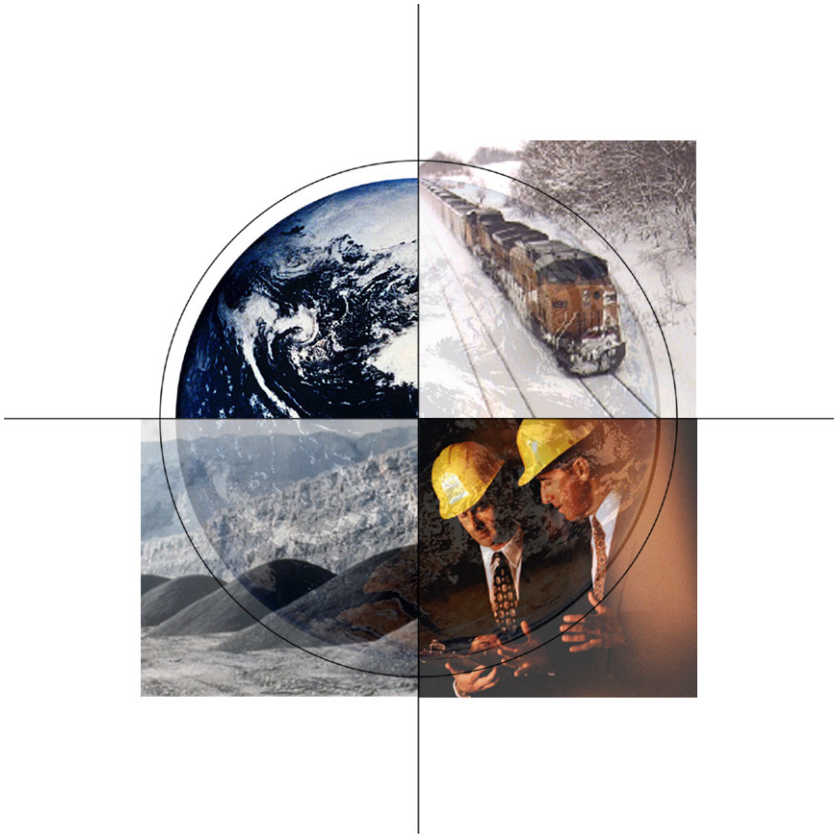
National Energy Technology Laboratory



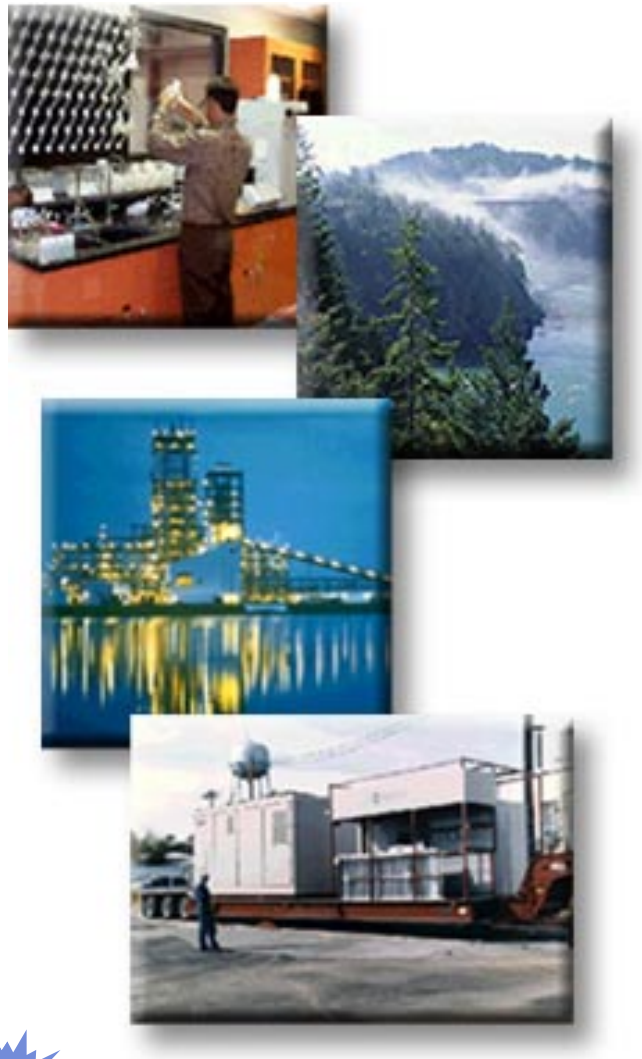
Overview of NETL and Selected Energy Technologies

Powered for the Future

NETL- Morgantown, WV
January 17, 2002

Lawrence A. Ruth, Office of Coal and Environmental Systems
National Energy Technology Laboratory

What We Are



- One of DOE's 15 national laboratories
- Government owned and operated
- Sites in Oklahoma, Pennsylvania, and West Virginia
- Over 1,100 federal and support contractor employees
- FY01 budget of $774 million

Our Mission

- **Resolve the environmental, supply, and reliability constraints of producing and using fossil resources to provide Americans with a stronger economy, healthier environment, and more secure future**
- **Support development and deployment of environmental technologies that reduce the cost and risk of remediating DOE's weapons complex**
- **Contribute to best business practices and energy policy development**

NETL's Five RD&D Areas

Electric Power Using Coal
Mining to Light Switch

Energy Policy Support
A Key Issue in Use of Fossil Energy

Strategic Center for Natural Gas
Borehole to Burner Tip

Clean Fuels

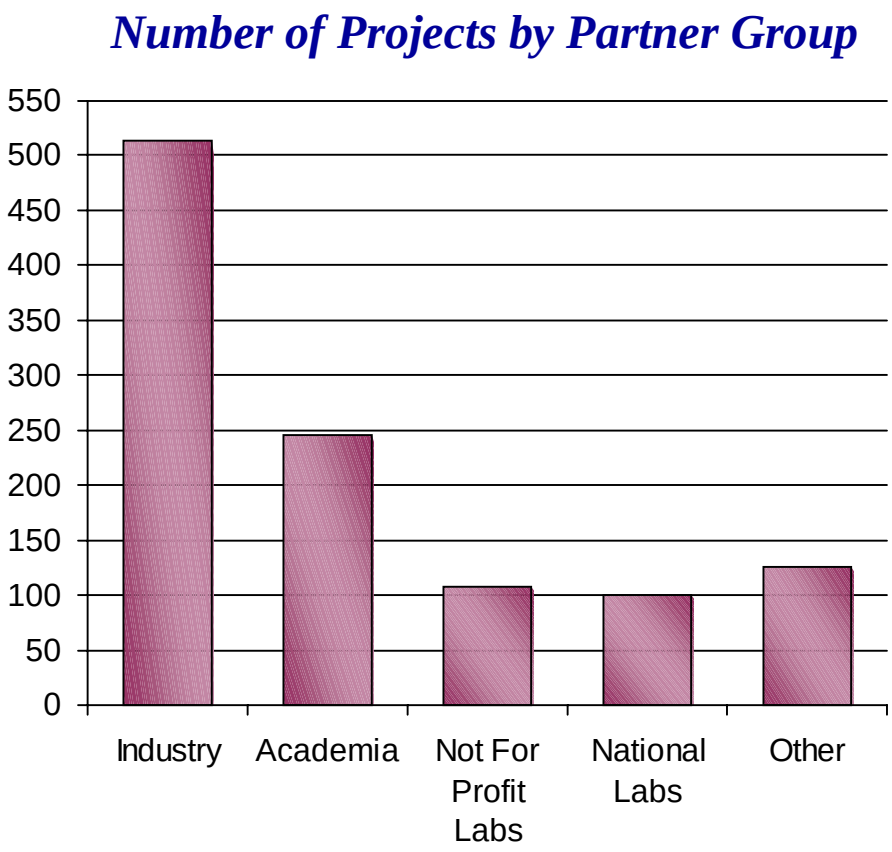
Oil Supply NPTO

Fuels from Coal and Gas
Supply and Delivery of Clean Fuels for Transportation/ Other End Use Sectors

Environmental Management/Defense Programs
Supporting DOE

Shape, Fund, and Manage Extramural RD&D

- **1,100 research activities in all 50 states and 26 countries**
- **Total award value of $7.9 billion**
- **Private sector cost sharing of $4.0 billion**
  - Leverages DOE funding
  - Ensures relevance
  - Mission accomplishment only through commercialization
- **53 active MOU's and MOA's**



Conduct On Site Science and Technology Research

- **Four Focus Areas and two technology clusters**
- **Involves 1/3 of staff**
- **31 CRADA's**
- **Research laboratories at Morgantown and Pittsburgh**

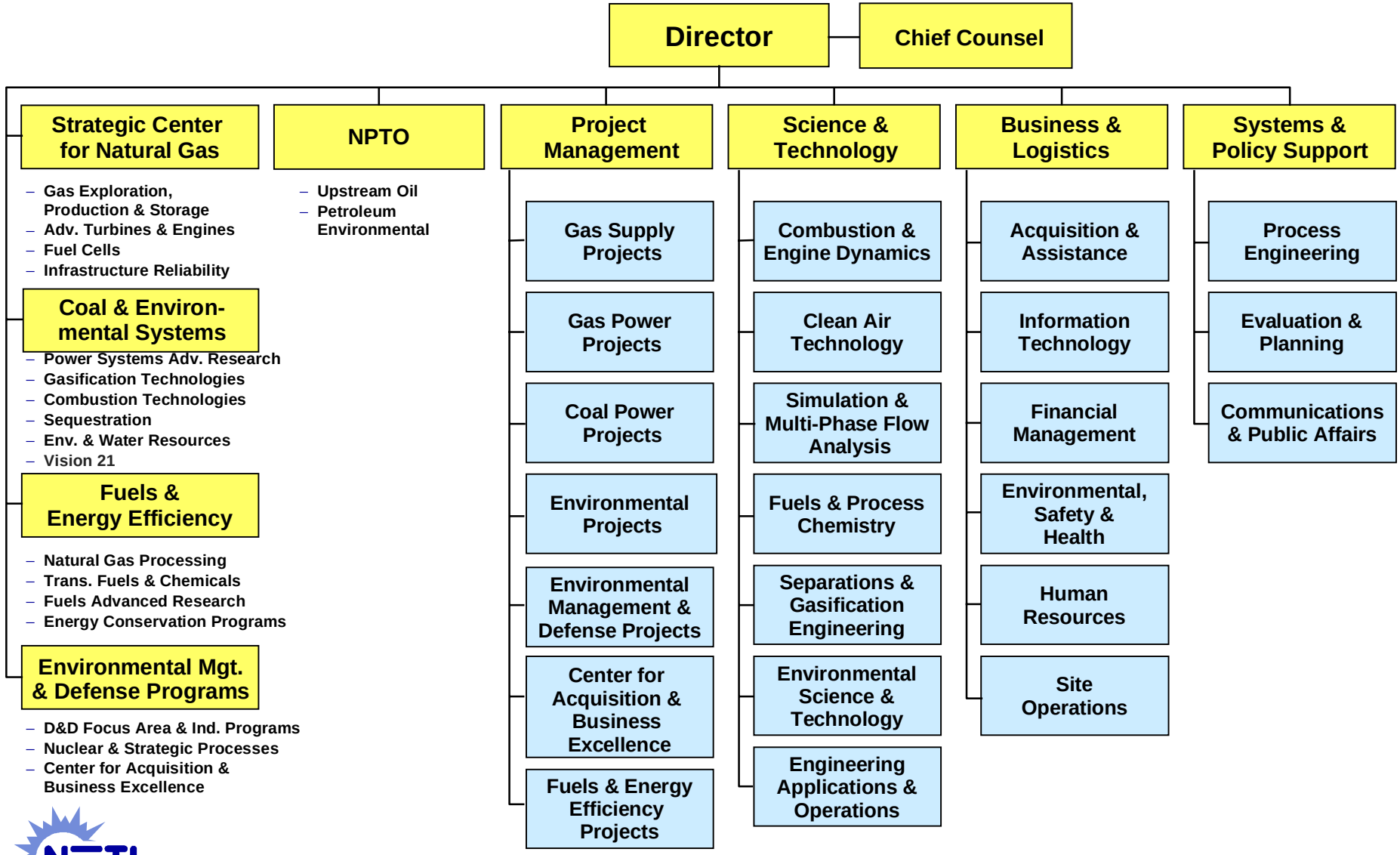
Carbon Sequestration Science
Safe, long-term storage of CO_2

Ultra-Clean Fuels
Clean, high-efficiency transportation systems

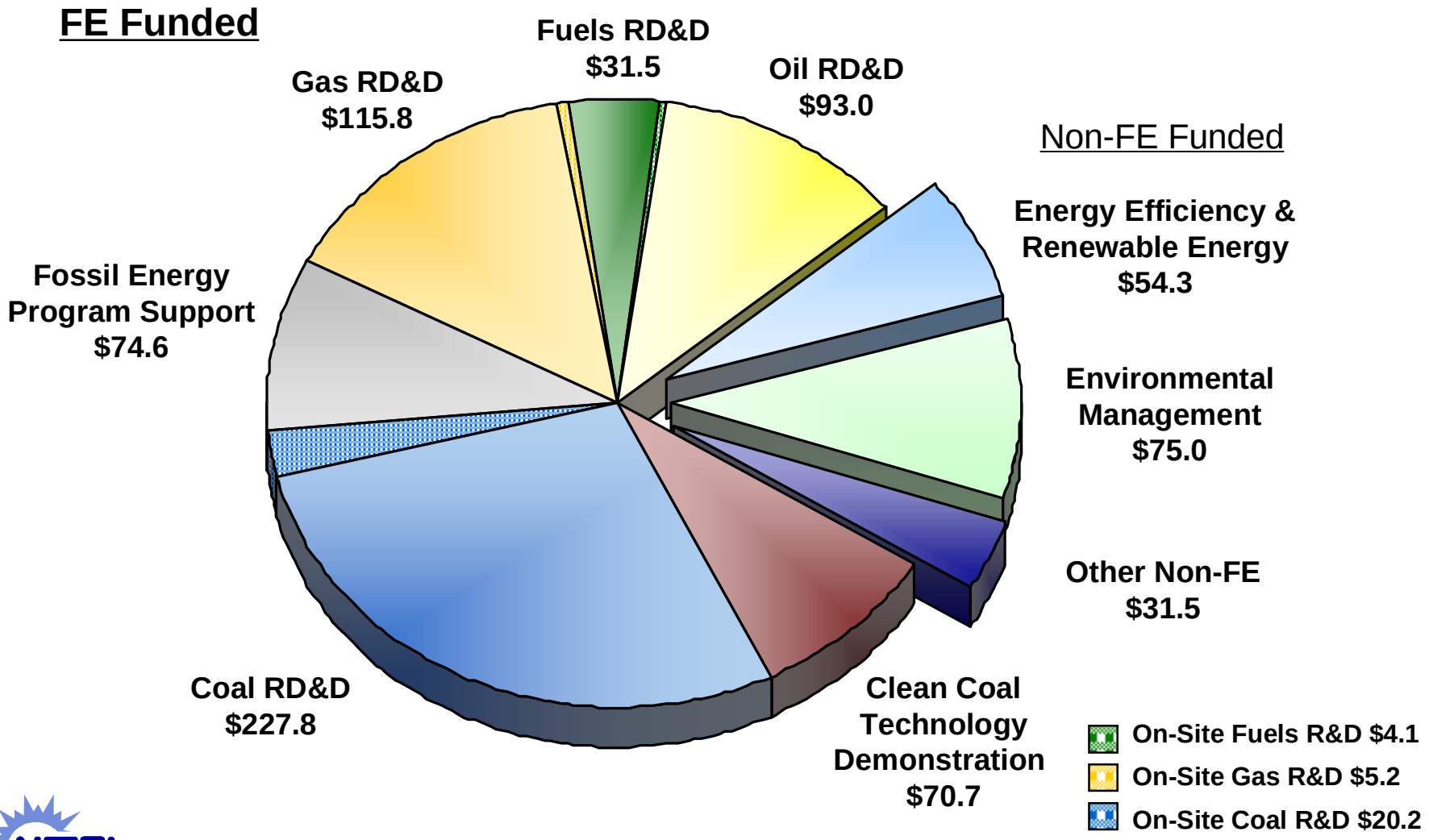
Gas Energy Systems Dynamics
Gas-fueled power generation systems

Computational Energy Science
Virtual simulations of energy plants of the future

NETL Organizational Chart

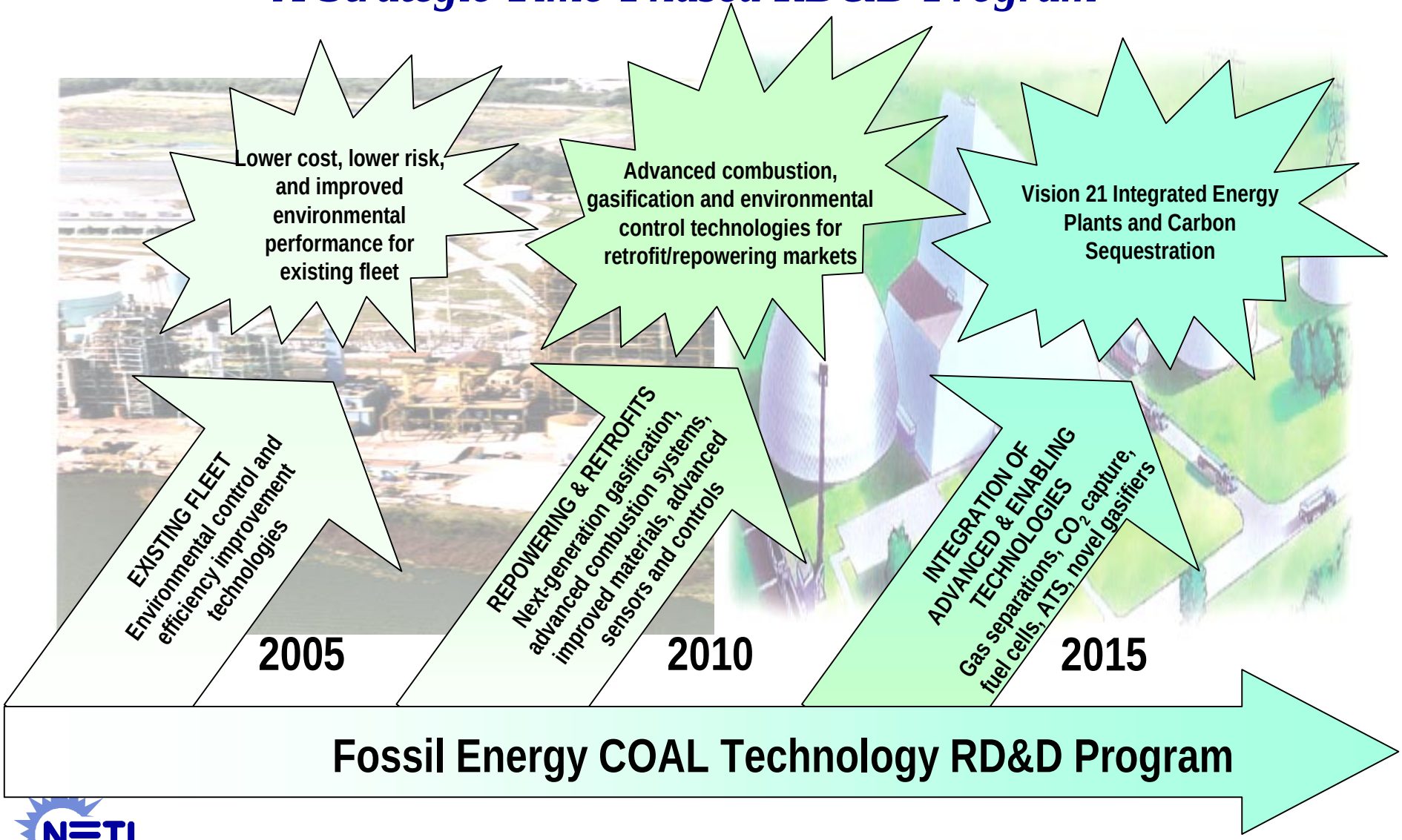


NETL FY01 Budget
($774.2 Million)



Coal-Based Power Technologies

A Strategic Time-Phased RD&D Program



Environment and Water Programs

Addressing near-term power market needs

Mission

- Provide environmental products and services to ensure low-cost, environmentally sound coal-based electric power and maintain U.S. leadership in export of electric-power generation technology and services

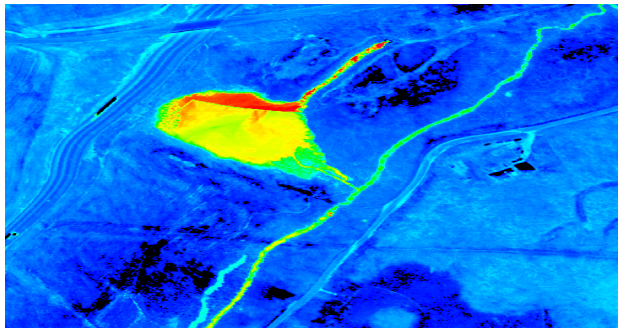
Near-term Emphasis

- Ultra-Low NOx burner pilot tests
- Mercury removal field tests
- Ambient air monitoring
- Combustion byproduct evaluations for mercury
- Policy support (mercury, multi-pollutant control, water)
- Technology feed for CCPI

Ambient Monitoring

Emissions Characterization

Emissions Control Technology



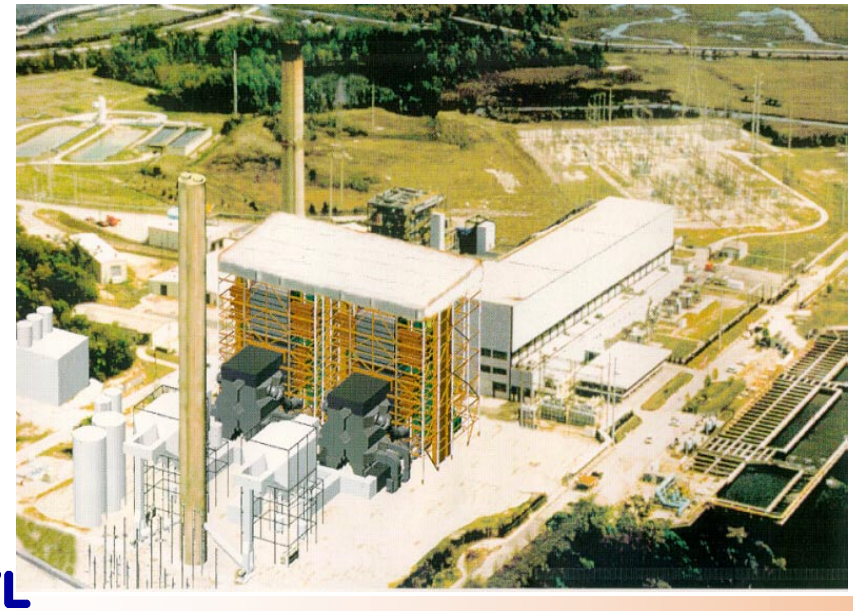
NETL Watershed Characterization

Combustion Systems

Technology for Existing and New Plants

Mission

- Promote development and commercialization of advanced clean, efficient, and affordable, coal-fired generation technologies for new and existing utility, industrial, and commercial markets



JEA CFB

Near-term Emphasis

- Complete HIPPS and transition IFC effort to combustion/gasification hybrid technology
- Vision 21 R&D (advanced materials and filters)
- Capitol power plant design
- Support CCT fluid bed demonstrations
- Strong international market opportunities; outreach

Gasification Systems

Core technology

Mission

- Foster commercialization of gasification-based processes that convert low-cost carbon-based feedstocks to combinations of electricity, steam, fuels, chemicals, and hydrogen

Tampa Electric Co. IGCC Polk Power Station

Near-term Emphasis

- Improved gasification and clean-up processes for integration with advanced power generation technologies (ATS, fuel cells) and fuel conversion systems
- Life testing of O_2 membrane modules
- Co-production design optimization
- Complete industry interviews-adjust technology roadmap

Advanced Research - Power Systems

Ingenuity, innovation and implementation

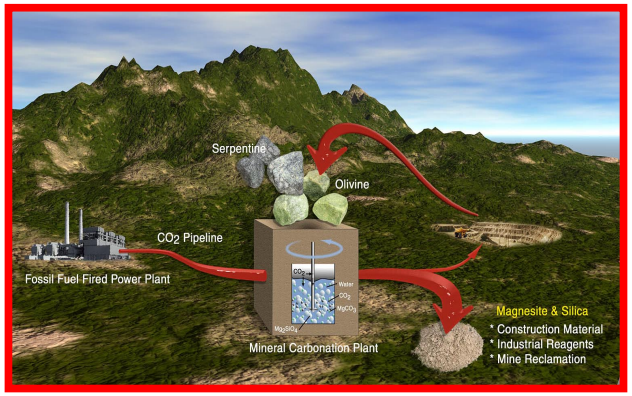
Mission

- Extend state of knowledge in fossil energy technology by supporting development and deployment of innovative systems capable of improving efficiency and environmental performance while reducing costs

Near-term Emphasis

- Advanced materials program development
- Virtual simulation for Vision 21 plants
- CO_2 mineral sequestration
- Bio-process research (sequestration, hydrogen)
- Sensors and controls
- Align UCR to Vision 21 support

Advanced materials consortium for ultra-supercritical power plants - NETL/ORNL/EPRI/CURC



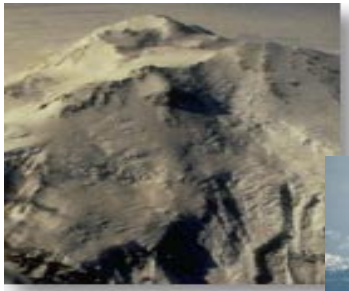
Mineral carbonation- NETL /Albany Research Center/LANL/ASU

Carbon Sequestration

Technology for a carbon constrained world

Mission

- Provide technology options that will allow for the continued use of fossil fuels for energy production and address stabilization of atmospheric carbon dioxide levels



Unmineable coal seams

Deep Ocean Injection

Near-term Emphasis

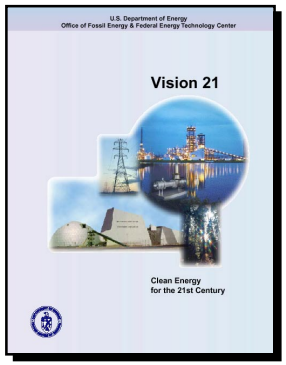
- Initiate experiments to sequester CO_2 in depleted oil and gas fields
- Host First National Conference on Carbon Sequestration (Washington DC May 14-17, 2001)
- Complete GHG Round 2 awards and down-select Novel Concepts projects
- Analyze multi-pollutant control approaches
- Establish NETL In-house Focus Area
- Conduct ocean sequestration field test

The Vision

Effectively remove, at affordable costs, environmental concerns associated with fossil fuel use for producing electricity and transportation fuels

Vision 21 Is Crosscutting Program

VISION 21
Modular Technology



INPUT

Feedstocks

Fossil
- Coal
- Gas
- Oil

Opportunity Feedstocks
- Biomass
- Mun waste
- Petcoke

<--------Systems Integration--------->

Modules — Combustion/ Gasification

Modules — Gas Cleanup

Modules — High-Temp Heat Exch.

Modules — Power

Modules — Gas Separation

Modules — Fuels/ Chemicals

OUTPUT

Electricity

Chemicals

Transportation Fuels

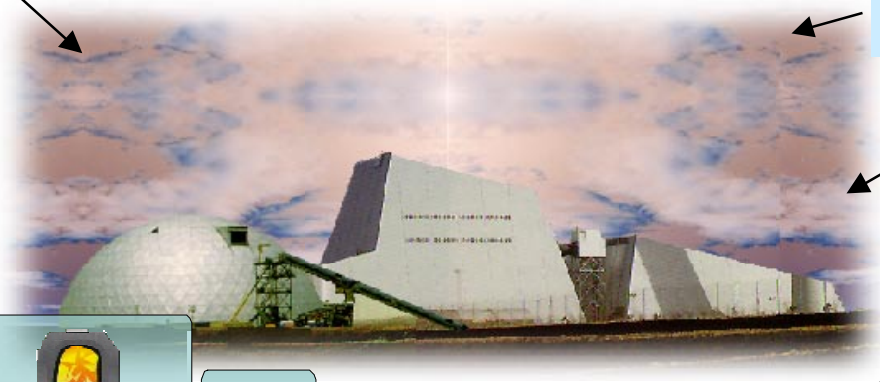
Syngas

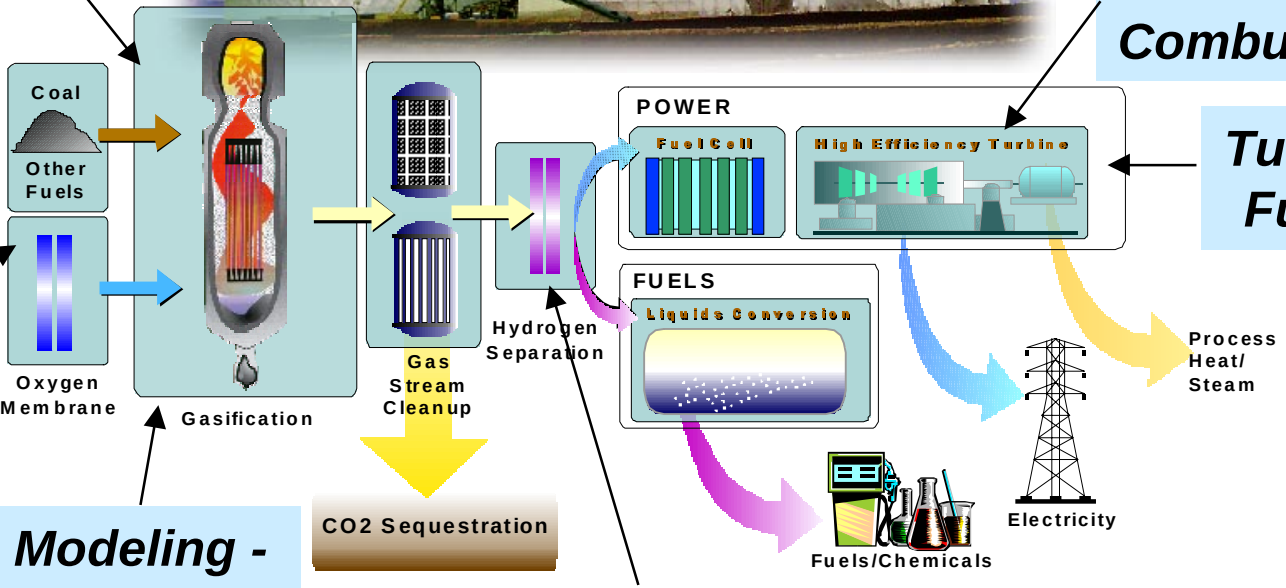
Hydrogen

Steam

Vision 21 Program

New Projects Contribute to the Ultra-Clean Energy Plant





Virtual Simulation

Systems Integration

Gasification & Combustion

Advanced Materials

Modeling - Combustion

Turbines & Fuel Cells

Oxygen Membrane

Modeling - Gas/Particle Flow

Hydrogen Membrane

High-Temperature Materials

Huntington Alloys
(Huntington, WV)

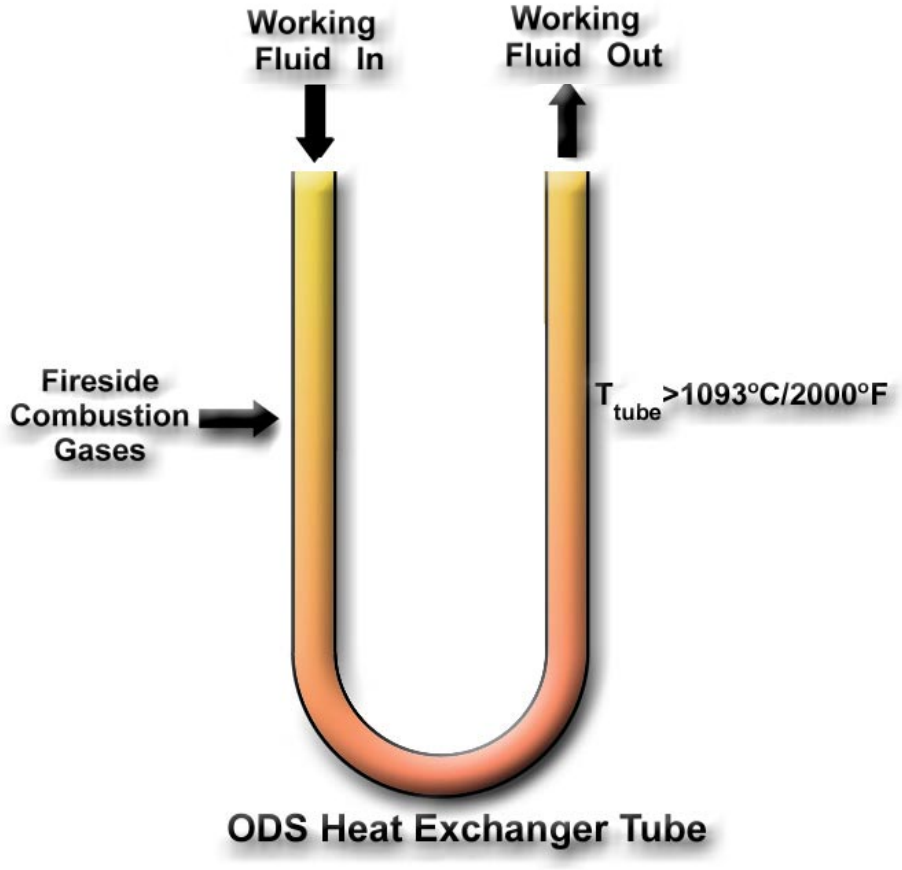
Foster Wheeler Development Corp.
(Livingston, NJ)

ORNL (Oak Ridge, TN)

University of California at San Diego

Michigan Technological University
(Houghton, MI)

Edison Welding Institute
(Columbus, OH)



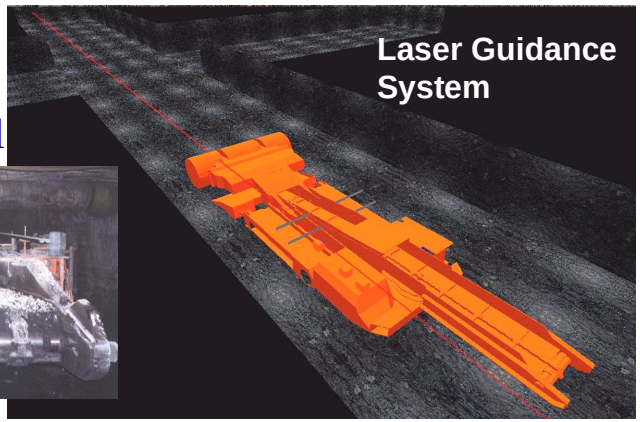
Stronger, corrosion-resistant, high-temperature oxide dispersion strengthened alloys for Vision 21 heat exchangers

DOE EE-OIT Mining Industry of the Future

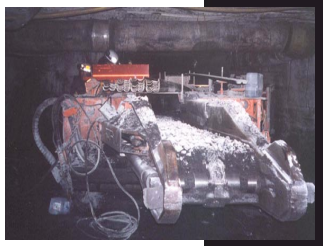
Everything Begins with Mining

Mission

- Mining is part of EE/OIT Industries of the Future Program- Goal; energy efficiency improvement in key US industries
- Encompass hard rock and coal mining sectors (NMA is sponsor)
- Couple research capabilities at National Labs with Industry needs and partners



INEEL/CMU/Consol

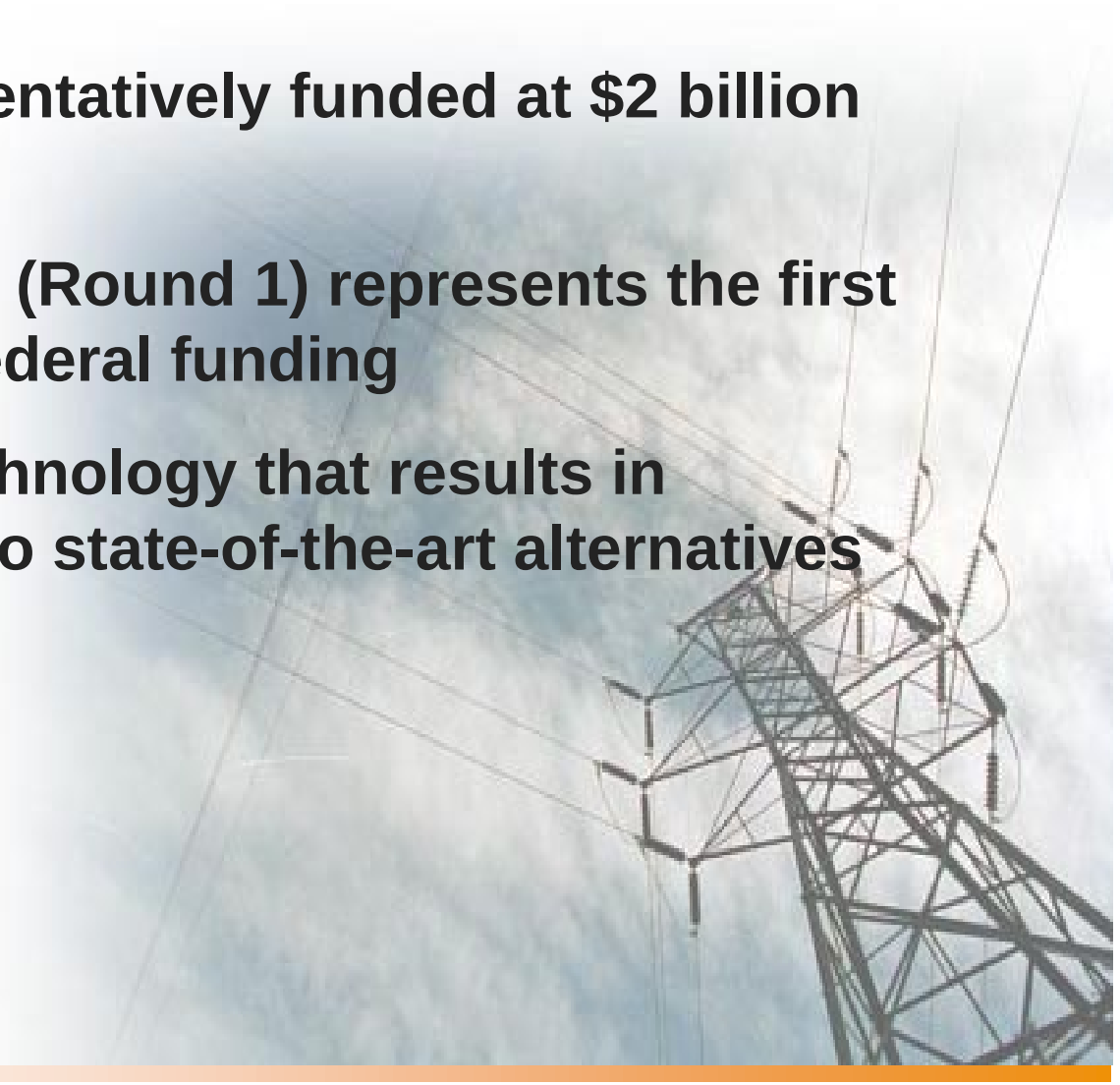


Program Activity

- 10 on-going National Lab led “cross-cutting technology” projects
- 16 new industry led crosscutting projects-15 awarded (April) 1 remaining
- New solicitation for “mineral processing technologies”--21 Lab led proposals reviewed-awards awaiting FY 2002 budget resolution
- $3.7 million appropriated in FY 2001
- NETL supports EE/OIT in program implementation

Clean Coal Power Initiative (CCPI)

- **Total program tentatively funded at $2 billion over 10 years**
- **This solicitation (Round 1) represents the first installment of federal funding**
- **Open to any technology that results in advancements to state-of-the-art alternatives**
  - Efficiency
  - Environmental
  - Economic



Fossil Energy Research Program Solicitations

- **Financial Assistance - Cooperative Agreements**
- **Awards**
  - Typically $100,000 - $1.5 million
  - Typically 2 to 3 years duration
- **Pre-applications required**
- **Many research areas of interest**
- **Solicitations typically issued November -- December timeframe**
- **Watch www.netl.doe.gov/business/**

Cooperative Research and Development Agreements

- **What is a CRADA?**
  - Joint research between private parties & NETL
  - Work that is mutually beneficial to each party
  - Each party supplies its own resources (may include personnel, equipment, facilities)
  - Participant dollars may be used to fund portions of NETL's effort
  - NETL may not use Federal dollars to support the participant's share of the work

Cooperative Research and Development Agreements

- **How do You Initiate a CRADA with NETL?**
  - Contact Diane Newlon, Technology Transfer Program Manager [Newlon@netl.doe.gov] telephone: 304/285-4086
  - Provide written expression of interest, defining a potential project, needed resources, etc.
  - Discuss idea with Diane and NETL technical expert
  - Obtain NETL Director approval
  - Negotiation process begins

Small Business Innovative Research
Small Business Technology Transfer Programs

- **The Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs make competitive grants to small businesses for technology-oriented research projects that crosscut all fossil energy areas.**

Small Business Innovative Research
Key Contacts

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Project Manager/SBIR Coordinator

National Energy

Technology Laboratory

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Doing Business with NETL
www.netl.doe.gov/business/index.html