



U.S. GEOLOGICAL SURVEY ENERGY RESOURCES PROGRAM NEWSLETTER
FALL 2008

Thank you for subscribing to the U.S. Geological Survey 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 Previous newsletter issues have been archived (in PDF format) and are accessible from: <http://energy.usgs.gov/newsletter.html> .

If you have any questions or comments regarding the ERP newsletter, please send an email to: gd-energyprogram@usgs.gov .

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ENERGY SPOTLIGHT

NEW NATIONAL ASSESSMENT OF U.S. GEOTHERMAL RESOURCES

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

Substantial Power Generation from Domestic Geothermal Resources

Geothermal energy is an extremely important but underutilized domestic, renewable energy resource. The nearly 15,000 Gigawatt-hours of geothermal power generated in 2005 constituted 25 percent of domestic non-hydroelectric renewable electric power generation (slightly more than 4,055,400 total Gigawatt-hours of electricity were produced in the United States in 2005).

Geothermal power production could add significantly to the electric power generating capacity in the United States. This potential is addressed in a U.S. Geological Survey Fact Sheet 2008-3082 released in September, 2008. It is the first national geothermal resource estimate in more than 30 years.

"The results of this assessment point to a greater potential for geothermal power production than previous assessments," said Dirk Kempthorne, U.S. Secretary of the Interior. "Geothermal energy is not only a renewable resource, but could significantly contribute to our domestic energy resource base."

The assessment evaluated 241 identified moderate-temperature (90 to 150°C; 194 to 302°F) and high-temperature (greater than 150°C) geothermal systems located on private and public lands. Geothermal systems located on public lands closed to development, such as national parks, were not included. Electric-power generation potential was determined for several low-temperature (less than 90°C) systems in Alaska for which local conditions make electric power generation feasible. The assessment also included a provisional estimate of the power generation potential from the application of unconventional, Enhanced Geothermal Systems (EGS) technology.

The results show the United States has an estimated: (1) 9,057 Megawatts-electric (MWe) of power generation potential from domestic, conventional, identified geothermal systems; (2) 30,033 MWe of power generation potential from conventional, undiscovered geothermal resources; and (3) 517,800 MWe of power generation potential from unconventional (high temperature, low permeability) EGS resources. Probabilities assigned to the power generation potential range from 3,675 MWe (95%) to 16,457 MWe (5%) for identified geothermal systems; 7,917 MWe (95%) to 73,286 MWe (5%) for undiscovered geothermal resources; and from 345,100 MWe (95%) to 727,900 MWe (5%) for EGS.

Assessment results also show that full development of the conventional, identified systems alone could expand geothermal power production by approximately 6,500 MWe, or about 2.6 times the

currently installed geothermal total of more than 2,500 MWe. The resource estimate for unconventional EGS (517,800 MWe) is more than an order of magnitude larger than the combined estimates for both identified and undiscovered conventional geothermal resources (39,090 MWe). If successfully developed, such resources could provide an installed geothermal electric power generation capacity equivalent to about half of the currently installed electric power generating capacity in the United States.

This assessment benefited from cooperation with the Department of Energy, Bureau of Land Management, the University of Nevada - Reno, the University of Utah, Idaho National Laboratory, Lawrence Berkeley National Laboratory, state and local agencies, and the geothermal industry.

To learn more about USGS National Geothermal Resource efforts please visit the [Energy Resources Program Web site](http://energy.usgs.gov) (<http://energy.usgs.gov>). The USGS fact sheet summarizing results of this assessment is accessible at: <http://pubs.usgs.gov/fs/2008/3082/> .

FEATURES

ALASKA STUDIES

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

The Yukon Flats Cretaceous(?) - Tertiary Extensional Basin, East-Central Alaska: Burial and Thermal History Modeling

One-dimensional burial and thermal history modeling of the Yukon Flats Basin, east-central Alaska, was conducted as part of an assessment of the region's undiscovered oil and gas resources. No deep exploratory wells have been drilled to date, so the subsurface geology of the basin is inferred from seismic reflection, gravity, and magnetic surveys, and from studies of shallow core holes and outcrops. A thick sequence of Upper Cretaceous(?) and Cenozoic nonmarine sedimentary rocks is believed to fill the basin; coal and organic-rich mudstone and shale within this sequence represent potential hydrocarbon source rocks. Burial and thermal history modeling represents the sole source of information on the thermal maturity of these potential source rocks. In this effort, we constructed four alternative burial history scenarios for a hypothetical well through the deepest portion of Yukon Flats Basin. They differ from each other in the thicknesses of Upper Cretaceous and Cenozoic strata, the timing of initial basin subsidence, and the timing of inferred unconformities. The burial modeling results indicate a present-day depth to the oil window of approximately 6,000 feet. The full report documenting this study is available from: <http://pubs.usgs.gov/sir/2007/5281/> .

ARCTIC STUDIES

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

Assessment of Undiscovered Oil and Gas Resources of the West Siberian Basin Province, Russia, 2008

The USGS recently assessed the undiscovered oil and gas potential of the West Siberian Basin Province in Russia as part of the USGS Circum-Arctic Resource Appraisal project. This province is the largest petroleum basin in the world, having an areal extent of about 2.2 million square km. It is a large rift-sag feature bounded on the west by the Ural fold belt, on the north by the Novaya Zemlya fold belt and North Siberian Sill, on the south by the Turgay Depression and Altay-Sayan fold belt, and on the east by the Yenisey Ridge, Turukhan-Igarka uplift, Yenisey-Khatanga Basin, and Taimyr High. Exploration has led to the discovery of tens of giant oil and gas fields, including the Urengoy gas field with more than 3,500 trillion cubic feet of gas reserves and the Samotlar oil field with reserves of nearly 28 billion barrels of oil.

The province has a total discovered oil and gas volume of more than 360 billion barrels of oil equivalent. The total estimated means for undiscovered conventional oil and gas resources are 3.7 billion barrels of oil, 651 trillion cubic feet of natural gas, and 20 billion barrels of natural-gas liquids. A fact sheet describing the study can be accessed at:

<http://pubs.usgs.gov/fs/2008/3064/> .

COAL

<http://energy.usgs.gov/coal.html>

Assessment of Coal Geology, Resources, and Reserves in the Gillette Coalfield, Powder River Basin, Wyoming

The Gillette coalfield, within the Powder River Basin in east-central Wyoming, is the most prolific coalfield in the United States. In 2006, production totaled about 37 percent of the nation's total yearly production. The Anderson and Canyon coal beds in the Gillette coalfield contain some of the largest deposits of low-sulfur sub-bituminous coal in the world. By utilizing the abundance of new data from recent coalbed methane development in the Powder River Basin, this study represents the most comprehensive evaluation of coal resources and reserves in the Gillette coalfield to date. Eleven coal beds were evaluated to determine the in-place coal resources. Six of the eleven coal beds were evaluated for reserve potential based on current

technology, economic factors, and current restrictions to the mining of alluvial valley floors and beneath land occupied by railroads, a Federal interstate highway, cities, and a gas plant. Other restrictions of a geologic nature, such as overburden thickness, coal bed thickness, and areas of burned coal, were also considered. Coal reserves are the portion of the recoverable coal that can be mined, processed, and marketed at a profit at the time of the economic evaluation. With a discounted cash flow at 8 percent rate of return, the coal reserves estimate for the Gillette coalfield is 10.1 billion short tons of coal (6 percent of the original resource total) for the 6 coal beds evaluated. The report is available at: <http://pubs.usgs.gov/of/2008/1202/> .

GIS Representation of Coal-Bearing Areas in North, Central, and South America

Worldwide coal consumption and international coal trade are projected to increase in the next several decades. Existing surficial geology GIS layers of the appropriate geologic age have been used as an approximation to depict the extent of coal-bearing areas in North, Central, and South America, and Greenland. Global surficial geology GIS data were created by the USGS for use in world petroleum assessments and these served as the major sources for the selection and creation of polygons to represent coal-bearing areas. Additional publications and maps by various countries and agencies were also used as sources of coal locations. GIS geologic polygons were truncated where literature or hardcopy maps did not indicate the presence of coal.

The provided GIS files are intended to serve as a backdrop for display of coal information. The depicted areas are not adequate for use in coal resource calculations, as they were not adjusted for geologic structure and do not include coal at depth. Additionally, some coal areas in Central America could not be represented by the mapped surficial geology and are shown only as points based on descriptions or depictions from scientific publications or available maps. Three attributes of the coal that are represented by the polygons or points include geologic age (or range of ages), published rank (or range of ranks), and information source (published sources for age, rank, or physical location, or GIS geology base). More information and links to the data can be found at: <http://pubs.usgs.gov/of/2008/1257/> .

GIS Representation of Coal-Bearing Areas in Africa

The African continent contains approximately 5 percent of the world's proven recoverable reserves of coal. Coal reserves will undoubtedly continue to be part of Africa's energy portfolio as demand grows in the future. A review of available literature indicates that 27 nations in Africa contain coal-bearing rock. South Africa accounts for 96 percent of the continent's total proven recoverable coal reserves, ranking it sixth in the world. This report is a digital compilation of published information on Africa's coal-bearing geology, and is intended to be used in small-scale spatial investigations in a GIS and as a visual aid for the discussion of Africa's coal resources.

Included in this GIS dataset are the rank, age, and location of coal in Africa as well as the complete reference to detailed source information used for each of the coal-bearing polygons presented. However, the dataset is not appropriate for use in resource assessments of at any

meaningful scale because of the lack of specific information such as the depth of coal beds at most locations. However, because this is the first dataset to show continent-wide distribution and general geologic relationships of coal, it is useful for guiding future resource investigations as well as for display and visualization purposes. Greater detail regarding the creation of this dataset as well as the sources used is provided in additional links at:
<http://pubs.usgs.gov/of/2008/1258/>.

GEOLOGIC CARBON DIOXIDE SEQUESTRATION

http://energy.er.usgs.gov/health_environment/co2_sequestration/

Congressional Testimony by Energy Resources Team Scientist Robert Burruss

Dr. Robert C. Burruss, Research Scientist with the U.S. Geological Survey, testified about geologic carbon sequestration to the Subcommittee on Environment and Hazardous Materials of the House Committee on Energy and Commerce. Dr. Burruss' full testimony can be accessed at:
http://energy.er.usgs.gov/images/co2_sequestration/burruss_testimony_2008.pdf.

The witness list and other witness-submitted testimony are found at:
http://energycommerce.house.gov/cmte_mtgs/110-ehm-hrg.072408.ClimateChange.shtml.

GIS DATA FINDER; NEW GIS DATA, SERVICES, AND MAPS

<http://energy.usgs.gov/search.html>

As a continuing effort to improve the accessibility of information, products, and services from our website and respond to customer feedback, the USGS Energy Resources Program has recently implemented the GIS Data Finder search capability. This application enables customers to search or browse through the Program's extensive collection of GIS-related products, including maps, GIS datasets and Internet Map Services from a single portal. Several new products have been added that include 24 datasets and one static map. To access these products, please visit:

http://certmapper.cr.usgs.gov/erp_datafinder_v1.1/explorer.jsp?goTo=browse&name=Newest%20Data,%20Services,%20and%20Maps&docId={9FB91B9C-41B1-499C-A64D-812DD06C7C9F}.

We are continuing to expand the functionality and search criteria available through the GIS Data Finder. If there are questions or comments regarding this search capability, please send an email to datamgt@usgs.gov.

HUMAN HEALTH AND ENVIRONMENT

<http://energy.usgs.gov/healthenviro.html>

Results of a Survey of Residential Home Heating Fuel and Stove Type and Use in the Shiprock Area of the Navajo Nation

For many Navajo people, coal provides an affordable and convenient means of home heating. However, coal combustion results in the formation and mobilization of materials that are known risk factors for respiratory and other diseases. The level of respiratory morbidity among the Navajo people is higher than can be explained by usual epidemiological risk factors. The Shiprock area of the Navajo Nation is somewhat unique, in that atmospheric thermal inversions trap air pollution low to the ground, especially in winter.

The purpose of this survey was to assess the fuel and stove type and use, and document other household characteristics that might be related to the exposure of potentially toxic coal combustion products. A total of 137 surveys were conducted in English and Navajo to ascertain and document fuel usage and the type, size, and conditions of heating stoves used in both traditional and modern homes. Results were presented to the community at the Shiprock Chapter in the Navajo language. The results were used to increase public awareness by emphasizing ways to properly use and store coal and improve stove function and ventilation. This Open-File Report is available at: <http://pubs.usgs.gov/of/2008/1249/>.

Summary of Mercury and Trace Element Results in Precipitation from the Culpeper, Virginia, Mercury Deposition Network Site (VA-08), 2002-2006

The VA-08 Mercury Deposition Network (MDN) site, southwest of Culpeper, Virginia, was established in autumn of 2002. This site, along with nearby VA-28 (~31 km west) at Big Meadows in Shenandoah National Park, fills a spatial gap in the mid-Atlantic region of the MDN network and provides mercury deposition data immediately west of the Washington, D.C., metropolitan area. The purpose of this report was to summarize findings from the Culpeper MDN site, using results for weekly precipitation, from the initiation of the site in November 2002 to the end of 2006, and to compare these results with those for the Big Meadows MDN Site. Results for the Culpeper site study indicate that the highest mercury (Hg) deposition is measured during the second and third quarters of the year (April-September). This is a result of both elevated Hg precipitation concentrations and greater precipitation during this period. The data also exhibit a general statistically significant negative correlation between weekly total precipitation and Hg concentrations, probably due to a dilution effect during larger precipitation events, especially during winter and spring. Comparison of results between the Culpeper and

Big Meadows study areas indicates that, although quarterly Hg deposition was not significantly different between sites, quarterly volume-averaged Hg precipitation concentrations were statistically larger and precipitation was significantly lower at VA-08. Lower Hg concentrations at the VA-28 site relative to VA-08 are likely a result of greater total precipitation and thus additional dilution of Hg in precipitation.

Results from concomitant trace elements in precipitation collected from July, 2005, to December, 2006, were used to better identify possible sources of Hg at the Culpeper MDN site. Principal component analysis of the Hg and trace metal data identified three primary source categories -- crustal sources, local wintertime heating oil, and regional anthropogenic emission sources. Air mass trajectory modeling and enrichment factor calculations are consistent with this interpretation. A preliminary source attribution model indicates that approximately 51 percent of the Hg in wet deposition is likely due to regional anthropogenic sources, whereas crustal sources and local oil combustion account for 9.5 percent and <1 percent, respectively. This calculation implies that the Hg burden accounts for approximately 40 percent of the Hg in wet deposition. This Open-File Report is available at: <http://pubs.usgs.gov/of/2008/1232/>.

NATIONAL OIL AND GAS ASSESSMENT

<http://energy.cr.usgs.gov/oilgas/noga>

Petroleum Systems and Geologic Assessment of Undiscovered Oil and Gas in the Wind River Basin Province, Wyoming

!!NEW CD-ROM!!

This new report, available online and in a CD-ROM, contains maps, associated spatial data, and assessments of the undiscovered oil and gas potential of the Wind River Basin Province, which encompasses about 4.7 million acres in central Wyoming. The assessment is based on the geologic elements of each total petroleum system (TPS) defined in the province, including hydrocarbon source rocks (source-rock maturation, hydrocarbon generation, and migration), reservoir rocks (sequence stratigraphy and petrophysical properties), and hydrocarbon traps (trap formation and timing). Using this geologic framework, the USGS defined three TPSs: (1) Phosphoria TPS, (2) Cretaceous-Lower Tertiary Composite TPS, and (3) Waltman Shale TPS. Within these systems, 12 assessment units (AU) were defined, and undiscovered oil and gas resources were quantitatively estimated within 10 of the 12 AUs. The USGS estimated a mean of 2.4 trillion cubic feet of undiscovered natural gas, a mean of 41 million barrels of undiscovered oil, and a mean of 20.5 million barrels of undiscovered natural gas liquids. The online version of this report is accessible via the following website: <http://pubs.usgs.gov/dds/dds-069/dds-069-j/>. For CD-ROM requests, please send an email to: eteamdisks@usgs.gov.

Assessment of Undiscovered Oil and Gas Resources of the Bighorn Basin Province, Wyoming and Montana, 2008

The USGS recently completed an assessment of the undiscovered oil and gas potential of the Bighorn Basin Province, which encompasses about 6.7 million acres in north-central Wyoming and southern Montana. Based on the geologic elements that define total petroleum systems (TPS), two (TPSs) were distinguished - Phosphoria TPS and Cretaceous–Tertiary Composite TPS. Within these two systems, eight assessment units (AU) were defined, and undiscovered oil and gas resources were quantitatively estimated within each AU. The USGS estimated the means of 989 billion cubic feet of gas, 72 million barrels of oil, and 13 million barrels of total natural gas liquids for the two TPSs. A USGS Fact Sheet summarizing the results is available at: <http://pubs.usgs.gov/fs/2008/3050/>.

Geologic Controls on the Growth of Petroleum Reserves, Chapter I

The geologic characteristics of selected siliciclastic and carbonate reservoirs in North America (largely the continental United States) were investigated to improve understanding of the role of geology in the growth of petroleum reserves. Reservoirs studied were deposited in (1) eolian environments, (2) interconnected fluvial, deltaic, and shallow marine environments, (3) deeper marine environments, (4) marine carbonate environments, (5) a submarine fan environment, and (6) a fluvial environment. Reservoirs in each formation were subdivided into categories, as appropriate, where the reservoirs had sufficiently different geological attributes to warrant separate treatment. Variables viewed as important when considering the designation of a reservoir category included depositional setting, source rock for contained petroleum, post-depositional alteration of the reservoirs, and type of trap or seal.

The connection between an oil reservoir's production history and geology was also evaluated by studying production histories of wells in disparate reservoir categories and wells in a single formation containing two reservoir categories. This effort was undertaken to determine, in general, if different reservoir production heterogeneities could be quantified on the basis of gross geologic differences. It appears that reserve growth in existing fields is most predictable for those in which reservoir heterogeneity is low and thus production differs little between wells, probably owing to relatively homogeneous fluid flow. In fields in which reservoirs are highly heterogeneous, prediction of future growth from infill drilling is notably more difficult. In any case, success at linking heterogeneity to reserve growth depends on factors in addition to geology, such as engineering and technological advances and political or cultural or economic influences. The USGS Bulletin documenting this study is available at: <http://pubs.usgs.gov/bul/b2172-i/>.

OTHER NEWS

CUSTOMER SATISFACTION SURVEY

The USGS recently conducted a survey to evaluate customer satisfaction and to gather customer feedback about this Newsletter. The USGS Energy Resources Program (ERP) values its customers, so the advice given will help us improve our science products and their delivery. Thanks to the responses of many readers, we now can report the findings from the survey. A summary of the report can be read on our website at http://energy.usgs.gov/PDFs/ERP_NewsletterSurveyResults2008.pdf.

Respondents were asked to rate their satisfaction with respect to various aspects of the Newsletter as well as their overall satisfaction with this information service. Respondents were also asked to provide information regarding what Newsletter features they use, how they use the information contained in the Newsletter, what decisions may have been affected by the information, and recommendations for improving the Newsletter. Results are separated into two groups: Subscribers and employees associated with the USGS ERP.

Overall customer satisfaction levels with the ERP Newsletter are high: the total satisfaction level (the sum of “very satisfied” and “satisfied” responses) from each group exceeds 98 percent. In addition, the vast majority of survey respondents experience the Energy Spotlight feature of the Newsletter as a useful newsletter feature.

A majority of survey respondents indicated they had accessed web links included in Newsletter issues as a means of obtaining more information about a research activity or publication. In addition, nearly all respondents (100 percent from subscribers and 93 percent from USGS) indicated the Newsletter is helpful as a means of staying up-to-date with the latest ERP research activities, products, and web information and services. When asked if the text summaries in the ERP Newsletter included sufficient details to be informative, 86 percent of subscriber respondents and 100 percent of USGS respondents indicated that the level of detail was “just right.”

In response to the responses to survey questions as well as specific comments offered, we will be implementing the following changes in upcoming Newsletter issues:

(1) Hyperlinks will be added to the PDF version of the Newsletter to facilitate faster access between the Table of Contents and a particular feature.

(2) A regular GIS/Geospatial feature will be added to the Newsletter to highlight the most recently available GIS coverages. This feature will complement our web-based GIS Data Finder, accessible at <http://energy.usgs.gov/search.html>, a new application that enables customers to search or browse through the Energy Resources Program’s vast collection of GIS-related

products including Maps, GIS Datasets and Interactive Map Services from a single portal. Users of this new application can access and download products based on a variety of product attributes including spatial location, content type, keyword, or research topic.

(3) The Newsletter scope will be expanded to better reflect the entire spectrum of ERP research, including ERP information, products, and activities that appear in other venues external to the ERP website.

Thank you again for providing us with your feedback. As always, if you have further comments or suggestions, please provide your feedback via the interactive survey on our website at: <http://energy.usgs.gov/survey.html> .

RECENT PUBLICATIONS

**Regional Stratigraphy and Petroleum Systems of the Michigan Basin, North America:
Swezey, C.S., 2008.**

U.S. Geological Survey Scientific Investigations Map 2978, 1 sheet.
<http://pubs.usgs.gov/sim/2978/>

**Large-Scale Digital Geologic Map Databases and Reports of the North Coal District in
Afghanistan**

U.S. Geological Survey Digital Data Series 317.
<http://pubs.usgs.gov/ds/317/> .