111 mmt CO₂

Electricity Demand 2011

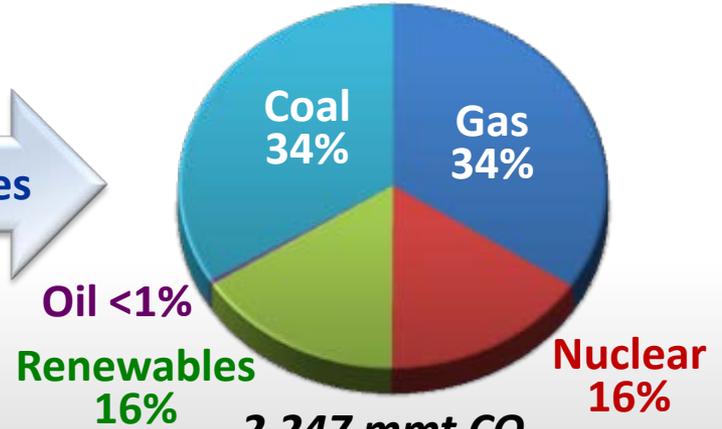
4,084 BkWh / Year
68% Fossil Energy



2,171 mmt CO₂

Electricity Demand 2035

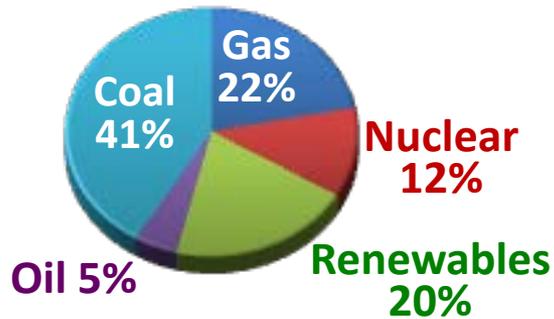
4,980 BkWh / Year
68% Fossil Energy



2,247 mmt CO₂

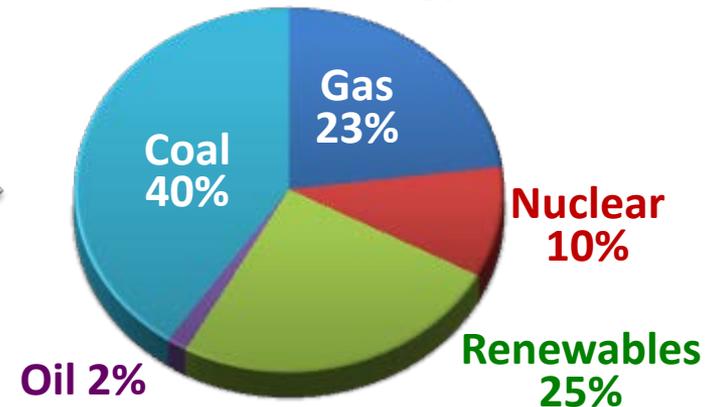


22,113 BkWhr / Year
68% Fossil Energy



12,954 mmt CO₂

39,854 BkWh / Year
65% Fossil Energy



19,122 mmt CO₂



DOE Mission

Ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions

NETL Mission

***Advance energy options to fuel our economy,
strengthen our security, and improve our
environment***

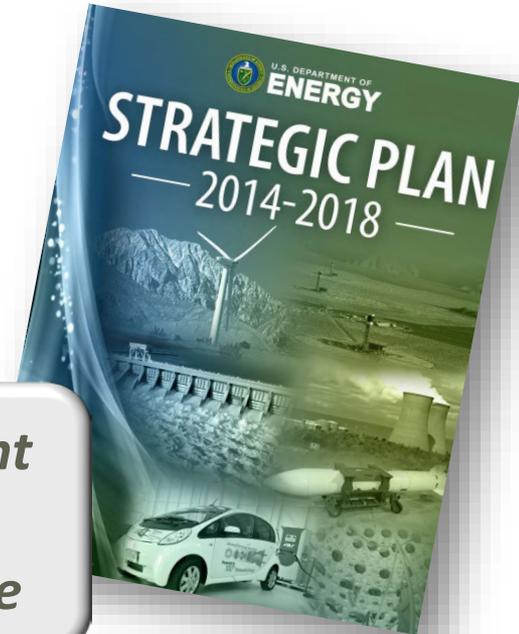
DOE Strategic Plan, 2014–2018

Three Strategic Goals

*Science and
Energy*

*Nuclear
Security*

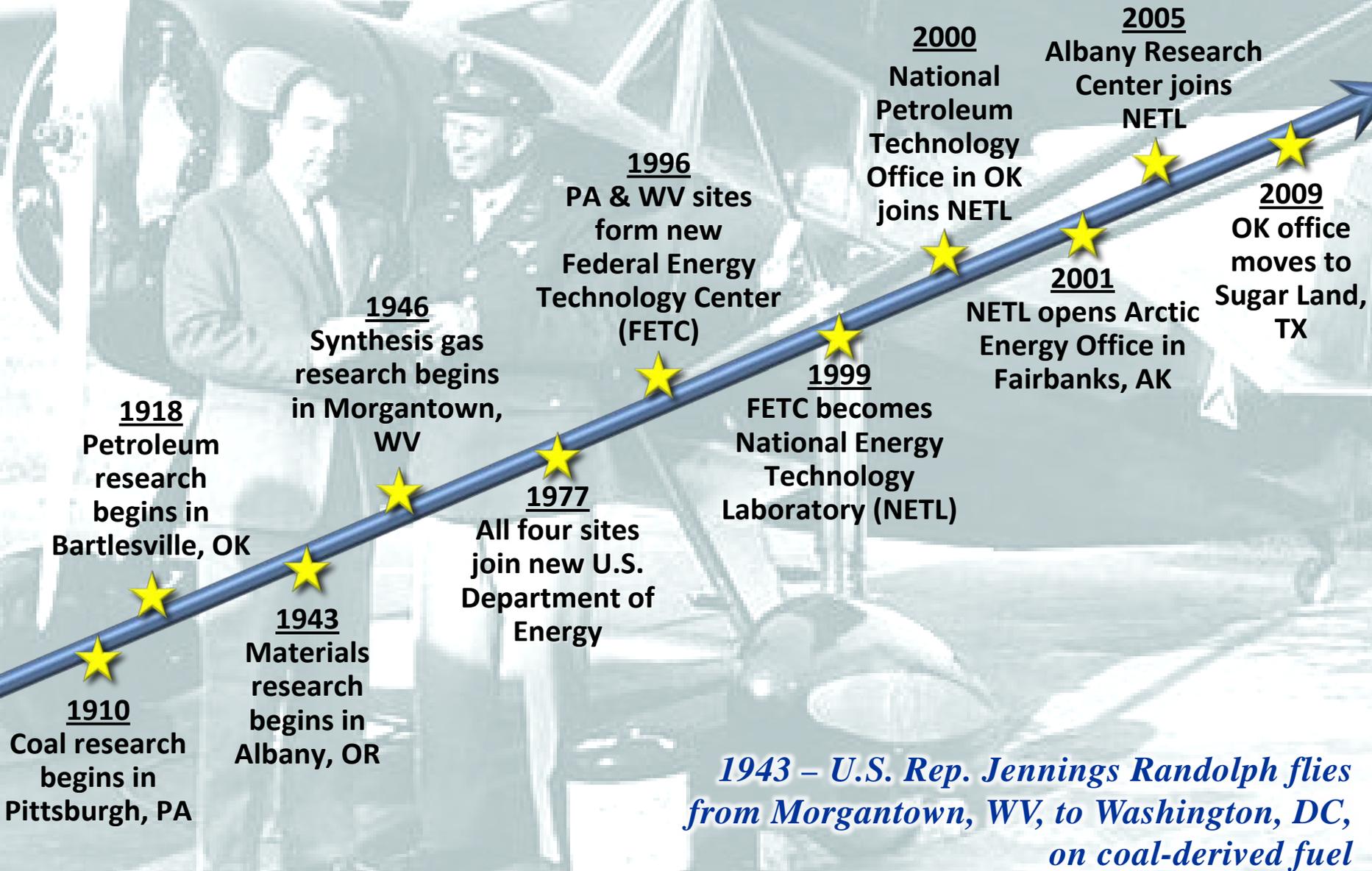
*Management
and
Performance*



“This strategic plan provides a roadmap for our work, highlights our major priorities for the next few years, and will be reflected in individual program plans.”

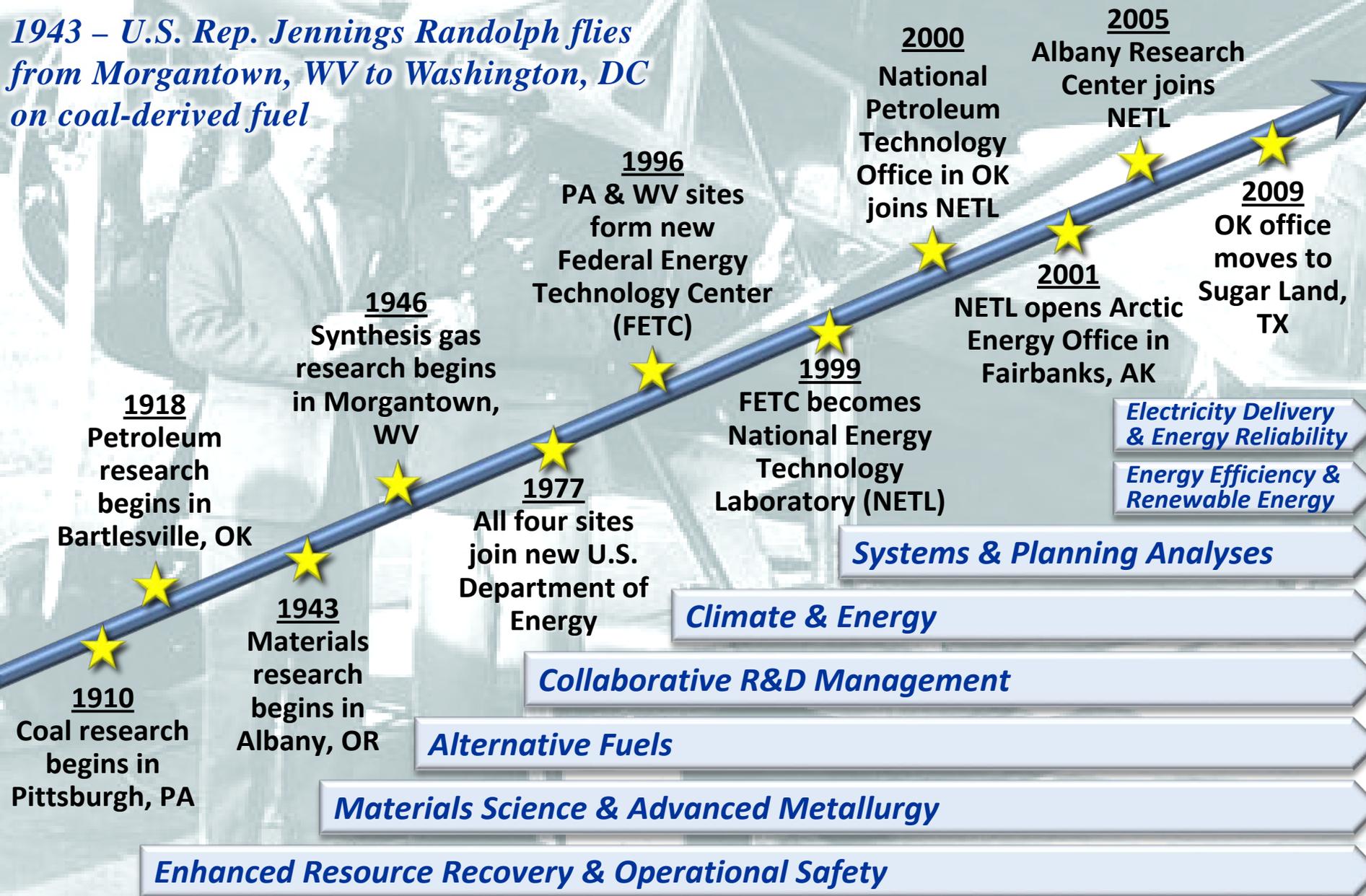
—Secretary Moniz

NETL: A Century of Energy Innovation



NETL: A Century of Energy Innovation

1943 – U.S. Rep. Jennings Randolph flies from Morgantown, WV to Washington, DC on coal-derived fuel



What is NETL Today?

A Full-Service National Laboratory



FE's implementing "program" laboratory



EERE's & OE's implementing "project" laboratory



Premier research national laboratory



Procurement, financial, technical & human resources capabilities to support any Departmental mission

National Energy Technology Laboratory

Where Energy Challenges Converge and Energy Solutions Emerge

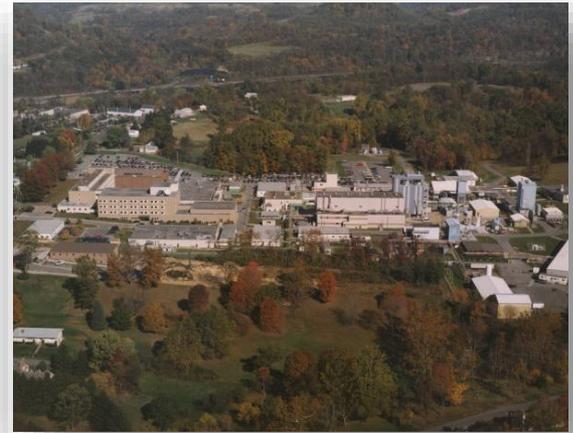
- Full service DOE national laboratory
- Dedicated to energy RD&D, domestic energy resources
- Fundamental science through technology demonstration
- Unique industry – academia – government collaborations



Oregon



Pennsylvania



West Virginia

National Energy Technology Laboratory

- **Full-service DOE federal laboratory**

- Program planning
- Budget formulation and execution
- Procurement
 - Contracting & financial assistance
- Project management
 - Including NEPA
- Legal
- Financial management & reporting
- Onsite research
- Program performance & benefit analysis

- **Dedicated to energy RD&D, domestic energy resources**

- Fossil Energy
- Support Offices of Electricity and Energy Efficiency

- **Fundamental science through technology demonstration**

- **Unique industry–academia–government collaborations**



Responsible for Substantial Infrastructure

- **Pittsburgh, PA, and Morgantown, WV**
 - Facilities 65 miles apart
 - 61 acres (Pittsburgh) and 137 acres (Morgantown)
 - 80 permanent and temporary buildings, > 969,000 sq. ft.
- **Sugar Land, TX, and Anchorage, AK**
 - Housed in leased space
 - 3,100 sq. ft. (Texas)
 - 750 sq. ft. (Alaska)
- **Albany, OR**
 - 44 acres
 - 38 buildings, > 258,000 sq. ft.
- **Fleet of ~65 federal vehicles**



Technology Support Facility, Morgantown

NETL's Customer Base

Fiscal Year 2014 Budget



Fossil Energy

~ \$ 562 million



**Energy Efficiency &
Renewable Energy**

~ \$ 162 million*



**Electricity Delivery &
Energy Reliability**

~ \$ 52 million



Other

~ \$ 59 million

**NETL also financially manages an additional \$1.1 billion for EERE's PMC (Golden/NREL)*

Site-Support Contractors Assist Lab Operations

The Majors

Alliant Enterprises JV, LLC

Small Business

Information Technology Operations & Maintenance Support Services (ITOMS)

The logo for Alliant Enterprises JV, LLC, featuring the letters 'AEJV' in white on a blue rectangular background.

Booz Allen Hamilton, Inc.

Large Business

Energy Sector Planning and Analysis Services (ESPA)

Booz | Allen | Hamilton

Goldbelt Eagle, LLC

Alaska Native Small Disadvantaged
8(a) Business

Site Operations Services (SOS)



KeyLogic Systems, Inc.

Small Business

Project Execution and Integration Services (PEI)



Leonardo Technologies, Inc.

Small Business

Program and Performance Management Services (PPM)



Smart Data Solutions

Small Disadvantaged Veteran- and
Minority-Owned 8(a) Business

Support Administrative Services (SAS)



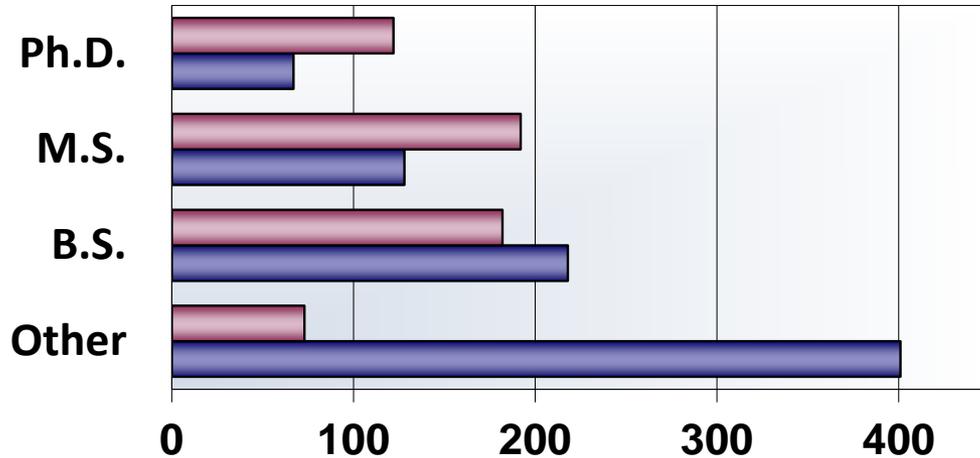
URS Corporation (URS Washington Division)

Large Business

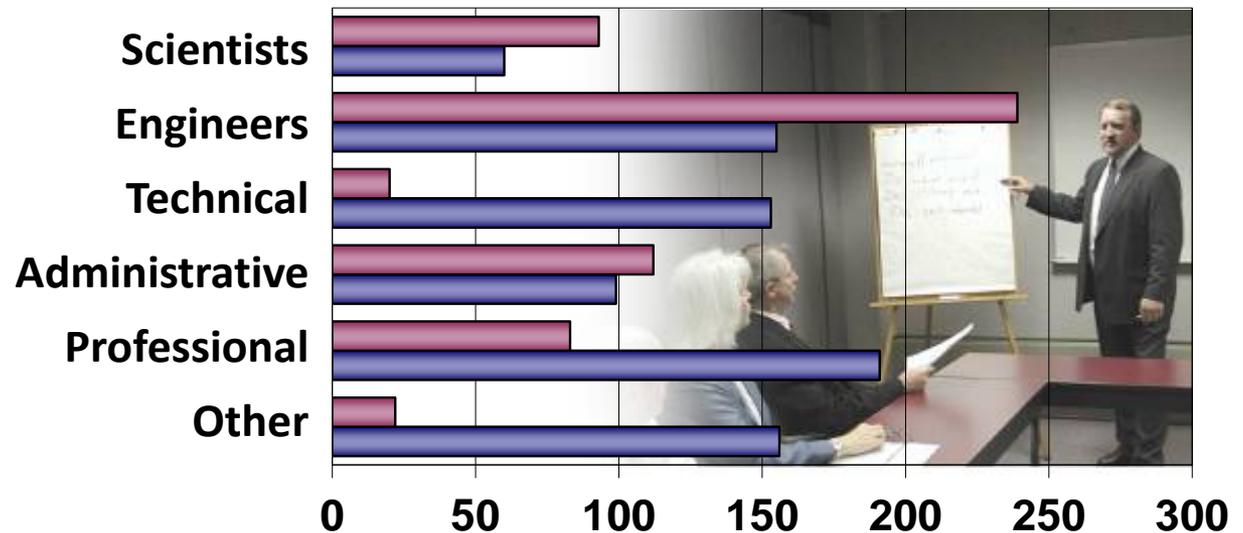
Research and Engineering Services (RES)



A Well-Trained Workforce



■ 569 Federal Employees
 ■ 814 Site Support Contractors



Some NETL Vital Statistics

- Provide \$200M per year to local economies through operations
- Nearly 1,400 employees: 40% federal, 60% support contractors
- Strongly technical-based staff

Federal Employees	
Scientists	16%
Engineers	42%
Technical	4%
Professional	15%
Administrative	20%
Other	4%

Site Support Contractors	
Scientists	7%
Engineers	19%
Technical	19%
Professional	23%
Administrative	12%
Other	19%

NETL's Investment in West Virginia

Impacting Economy Through Onsite Operations

- **Contributed \$72M through federal & contractor salaries**
 - Supports 628 full-time jobs
- **Obligated \$31M to WV small businesses through site-support contracts**
- **Draw more than 1,000 visitors to Morgantown area per year**

Impacting Economy Through R&D

- **Managed multi-year agreements & contracts with total award value of \$127M, including \$113M in federal funds**
 - Generates 1,225 job-years*

**Job estimate based on the President's Council of Economic Advisors Guidance, May 2009*

FY 2013

NETL's Investment in Pennsylvania

Impacting Economy Through Onsite Operations

- **Contributed \$70M through federal & contractor salaries**
 - Supports 553 full-time jobs
- **Draw nearly 1,500 visitors to Pittsburgh area per year**

Impacting Economy Through R&D

- **Managed multi-year agreements & contracts with total award value of \$1.7B, including nearly \$856M in federal funds**
 - Generates 9,305 job-years*

**Job estimate based on the President's Council of Economic Advisors Guidance, May 2009*

FY 2013

NETL's Investment in Oregon

Impacting Economy Through Onsite Operations

- **Contributed \$14M through federal & contractor salaries**
 - Supports 115 full-time jobs
- **Draw more than 200 visitors to Albany area per year**

Impacting Economy Through R&D

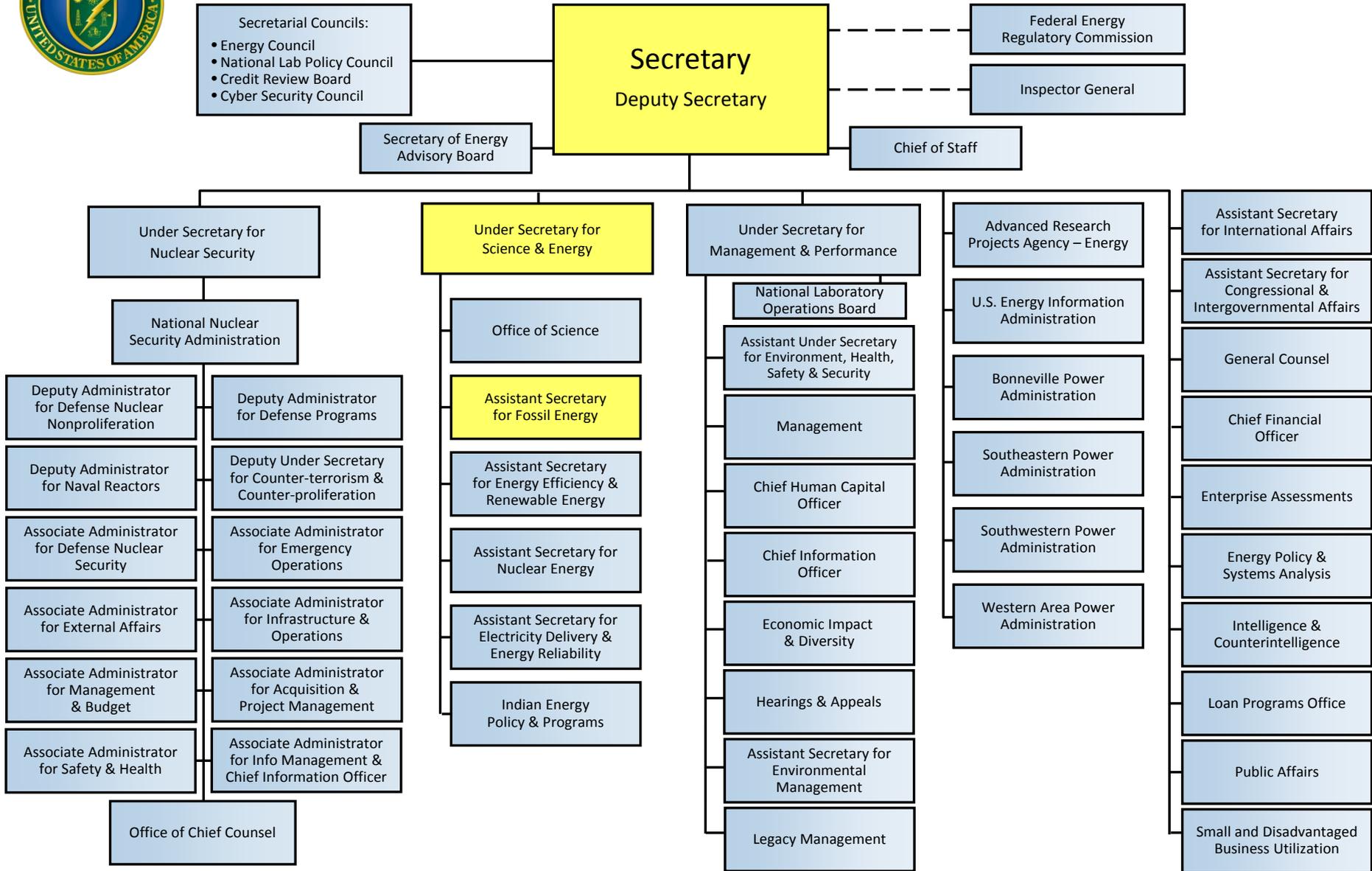
- **Managed multi-year agreements & contracts with total award value of \$161M, including \$82M in federal funds**
 - Generates 893 job-years*

**Job estimate based on the President's Council of Economic Advisors Guidance, May 2009*

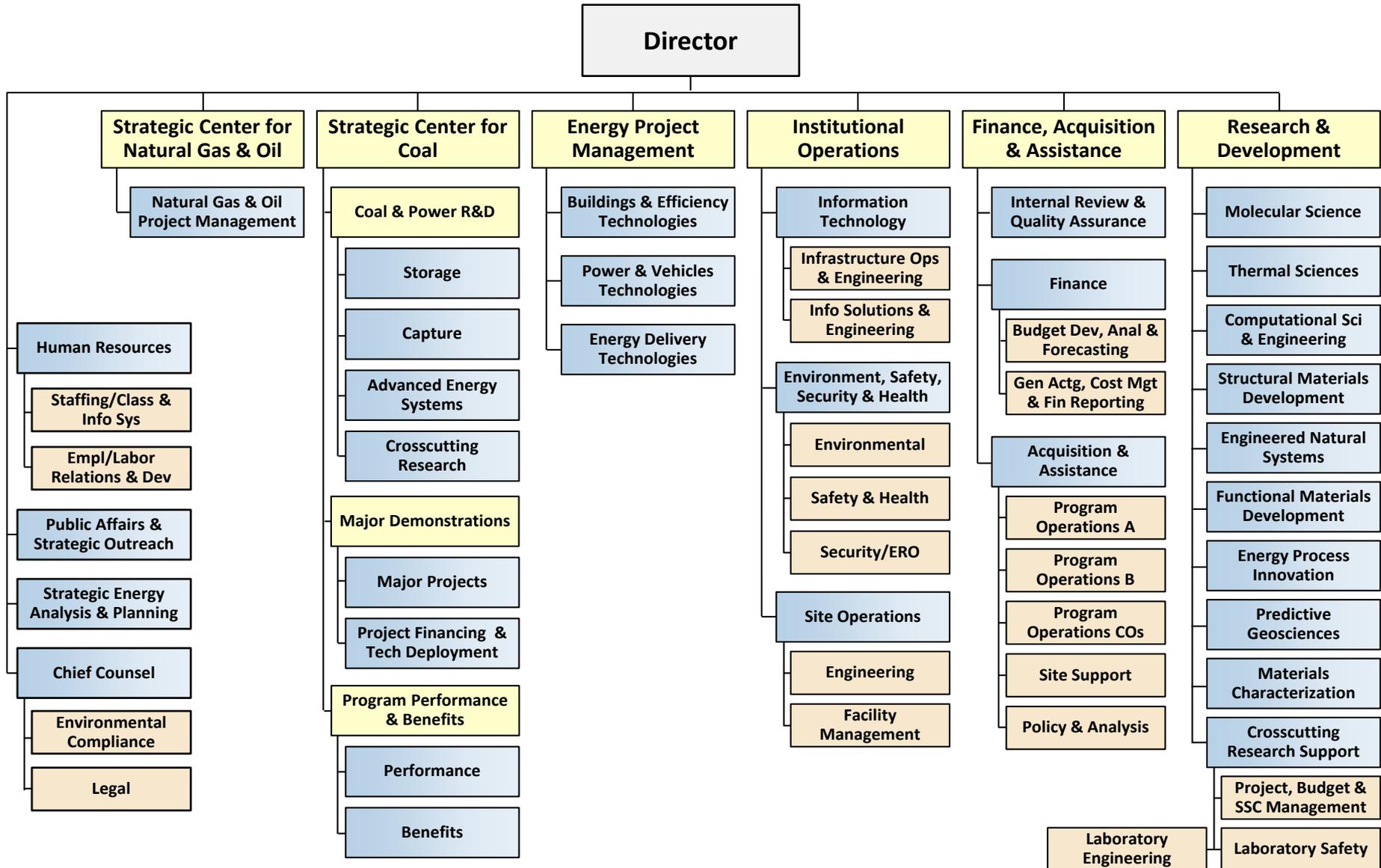
FY 2013



U.S. Department of Energy

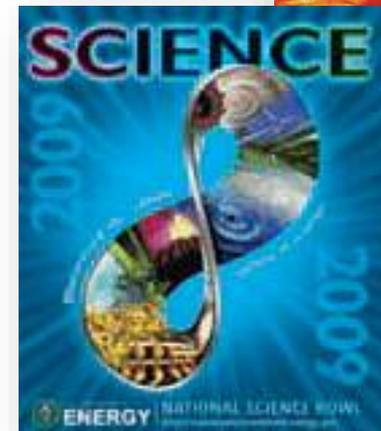


National Energy Technology Laboratory



Focus on Education

- 500 extramural projects with academic institutions
- 50 intramural projects, 100 academic collaborators
- 65 research associates
- **Community initiatives**
 - Speakers' bureau
 - Donation of computers & equipment
 - Science Bowl
 - Education webpage
 - Job shadowing for high school students
 - Laboratory tours
 - Science training for K-12 teachers
 - Minority mentoring
 - Teaming
 - National Geographic JASON project

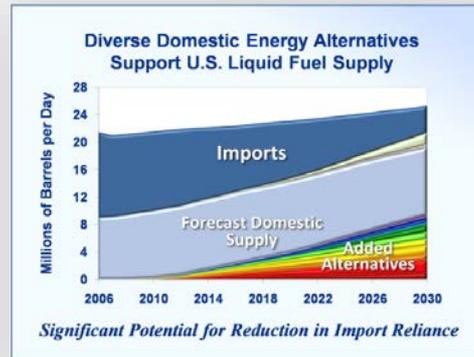


NETL Applies Basic Science to Technology Development, Demonstration, and Transfer

Onsite Research and Development



Systems, Analysis, and Planning



Extramural Research and Collaboration



Developing the critical science and technology to discover and commercialize advanced energy systems that efficiently utilize domestic resources in an environmentally sustainable manner

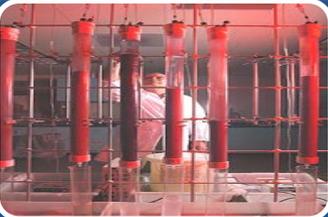
Office of Research and Development

Innovating Energy Technologies



Computational & Basic Sciences

- Integrate computation with experimental research
- Model from atomic- to device- to facility-scale



Geological & Environmental Sciences

- Investigate clean power generation and gas & oil technologies
- Enhance proven, unconventional, new, and renewable resources



Materials Science & Engineering

- Seek new and improved materials
- Design and fabricate metals, alloys, and ceramics



Energy Systems Dynamics

- Conceive and develop pre-commercial technologies
- Improve in-plant devices and processes

Establishing Strong National Laboratory Research Alliances

Carbon Capture Simulation Initiative (CCSI)



Identify Promising Concepts

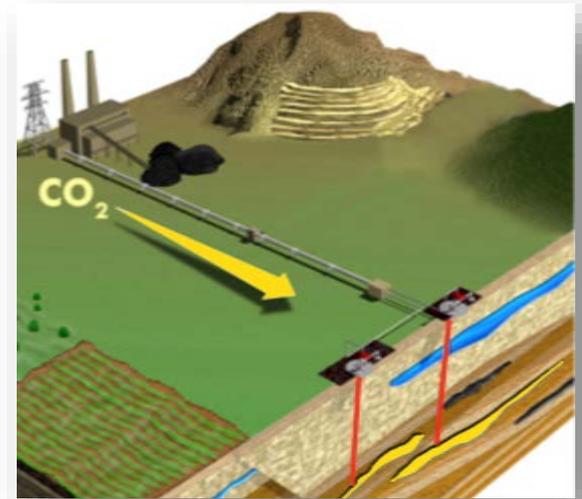


Develop Optimal Designs



Quantify Technical Risk in Scale-up

National Risk Assessment Partnership (NRAP)



Lawrence Berkeley
National Laboratory



Lawrence Livermore
National Laboratory



Pacific Northwest
NATIONAL LABORATORY

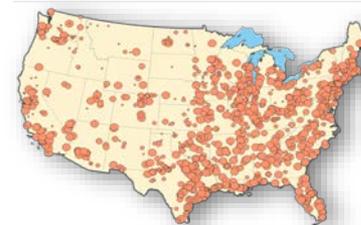
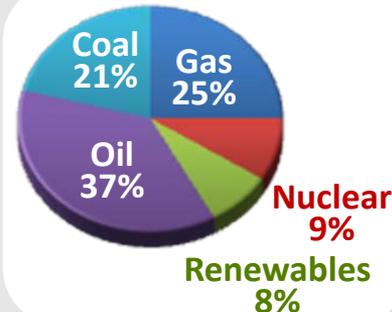
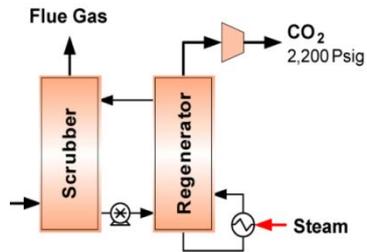
Accelerate Learning During Development & Deployment



Systems, Analyses, and Planning

Informing Energy Policy Development & Technology Deployment

Analyses



Technologies

Benefits

Situations & Trends

Integrated Electric Power Systems

Drivers

- Technology evaluation
- Process & cost engineering
- R&D targets

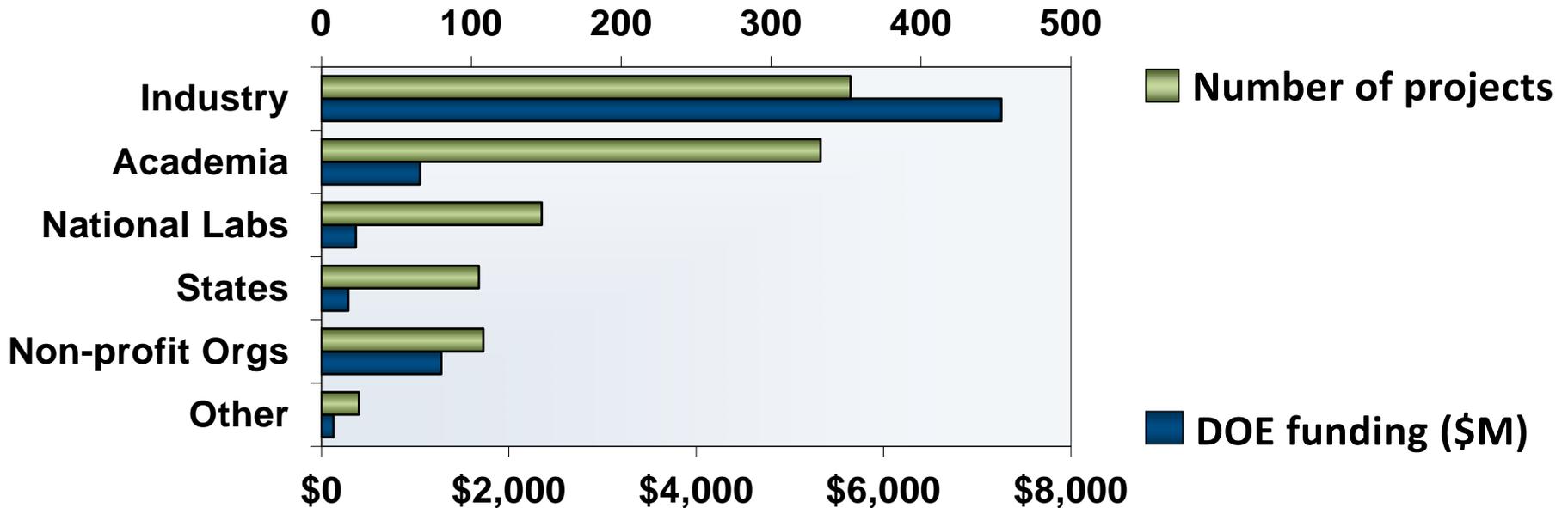
- Policy scenarios
- Market deployments
- National benefits of R&D

- Current conditions
- Future scenarios

- Cost of electricity
- System design & integration

NETL's Overall Portfolio of Responsibility

- Nearly 1,100 activities nationwide
- Total award value more than \$23 billion
- Private sector cost-sharing nearly \$13 billion



NETL Program Areas

Strategic Center for Coal



Strategic Center for Natural Gas and Oil



Energy Project Management



Strategic Center for Coal

Critical R&D Challenges to Near-Zero Emissions from Coal

Near-Term Plants

Pulverized Coal

Power generation

Improve efficiencies

Minimize criteria pollutants

Minimize water usage

Minimize greenhouse gases

Future Plants

Advanced Coal

Power and multiple products

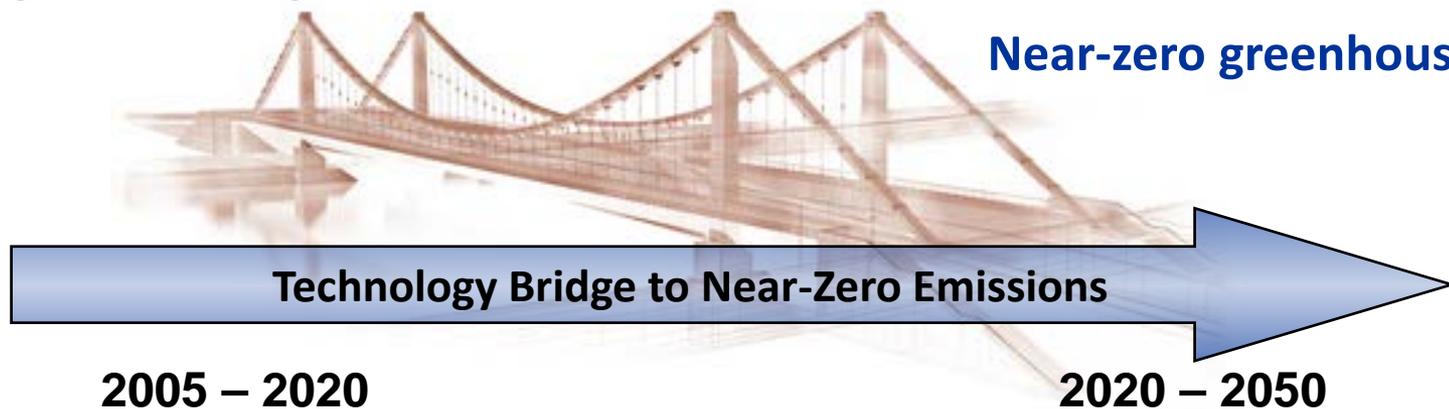
Improve reliability

Maximize efficiencies

Near-zero criteria pollutants

Near-zero water usage

Near-zero greenhouse gases



Strategic Center for Natural Gas and Oil

Advancing Technologies Supporting Development of Domestic Unconventional Resources



Tens of billions of barrels of residual oil recoverable via CO₂ enhanced oil recovery in mature fields in 22 states



Potentially thousands of trillion cubic feet of natural gas from methane hydrate in Alaska and the Gulf of Mexico



Hundreds of trillion cubic feet of natural gas in shales and tight gas sands across the country

Energy Project Management

NETL Expertise Used to Help Other Government Organizations

- **Non-FE extramural RD&D**
- **Helping to implement other DOE, government programs for 25+ years**
 - Office of Engineering and Construction Management
 - Environmental Management
 - Legacy Management
 - Department of Homeland Security
 - Department of Defense
- **Technical, administrative, and project management support**
 - Documented procedures, policies
 - Disciplined process with tracking
- **Implementation activities**
 - Acquisition (contracts)
 - Financial assistance (can only be awarded by Federal personnel)

Electricity Delivery & Energy Reliability

- *Grid modernization*
- *Reliable & secure energy supplies*
- *Disaster response*



Energy Efficiency & Renewable Energy

- *Vehicle Technologies*
- *Solid State Lighting*
- *Advanced Manufacturing*



Return on Investment from Fossil Energy R&D



FE RESEARCH — THE RETURN ON INVESTMENT

<i>\$111 billion in benefits¹</i>	<i>37 million tons of avoided SO₂, 16 million tons of avoided NO_x¹</i>	<i>1.2 million jobs created¹</i>	<i>40-fold increase in shale gas production since 1990²</i>	<i>10-fold increase in EOR using CO₂ injection since 1980³</i>	<i>50–75% cost reduction in mercury control at coal-fired power plants⁴</i>
<i>\$13 return for every \$1 invested¹</i>		<i>Thousands of researchers trained</i>			
<i>2000–2020</i>	<i>2000–2020</i>	<i>2000–2020</i>	<i>2000–2011</i>	<i>1985–2010</i>	<i>2000–2008</i>
<i>Clean Coal Program</i>	<i>Clean Coal Program</i>	<i>Clean Coal Program</i>	<i>Natural Gas & Petroleum Technologies Program</i>	<i>Natural Gas & Petroleum Technologies Program</i>	<i>Mercury Control Program</i>

¹Bezdek, R., Wendling, R., *The Return on Investment of the Clean Coal Technology Program in the USA*. Energy Policy, Vol. 54, March 2013, pp. 104–112. ²DOE EIA Annual Energy Outlook 2013, Figure 91. ³Oil & Gas Journal, April 5, 1982, Annual Production Report, p. 140; Oil & Gas Journal, April 23, 1990, Annual Production Report, p. 52; Oil & Gas Journal, March 20, 2000, 2000 Worldwide EOR Survey, p. 42.

⁴http://www.netl.doe.gov/technologies/coalpower/ewr/mercury/pubs/NETLHgR_Darticlefuelprocessingnov09.pdf.

Return on Investment from Fossil Energy R&D



FE RESEARCH — THE RETURN ON INVESTMENT

16 million tons of avoided NO_x emissions 2000–2020¹

1.2 million jobs created 2000–2020¹

\$111 billion in benefits 2000–2020¹

650 U.S. fossil energy patents 1976–2013⁴

58 GW of mercury-control technology installed²

\$1.9 trillion in health benefits⁵

37 million tons of avoided SO₂ emissions 2000–2020¹

Thousands of scientists and engineers trained

\$13 return for every \$1 invested¹

148 GW projected by 2015³

FE research contributes to EPA-estimated health benefits from reduced pollution 1990–2020



¹Bezdek, R., Wendling, R., The Return on Investment of the Clean Coal Technology Program in the USA. Energy Policy, Vol. 54, March 2013, pp. 104–112. ²Institute of Clean Air Companies, http://www.icac.com/?page=Mercury_Controls, Updated Commercial Hg Control Technology Bookings (October 2011), accessed 08/21/13. ³EPA Base Case, IPM analysis of EGU GHG NSPS, downloaded from http://www.epa.gov/airmarkets/progsregs/epa-ipm/proposedEGU_GHG_NSPS.html, 08/21/13. ⁴USPTO online search 08/29/13 on ABST/("fossil fuel*" OR coal OR oil OR petroleum OR "natural gas" OR methane OR hydrate) AND (electric* OR energy OR power OR generat* OR turbine) AND (AN/"department of energy" OR GOVT/"department of energy"). ⁵The Benefits and Costs of the Clean Air Act from 1990 to 2020, U.S. EPA Office of Air and Radiation, March 2011.

Notable Program Successes

Advanced Pollution Controls

- Installed on 75% of U.S. coal plants
- 1/2 to 1/10 cost of older systems

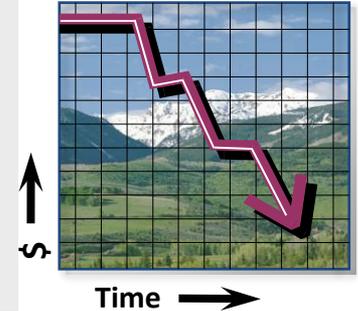
*Flue Gas
Desulfurization
(FGD) Scrubbers*



Low-NOx Burners

HAPs/Mercury Control

- Reduced cost by 50–70% while achieving 80–90%+ Hg capture
- Developed technology (e.g., ACI) commercially deployed on today's power plants



Advanced Coal Power Systems

- World's largest circulating fluidized bed combustion (CFBC) power plant
- Two "super-clean" coal-based integrated gasification combined cycle (IGCC)



Wabash IGCC



Jacksonville Electric CFBC



Tampa IGCC

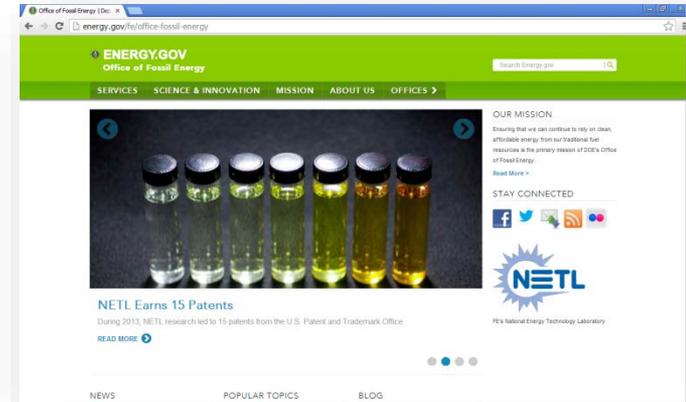
For More Information

NETL Customer Service

1-800-553-7681



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Office of Fossil Energy
energy.gov/fe/office-fossil-energy

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