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U.S. GEOLOGICAL SURVEY ENERGY RESOURCES PROGRAM NEWSLETTER  
FALL 2007

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Thank you for subscribing to the USGS Energy Resources Program Newsletter. This quarterly newsletter provides the latest news, information, and products from the USGS Energy Resources Program. In addition to recent publications, we are continuing to expand the content available through our redesigned website. Previous newsletter issues have been archived (in pdf) and may be downloaded at: <http://energy.usgs.gov/newsletter.html>.

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ENERGY SPOTLIGHT:

Coal Quality – A National and Global Issue

[http://energy.er.usgs.gov/coal\\_quality/index.htm](http://energy.er.usgs.gov/coal_quality/index.htm)

## Coal Quality – A National and Global Issue:

Global economies and environmental issues have linkages with energy resources and their utilization. Worldwide coal production and international coal trade are expected to increase during the next several decades, as projections indicate that the global energy mix will remain dependent on fossil fuels. Given this context, worldwide coal use will play an increasingly visible role in global environmental, economic, and energy discussions.

Information on coal resources and coal quality is needed to facilitate informed decisions regarding domestic coal resource allocation, import and export opportunities, foreign policy objectives, technology transfer policies, foreign investment prospects, environmental and human health studies, and byproduct use and disposal issues. For example, ultimate and proximate compositions, calorific value, and forms of sulfur are fundamental properties in evaluating the economic value of a coal. Determining trace element concentrations in coal samples, combined with total sulfur and ash yield, is essential to assess the environmental effects of coal use, as well as the suitability of the coal for cleaning, gasification, liquefaction, and other treatments. For more information on USGS coal quality research activities, please visit:

[http://energy.er.usgs.gov/coal\\_quality/index.htm](http://energy.er.usgs.gov/coal_quality/index.htm)

## Performance Audit of the USGS Energy Resources Program Inorganic Geochemistry Laboratory:

The USGS Inorganic Geochemistry Laboratory (IGL), an integral component of coal quality and other energy resource studies, conducts analyses of major, minor, and trace elements in coal, overburden, water, and related samples not only from U.S. coal regions, but also from around the world. A performance audit of the IGL was conducted to ensure that a high level of analytical performance was maintained and to identify any procedures and techniques that could be enhanced. The audit concluded that the IGL performance for trace element analyses ranked within the top two among the nine laboratories from the around the world that participated in this comparison. Several recommendations made to enhance performance on major and minor elemental parameters were implemented, and the resulting improvements were documented. For more information on the IGL performance audit findings, please visit the USGS Open-File Report located at: <http://pubs.usgs.gov/of/2007/1136/>

## Coal Quality and Major, Minor, and Trace Elements in Coal Samples from the Powder River, Green River, and Williston Basins, Wyoming and North Dakota:

The USGS, in cooperation with the Wyoming Reservoir Management Group (RMG) of the Bureau of Land Management (BLM) and nineteen independent coalbed methane (CBM) gas operators in the Powder River and Green River Basins in Wyoming and the Williston Basin in North Dakota, collected 963 coal samples from 37 core holes between 1999 and 2005. The USGS determined the ultimate composition of all coal core samples. Analyses also included

proximate analysis, calorific value, equilibrium moisture, apparent specific gravity, and forms of sulfur for selected samples. In addition, samples from three core holes (129 samples) were analyzed for major, minor, and trace element contents. Determination of coal quality in the deeper part of the Powder River Basin is especially important, because these coals are targeted for future mining and development. The mineable coal beds (as much as 200 ft thick) in the Wyodak-Anderson coal zone generally have low ash yield and low total sulfur content. The original ash content is either the result of an influx of clastic sediments deposited during flood events or from volcanic ashfalls at the time of deposition. Trace elements of environmental concern are generally present at low levels in the Powder River Basin coals for which major, minor, and trace element contents were determined. For more information on this study and the analytical results, please visit the USGS Open-File Report at the following link:

<http://pubs.usgs.gov/of/2007/1116/>

### Fly Ash: From Cradle to Grave

Coal utilization faces continuing challenges to diminish its environmental “footprint.” A key goal of USGS research is to develop reliable databases that document the relations between geological controls on coal quality and the resultant coal combustion products (CCPs). A “cradle to grave” approach has been adopted to focus on integrating multiple aspects of coal quality such as how and (or) where different coal quality characteristics form and what happens to these characteristics through the process of mining, production, transport, utilization, and waste disposal. The goals of these types of study are to follow the flow of coal from in-the-ground, through the power plant, and ultimately to the disposal or utilization of the various CCPs.

USGS scientists, in collaboration with other researchers, recently developed a tutorial describing the tenets of these studies, and the analytical procedures and laboratory instrumentation used for the research. The tutorial describes how “cradle to grave” studies are conducted and their importance in providing improved, comprehensive, science-based data sets for policy and decision makers. The tutorial was presented on June 10, 2007, at the 32nd International Technical Conference on Coal Utilization & Fuel Systems, The Power of Coal, Clearwater Coal Conference in Clearwater, Florida, USA. The tutorial is available as a USGS Open-File Report and may be downloaded from the following website: <http://pubs.usgs.gov/of/2007/1160/>

### The USGS World Coal Quality Inventory:

The USGS is cooperating with many agencies and scientists from the world’s coal producing countries on a project termed the World Coal Quality Inventory (WoCQI; [http://energy.er.usgs.gov/coal\\_quality/wocqi/index.html](http://energy.er.usgs.gov/coal_quality/wocqi/index.html)). The project, which will be completed in late 2007, has a primary objective of obtaining and characterizing representative coal samples

from most of the world's producing coal provinces. The coal samples were analyzed using the same laboratories and the same methodologies to facilitate comparison of the coal quality data, culminating in a one-of-a-kind database on coal quality.

#### The USGS World Coal Quality Inventory – South America:

South America has high energy resource potential and a recent USGS Open-File Report, available at <http://pubs.usgs.gov/of/2006/1241/>, contains information on the geology, production, use, quality, and environmental significance of the coal resources in South American countries. Information on coalbed methane resources or production is also reported. A total of 135 coal samples were collected and analyzed, and the data are presented in the WoCQI report as individual country chapters (with number of samples in parentheses) for Argentina (7), Brazil (57), Chile (23), Colombia (16), Peru (16), and Venezuela (16).

#### The USGS World Coal Quality Inventory – Geochemistry of Selected Coal Samples from Sumatra, Kalimantan, Sulawesi, and Papua, Indonesia:

Indonesia has significant coal resources, and is among the world's largest exporters of thermal (steam) coal and metallurgical (coking) coal. A USGS Open-File Report may be downloaded from <http://pubs.usgs.gov/of/2007/1202/> that contains geochemical data from a selected group of Indonesian coal samples from a range of coal types, localities, and ages collected for the WoCQI project.

#### Quality of Selected Hungarian Coals:

Coal has been mined in Hungary since the 18th century. The USGS and Hungarian Geological Survey participated in a collaborative study, conducted under the auspices of the United States–Hungarian Science and Technology Fund, during which a total of 39 samples collected and analyzed from five coal mines (four underground, one surface) that produce collectively about one-third of the Hungary's coal. Several properties of the coal samples were analyzed, including: moisture, ash yield, sulfur content, and heating value. The full report may be accessed at the following link: <http://pubs.usgs.gov/sir/2006/5289/>

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CIRCUM-ARCTIC RESOURCE APPRAISAL:

<http://energy.usgs.gov/arctic/>

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Assessment of Undiscovered Oil and Gas Resources of the East Greenland Rift Basins Province:

USGS scientists recently completed an assessment of the potential for undiscovered, technically recoverable (assuming the absence of sea ice) oil and gas resources in the East Greenland Rift Basins Province. Northeast Greenland is the prototype for the new USGS Circum-Arctic Resource Appraisal (CARA) because the area shares important characteristics with many Arctic basins, including the existence of sparse data, high resource potential, environmental sensitivity, much geological uncertainty, and significant technical barriers exploration and development. The new study supersedes a previous USGS assessment of the same area completed in 2000 and was greatly facilitated by new information made available through collaboration with the Geological Survey of Denmark and Greenland. This information significantly improved the geological understanding of the area. Using a geology-based methodology, the USGS estimates the mean undiscovered, conventional petroleum resources in the province to be approximately 31,400 MMBOE (million barrels of oil equivalent) of oil, gas, and natural gas liquids.

For more information on the USGS CARA study, including a Fact Sheet summarizing the East Greenland Rift Basins assessment results, please visit the following web page:

<http://energy.usgs.gov/arctic/>

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ENERGY POLICY ACT OF 2005:

COAL INVENTORY REPORT

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Section 437 of the Energy Policy Act of 2005 (EPAAct) directs the Secretary of the Interior, in consultation with the Secretaries of Energy and Agriculture to conduct an inventory of coal resources underlying Federal lands that are presently available for coal development, as well as the extent and nature of any restrictions on the development of coal resources on those lands. Further, EPAAct directs the Secretary of Energy to submit a report to Congress containing the inventory and update it as the availability of data and developments in technology warrant.

This report was prepared under the auspices of a multi-agency steering committee consisting of scientists from the Department of Energy (DOE) Office of Fossil Energy and National Energy Technology Laboratory and Energy Information Administration, Department of the Interior's BLM and USGS, and the USDA-Forest Service. Previously completed USGS coal resource assessments and associated digital information layers formed the basis for the inventory.

The inventory report focused on the Powder River Basin, Wyoming, because it is the area for which there are currently available the most complete datasets to determine the restrictions on the development of Federal coal resources. Among the findings of the inventory report is that, for the Powder River Basin, approximately 1.5 percent (82,000 acres, or 128 square miles) of assessed Federal coal resource acreage is available for mining under standard lease terms. Based on coal resource estimates, these lands contain 5 percent (27 billion short tons) of the Federal coal resource.

The multi-agency inventory report was recently submitted to Congress, and can be accessed at the following DOE website: [http://www.fossil.energy.gov/epact/epact437\\_final\\_rpt.pdf](http://www.fossil.energy.gov/epact/epact437_final_rpt.pdf)

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**GAS HYDRATES:**

<http://energy.usgs.gov/other/gashydrates/>

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**Thermal Properties of Methane Gas Hydrates:**

Gas hydrates are ice-like crystalline solids composed of water and methane (natural gas) and are present worldwide in shallow permafrost and offshore continental margin sediments. The methane stored in gas hydrates is of interest and concern to policy makers as a potential alternative energy resource, but also as a potent greenhouse gas that could be released from sediments to the atmosphere, and as a potential geohazard in offshore settings that could cause submarine landslides, endangering offshore infrastructure. Gas hydrate stability is sensitive to temperature changes. To understand methane release from gas hydrate, the USGS conducted a laboratory investigation of pure methane hydrate thermal properties at conditions relevant to naturally occurring accumulations of methane hydrate. For more information on this research, please see the new Fact Sheet available from the USGS Coastal and Marine Geology Program at the following link: <http://pubs.usgs.gov/fs/2007/3041/>

**Amplitude Variation of Bottom Simulating Reflection with Respect to Frequency—Transitional Base or Attenuation:**

Gas hydrates are ice-like crystalline solids composed of water molecules surrounding a methane molecule. Gas hydrates form at specific temperature and pressure conditions when water is saturated with gas, and are stable within the upper several hundred meters of sediments below the sea floor. The presence of gas hydrates in ocean sediments has generally been inferred from bottom simulating reflections (BSR) in seismic profiles. The BSR simulates the sea floor surface because the base of hydrate phase stability or phase boundary parallels the sea floor. The amplitude of a BSR, which occurs near the phase boundary between gas hydrate-bearing sediments and underlying gas-filled sediments, strongly depends on the frequency content of a seismic signal, as well as the impedance contrast across the phase boundary. Analysis indicates

that seismic attenuation of gas hydrate-bearing sediments, velocity dispersion, and a transitional base all contribute to the frequency-dependent BSR amplitude variation in the frequency range 10–500 Hz. The USGS Scientific Investigations Report describing this research may be downloaded from the following link: <http://pubs.usgs.gov/sir/2007/5091/>

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HUMAN HEALTH AND ENVIRONMENT:  
<http://energy.usgs.gov/healthenviron.html>  
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Study indicates doubling of the coastal erosion rate in the past 50 years along a segment of the Arctic coast of Alaska:

USGS scientists recently completed a quantitative analysis, published in the July 2007 issue of *Geology*, documenting the effects of accelerated coastal land loss and thermokarst lake expansion and drainage along a section of the Alaska North Slope coastline. The data used in the analysis span the timeframe 1955-2005 and consist of 1955 USGS topographic maps, and 1985 and 2005 Landsat 5 Thematic Mapper images. From these data, USGS scientists observed that the rate of land loss attributed to coastal erosion more than doubled, from 0.48 km<sup>2</sup> per year during 1955–1985 to 1.08 km<sup>2</sup> per year during 1985–2005. The results from this quantitative analysis contribute to an enhanced understanding of the dynamic and interactive processes that shape the landscape in this area, and provide information that is critically needed in sound land-management and policy decision making for sensitive Arctic areas.

For more information on this study, including maps and images of the study area, please visit the following website: [http://energy.usgs.gov/alaska/ak\\_coastalerosion.html](http://energy.usgs.gov/alaska/ak_coastalerosion.html)

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NATIONAL OIL AND GAS ASSESSMENT:  
<http://energy.cr.usgs.gov/oilgas/noga/>  
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Assessment of Undiscovered Oil and Gas Resources of the Illinois Basin, 2007:

Using a geology-based assessment methodology, the USGS estimated the following mean values for of undiscovered, technically recoverable oil and gas resources in the Illinois Basin: 214 million barrels of oil (MMBO) [F95 value of 41 MMBO, F5 value of 505 MMBO]; 4.65 trillion cubic feet of natural gas (TCFG) [F95 value of 1.55 TCFG, F5 value of 9.98 TCFG]; and, 24 million barrels of natural gas liquids (MMBNGL) [F95 value of 3 MMBNGL, F5 value of 60 MMBNGL].

A summary fact sheet on the recently released Illinois Basin assessment may be accessed at:  
<http://pubs.usgs.gov/fs/2007/3058/>

Gulf Coast Region: Cretaceous-Tertiary coal beds

Using a geology-based assessment methodology, the USGS estimated a mean of 4.06 trillion cubic feet (TCF) of undiscovered, technically recoverable natural gas resources [F95 value of 1.66 TCF; F5 value of 7.92 TCF] in Cretaceous-Tertiary coal beds of the onshore lands and State waters of the Gulf Coast. More details are available in the new USGS Fact Sheet at the following link: <http://pubs.usgs.gov/fs/2007/3039/>

More information on USGS Gulf Coast petroleum resource assessment activities may be found at the following website:  
[http://energy.er.usgs.gov/regional\\_studies/gulf\\_coast/gulf\\_coast\\_assessment.html](http://energy.er.usgs.gov/regional_studies/gulf_coast/gulf_coast_assessment.html)

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ADDITIONAL RECENT PUBLICATIONS:  
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**U.S. Geological Survey Bulletin 2204-F**

Total Petroleum Systems of the Carpathian–Balkanian Basin Province of Romania and Bulgaria  
<http://pubs.usgs.gov/bul/2204/f/>

**U.S. Geological Survey Open-File Report 2007–1061**

Results from coalbed methane drilling in Winn Parish, Louisiana  
<http://pubs.usgs.gov/of/2007/1061/>

**U.S. Geological Survey Open File Report 2007–1142**

Log ASCII Standard (LAS) files for geophysical wireline well logs and their application to geologic cross sections through the central Appalachian basin  
<http://pubs.usgs.gov/of/2007/1142/>

**U.S. Geological Survey Professional Paper 1732-D**

Estimating the Amount of Eroded Section in a Partially Exhumed Basin from Geophysical Well Logs: An Example from the North Slope  
<http://pubs.usgs.gov/pp/pp1732/pp1732d/>



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CUSTOMER SATISFACTION SURVEY – USGS ENERGY RESOURCES PROGRAM WEBSITES:

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USGS Energy Resources Program Website Customer Satisfaction Survey:

The USGS recently conducted a survey to evaluate customer satisfaction with respect to the revised Energy Resources Program websites. Survey respondents were asked to rate their satisfaction with various aspects of the Energy Resources Program websites as well as their overall satisfaction. In addition, respondents were asked what portions of the website they use, how they used the website information and what decisions were affected by the information. We thank those who responded to the survey and provided their comments. The USGS Energy Resources Program values its customers, so the advice given will help us improve our science products and their delivery. We are currently studying the feedback received from this survey and will provide a summary of results in an upcoming newsletter issue, along with a list of actions that will be taken in response to our customer feedback. If you did not take the survey, but have feedback that you would like to share, please provide comments on the interactive survey on our web site (<http://energy.usgs.gov/survey.html>).

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OTHER USGS NEWS:

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USGS Congressional Briefing Series – Climate Change: Consider the Energy Mix (The Importance of USGS Energy Resource Information to Climate Change Response Strategies):

In the coming decades, climate change may significantly affect how we choose to use energy resources. Decision-makers need accurate information about national and global resources, both conventional and unconventional, to develop realistic energy mix scenarios, climate change models and response strategies. The USGS and its partners are working to provide the science needed by policymakers to foster the right energy mix to help ensure a healthy planet, a strong economy, and a secure Nation for future generations.

The Congressional Briefing Series event, hosted on July 27, 2007, by the American Association of Petroleum Geologists, featured speakers from the U.S. Climate Change Science Program Office, the Department of Energy/National Energy Technology Laboratory, and the USGS. Speaker presentations may be accessed at the following website:

[http://www.usgs.gov/solutions/cc\\_energy.html](http://www.usgs.gov/solutions/cc_energy.html)

The USGS Congressional Briefing Series began in 1999 for the purpose of increasing awareness of the role and relevance of USGS science in the public policy debate and to ensure that science is at the table when Congress is making decisions.

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#### UPCOMING EVENTS:

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Geological Society of America 2007 Annual Meeting, Powder River Basin Field Trip (October 25-26, 2007):

At the upcoming Geological Society of America (GSA) Annual Meeting in Denver, Colorado, USGS and Bureau of Land Management scientists will lead a pre-meeting field trip entitled, “Cornucopia of Coal and Coalbed Gas in the Powder River Basin: From Mining and Utilization to Methane and Methanogens.”

The Powder River Basin (PRB) in Wyoming and Montana contains abundant, thick subbituminous coals of the Paleocene Fort Union Formation. The coals are surface mined primarily for use as fuel in electric power generation, and the deeper beds are being drilled extensively for coalbed methane (CBM). This two-day field trip to the PRB highlights exploration, development, distribution, and utilization of this cornucopia of fuel energy. Drilling operations, completed wells, gas compression, and surface water disposal complexes are examined to gain insight about CBM exploration, development, and gas acquisition in the PRB. A study of the microbial origin of the coalbed gas revealed by methanogens of co-produced water and coal reservoirs is also discussed. More information on the field trip is provided at the GSA Annual Meeting website: [http://www.geosociety.org/meetings/2007/ft\\_pre.htm](http://www.geosociety.org/meetings/2007/ft_pre.htm)

Geological Society of America 2007 Annual Meeting, Topical Sessions:

USGS scientists are co-chairing sessions on energy resources research at the upcoming annual meeting of the Geological Society of America (GSA). One session is entitled, Materials Flow in Coal Utilization, and focuses on tracking the disposition of materials from “cradle to grave” during coal utilization for electric power generation. More information on the scheduled presentations for this session may be accessed at the following GSA website: [http://gsa.confex.com/gsa/2007AM/finalprogram/session\\_19360.htm](http://gsa.confex.com/gsa/2007AM/finalprogram/session_19360.htm)

Another session at the GSA meeting entitled, Microbial Origin of Hydrocarbon Gases in Coal Beds and Sedimentary Basins, is exploring the recent contributions from biogeochemistry, sedimentary geology, isotope geochemistry, and molecular biology to provide a better understanding of biogenic gas formation in subbituminous coal beds in the Powder River Basin and other sedimentary basins. More information on the scheduled presentations for this session is also given at the website: [http://gsa.confex.com/gsa/2007AM/finalprogram/session\\_19573.htm](http://gsa.confex.com/gsa/2007AM/finalprogram/session_19573.htm)

USGS Open House (Reston, Virginia) – November 3, 2007:

**You're Invited! USGS Open House 2007: Dig the Earth? Discover Our Science!**

Explore more than 125 years of earth science at the USGS Open House on Saturday, November 3, 2007, from 10:00 a.m. – 5:00 p.m. at the USGS National Center, 12201 Sunrise Valley Drive, Reston, VA 20192. Exhibits, demonstrations, hands-on activities and live entertainment will introduce the whole family to the wonders of science. Great resource materials are available for teachers. Admission and parking are free. Food and beverages are for sale. Most activities are indoors – the event will take place rain or shine. For directions to the USGS National Center, please visit the following web page: <http://energy.usgs.gov/visit.html>