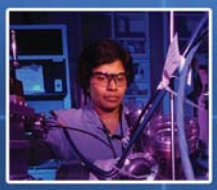
Fossil Energy Today

A Newsletter About Innovative Technologies for Fossil Energy



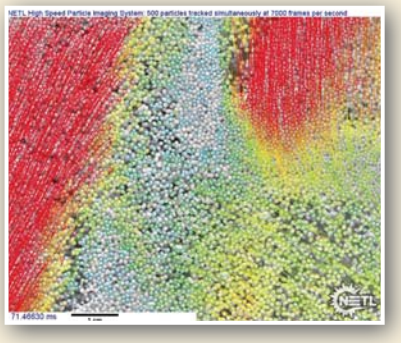
Office of Fossil Energy, U.S. Department of Energy • Issue No. 1, First Quarter, 2011

NETL's High-Speed Imaging System Successfully Applied in Medicine, Broad Spectrum of Industry

A groundbreaking Department of Energy-developed imaging system originally designed to help create cleaner fossil energy processes is finding successful applications in a wide range of medical, chemical processing, energy, and other industries.

Developed by the Office of Fossil Energy's National Energy Technology Laboratory (NETL), the high-speed imaging technology known as "particle imaging velocimetry" (PIV) is being put to use by a research consortium of more than 25 major chemical and energy companies and may soon have other uses as well.

Underscoring its versatility, the high-speed PIV system is finding application in the development of medical devices that handle blood. It is aiding the University of Pittsburgh Medical Center's McGowan Institute of Regenerative Medicine in studying blood flow in a piece of equipment that functions as an artificial lung. Earlier this year a version of the PIV software was used to help estimate the amount of oil leaking from the damaged Macando well in the Gulf of Mexico.



NETL's high speed PIV system tracks one thousand particles simultaneously in a cold flow gasification riser experiment

Imaging systems allow researchers to study in detail how particles move inside high concentration flow fields, such as coal particles during the gasification process. Particle motion or dynamics are of critical importance in determining the reaction rate, efficiency and reliability of various energy systems. The use of imaging systems to study particle behavior in gasses and liquids commonly uses the most advanced high speed, high resolution digital camera technology. NETL's high-speed PIV system is now providing the first observations and detailed measurements of particle motion in these environments.

The brain that makes the system work is its software, which simultaneously tracks the motion of thousands of microscopic particles. It is nearly impossible for the human eye to follow a moving particle smaller than a grain of salt. However, the high-speed PIV's software can follow thousands of particles at the same time while they are moving among billions of particles at high speed.

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Welcome to *Fossil Energy Today*

Welcome to a new digital newsletter published quarterly by the Department of Energy's Office of Fossil Energy (FE). *Fossil Energy Today* is designed to keep you updated on important activities, progress and other developments within FE – all in an easily accessible and readable format. I hope you will find *Fossil Energy Today* interesting and informative, and I encourage you to take a few minutes to read this first edition.

As we begin the New Year, I think it's important to highlight some of the achievements of 2010. This past year was a good one for FE – we benefitted from the leadership of Dr. James Markowsky as Assistant Secretary and his senior management team, as well as the hard work and dedication of the entire FE team.

With an investment of $3.4 billion from the 2009 American Recovery and Reinvestment Act, the **Office of**

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NETL researchers first used the high-speed PIV system to study flow fields in NETL's cold flow circulating fluidized bed unit, a large cold-flow gasification experiment conducted at the laboratory's site in Morgantown, West Virginia. With the aid of the high-speed PIV system, researchers viewed, recorded, and measured the precise motion of microscopic particles that simulate the motion of coal particles in a gasification chamber.

The PIV system is also being put to work in the labs of Chicago-based research consortium Particulate Solids Research Inc., to provide new insight into an important phenomenon called "particle clustering." This process can affect the design and operation of systems that rely on particle flow fields.

NETL has applied for a patent for this technology and is expanding application of the PIV system to other labs and other particle-flow applications, such as the rapid formation of methane hydrate particles, jet injection of catalysts into particle systems, and visualization of drill tip behavior during experiments conducted in NETL's ultra-deep single cutter drilling simulator. ◆

"Welcome" continued from page 1

Clean Coal got a jump start towards the goal of commercial carbon capture and storage (CCS) deployment in the post-2020 timeframe. The third round of the Clean Coal Power Initiative was a particular success, with five major projects awarded. We also launched FutureGen 2.0, which will demonstrate oxy-combustion technology with CCS and could lead to a regional carbon dioxide (CO_2) repository in Illinois. And to move the ball further down the field, we accelerated our R&D on advanced CCS technologies through our Industrial Carbon Capture and Storage program and two new simulation initiatives – representing a $635 million investment toward our goal of commercial CCS deployment in post-2020.

As we move into 2011, with all its challenges and opportunities, we are proud of our accomplishments and look forward to continued progress in the coming year.

Our Regional Carbon Sequestration Partnerships continue to address the challenges to carbon storage, with nine large-scale CO_2 injections of a million tons or more each and the development of a number of best practices.

Additionally, FE continued to provide global leadership on CCS through our involvement with organizations like the Carbon Sequestration Leadership Forum, the International Energy Agency and the Global Carbon Capture and Storage Institute, as well as bilateral cooperation with key countries, including China, Canada and Australia.

The **Oil and Natural Gas Program** remains a leader in methane hydrate R&D. Last March, FE's National Energy Technology Laboratory released initial findings from the May 2009 expedition of the Gulf of Mexico Hydrates Joint Industry Project. These reports highlighted the discovery of various gas hydrate occurrences in the deepwater Gulf of Mexico and documented resource-quality accumulations of gas hydrate in U.S. waters. The results of the Gulf of Mexico project underscore the potential of gas hydrate for the nation's future energy portfolio. The reports can be found at http://www.netl.doe.gov/technologies/oil-gas/FutureSupply/MethaneHydrates/JIPLegII-IR/.

The methane hydrate program received accolades from the prestigious National Research Council, which praised the program for "raising the profile of and interest in methane hydrate as a huge potential energy source." The Council also commended the program's progress toward the goal of achieving production of methane from hydrates.

In September 2010, the 10th U.S.-China Oil and Gas Industry Forum brought together experts from both countries to discuss common goals for the development of secure, reliable and economic sources of oil and natural gas while facilitating investment in their respective energy industries.

The **Strategic Petroleum Reserve** (SPR) has also been active on a number of fronts. The acquisition of a replacement storage cavern at the Bayou Choctaw SPR site in Louisiana moved forward, with construction expected to begin later this year.

In addition, SPR enjoyed widespread recognition for their environmental stewardship, receiving OSHA's Voluntary Protection Program "STAR" status and DOE's EStar Award for its Storm Recovery Debris Waste Management Project following Hurricanes Gustav and Ike. SPR also received the 2010 Federal Electronics Challenge Silver Award for electronic recycling.

We've gotten off to a good start in 2010. We have a lot of work to do – and a lot to look forward to – in 2011. As we move forward this year, *Fossil Energy Today* will provide quarterly updates on our progress and other news from across FE. I hope you enjoy this inaugural edition, and I encourage you to check your inbox for future editions.

Dr. Victor K. Der
Acting Assistant Secretary for Fossil Energy

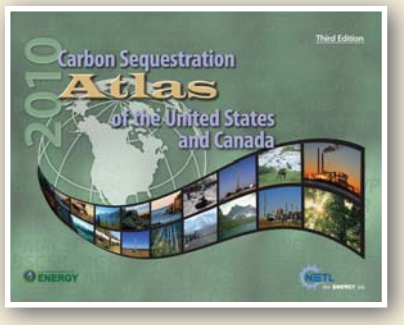
DOE Releases Third Carbon Sequestration Atlas

Latest Edition Estimates Up to 5,700 Years of CO_2 Storage Potential in U.S. and Portions of Canada

There could be as many as 5,700 years of carbon dioxide (CO_2) storage potential available in geologic formations in the United States and portions of Canada, according to the latest edition of the U.S. Department of Energy's (DOE) Carbon Sequestration Atlas (Atlas III).

The updated preliminary estimate, based on current emission rates, documents 1,800 billion to more than 20,000 billion metric tons of CO_2 storage potential in saline formations, oil and gas reservoirs, and unmineable coal areas. This suggests the availability of approximately 500-to-5,700 years of CO_2 storage for the U.S. and covered Canadian areas, according to the third edition of the Atlas. Safe and permanent geologic CO_2 storage is an important element in carbon capture and storage (CCS) technology, considered by many experts as a major component in a portfolio strategy for reducing atmospheric carbon dioxide buildup due to human activity.

The primary purpose of Atlas III is to update U.S./Canadian CO_2 storage potential and provide updated information on the activities of DOE's seven Regional Carbon Sequestration Partnerships (RCSPs), comprised of more than 400 organizations, 43 states, and four Canadian provinces. Atlas III also outlines DOE's Carbon Sequestration Program and international carbon capture and storage (CCS) collaborations, as well as worldwide CCS projects, and CCS regulatory issues. It also presents updated information on the location of CO_2 stationary source emissions, as well as the locations and geologic storage potential of various formations and it provides details about the commercialization opportunities for CCS technologies from each RCSP.



There are two editions of the new Atlas available: An interactive version located at the NATCARB Web site, and a print version available for viewing and downloading at the NETL Web site.

NETL has now created three atlases in collaboration with the RCSPs and the National Carbon Sequestration Database and Geographical Information System (NATCARB) team.

More information on the Regional Carbon Sequestration Partnerships can be found at: www.fossil.energy.gov/programs/sequestration/partnerships.

Prestigious "Coal-Fired Project of the Year" Award Goes to Plant Demonstrating Innovative DOE-Funded Technology

An innovative project demonstrating DryFining™ technology, a more cost-effective way to control coal-based power plant emissions while improving fuel quality, has been named the 2010 Coal-Fired Project of the Year by the editors of Power Engineering magazine.

The project, managed by NETL, was developed with funding from the DOE Clean Coal Power Initiative (CCPI), and was originally implemented at Great River Energy's Coal Creek Station in Underwood, North Dakota in 2009. Other team members on the DryFining™ project were Lehigh University, WorleyParsons, Heyl & Patterson, and EPRI. The prestigious Power Engineering industry award honors technologies that "ushered in breakthrough solutions" in coal-fired, gas-fired, nuclear, and renewable sustainable energy categories.

DryFining™ works by simultaneously drying and refining coal and reducing potentially harmful emissions. The process not only uses power plant waste heat to reduce moisture, but also generates more energy from less coal. Because DryFining™ segregates particles by density, a significant amount of higher density compounds containing pollutants can be removed rather than oxidized in the boiler. The project was originally tested in Great River Energy's 546-megawatt Coal Creek Station Unit 2. Following a successful increase in boiler efficiency and reduction of emissions, Great River Energy expanded the project by building full-scale dryer modules for the entire Coal Creek Station.

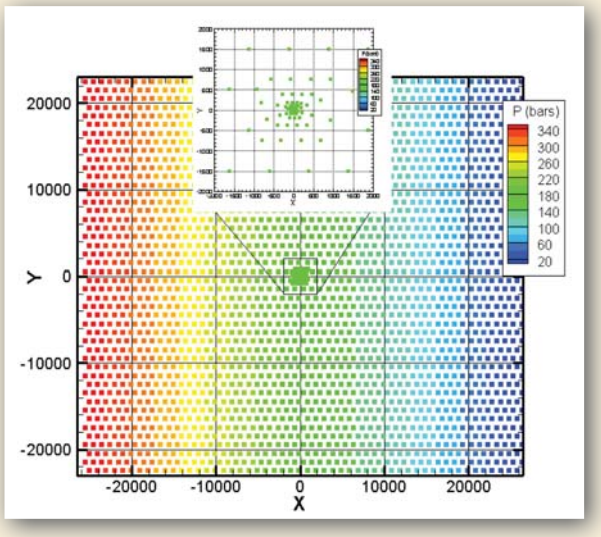
Nearly one-third of the electric power generated by coal in the country comes from plants that burn high-moisture coal, making this technology an important development for efficiently powering the Nation. Great River Energy noted that DryFining™ has a lower initial cost of installation and reduces expenses by more than $20 million annually. The financial and operational advantages to the Coal Creek Station, in comparison with alternative emissions control equipment, could eventually be seen in similar plants with the addition of the DryFining™ system.

National Risk Assessment Program Storage Retention Goals for Carbon Sequestration

The effectiveness of carbon dioxide (CO_2) sequestration depends greatly on storage permanence. A key goal of NETL's Carbon Sequestration Research Program is at least 99 percent retention of CO_2 in underground reservoirs over a 100-year period. However, variability in field conditions greatly complicates quantitative leakage risk predictions.

NETL is collaborating with other U.S. Department of Energy national labs in a new effort–the National Risk Assessment Program (NRAP). The objectives of NRAP are to integrate scientific insight from across the sequestration research community and to ensure development of the science base necessary for appropriate risk assessment (including strategic monitoring) to support large-scale underground carbon storage projects. This NETL-led effort includes researchers from the Los Alamos, Lawrence Berkeley, Lawrence Livermore, and Pacific Northwest national laboratories.

After the NRAP develops its findings and recommendations, the program will look to identify field test sites where these tools can be validated. ◆



Pressures & saturations at the top of the reservoir layer after 50 years of CO_2 injection and 50 years post-injection. This information is being integrated in a systems model to quantify the risks of carbon storage.

Geothermal Efforts in the RMOTC Oil Field

Determining a practical use for the millions of gallons of hot water produced from oil fields has been some of the most visible testing at DOE's RMOTC (Rocky Mountain Oilfield Testing Center) located in the Naval Petroleum Reserve No. 3 (NPR-3) outside of Casper, Wyoming. RMOTC has been a leader in the testing and demonstration of technologies using hot water co-produced during oil production, traditionally considered a waste stream, as an energy source for power production. Two tests and a national symposium on the subject have been part of RMOTC's contribution as industry, academia and government come together to evaluate geothermal power generation in oil fields.

In October 2008, RMOTC began testing the first use of traditional geothermal power generation technology in an oil field setting. The test was initially conducted under a DOE cooperative research and development agreement between RMOTC and Ormat Technologies, Inc. of Reno, Nevada. The power system provided by Ormat for the test is a commercial design Organic Rankine Cycle (ORC) 250 kW (kilowatt) power plant modified to use low temperature (190 °F) water separated from co-produced oil from depths of about 5,200 feet in the Tensleep Formation at NPR-3. The binary power unit uses the hot water as the heating fluid for a heat exchanger in the Ormat Energy Converter (OEC). In the heat exchanger, a secondary working fluid, isopentane (an organic fluid with a low boiling point), is vaporized by the heat given up by the water. That pressurized vapor is then used to spin a turbine coupled to a generator to produce electricity.

When operating at full capacity, this low-temperature geothermal test uses approximately 40,000 barrels of produced water daily. The water volume and temperature have been shown to be reliable over time and are the result of forced convection of hot water at great depth which is recharged in the Big Horn Mountain Range located 90 miles to the northwest. Once the water has passed through the power plant, it is cooled in open-air ponds before discharge into a local watercourse. The water, which is relatively fresh and is monitored regularly for quality, has proven to be an asset for wildlife and agriculture downstream of the field.

The Ormat unit is connected to the NPR-3 field electrical system to power oil field production equipment. The Ormat unit has been reliably producing 150-250 kW gross power, which is metered and

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monitored for both reliability and quality. The unit typically contributes 10-12% of the total field power requirements.

In the fall of 2009, DOE purchased the test unit as part of a collaborative agreement between Fossil Energy and the Geothermal Technologies Program (GTP) within the DOE's Energy Efficiency and Renewable Energy office. The test is expected to continue through 2011 in order to monitor daily operation and provide for additional data collection. This multi□year collaboration will demonstrate the versatility, reliability, and widespread deployment capabilities of low-temperature geothermal electricity production systems in oil fields.

RMOTC is currently hosting a second low-temperature geothermal test with Recurrent Engineering of Pennsylvania. This test is validation of a commercial 50 kW binary geothermal power generation unit that uses a Kalina cycle incorporating an ammonia and water mixture as the working fluid. The test will also be at low temperatures (210°F and lower) and use hot water from a Madison formation well at NPR-3. We expect results by Spring 2011.

RMOTC also hosted its first technical symposium August 18-19 in Casper with GTP, DOE's National Renewable Energy Laboratory (NREL) and Southern Methodist University (SMU). The Geothermal in the Oil Field Symposium focused on the application of low-temperature geothermal power production in oil and gas operations, including co-produced and geo-pressured reservoirs and other related technologies and settings in the western U.S. Attendance for this inaugural event exceeded expectations with 107 attendees from across the spectrum of low-temperature geothermal investigations by industry, academia and government and set the stage for future collaboration across these groups.

For more information on RMOTC's geothermal activities, please visit www.rmotc.doe.gov.

Fossil Energy Spotlight

A Look at Notable News, Projects, and Research

DOE-Sponsored Study Shows "Sour" Gas Streams Are Safe for Carbon Sequestration

Gas streams containing high levels of both carbon dioxide (CO_2) and hydrogen sulfide (H_2S) can be safely used for carbon capture and storage (CCS), according to results from a field test completed by the Plains CO_2 Reduction (PCOR) Partnership.

The test by PCOR—one of seven members of DOE's Regional Carbon Sequestration Partnership (RCSP) program—also demonstrated that carbon sequestration using so-called "sour" gas streams can be combined successfully with enhanced oil recovery (EOR) and H_2S disposal.

The findings help support national and global efforts to develop and deploy CCS use as one option for mitigating global climate change. CCS involves the permanent storage of human-generated CO_2 emissions in geologic formations deep underground, including depleted oil and gas reservoirs, deep saline formations, and unmineable coal seams. Some of these same geologic formations may also be fit for large-scale storage of CO_2 streams containing significant quantities of H_2S, a toxic and flammable "sour" gas that smells like rotten eggs. Results from the Zama field test will help in determining the technical and economic viability of CO_2 and sour gas storage and support the ultimate deployment of commercial-scale projects. ◆

More information available at:
http://www.fossil.energy.gov/news/techlines/2010/10046-PCOR_Project_Demonstrates_Importan.html

The Zama Field demonstration is one of four PCOR Partnership CO_2 sequestration validation projects and is one of several projects being conducted under Phase II of the overall U.S. Department of Energy Regional Carbon Sequestration Partnership Program.

DOE Manual Studies 11 Major CO_2 Geologic Storage Formations

Information in Comprehensive Report Important to Carbon Capture and Storage Research

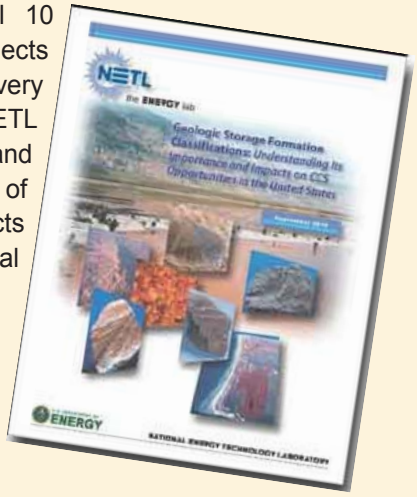
A comprehensive study of 11 geologic formations suitable for permanent underground carbon dioxide (CO_2) storage is contained in a new manual issued by DOE.

Using data from DOE's Regional Carbon Sequestration Partnerships (RCSP) and other sponsored research activities, the Office of Fossil Energy's National Energy Technology Laboratory (NETL) developed the manual to better understand the characteristics of geologic formations that could potentially be used for carbon capture and storage (CCS). In CCS, CO_2 is captured from large stationary sources, such as power plants, and injected for permanent storage in suitable underground reservoirs. CCS is a key component in America's efforts to reduce CO_2 emissions and mitigate global climate change.

As part of the further research required before commercial-scale CCS implementation, one of DOE's program goals is identifying geologic formations that can store large volumes of CO_2, receive CO_2 at an efficient and economic rate of injection, and safely retain the CO_2 over long time periods. The manual investigates those three criteria for 11 major classes of geologic reservoirs.

The manual builds on lessons learned from CO_2 behavior in geologic reservoirs during earlier investigations. To date, DOE's carbon sequestration program has implemented 28 CO_2 injection field projects in conjunction with the RCSP initiative and an additional 10 site characterization projects through the American Recovery and Reinvestment Act. NETL evaluated the geology and depositional environments of each of the sponsored projects to determine if additional efforts need to be focused.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10050-Geologic_Storage_Manual_Issued.html



Geologic Storage Formation Classifications: Understanding Its Importance and Impact on CCS Opportunities in the United States

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Innovative Telemetry System Will Help Tap Hard-to-Reach Natural Gas Resources

Technology Developed by DOE and Industry Partners is Commercialized for Use in the Private Sector

The commercialization of an innovative telemetry communications system developed through a DOE research program will help U.S. producers tap previously hard-to-reach natural gas resources deep underground, resulting in access to additional supplies that will help enhance national energy security.

The patented, proprietary Sharewell L.P. EM-MWD electromagnetic (EM) telemetry system was initially developed by the Office of Fossil Energy's (FE) National Energy Technology Laboratory (NETL) and E-Spectrum Technologies of San Antonio, Texas, under a four-year, cost-shared agreement. It was part of FE's Deep Trek initiative to foster new technologies to facilitate deep exploration of natural gas resources.

Using novel new technologies normally associated with interplanetary deep space navigation and missile guidance systems, the technology is designed to transmit data to and from downhole equipment in real time, enable surface processing of downhole sensor data, and control downhole tools directly from the surface. The technology allows the system to successfully operate at greater depths than other EM systems and to propagate signals through formations that typically weaken electromagnetic waves.

DOE's Deep Trek Program was established in 2002 to develop "smart" systems to address the needs of U.S. producers drilling to depths of 15,000 feet and deeper, where more than 125 trillion cubic feet (Tcf) of untapped natural gas is estimated to be in place. For comparative purposes, DOE's Energy Information Administration estimates technically recoverable U.S. natural gas resources at 2,119 Tcf, with proved reserves of 238 Tcf.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10053-Smart_Drilling_Tool_Commercialized.html

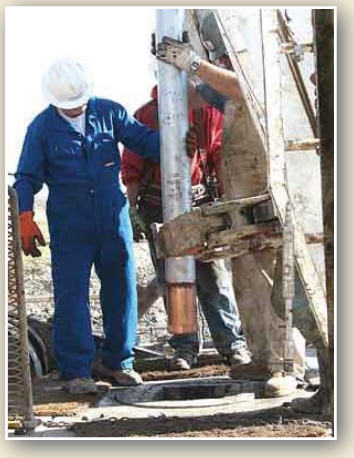
DOE-Sponsored Field Test Finds Potential for Permanent Storage of CO_2 in Lignite Seams

A field test sponsored by DOE has demonstrated that opportunities to permanently store carbon dioxide (CO_2) in unmineable seams of lignite may be more widespread than previously documented. This finding supports national efforts to address climate change through long-term storage of CO_2 in underground geologic reservoirs.

The PCOR Partnership, one of seven partnerships in DOE's Regional Carbon Sequestration Partnership Program, collaborated with Eagle Operating Inc. (Kenmare, North Dakota) to complete the field test in Burke County, North Dakota. In March 2009, approximately 90 tons of CO_2 were injected over 2 weeks into a coal seam 10–12 feet thick at a depth of approximately 1,100 feet. Testing demonstrated that the CO_2 did not significantly move away from the wellbore and was contained within the coal seam for the duration of a 3-month monitoring period.

The partnership also evaluated a variety of carbon storage operation conditions to determine their applicability to similar coal seams. While the results did not change the initial regional storage capacity estimates at nearly 600 million tons for lignites in the U.S. portion of the Williston Basin, they do suggest that suitable lignite seams are potential targets for CCS.

The study also investigated the feasibility of combining CO_2 storage with enhanced methane production. When CO_2 comes in contact with coal, including low-rank coals like lignite, the CO_2 molecules physically attach to the coal. In many cases, the CO_2 displaces methane, the primary component of natural gas, making it easier to recover. This combination potentially offers both a near-term economic return and a long-term environmental benefit.



Lowering the core barrel at the PCOR Partnership lignite site.

The successful injection and storage of CO_2 in the PCOR test opens the door for the conduct of similar CO_2 injection tests at a larger scale and longer duration to confirm an optimal injection regime, investigate the economics of this carbon storage option, and adapt monitoring tools.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10054-Field_Test_Demonstrates_CO2_Storag.html

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World Gasification Database Now Available from DOE

Database Consolidates World's Gasification Plant Information, Illustrates Growth of Gasification Industry

A database just released by DOE documents the worldwide growth of gasification, the expected technology of choice for future coal-based plants that produce power, fuels, and/or chemicals with near-zero emissions.

The 2010 Worldwide Gasification Database, a comprehensive collection of gasification plant data, describes the current world gasification industry and identifies near-term planned capacity additions. The database reveals that the worldwide gasification capacity has continued to grow for the past several decades and is now at 70,817 megawatts thermal (MWth) of syngas output at 144 operating plants with a total of 412 gasifiers.

Gasification is a technological process that uses heat, pressure, and steam to convert any carbon-based raw material into synthesis gas, or syngas. It offers an environmentally friendly alternative to more established ways of converting feedstocks, such as coal and biomass, into useful products, such as electricity or fuels. The use of gasification in more than 27 industrialized countries, as well as the diversity of its products, illustrates the enormous potential for the continued growth of the gasification industry.

The new database is available in Microsoft Excel format, making it easily accessible to parties who are interested in understanding the world's use of gasification for energy and chemical production. Compiled by the Office of Fossil Energy's National Energy Technology Laboratory, in collaboration with members of the Gasification Technologies Council, the database includes information about syngas capacity, feedstock, product, gasifier technology, plant owner/operator, and location for all gasification plants worldwide.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10055-World_Gasification_Database_Now_Av.html

NETL Researchers Patent Multi-Functional Sorbent

As a way of increasing the efficiency of coal-based power generation systems, researchers at NETL invented the first multi-functional, regenerable sorbent to simultaneously remove hydrogen chloride and hydrogen sulfide from coal gasification gas streams at warm gas temperatures of 200–500ºC.

Hydrogen sulfide and hydrogen chloride are major pollutants that have to be removed from the coal gasification gas streams to utilize the coal gas for various applications. After capture, the sorbent can be regenerated with oxygen. The resultant chlorine and sulfur dioxide that are formed can then be used to produce by-product liquid sulfuryl chloride, which is used in various applications including pesticide production or as a chlorine source. Multi-functional sorbents are important to minimize the cost and number of steps involved in the cleanup process.

NETL and Regional University Alliance Team Develop New Materials and Non-Destructive Evaluation Techniques

NETL, the University of Pittsburgh, and West Virginia University, under the NETL-Regional University Alliance consortium, collaboratively developed advanced turbine material systems and early failure non-destructive evaluation (NDE) prediction techniques for application to future gas turbine engines. The team demonstrated that variation in average surface stiffness measured by micro-indentation, as well as wave reflection amplitude and travel time observed by pulse-echo NDE techniques, could be used to identify the early onset of internal thermal barrier coating (TBC) debonding in bench-scale laboratory testing. And, importantly, micro-identification could be used prior to visually observing external crack formation, spallation, and loss of the TBC coating.

The success of the team's acousto-ultrasonic NDE efforts attracted a field-service supplier to provide an in-service full combustor liner to identify potential subsurface TBC debonding areas where refurbishment would be needed. Also, working in conjunction with commercial metal and coating suppliers, the team demonstrated the stability, insulating capability, and cyclic operating life of a high-purity, low-density thermal barrier coating that exceeded bench-scale performance of conventional state-of-the-art TBC coatings.

The feasibility of diffusion barrier coatings to reduce elemental interdiffusion, while retaining high-temperature oxidation resistance of nickel-based super alloys, was shown. Excellent high- temperature life as compared with commercial state-of-the-art bond coat systems was demonstrated for NETL's modified, reduced-cost, diffusion bond coat system. Also, thicknesses and compositions of extreme temperature over layer coatings were projected for use in advanced land-based engines. Details of these efforts are provided in the Office of Fossil Energy Advanced Turbine Program, and Fiscal Year 2010 Turbine Annual Report.

The NETL Regional University Alliance (NETL-RUA) is an applied research collaboration that combines NETL's fossil energy expertise with the broad capabilities of five nationally recognized, regional universities: Carnegie Mellon University (CMU), Pennsylvania State University (PSU), the University of Pittsburgh (Pitt), Virginia Tech (VT), and West Virginia University (WVU). For more information, visit: http://www.netl.doe.gov/rua.index.html.

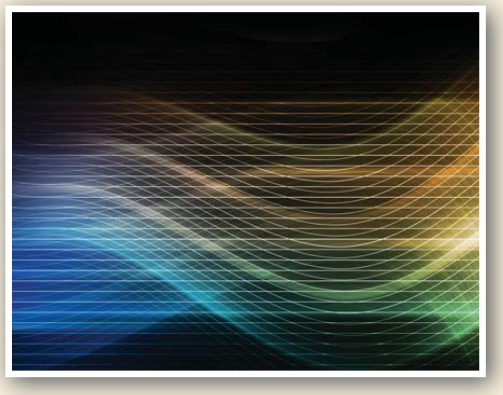
Recent Projects Selected by DOE

Novel Monitoring Networks for Advanced Power Systems

Five projects that will develop technologically sophisticated monitoring networks for advanced fossil energy power systems have been selected for continued research. The projects will support efforts by the FE's Advanced Research—Coal Utilization Science Program to study novel approaches in model development and validation; monitoring refractory health; and wireless, self-powered sensors for advanced, next-generation power systems. They will monitor the status of equipment, materials degradation, and process conditions that impact the overall health of a component or system in the harsh high-temperature, highly corrosive environments of advanced power plants.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10040-Projects_To_Develop_Novel_Monitori.html

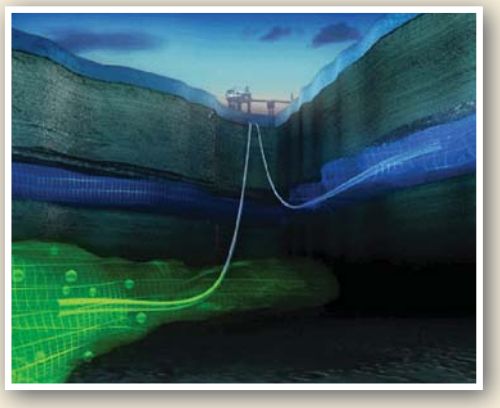
Advance Innovative Materials for Fossil Energy Power Systems



Four projects that will develop capabilities for designing sophisticated materials with unique thermal, chemical and mechanical properties that can withstand the harsh environments of advanced fossil energy power systems have been selected. These innovative systems are both fuel efficient and produce lower amounts of emissions, including carbon dioxide for permanent storage.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10044-DOE_Selects_Materials_Projects.html

Tools for Unconventional Oil and Gas Resources



Ten projects focused on two technical areas aimed at increasing the nation's supply of "unconventional" fossil energy, reducing potential environmental impacts, and expanding carbon dioxide (CO_2) storage options have been selected for further development.

The projects include four that would develop advanced computer simulation and visualization capabilities to enhance understanding of ways to improve production and minimize environmental impacts associated with unconventional energy development; and six seeking to further next generation CO_2 enhanced oil recovery (EOR) to the point where it is ready for pilot (small) scale testing.

More information available at: http://www.fossil.energy.gov/news/techlines/2010/10047-Projects_Selected_to_Boost_Unconve.html

Recovery Act Funding for Carbon Capture and Storage – Recent Highlights

Clean Coal Power Initiative (CCPI) Round 3 ($800 Million)

CCPI 3 is focused on accelerating the development of advanced coal technologies with carbon capture and storage (CCS) at commercial-scale. Projects were awarded, each designed to meet the following objectives:

- Make progress toward a target CO_2 capture efficiency of 90 percent;
- Make progress toward a capture and sequestration goal of less than 10 percent increase in the cost of electricity for gasification systems and less than 35 percent for combustion and oxy-combustion systems; and
- Capture and sequester or put to beneficial use more than 300,000 tons per year of CO_2.

FutureGen 2.0 ($1 Billion)

FutureGen 2.0 will repower a 200 megawatt coal-fired power plant in Meredosia, Ill. with advanced oxy-combustion technology, delivering 90 percent CO_2 capture and eliminating most SO_x, NO_x, mercury, and particulate emissions. The project will also establish a regional CO_2 storage site in Illinois, which will store more than a million tons of CO_2 per year.

The FutureGen Alliance will help design the test program for the new facility to incorporate a broad range of coals and operating conditions to expand the market for this repowering approach.

Industrial Carbon Capture and Storage ($575 Million)

Projects were selected to accelerate CCS research and development for industrial sources. These projects represent an unprecedented investment in the development of clean coal technologies.

Selections include projects from four different areas of CCS research and development:

- Large scale testing of advanced gasification technologies;
- Advanced turbo-machinery to lower emissions from industrial sources;
- Post-combustion CO_2 capture with increased efficiencies and decreased costs; and
- Geologic storage site characterization.

CCS Simulation ($60 Million)

CCS Simulation Initiative ($40 Million): Using advanced modeling and simulation, researchers from national laboratories and regional university alliances will develop science-based methods aimed at lowering the cost of carbon capture while reducing risks associated with its storage. The efforts by the organizations build upon the efforts of DOE's National Risk Assessment Partnership.

Simulation-Based Engineering User Center ($20 Million): The Simulation-Based Engineering User Center (SBEUC) will be primarily used for developing and deploying the simulation tools developed under the CCS Simulation Initiative. Through enhanced ability to predict industrial scale performance, the development of the SBEUC will accelerate the research and development of CCS technologies and support the Administration's goal to overcome the barriers to widespread, cost-effective deployment of CCS within 10 years.

Upcoming Events

www.fossil.energy.gov/news/events

January 30 – February 2
Energy and Environment Conference
Phoenix, Arizona
DOE Contact: Gene Kight, 301-903-2624
http://www.euec.com/index.aspx

February 8-10
2011 International Colloquium on Environmentally Preferred Advanced Power Generation
Costa Mesa, California
DOE Contact: Travis Shultz, 304-285-1370
http://www.apep.uci.edu/ICEPAG2011/Default.aspx

April 10-13
2011 AAPG Annual Conference and Exhibit
Houston, Texas
DOE Contact: Ginny Weyland, 281-494-2517
http://www.aapg.org/houston2011/

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Comments are welcome and may be submitted.