

U.S. DOE Office of Fossil Energy Advanced Research Program Introduction

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Sensors and Controls Workshop
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Secretary of Energy's Strategic Objectives

- The Advanced Research portfolio of programs provide a bridge between basic research and the development and deployment of highly efficient environmentally benign power and energy production systems.
- It provides a means by which advanced concepts are transformed into future working technologies. It is crosscutting in nature and supports all key Fossil Energy elements including reducing greenhouse gases emissions and carbon capture and storage systems.



Fossil Energy Program Focus

- **Climate Change Mitigation Solutions with Fossil Fuels through deployment of affordable and effective Near Zero Emissions Technologies**
- **National Security (energy, economic, environmental, and defense) with strategic safeguards on fossil energy reserves and supplies while reducing reliance on imported energy.**



Office of Fossil Energy

Programmatic Goal & Institutional Goal

Cut Carbon Emissions – Technology for 2020 deployment

Make less – develop much more efficient generating and conversion technologies that integrate with Carbon Capture & Storage.

Capture what's left – develop low cost, low energy consuming capture technologies for both existing and new fossil power and industrial sources

Store it safely – prove the safe, permanent, and verifiable geologic storage capacity needed to meet our carbon reduction commitments

A Faster Technology Development Cycle

Know the Roadblock - Identify barriers to rapidly advancing from research to commercial deployment.

Do it Faster - Develop ways to accelerate the processes while maintaining adequate oversight and safeguards.

Learn from Others - Benchmark private sector technology development cycles.



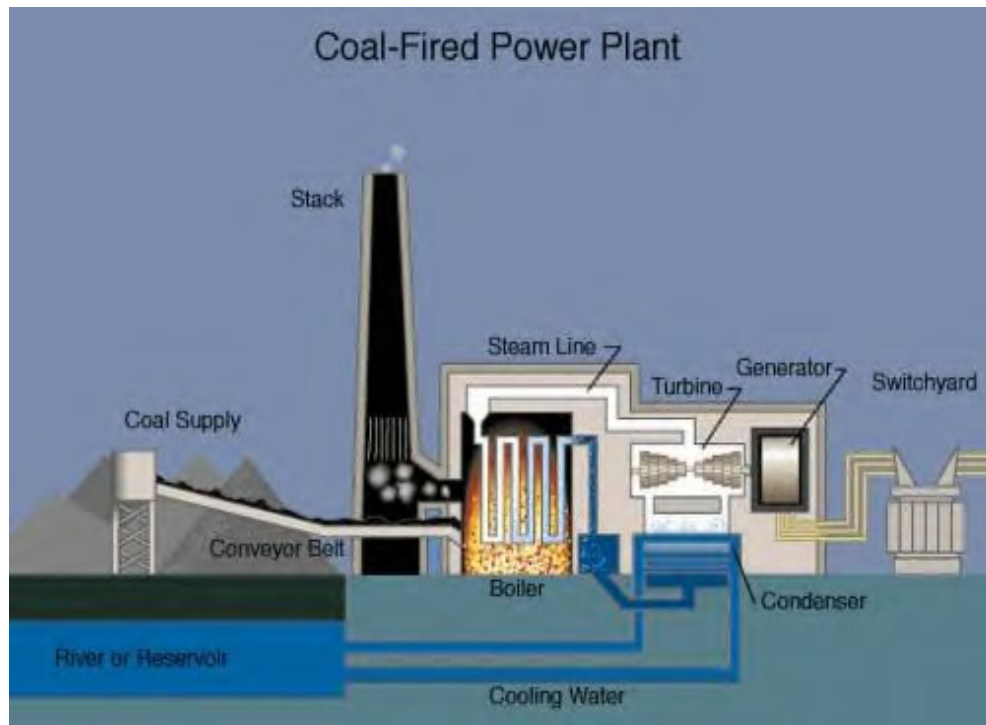
Actions Underway to meet Priorities

Carbon Capture and Storage Research Design Demonstration & Deployment Through Near Zero Emissions Program

- Research focused on validating CO₂ storage (injection, migration and monitoring)
- Develop and demonstrate low cost/energy capture and technologies to increase efficiency to offset Carbon Capture & Storage penalties
- American Recovery and Reinvestment Act (\$3.4B)– focus on early demonstrations of Carbon Capture & Storage technology and Carbon Capture & Storage projects
- Clean Coal Power Initiative & Industrial Carbon Capture and Storage Programs



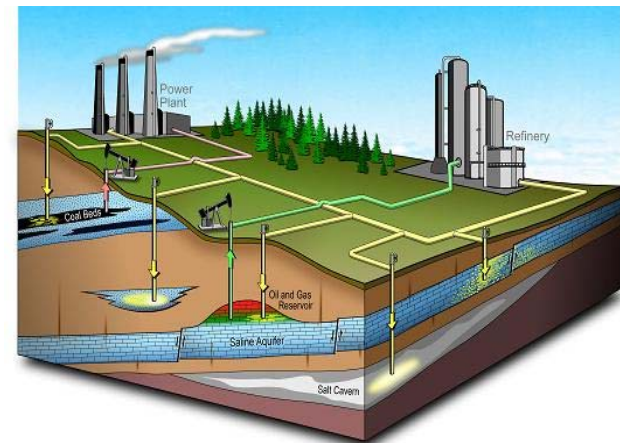
Coal Fired Power Plant



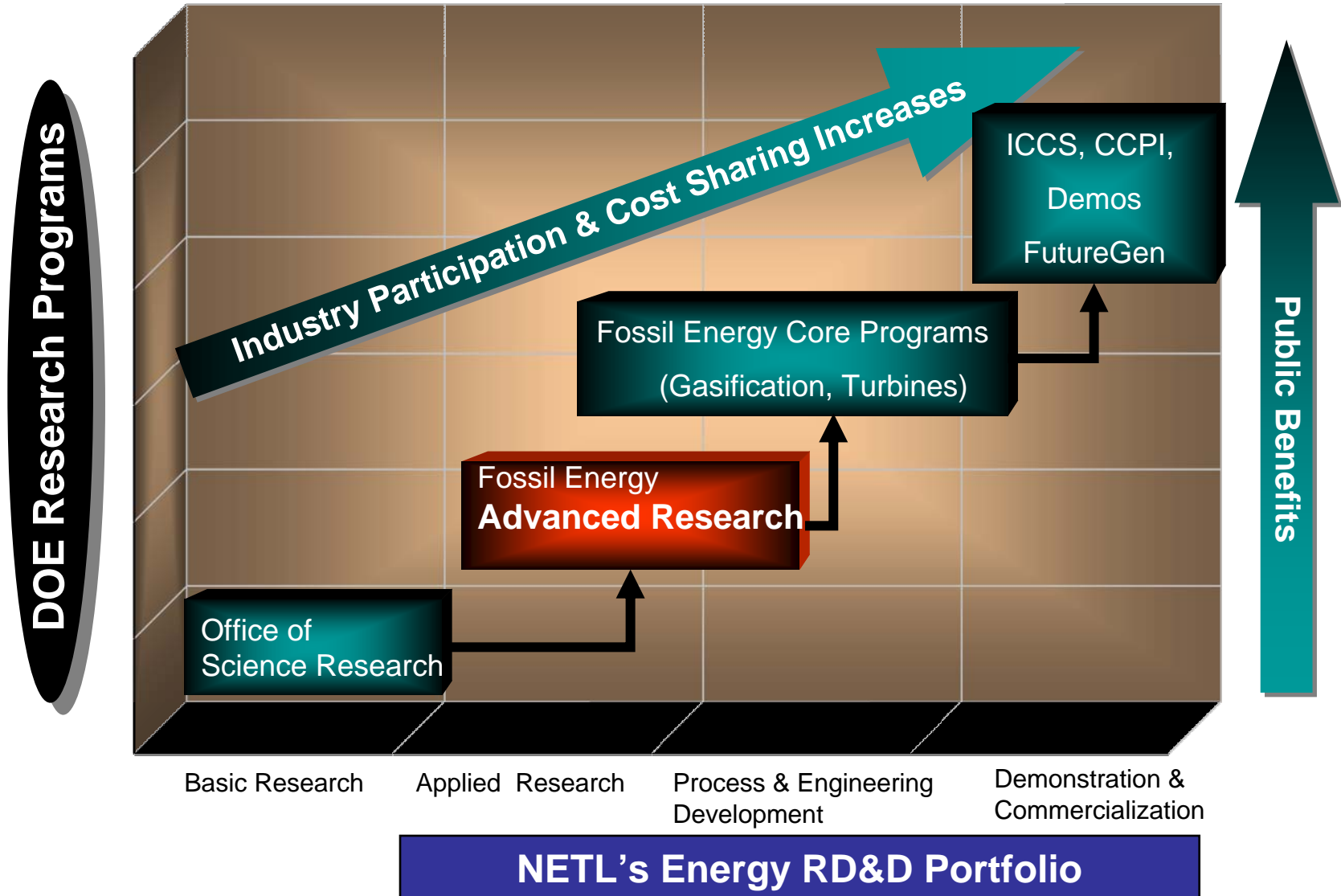
Carbon Sequestration Program Goals

Develop Technology Options That...

- **Deliver technologies & best practices that provide Carbon Capture and Safe Storage (CCSS) with:**
 - 90% CO₂ capture at source
 - 99% storage permanence
 - < 10% increase in Cost of Electricity
 - Pre-combustion capture (Integrated Gasification Combined Cycle)
 - < 35% increase in Cost of Electricity
 - Post-combustion capture
 - Oxy-combustion



Fossil Energy Program Outline



Basic Research

Applied Research

Process & Engineering Development

Demonstration & Commercialization

NETL's Energy RD&D Portfolio



Advanced Research Program

NETL

- **Robert Romanosky**,
Technology Manager
- **Susan Maley**,
Project Manager (Coal Utilization Science)



Identify and execute Research & Development in sensing and advanced process control to enable advancement and availability of key technologies for near zero emission power systems

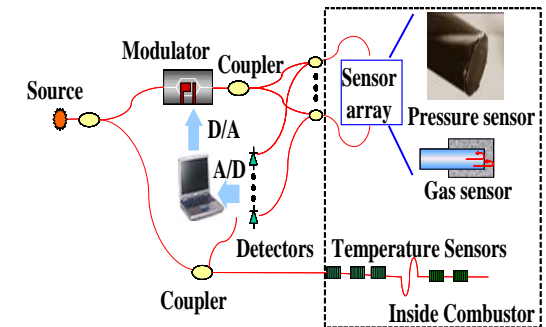
Advanced Research Subprograms

- **Coal Utilization Science (CUS)**



Emphasizes research into instrumentation, sensors, and process control for advanced near zero emission power systems. Has strong modeling, simulation, and visualization components that enable advanced process control development.

- Sensors & Control Innovations
- Computational Systems Dynamics



- **High Performance Materials (MAT)**

Addresses materials requirements for all fossil energy systems, including materials for coal fuels technologies and for advanced power generation technologies.

- High Temperature Materials Research
- Materials for Ultra Supercritical



Advanced Research Subprograms - continued

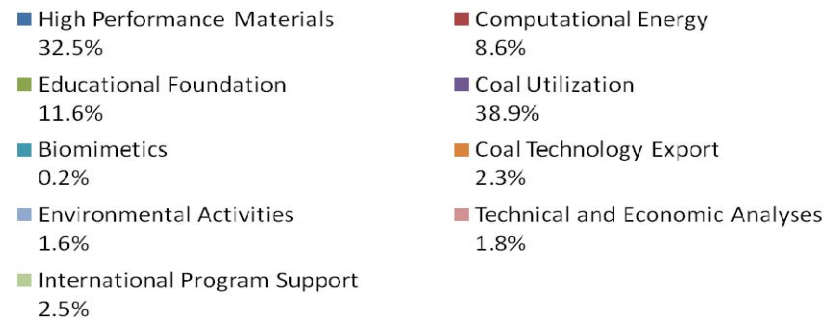
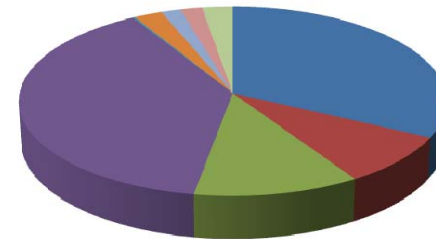
- Computation Energy Science Focus Area (CES)
 - Provides simulation and computational resources to FE programs that will speed the development and reduce the costs associated with advanced power system design and performance modeling
- University Coal Research (UCR) and Historically Black Colleges & Universities (HBCU)
 - Trains the next generation of scientists and engineers to maintain America's status as a world leader in coal research.
- Headquarters administered subprograms
 - Coal Technology Export, Environmental Activities, Technical and Economic Analysis, and International Program Support



Advanced Research Program

Program	FY09	FY10	FY11
High Performance Materials	7,735	9,100	9,100
Computational Energy Science	3,000	2,400	2,400
Educational Programs	3,226	3,250	3,250
Coal Utilization Science	10,913	10,900	10,900
Biomimetics	-	50	-
Coal Technology Export	750	650	650
Environmental Activities	700	450	450
Technical and Economic Analyses	900	500	500
International Program Support	776	700	700
	28,000	28,000	28,000

FY10 % Budget Allocations



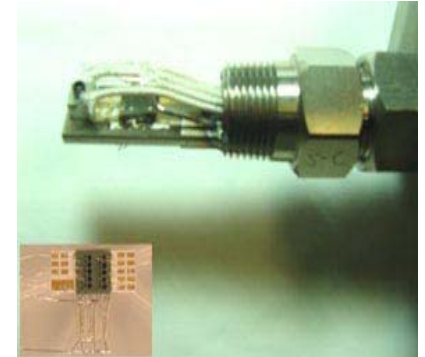
Why Sensors and Controls

- **Fossil energy is critical to U.S. economy: 85% of energy use in the U.S. is supplied by fossil fuels; 53% of electric power is generated by coal.**
- **Concerns on global climate change requires significantly higher efficiency and substantially lower carbon emissions.**
- **Environmental concerns mandate higher reductions in pollutant emissions.**

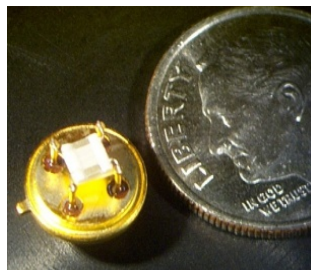
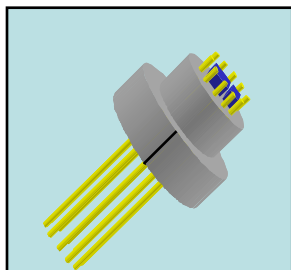
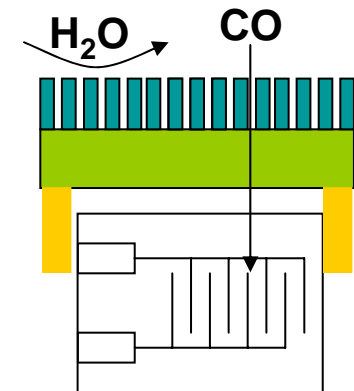


Sensors and Controls

Will improve reliability, enhance efficiency, reduce operating and maintenance costs, enhance grid connectivity, reduce CO₂ and other emissions.



There is room for improvement of the sensors and instrumentation used in power plants currently, indicating Research & Development opportunities.



Advanced Research Program

Our Challenges:

Discovery – Fostering of new breakthroughs

Innovation – The creation of a new product

Embracing - The use of new technology

Dissemination – The adoption of technology



Advanced Research

Web sites:

<http://www.fossil.energy.gov/programs/powersystems/advresearch/index.html>

<http://www.netl.doe.gov/technologies/coalpower/advresearch/index.html>

