

FOSSIL ENERGY TODAY

A Newsletter
About Innovative
Technologies
for Fossil Energy



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INDUSTRIAL CARBON CAPTURE, STORAGE PROJECT BEGINS CONSTRUCTION

Recovery Act Funded Project to Store 1 Million Tons of CO₂ per Year

Construction activities began at an Illinois ethanol plant that will demonstrate carbon capture and storage. The project, sponsored by the Office of Fossil Energy, is the first large-scale integrated carbon capture and storage (CCS) demonstration project funded by the American Recovery and Reinvestment Act (ARRA) to move into the construction phase.

Led by the Archer Daniels Midland Company (ADM), a member of DOE's Midwest Geological Sequestration Consortium, the Illinois-ICCS project is designed to sequester approximately 2,500 metric tons of carbon dioxide (CO₂) per day in the

saline Mount Simon Sandstone formation at depths of approximately 7,000 feet. Researchers estimate that the sandstone formation can potentially store billions of tons of CO₂ and has the overall potential to sequester all of the more than 250 million tons of CO₂ produced each year by industry in the Illinois Basin region.

“Illinois is at the forefront of helping ensure the US remains competitive in the global clean energy economy, creating new jobs while reducing carbon pollution.”

— Steven Chu, U. S. Secretary of Energy

The injected CO₂ will come from the byproduct from processing corn into fuel-grade ethanol at ADM's biofuels plant adjacent to the storage site in Decatur, Illinois.

Because all of the captured CO₂ is produced from biologic fermentation, a significant feature of the project is its “negative carbon footprint,” meaning that the sequestration results in a net reduction of atmospheric CO₂.

In October 2009, DOE selected the ADM team — which now includes Schlumberger Carbon Services, the Illinois State Geological Survey, and

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Groundbreaking ceremony for the Illinois Industrial Carbon Capture and Sequestration Project — National Sequestration Education Center, Richland Community College, Decatur, Ill., on August 24.

From L-R: Paula Wood, Richland Board of Trustees; Bruce Campbell, Richland Board of Trustees; Myung Kim, Richland Foundation; Dr. Douglas Brauer, Richland Community College; Dr. Sai Gollakota, National Energy Technology Laboratory; Dr. Gayle Saunders, Richland Community College; Thomas Sarkus, National Energy Technology Laboratory; Scott McDonald, Archer Daniels Midland Company; Eric Berlin, Schlumberger Carbon Services; Dr. Robert Finley, Illinois State Geological Survey; Dale Colee, Richland Board of Trustees; Dr. Joseph Schrodt, Richland Foundation; Emmett Sefton, Richland Board of Trustees; Neil Pistorius, Community Member.

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A NEW PATH FORWARD: CARBON CAPTURE, UTILIZATION AND STORAGE

By Charles McConnell

Carbon capture and storage technology is at a crucial turning point. Commercial-scale demonstration projects getting underway throughout the world, with commercial deployment slated over the next decade. Here at home, we hope to have five to ten commercial-scale demonstration projects up and running by 2016 – with commercial, real-world deployment around 2020.

Real-world application of these technologies is the ultimate goal of the Office of Fossil Energy’s Clean Coal program. As we move forward, though, we recognize that barriers to commercialization remain. In particular, the economic barriers have been particularly daunting. Simply focusing on storing CO₂ – where the main considerations are cost and risk – hasn’t yet provided a compelling incentive for industry to commit capital and resources to invest in these technologies.

And right now, industry, policymakers and the public are asking “At what cost will we commit to deploying them.”

This is a critical question because it underscores the importance of further technology development. It also underscores uncertainty. And uncertainty is perhaps the greatest barrier to meeting our energy and environmental challenges.

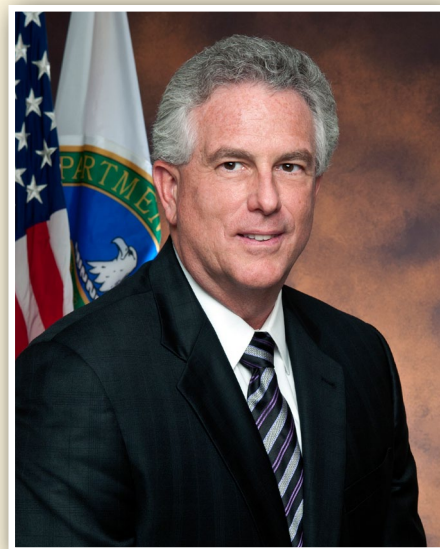
At the end of the day, we are obliged to create a compelling choice of advancement – in other words, game-changing technology at acceptable cost in terms of sustainability, environmental responsibility, and return on financial investment.

This reality requires that we move away from a focus on CO₂ storage alone. Going forward, then, we will focus our efforts on ways to put CO₂ to commercial use. Beneficial utilization of carbon dioxide promises to deliver the economic incentives needed to move critical technology forward, at the same time putting CO₂ to good, productive use. So instead of referring to carbon capture technologies as CCS, it will increasingly become more accurate to use the acronym CCUS – for carbon capture, utilization and storage.

Captured CO₂ is already being used in industrial processes, and our R&D is looking at ways to expand those uses. CO₂ is also being used for enhanced oil recovery, or EOR. And it’s in CO₂ – EOR that we see the greatest potential for CO₂ utilization. In fact, CO₂ – EOR can be called “The Un-Mined Gold Story for Energy Security and Jobs,” and here’s why.

The National Energy Technology Laboratory has estimated that there are 62 billion barrels of technically recoverable oil available with current CO₂ – EOR technology. Looking at “next-generation” CO₂ – EOR technology, there could be as much as 137 billion barrels of technically recoverable barrels, with 67 billion barrels economically recoverable. The non-profit U.S. Carbon Sequestration Council notes that over the next three decades expanded EOR production could result in a 30 – 40 percent reduction in imported oil, spurring \$10 trillion in economic activity over 30 years while creating 2.5 million jobs

Clearly, the benefits of using captured CO₂ for EOR are substantial – more sustainable domestic energy production; economic growth and more jobs; and increased environmental security. At the same time, incentives like those promised by CO₂ re-use can help us achieve wide-spread commercial deployment of advanced CCUS technologies.



Charles McConnell is the Chief Operating Officer in the Office of Fossil Energy. His nomination for Assistant Secretary of Fossil Energy is pending.

Hear McConnell explain important topics relating to CCUS and Enhanced Oil Recovery in a video series available on the Office of Fossil Energy Facebook page at www.facebook.com/fossilenergy.

“Archer Daniels” continued from page 1

Richland Community College — to conduct one of 12 projects in Phase 1 of its Industrial CCS program. DOE then selected the project in June 2010 as one of three projects to receive continued (Phase 2) funding.

The Office of Fossil Energy’s National Energy Technology Laboratory manages the Illinois-ICCS project, which receives \$141.4 million in ARRA funding and another \$66.5 million private sector cost-sharing. Since ADM does not presently have a locally feasible CO₂ re-utilization option, such as enhanced oil recovery, the federal funding offsets potential technical and economic risks and provides an opportunity for ADM and its partners to gather crucial scientific and engineering data in advance of carbon capture requirements.

The Illinois-ICCS project includes the design, construction, and demonstration of a CO₂ compression and dehydration facility as a precursor to CO₂ storage and subsequent monitoring, verification, and accounting of the stored CO₂. The operations phase of the project—capture and storage of the CO₂—is expected to begin in late summer 2013. The operations phase will create approximately 260 jobs and add to an understanding of long-term CO₂ storage in saline formations.

Integral to the project will be the formation of an educational and training facility, the National Sequestration Education Center, slated to be housed at nearby Richland Community College in Decatur. The center will contain classrooms, training, and laboratory facilities, and it will offer students associate degrees in sequestration technology.



ADM's Agricultural Processing and Biofuels Plant, Decatur, IL.

DOE-SUPPORTED CONSORTIUM LEADS TO NEW TECHNOLOGIES

New technologies that improve environmental protection while helping small, independent oil and natural gas operators contribute to domestic energy production have resulted from U.S. Department of Energy support of the Stripper Well Consortium (SWC).

“Stripper wells” are wells that produce less than 10 barrels of oil or 60,000 standard cubic feet of natural gas per day. According to the Interstate Oil and Gas Compact Commission, more than 375,000 U.S. stripper oil wells account for nearly 720,000 barrels of oil per day, or about 20 percent of the U.S. production. More than 322,000 stripper natural gas wells produce over 2 trillion standard cubic feet of natural gas annually, or 19 percent of the total U.S. natural gas production.

By improving the economics of oil and natural gas production from these marginal wells, the nearly 100 technology-driven projects funded since the SWC was founded in 2000 have helped maximize the recovery of domestic hydrocarbon resources, minimize environmental impacts, and strengthen the nation’s energy security. In addition, every

dollar of stripper oil and natural gas production generates roughly one dollar of economic activity, and nearly 10 jobs are dependent upon every one million dollars of stripper well oil and natural gas produced.

The Consortium is mainly composed of small, domestic oil and natural gas producers, as well as service and supply companies, trade associations, industry consultants, technology entrepreneurs, and academia. Its goal is to keep stripper wells productive in an environmentally sustainable way.

Many SWC projects have resulted in commercialized technologies over the years and have been previously highlighted by DOE. Additional technologies, developed over the past couple of years, are now moving toward commercialization and are expected to positively impact the oil and natural gas industry.

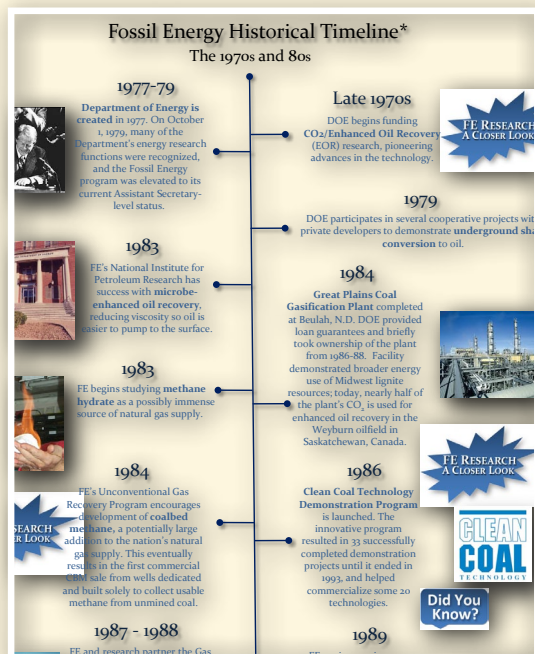
Learn about the technologies created at http://www.fossil.energy.gov/news/techlines/2011/11052-DOE_Support_of_Consortium_Yields_R.html

FE R&D: A LEGACY OF BENEFIT

As most Americans are aware, we are living in an era of fiscal austerity and responsibility, when receiving benefit and value for each dollar spent is more important than ever. This is especially true when it comes to federal agency use of public funds resulting from taxpayer dollars.

That's why the legacy established by the U.S. Department of Energy's Office of Fossil Energy (FE) over the past three decades is a particularly significant achievement. During that time, FE research and development has returned both monetary and tangible benefits to society for the public funds invested. Among its more notable accomplishments:

- **Enhanced Oil Recovery (EOR)** – FE pioneered technologies that today help provide about 13 percent – or over 660,000 barrels daily – of total U.S. oil production; about 5 percent of total production (281,000 barrels per day) is from operations that inject carbon dioxide (CO₂) to squeeze out additional, hard-to-recover oil from mature fields. Consequently, EOR has great promise not only for enhancing domestic energy production and increasing energy security, but also providing a long-term means of safely storing CO₂ in geologic formations.
- **Clean Coal Technology Demonstration Program (CCTDP)** – During its existence (1986-93), CCTDP produced 33 successfully completed demonstration projects and developed some 20 innovative technologies, many of which (low nitrogen oxide (NO_x) burners, flue gas desulfurization, fluidized bed combustion, etc.) are now in the marketplace. These technologies have increased energy production and efficiencies while contributing to significant air quality improvements, including a reduction in acid rain.
- **Shale Resources** – Advanced drilling, hydraulic fracturing and environmental technologies from FE R&D have helped to greatly increase oil and gas production from these abundant resources, particularly over the past decade. For example, U.S. shale gas production has risen fourteen-fold since 2000 and now accounts for 14 percent of the nation's natural gas supply, while reserves have risen to 827 trillion cubic feet, about one-third of total domestic resources.
- **Ultra-Deepwater Resources** – Over the years, FE has accumulated extensive expertise and advisory capacity in ultra-deepwater resource location, production, safety and environmental protection, increasing the production of this important domestic energy to our nation's oil and natural gas supplies. Ultra-deepwater resources now account for 32 percent of U.S. crude oil production and 13 percent of total dry gas production, and the contributions are expected to continue to grow in the years ahead.
- **13-to-1 Return on Investment** – In a 2009 study, Management Information Services estimated FE's Clean Coal Technology Program (CCTP) will deliver total monetary benefits of \$111 billion between 2000 and 2020, a 13-to-1 return for every taxpayer dollar invested.



Learn more about the legacy created by the Office of Fossil Energy through an online timeline of the office at www.fossil.energy.gov/aboutus/history/researchsuccesses/timeline.html.

Despite this impressive list of achievements, FE's staff of 1,000 scientists, engineers, technicians and administrative personnel aren't resting on their laurels. They continue to focus on helping FE fulfill its mission of developing innovative technologies that increase domestic energy, lower costs and improve environmental protection. Because of their efforts, the U.S. is in the forefront of global efforts to develop and demonstrate cutting-edge processes. Many of these make coal use cleaner and more efficient while lowering costs, and will result in the capture and long-term, safe geologic storage of CO₂ while providing abundant energy.

For more information on FE's R&D legacy and return of benefits visit:

<http://fossil.energy.gov/aboutus/history/researchsuccesses/index.html>.

PRUDENT DEVELOPMENT OF NATURAL GAS & OIL RESOURCES DETAILED IN NEW STUDY

Significant technology advances have unlocked abundant natural gas and oil resources, but the potential benefits can only be realized if developed prudently, according to a major new report by the National Petroleum Council (NPC) titled *Prudent Development: Realizing the Potential of North America's Abundant Natural Gas and Oil Resources*. The report was recently presented to Secretary of Energy Steven Chu at the 121st meeting of the NPC.

The National Petroleum Council was established by the Secretary of the Interior in 1946 at the request of President Harry S. Truman. In 1977, the U.S. Department of Energy was established and the Council's functions were transferred to the new Department.

The purpose of the Council is to advise the Secretary of Energy on matters related to oil and natural gas, or the oil and natural gas industries.

The Council is chartered by the Secretary of Energy, under the provisions of the Federal Advisory Committee Act of 1972. The Council membership of about 200 persons is selected and appointed by the Secretary of Energy. Individual members serve without compensation as representatives of their industry or associated interests as a whole, not as representatives of their particular companies or affiliations.

Read the full study on the NPC website: <http://www.npc.org/>.

CO₂ INJECTION IN OILFIELD COULD GREATLY INCREASE PRODUCTION, PERMANENTLY STORE CO₂

The feasibility of using carbon dioxide (CO₂) injection for recovering between 250 million and 500 million additional barrels of oil from Kansas oilfields has been established in a study funded by the Department of Energy.

The University of Kansas Center for Research studied the possibility of near-miscible CO₂ flooding for extending the life of mature oilfields in the Arbuckle Formation while simultaneously providing permanent geologic storage of carbon dioxide, a major greenhouse gas.

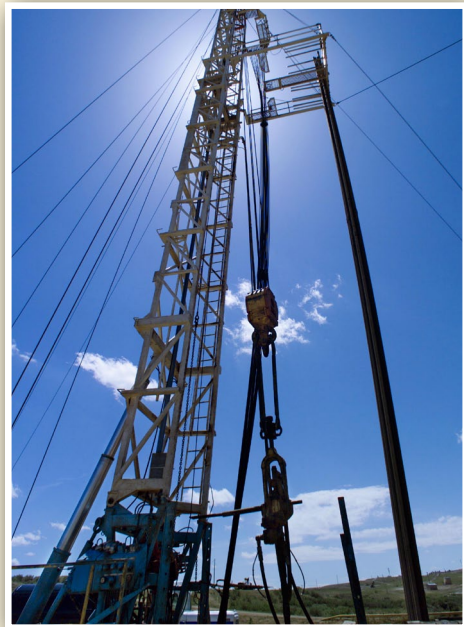
Miscibility refers to the pressure at which the CO₂ and oil are completely soluble in one another or form a single phase. Below the minimum miscibility pressure (MMP), the injected CO₂ mixes with and swells the oil to reduce its viscosity, increasing its ability to flow through the reservoir more easily to the production well.

In the laboratory, researchers subjected core samples from the Arbuckle Formation to simulate CO₂ flooding. The studies showed that more than 50 percent of the residual oil remaining after water-flooding could be recovered from Berea Sandstone, Baker dolomite, and Arbuckle dolomite cores at pressures below the MMP.

The investigators also conducted simulation studies which indicated that the ultimate oil recovery is highly dependent on the degree of reservoir heterogeneity. Maximum recovery efficiency can be achieved by proper design and implementation of CO₂ injection, with optimization of injection pressure, injection rates, and the well pattern.

The project is now moving into a second phase of research, in which researchers will conduct a variety of tests to improve characterization of Arbuckle reservoirs. The testing will determine the nature of the flow paths and average properties in the reservoir, assess the effect of geology on process performance, calibrate a reservoir simulation model, and identify operational issues and concerns for future applications of near-miscible CO₂ flooding.

The Arbuckle Formation has produced 36 percent (2.2 billion barrels) of the 6.1 billion barrels of total Kansas oil produced over the past 100 years. Oil production peaked in the 1950s, tapering off to the point where today, 90 percent of the wells operated by more than 100 small producers pump less than five barrels per day.



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“CO₂ Injection” continued from page 5

The Arbuckle was chosen for the DOE-sponsored project because it represents a significant resource for improved oil recovery even though miscibility with CO₂ is not achievable at the operating pressures in most Arbuckle reservoirs.

Following primary oil recovery (in which oil is naturally driven from a reservoir) and secondary recovery (in which pressure is applied to force the oil from the reservoir, usually by water flooding), as much as two thirds of the original oil in place typically remains stranded in a reservoir. Additional oil can be recovered using improved oil recovery techniques that increase the mobility of the crude oil. This enhanced oil recovery not only adds to U.S. domestic energy supplies, but also provides a means of safe, secure long-term storage of CO₂, and is a key component of carbon capture, storage and utilization research.

Near-miscible CO₂ flooding may be applicable to thousands of mature oilfields in Kansas and prevent them from being abandoned prematurely. According to the Kansas Geologic Survey, more than 6,400 highly compartmentalized reservoirs exist in Kansas, though about a third of these are small fields with an average of five producing wells or less.

The project was administered through the Research Partnership to Secure Energy for America to address the technology challenges of small producers as part of the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Program (Energy Policy Act, 2005). The program is managed by the National Energy Technology Laboratory.

Learn more about this project and read the project report at

<http://www.netl.doe.gov/technologies/oil-gas/EPAAct2005/Projects/SPR/0712303-UKansas.html>

CORONARY STENTS IMPROVED BY NOVEL ALLOY

NETL Research Helps Enable Thinner, More Flexible Designs, Increasing Patient Safety

Metallurgists at the National Energy Technology Laboratory have helped develop a new alloy that is increasing the safety of an important medical procedure by being used to manufacture more flexible and conformable coronary stents.

The novel platinum-chromium (PtCr) alloy, developed by a research team at NETL and Boston Scientific Corporation, is being used to manufacture coronary stents that allow easier placement by the doctor and more safety for the patient.

A coronary stent is a small, expandable mesh tube that is placed in a narrowed or weakened coronary artery, allowing the passageway to stay open. Every year coronary stents save thousands of lives by expanding diseased arteries and allowing blood to flow freely.

NETL’s involvement in the project goes back more than 10 years, when scientists at Boston Scientific requested the laboratory’s help with research to improve the traditional 316L stainless steel traditionally used in coronary stents. Boston Scientific recognized NETL’s metallurgy capabilities and offered to fund the entire research project. Over the next decade, NETL and Boston Scientific researchers worked together to design the PtCr alloy and develop the process methodology to produce the alloy for use as stent material.

The PtCr alloy solves many of the past problems surrounding traditional stents. The addition of platinum provides physical properties that allow a stent to be both thin and visible on x-ray, a problem with stainless steel stents. Its flexibility allows easier movement through arterial bends



Photo courtesy of Boston Scientific Corporation

Coronary stents made from a novel PtCr alloy are more flexible and conformable than traditional stents. The PtCr alloy was developed by a research team that included metallurgists from NETL. The improved stents are manufactured by Boston Scientific Corporation.

without causing damage. The addition of high-melting platinum also gives the stent a higher corrosion resistance, which optimizes the stent’s long-term stability within the body. The alloy’s increased strength also decreases recoil, which reduces the likelihood of constriction after deployment.

Following a series of trials — melting, casting, fabricating, and characterizing the properties of different alloys — and after many clinical trials, Boston Scientific’s PROMUS® ELEMENT™ and ION™ stents, made from the novel PtCr alloy, were ready to market. Since introduction of the improved coronary stents in January 2010, sales have exceeded \$1 billion.

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“Coronary Stent” continued from page 6

The breakthrough was recognized by *R&D Magazine*, which named the PtCr alloy one of the 100 most technologically significant products to enter the marketplace in the past year.

NETL’s materials sciences research team has conducted a wide variety of work in high-temperature alloy development and processing. NETL’s materials research includes making more effective armor for the Army, new turbine alloys to help the Nation’s power systems operate more efficiently, and now a medical alloy that helps save lives.

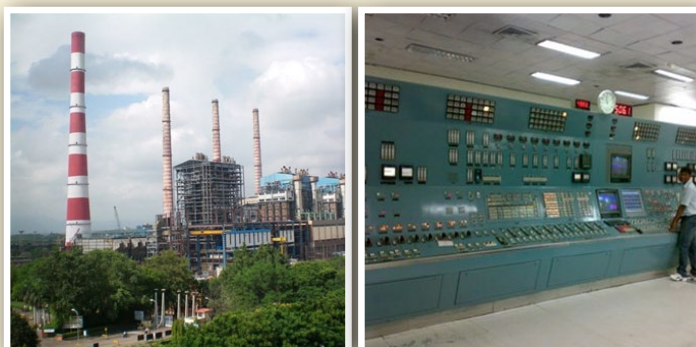
NETL CONCLUDING THREE DECADES OF SUPPORT TO USAID/INDIA

Since 1982, the India Mission of the U.S. Agency for International Development (USAID/India) has promoted and demonstrated better coal utilization technologies and practices in India’s power generation sector.

Among those programs were:

- Alternative Energy Research and Development Program (1982-1992) – Help India develop combustion technologies and test facilities to advance the use of indigenous high-ash coal and biomass resources cleanly for electric power generation, while reducing generation of greenhouse gases (GHG).
- Energy Management Consultation and Training Program (1993-1995) – Improve the availability, reliability, and efficient use of energy in India through improved management, policy reforms, and public awareness. Assess and evaluate the conditions of Indian thermal power plants and identify measures for extending their useful life.
- Program for Accelerating Commercial Energy Research (1993-1997) – Promote development of new/innovative products/processes for the Indian energy sector.
- Indo-US Coal Preparation Program (1994-1996) – Demonstrate the commercial feasibility and economic and environmental benefits from using beneficiated coal in Indian power plants.

The body of close collaboration, cooperation, advice, and guidance under the above-mentioned programs provided an exceptionally strong foundation for USAID/India to rely upon the National Energy Technology Laboratory for continued support for its now concluding Greenhouse Gas Pollution Prevention (GEP) Project (1995-2011). The original GEP Project (1995-2002) had two major components: (1) the Alternative Bagasse Cogeneration (ABC) Component, which demonstrated year-round use of biomass fuels for efficient cogeneration in the Indian sugar industry; and (2) the Efficient Coal Conversion (ECC) Component, which focused on technology demonstration, training, and outreach



NTPC Korba Power Plant in India

for improving the performance of existing coal-fired power plants.

In 1998, USAID/India launched climate change activities to generate greater awareness and outreach among various stakeholders of the successes of the GEP Project under the ABC and ECC Components and to develop projects for investment from new and emerging funding mechanisms for climate change mitigation.

Subsequently, the Government of India (GoI) and USAID/India signed a Project Agreement Amendment of the GEP Project in September 1999 to launch the Climate Change Supplement to expand the ongoing current ECC activities as the Efficient Power Generation Component and add two new elements: (1) fostering climate change initiatives for

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“US/AID-India” continued from page 7

sustainable development, and (2) linking urban development and climate change activities.

These elements were carried out through the two-phase GEP Project Climate Change Supplement. The first phase of the Efficient Power Generation Component (2000-2005) aimed to: (1) establish a self-sustaining institution for technical support to improve efficiency in India’s thermal power sector, and (2) conduct a study on advanced coal conversion technologies suitable for India. Based on the success of Phase I, USAID/India approved additional funding for a second phase of Efficient Power Generation Component for NETL’s continued technical assistance until September 30, 2011.

USAID/India has met much of its technical support needs for these programs through a series of Participating Agency Service Agreements (PASAs) with NETL, and its predecessor organizations. NETL has provided technical and management support to identify and demonstrate clean coal power technologies and related best U.S. power plant testing, evaluation, and operations and maintenance (O&M) equipment, tools, technologies, and practices to various organizations across the Indian power generation community. This included the introduction and demonstration of U.S. power plant community best O&M standards and practices for subcritical and supercritical coal-fired power plants to improve power plant thermal efficiency, coupled with issuance and distribution of a Heat Rate Improvement Guidelines manual to all Indian power plants for use in improv-

ing the operation of coal-fired power stations.

The GEP Project has been beneficial to the power generating utilities that have participated in the various Project activities, and has been a success in almost all of its activities. This spans the improvement of reliability and plant load factors in NTPC and several state utility power plants, introduction of U.S. power plant community best O&M practices, and GHG reduction. This approach has been widely accepted by the GoI as the most viable, cost efficient and sustainable way to address the climate change issue.

With technical support from NETL, the National Thermal Power Corporation, Ltd. (now, NTPC Ltd.), NETL’s primary partner on the GEP Project, established the Center for Power Efficiency and Environmental Protection (CenPEEP), followed by an additional two regional centers. CenPEEP has hosted over 43 U.S. teams and over 15 Indian teams have visited U.S. power stations and institutes for training. More than 110 workshops have been conducted on a broad range of topics, and CenPEEP has provided more than 14,000 person-days of training to the Indian power community. More than 300 demonstration exercises using state-of-the-art technologies and procedures have been conducted and replicated in various Indian power stations.

These activities have led to more than 29 million tonnes of CO₂ emissions avoided at



Representatives of the United States and India attended the Power Plant Summit 2011 in India this spring. NETL’s Scott Smouse (third from right) attended the meeting.

NTPC power plants including more in other state utilities. CenPEEP, now serving as the nationally recognized national resource center for acquiring, demonstrating, and disseminating technologies and best practices for the improvement of power plant operating efficiency, availability, and environmental performance in coal-fired power plants, has received four national and international awards.

What USAID and NETL have accomplished in India through these programs, though largely technical in nature, has created lasting impressions and long-distance relationships have been built and maintained. Strong linkages has been generated among USAID/India and its U.S. partners, and with the Indian government and non-governmental entities and various Indian state governments, state utilities, research organizations, private sector companies, and educational institutions. These linkages were instrumental in supporting related work on coal power generation best practices implemented under the Power Generation & Transmission Task Force of the Asia-Pacific Partnership on Clean Development and Climate (APP) and a bilateral relationship under the Power Working Group of the U.S.-India Energy Dialogue.

“These activities have led to more than 29 million tonnes of CO₂ emissions avoided at NTPC power plants including more in other state utilities.”

ENERGY MINISTERS ENDORSE CCUS AS KEY TO COMBATING CLIMATE CHANGE

Urge Rapid Deployment of Large Demonstrations

Energy and environment ministers from the Carbon Sequestration Leadership Forum's (CSLF) member nations endorsed carbon capture, utilization, and storage technologies (CCUS) as a key component of international plans to combat climate change at the 4th CSLF Ministerial Meeting in Beijing this past September.

In a Communiqué released following day-long discussions, CSLF member country Ministers and Heads of Delegation affirmed that CCUS is an indispensable element of any effective response to climate change and urged the world to increase the number of large demonstrations to enable the deployment of CCUS commercially by the end of this decade.

CCUS is a group of technologies for capturing carbon dioxide (CO₂), a major greenhouse gas, emitted by power plants or industrial facilities, utilizing it for such things as enhanced oil and gas recovery and safely inject-



The CSLF held its 4th Ministerial Meeting in Beijing, China, on September 19-23, 2011. Energy ministers from 24 countries and the European Commission attended.

ing it deep underground into suitable, permanent geologic storage sites. It is increasingly viewed by international experts as an essential part of a portfolio of responses by the world to effective management and reduction of human-based CO₂ emissions.

The CSLF's support at a high-level meeting here is an indication the international community views carbon capture and storage as an integral component of any international plan to combat climate change.

The CSLF has recognized 30 active and completed diverse carbon capture and storage projects throughout the world, projects that are sharing their results globally through the CSLF. Ministers said it is clear that while significant progress is being made on CCUS, challenges remain. "Challenges that can — and will — be overcome," they stated.

One such challenge is the requirement that new projects will require the development of policies to underpin necessary financial investments and bring about a mix of public and private financing.

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U.S. Energy Secretary Steven Chu spoke at the CSLF Ministerial Meeting.

CSLF ENDORSES SIX NEW CCUS PROJECTS

The Carbon Sequestration Leadership Forum added six new carbon capture, utilization and storage projects to its existing portfolio in an ongoing effort to bring together developed and developing nations in a collaborative quest to curtail manmade emissions of carbon dioxide.

The six new projects include:

- **Rotterdam Opslag en Afvang Demonstration (ROAD) Project (The Netherlands)** – The goal of the ROAD Project is to demonstrate that an industrial-scale, integrated CCUS chain (capture on a coal-fired coal plant and offshore storage) can be applied in a reliable and efficient way within a 10-year timeframe (by 2020) and can make a substantial contribution to climate change objectives. The project will share knowledge and experiences with other industries, countries, general public, NGOs and other stakeholders. ROAD is one of the six large-scale CCUS demonstration projects within the European Energy Programme for Recovery. Captured CO₂ will be transported via pipeline and injected into depleted gas reservoirs under the North Sea.
- **CGS Europe Project - Pan-European Coordination Action on CO₂ Geological Storage (Europe)** – CO₂ Geological Storage (CGS) Europe is a collaborative project involving extensive structured networking, knowledge transfer and information exchange, and is designed to facilitate the large-scale demonstration and deployment of CCUS, and to support implementation of the Directive on geological storage of carbon dioxide in all relevant EU Member States and associated countries.

Building on the sound basis of the CO₂ GeoNet Association, the CGS Europe Project will create a pan-European network of experts in the geological storage of CO₂ and a centralized

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“Communique” continued from page 9



From L-R: Xie Zhenhua, Vice Chairman, National Development and Reform Commission, China; Wan Gang, Minister, Ministry of Science and Technology, China; and Steven Chu, Secretary of Energy, U.S., attend a press conference during the CSLF ministerial in China.

“Financing of projects will be a greater challenge, especially in developing countries, but a challenge that must be overcome. We today reaffirmed our commitment to work with the private sector to build and finance the needed demonstration projects over the next decade,” the Ministers stated.

The Ministers also applauded the decision at last year’s United Nations Framework Convention on Climate Change (COP 16) to recognize CCUS as a measure in the Clean Development Mechanism (CDM). They called on delegates at the upcoming COP 17, to be held in Durban, South Africa, to recognize the key role of CCUS as a low carbon technology in mitigating climate change and to finalize the inclusion of CCUS as a measure in the CDM and in any other financial mechanisms created to mitigate greenhouse gas emissions.

The Ministers indicated they welcome additional international collaborations on CCUS through the International Energy Agency, Global Carbon Capture and Storage Institute, and the Clean Energy Ministerial (CEM). The increasing number of such collaborations is seen as a reflection of the growing global recognition of the criticality of CCUS, they said.

A full text of the Ministerial Communiqué may be read at www.cslforum.org.

“Projects” continued from page 9

knowledge base which will provide an independent source of information, research and advice for national, European, and international stakeholders. It will enable access to the most up-to-date results of CO₂ storage studies, the sharing of experiences and best practices, support of implementation of regulations, the formulation of relevant new research and the development of appropriate new projects.

- **SaskPower Integrated CCS Demonstration at Boundary Dam Unit 3 (Canada)** – The goal of this project is commercial co-production of electricity and CO₂ for sale using indigenous coal resources. The Boundary Dam ICCS Demonstration Project is expected to be the first application of full stream flue gas treatment for a pulverized coal unit. Operations of the highly integrated system will demonstrate not only CO₂ capture technology, but its interaction and optimal thermodynamic integration with the heat power cycle and with power production at full commercial scale. The captured CO₂ will be used for Enhanced Oil Recovery.
- **CO₂ Capture Project, Phase 3 (United States, Europe, Canada)** – The CO₂ Capture Project (CCP) is a partnership of several major energy companies working together to advance the technologies and to improve operational approaches in order to reduce costs and accelerate the deployment of CCUS. The CCP is currently in its third phase of activity – CCP3 (2009-2013). During the course of CCP3, the program will culminate in at least two field demonstrations of capture technologies and a series of monitoring field trials which will provide a clearer understanding of how to better monitor CO₂ in the subsurface.
- **Jämschwalde Project (Germany)** – The goal of this project is to technically and economically validate the complete CCUS chain including the demonstration of oxyfuel and post-combustion capture (PCC) for lignite, CO₂ transportation and geological storage. The combination of two different CO₂ capture technologies (Oxyfuel and PCC) allows both technologies to be demonstrated and developed for commercial application. Oxyfuel technology was chosen on account of its potential to obtain high efficiency and capture rates when applied to newly built power plants. The rationale behind PCC is that it is the best option to retrofit existing power plants. The captured CO₂ will be transported by pipelines to be stored in deep geological formations.
- **Zero Emission Porto Tolle (ZEPT) Project (Italy)** – The goal of the Porto Tolle Zero Emission Project is to demonstrate the industrial application of the CO₂ capture and geological storage in the power sector at full scale. The demonstration plant will be operated for an extended period (10 years) in order to fully demonstrate the technology on an industrial scale, access clearly identify the real costs of CCUS and provide a commercial solution for new installations after 2020. The project is intended to prove the retrofit option for high-efficiency coal fired units which will be built (or replaced) in the coming 10-15 years.

FUTURE OF COAL-BASED ENERGY PRODUCTION ADDRESSED AT INTERNATIONAL PITTSBURGH COAL CONFERENCE

Nearly 400 national and international scientists, engineers, and business professionals recently convened in Pittsburgh, Pa., for the 28th Annual International Pittsburgh Coal Conference.

An exceptional lineup of keynote speakers, including Fossil Energy's Chief Operating Officer, Chuck McConnell, and Dr. Anthony Cugini, Director, National Energy Technology Laboratory, provided for comprehensive plenary sessions highlighting the importance of fossil energy as a strategic component of the world's current and future energy portfolio. Plenary sessions also addressed fossil energy production and policy issues, financing and coal infrastructure, international coal-based power initiatives, and emerging clean coal technologies.



Chuck McConnell, COO, Office of Fossil Energy, addressing the audience during the recent International Pittsburgh Coal Conference. Also pictured are Thomas Bonner, President, Cogentrix Energy (left) and Steve Herman, Managing Director, Energy Capital Partners (right).

New to this year's agenda was the inclusion of sessions on energy business and major technology demonstrations focused on carbon management. These unique sessions served to establish a dialogue between technology developers and financial and risk management professionals. Scientific sessions covered a range of coal-related technology in the areas of coal gasification, carbon capture and utilization, combustion science, and environmental mitigation.

The 29th Annual International Pittsburgh Coal Conference will be held at the David L. Lawrence Convention Center in Pittsburgh, Pa., October 15–18, 2012. Additional information about the conference can be found at www.engr.pitt.edu/pcc.



NETL Director Anthony Cugini delivering his keynote address at the recent International Pittsburgh Coal Conference. Seated is Stephen Winberg, Vice President, R&D, Consol Energy.

ADDITIONAL STORAGE CONTRACTS AWARDED FOR HEATING OIL RESERVE

The U.S. Department of Energy has completed the acquisition of commercial storage services for the one million barrel Northeast Home Heating Oil Reserve (NEHHOR).

Two awards totaling 350,000 barrels have been made to companies that had earlier received storage contracts totaling 650,000 barrels. Hess Corporation in Groton, Conn., has been awarded a second contract for 100,000 barrels, increasing its storage obligation to 500,000 barrels. Global Companies LLC in Revere, Mass., was awarded a second contract for 250,000 barrels, increasing its obligation to 500,000 barrels. The contract terms are for one year with three option years.

The Northeast Home Heating Oil Reserve was authorized by Congress in the Energy Policy Act of 2000 as an emergency stockpile of up to two million barrels of Government-owned heating oil for the Northeastern States. Through February 2011, the NEHHOR held a total of two million barrels in both New England and New York Harbor. At the end of the winter heating season, DOE announced a competitive sale of the NEHHOR stocks for the purpose of replacing them with cleaner burning ULSD prior to the 2011-2012 heating season. The conversion was conducted in order to comply in advance of new mandates being phased in by several Northeastern states for more stringent fuel standards that will require replacement of high sulfur (2000 parts per million) heating oil to ultra-low sulfur distillate (15 parts per million).

Learn more about the Northeast Home Heating Oil Reserve at www.fossil.energy.gov/programs/reserves/heatingoil/index.html

Upcoming Events

<http://www.fossil.energy.gov/news/events/index.html>

October 17 - 19

[2011 Gasifications Technologies Conference](#)

San Francisco, Calif.

DOE Contact: Gene Kight, 301-903-2624

December 5-7

[9th Annual EOR Carbon Management Workshop](#)

Houston, Texas

DOE Contact: Gene Kight, 301-903-2624

December 13 - 15

[2011 Power-Gen International](#)

Las Vegas, Nev.

DOE Contact: Gene Kight, 301-903-2624



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Contact: Jenny Hakun, Editor
Phone: 202-586-5616
E-mail: energytoday@hq.doe.gov

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Comments are welcome and may be submitted to the editor.