Office of Fossil Energy

Christopher Smith
Principal Deputy Assistant Secretary
U. S. Department of Energy

September, 2014

U.S. DEPARTMENT OF ENERGY

Fossil Energy

The Office of Fossil Energy consists of three major programs

Fossil Energy

Oil and Natural Gas

- Promote prudent development of domestic oil and natural gas resources
- Quantify and mitigate impacts/risks of resource development, with a focus on unconventional resources
- Conduct research to promote new sources of natural gas, such as methane hydrate
- Manage the DOE's natural gas regulatory process

Coal and Power Systems

- Reduce cost of pre- and post-combustion CO_2 capture from power and industrial sources through R&D and major demonstrations
- Quantify and mitigate risks of long term CO_2 storage through R&D and major demonstrations
- Increase efficiency of power generation through R&D of systems and materials
- Research new power generation systems

Strategic Petroleum Reserve

- Provide the United States with an effective response option should a disruption in commercial oil supplies threaten the U. S. economy.
- SPR reserve capacity:

  Bryan Mound - 254 MMB in 20 caverns

  Big Hill - 171 MMB in 14 caverns

  West Hackberry - 229 MMB in 22 caverns

  Bayou Choctaw - 74 MMB in 7 caverns

Unconventional Oil and Gas

Prudent development of onshore unconventional resources

Major Goals: Wellbore integrity, flow, and control engineered systems, imaging, and materials green processes, water treatment, water management

Offshore

Keeping pace with technology advancements for safe and clean production

Major Goals: High temp/high pressure materials sensors and systems barriers preventing loss of well control

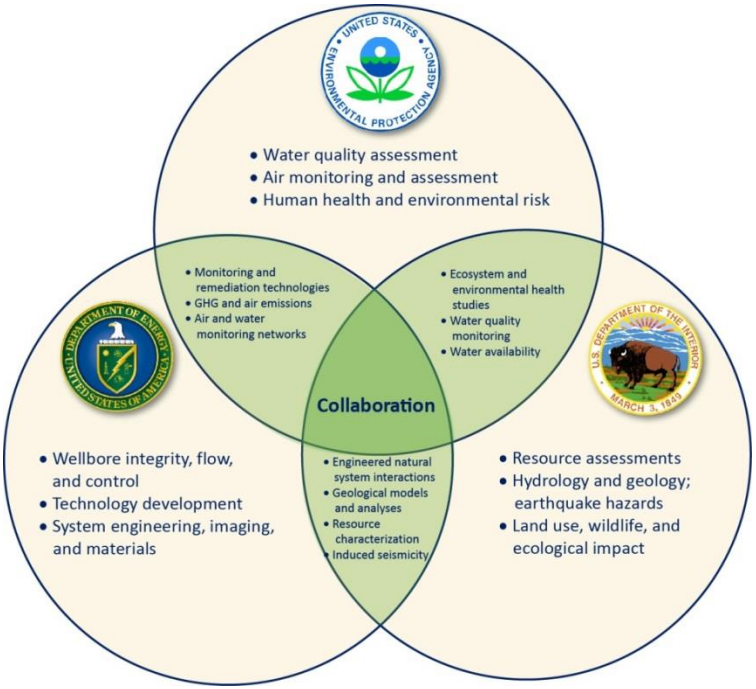
Methane Hydrate

Increase our understanding of the occurrence, nature, and behavior of naturally-occurring gas hydrates

Major Goals: Conduct research on understanding methane dynamics in gas-hydrate-bearing areas and to analyze prospective field activity

Offshore: Deepwater Horizon and the National Oil Spill Commission

- President Obama establish the Commission on May 21, 2010.
- The Commission recommended the refocus of the DOE ultra-deepwater research program to address and mitigate technical risk associated with offshore drilling.
- NETL led a National Lab team to develop estimates of the flow during the disaster and after the completion of the relief well.
- The National Academies of Science is receiving BP Settlement funds of $500 million/30 years for Gulf of Mexico research on health and safety.
- DOE is collaborating with the Department of the Interior on R&D topics.



Onshore: Multi-Agency Collaboration

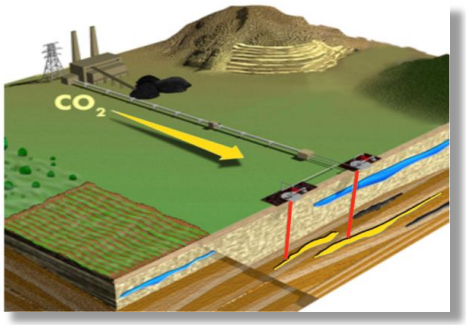
- DOE/EPA/USGS created a Steering Committee to coordinate all unconventional oil and gas R&D. FE initiated this collaboration and chairs the Steering Committee.
- Steering Committee's goal is to ensure that each agency is focused on research topics within their unique core competency.
- Steering Committee has published a research framework.

- www.Unconventional.Energy.Gov

CO2 Capture

Cost effective capture for new and existing plants

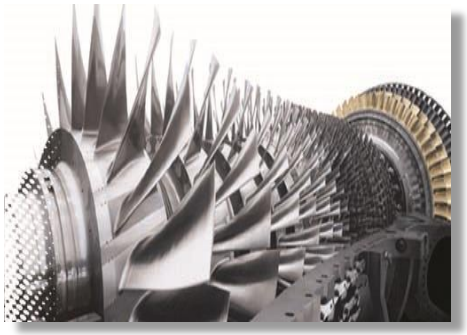
Major Goals: 2nd generation pilot tests (10 to 20 MW) by 2020. Transformational technology field tests by 2025



CO2 Storage

Safe, permanent storage of CO2 from power and industry

Major Goals: technologies and tools available to measure and account for 99% of injected CO2. CCS best practices and protocols completed by 2020.



Advanced Energy Systems

Gasification, Advanced turbines, Advanced combustion, CBTL, and fuel cells

Major Goals:

2025: 20-30% reduction in combined cycle capital cost (2nd gen)

2025: Advanced combustion ready for pilot scale operation (transformational)

Crosscutting Research

Crosscutting technology development program

Major Goals:

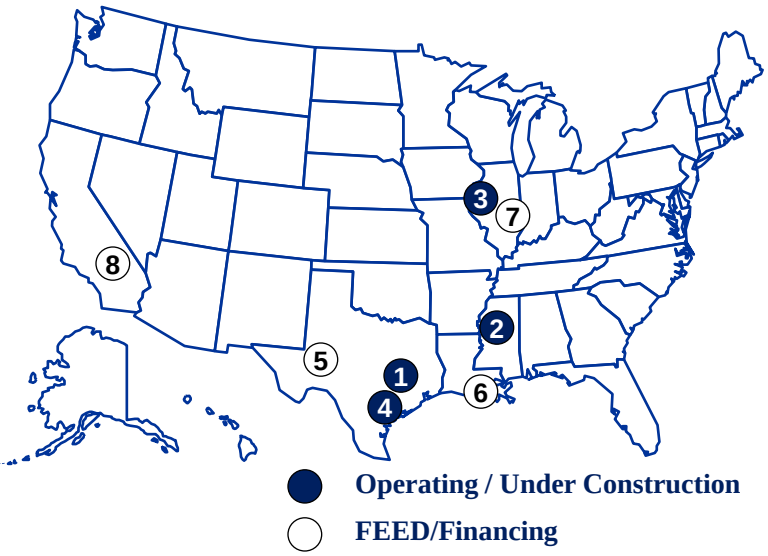
2016: advance 2nd gen materials, sensors, modeling technologies to applied programs

2020: develop distributed communication sensor networks (transformational tech)

FE manages 8 major demonstration projects to advance capture technologies

Fossil Energy

Major CCUS Demonstrations



- **Portfolio represents both EOR and storage in saline aquifers**
- **Portfolio includes industrial and power capture**
- **Portfolio includes pre-, post-, and oxy-combustion capture**

	Partnership	Project	Status
1	Air Products	Steam Methane Reformer Hydrogen Production. EOR utilization ~925,000 MT/year	Operations
2	Southern Company Services (Kemper)	Integrated Gasification Combined Cycle (IGCC). EOR utilization ~3,000,000 MT/year	Under Construction
3	Archer Daniels Midland	Ethanol Fermentation CO2. Saline storage ~900,000 MT/year	Under Construction
4	NRG Energy (Petra Nova) WA Parish	Retrofit Pulverized Coal Plant. EOR utilization ~1,400,000 MT/year	Under Construction
5	Summit Texas Clean Energy Project	Integrated Gasification Combined Cycle Polygeneration. EOR utilization ~2,200,000 MT/year	Financing
6	Leucadia Energy, LLC	Methanol from Petcoke Gasification. EOR utilization ~4,500,000 MT/year	Front End Engineering & Design
7	FutureGen 2.0	Oxycombustion Pulverized Coal Boiler Retrofit. Saline storage ~1,000,000 MT/year	Front End Engineering & Design
8	Hydrogen Energy California (HECA)	Integrated Gasification Combined Cycle Polygeneration. EOR utilization ~2,570,000 MT/year	Front End Engineering & Design

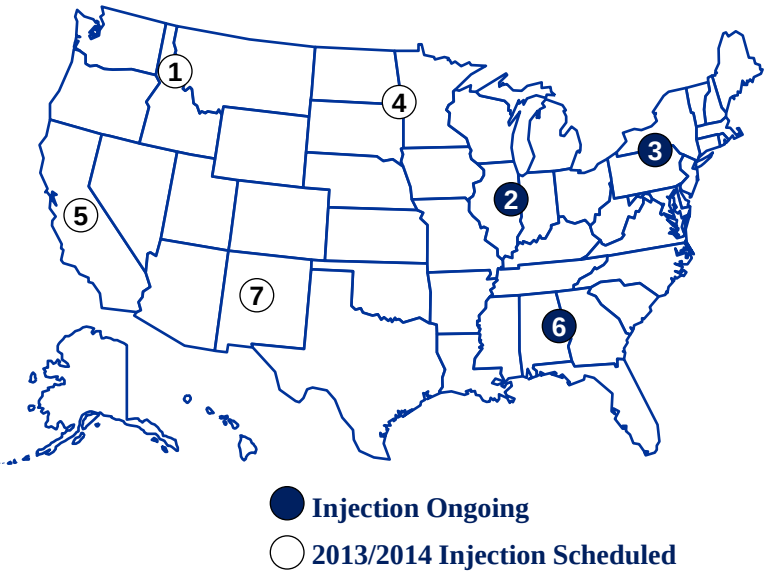
Critical Requirement For Significant Wide Scale Deployment - Capturing Lessons Learned

Best Practices Manual	Version 1 (Phase II)	Version 2 (Phase III)	Final Guidelines (Post Injection)
Monitoring, Verification and Accounting	2009/2012	2016	2020
Public Outreach and Education	2009	2016	2020
Site Characterization	2010	2016	2020
Geologic Storage Formation Classification	2010	2016	2020
**Simulation and Risk Assessment	2010	2016	2020
**Carbon Storage Systems and Well Management Activities	2011	2016	2020
Terrestrial	2010	**2016 – Post MVA Phase III**	

CO_2 Storage Demonstrations
FE manages 7 regional partnerships to conduct CO2 injection projects

Fossil Energy

Regional Carbon Sequestration Partnerships



- **Geology: Projects represent six of eleven identified depositional environments in the United States.**
- **Storage methodology: Projects include EOR and saline aquifer storage**
- **Preceded by 20 small-scale projects that cumulatively injected over 1 million tonnes**

	Partnership	Project	Status
1	Big Sky Carbon Sequestration Partnership	Saline storage of naturally occurring CO2 (1 million tonnes over 4 years)	Site operations; Injection 2014
2	Midwest Geological Sequestration Consortium	Saline storage of CO2 from ADM biofuel production (1 million tonnes over 3 years)	Injection began Nov. 2011
3	Midwest Regional Carbon Sequestration Partnership	EOR using CO2 from gas processing plant (1 million tonnes over 4 years)	Injection began Feb. 2013
4	Plains CO2 Reduction Partnership	1) Project 1: EOR using CO2 from ConocoPhillips Gas Plant (1 million tonnes over 2 years) 2) Project 2: Saline storage of CO2 from Spectra Energy gas processing plant (1.3 million tonnes over 2 years)	1) Injection June 2013 2) Site operations; injection 2015
5	West Coast Regional Carbon Sequestration Partnership	Regional Characterization	No large-scale injection
6	Southeast Regional Carbon Sequestration Partnership	1) Project 1: Saline leg of EOR; storage natural CO2 (Over 3.6 million tonnes by Sept. 2014) 2) Project 2: Saline storage of amine captured CO2 from coal-fired generation (250,000 tonnes over 2 years)	1) Injection began 2009 2) Injection began Aug. 2012
7	Southwest Regional Partnership on Carbon Sequestration	EOR storage of CO2 from fertilizer and ethanol plants (1 million tonnes over 5 years)	Site operations; injection late 2013

National Risk Assessment Partnership (NRAP)

Fossil Energy

NRAP is a coalition of national labs and universities that leverage DOE's core competency in engineered-natural systems to build confidence in long-term CO_2 storage by predicting the behavior of storage-sites.

NRAP is developing a defensible, science-based methodology and platform (toolset) for quantifying risk profiles at most types of CO_2 storage sites in order to guide decision making and risk-management strategies.

Elucidate key fundamental physics/chemistry → **Predict behavior of critical components** → **Predict system behavior (reservoir to receptor) over space and time** → **Quantify risk and safety relationships**

NRAP Technical Team

NETL-RUA Regional University Alliance

Berkeley Lab

Los Alamos National Laboratory EST. 1943

Pacific Northwest National Laboratory

URS

NRAP Stakeholder Group

AEP American Electric Power

Blue Source

ieaghg

ExxonMobil

Whiting

bp

EPA United States Environmental Protection Agency

IEc

MIT

NRDC Natural Resources Defense Council The Earth's Best Defense

Schlumberger

Southern States Energy Board

Stanford University

The University of Utah

Wade, LLC

Zurich Because change happens