

STATEMENT OF
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U.S. DEPARTMENT OF THE INTERIOR
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COMMITTEE ON NATURAL RESOURCES
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

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Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear here today to discuss with you the U.S. Geological Survey's role in studying, understanding, and assessing the undiscovered, geologically based, energy resources of the Nation (exclusive of the Federal offshore) and World and the Minerals Management Services' (MMS) role in providing information on Federal resources of the Outer Continental Shelf (OCS).

Introduction

Adequate, reliable, and affordable energy supplies obtained using environmentally sustainable practices are essential to economic prosperity, environmental and human health, and political stability. National and global energy demand and resource consumption are projected to increase over the next several decades, though at a slower rate than in recent years. The United States currently consumes 21 percent of the total world primary energy consumption and produces 15 percent of the total world primary energy production. Thus, the volumes, quality, and availability of domestic and foreign energy resources are of critical importance to the United States. The Nation continues to face important decisions regarding the competing uses of public lands and offshore waters, the supply of energy to sustain development and enable growth, and the environmental effects of energy resource development.

Role of the U.S. Geological Survey

The U.S. Geological Survey (USGS) provides the research and information needed to address these challenges by conducting scientific investigations of geologically based energy resources, such as research and assessment on the geology of oil, gas, and coal resources, emerging resources such as gas hydrates, underutilized resources such as geothermal, and unconventional resources such as oil shale, and research on the effects associated with energy resource occurrence, production, and (or) utilization. Our goal is: (1) to understand the processes critical to the formation, accumulation, occurrence, and alteration of geologically based energy resources; (2) to conduct scientifically robust assessments of those resources; and (3) to study the impact of energy resource occurrence and (or) production and use on both environmental and human health. The results from these geoscientific studies are used to evaluate the quality and distribution of energy resource accumulations, and to assess the energy resource potential of the Nation (exclusive of the Federal OCS)) and the World. As one example, the USGS recently produced the first-ever estimate of undiscovered, technically recoverable gas from natural

gas hydrates. Although these resources have not yet been proven economic, this USGS assessment estimates a mean of 85.4 trillion cubic feet of technically recoverable gas from gas hydrates on the Alaska North Slope.

The results from this and other USGS research provide impartial, robust scientific information about energy resources that directly supports the U.S. Department of the Interior's mission of protecting and responsibly managing the Nation's natural resources. The USGS and MMS information is used by policy and decision makers, land and resource managers, other Federal and State agencies, the domestic energy industry, foreign governments, nongovernmental groups, academia, other scientists, and the public. The USGS works with the MMS, which has responsibility for energy and minerals management in Federal offshore waters, to provide an integrated evaluation of the Nation as a whole. Collectively, information from USGS research advances the scientific understanding of energy resources, contributes to plans for a balanced and secure energy future, and facilitates the strategic use and evaluation of resources.

USGS and MMS National Oil and Gas Resources Research and Assessment Activities

The overall goal of USGS domestic energy activities is to conduct research and assessments of all geologically based energy resources. This includes undiscovered, technically recoverable oil and natural gas resources, both conventional and unconventional of the United States (exclusive of the Federal OCS, which is assessed by the MMS). These are resources that have yet to be found (drilled), but if found, could be recovered using currently available technology and industry practice. Economic factors are not always considered; for example, it may not be economically feasible to exploit gas hydrate resources on the Alaska North Slope and both conventional and unconventional Alaskan gas resources are currently considered stranded without the means of transporting gas from the region. The purpose of USGS and MMS assessments are to develop robust, geologically based, statistically sound, well-documented estimates of quantities of energy resources having the potential to be added to reserves, and thus contribute to the overall energy supply. The USGS and MMS resource assessment methodologies are thoroughly reviewed and externally vetted so as to maintain the transparency and robustness of the assessment results.

The current USGS effort to update national (onshore and State waters) assessments of oil and gas resources is done in support of the Energy Policy and Conservation Act (EPCA) Amendments of 2000 (P.L. 106-469 §604). Through a collaborative, multi-agency effort involving the Bureau of Land Management, the USGS, the U.S. Forest Service, the Department of Energy, and the EIA, the USGS provides the oil and gas resource estimates as the basis for the EPCA inventory. The USGS role is to assess the potential volumes of conventional and continuous (unconventional) resources (e.g., coalbed gas, shale gas, tight gas sands) in each priority province using established, externally reviewed and vetted methodologies and provide this information to the appropriate land and resource management agencies for subsequent analysis. The Energy Policy Act of 2005 (P.L. 109-58) re-authorized EPCA 2000 assessment activities by the USGS, emphasizing the unique and critical role of the USGS and specifically mandated that "the same assessment methodology across all geological provinces, areas, and regions [be used] in

preparing and issuing national geological assessments to ensure accurate comparisons of geological resources.”

The estimate of undiscovered, technically recoverable resources changes over time. There are several reasons for this, including scientific and technological developments regarding petroleum resources in general and improvements to the geologic understanding in numerous settings. These advances in geologic understanding, as well as changes in technology and industry practices, necessitate that resource assessments be periodically updated to take into account such advances. One example of this change is the recently updated USGS assessment of the Bakken Formation in the U.S. portion of the Williston Basin. This assessment, released in 2008, shows an estimated 3.0 to 4.3 billion barrels of undiscovered, technically recoverable oil compared to USGS’s 1995 mean estimate of 151 million barrels of oil. Another example is the USGS assessment of gas hydrates on the Alaskan North Slope. Substantial investments in gas hydrate research now support categorizing some accumulations of gas hydrates as technically recoverable. Research challenges remain in order to determine if this technically recoverable resource will be economically recoverable, but current multi-organizational (including USGS) and multi-disciplinary efforts are focused on overcoming these obstacles.

The passage of the OCS Lands Act in 1953 established Federal jurisdiction over the mineral resources of the OCS and authorized the Secretary of the Interior to manage oil and natural gas and other marine minerals activity seaward of state submerged lands. Oil and natural gas produced offshore on the OCS is a major supply source of energy for the domestic market. About 17 billion barrels of oil and 174 trillion cubic feet of natural gas have been produced from the OCS since 1954. Current production levels are about 1.4 million barrels of oil and about 8 billion cubic feet of natural gas per day. This represents approximately 27 percent of domestic oil production and 14 percent of natural gas production. But these shares are expected to grow over the next 7 years as new deepwater production in the Gulf of Mexico comes on line (*Gulf of Mexico Oil and Gas Production Forecast: 2007-2016, May 2007*). Recent discoveries in the deep and ultra-deep waters of the Gulf of Mexico could help provide a significant source of oil and gas supplies for decades to come.

OCS oil and gas resource assessments are completed as part of the Secretary’s responsibilities for managing OCS energy and mineral resources and the requirement to assure fair market value for OCS lands to be leased. The MMS conducts resource assessments for the OCS at various scales and for many purposes. Regional assessments may be prepared simply to develop an inventory of potential oil and natural gas resources as part of an evaluation of future supply options. Assessments may be undertaken to analyze the relative merits of oil and gas development proposals and alternatives versus other competing uses. Resource estimates also provide critical input to decision makers regarding the virtues of various policy alternatives, and provide data essential for valuing Federal lands prior to leasing or analyzing industry exploration or development proposals. The MMS conducts periodic national assessments of the oil and natural gas resource potential of the Nation’s Outer Continental Shelf; and in 2005, Congress directed (in Section 357 of the Energy Policy Act of 2005) that the Secretary conduct a comprehensive inventory and analysis of oil and natural gas resources of the U.S. OCS.

This MMS assessment, which was completed in 2006, considers recent geophysical, geological, technological, and economic information and utilizes a probabilistic play based approach to estimate the undiscovered technically recoverable resources (UTRR) of oil and gas for individual plays. This methodology is suitable for both conceptual plays where there is little or no specific information available, and for developed plays where there are discovered oil and gas fields and considerable information is available. After estimation, individual play results are aggregated to larger areas such as basins and regions. Estimates of the quantities of historical production, reserves, and future reserves appreciation are presented to provide a frame of reference for analyzing the estimates of UTRR.

Reserve growth is well documented in the United States and is a major component of the Nation's remaining oil and natural gas resources. In fact, most additions to world oil reserves in recent years are from growth of reserves in existing fields rather than new discoveries. The EIA's 2009 forecast of significant increases in domestic oil production is partly owing to advances in enhanced oil recovery technologies. Given this context, it is important to note the important distinction between the terms "resource" and "reserves." Resource is a concentration of naturally occurring solid, liquid, or gaseous hydrocarbons in or on the Earth's crust, some of which is, or potentially is, economically extractable. Reserves specifically refer to the estimated quantities of identified (discovered) petroleum resources that as of a specified date, are expected to be commercially recovered from known accumulations under prevailing economic conditions, operating practices, and government regulations.

Reserve growth occurs for a variety of reasons, including: (1) extensions of existing fields, infill drilling and new pool discoveries, (2) application of new recovery technologies and improved efficiency, and (3) revisions resulting from recalculation of viable reserves in dynamically changing economic and operating conditions. The assessment of both undiscovered resources and of additions to reserves from discovered fields and reservoirs requires estimation of reserve growth. The USGS has an active research effort to develop a methodology and approach for better quantifying domestic and global contributions of reserve growth to the petroleum resource endowment.

Undiscovered, technically recoverable mean oil resources total 48 billion barrels of oil onshore and in State waters and 86 billion barrels of oil for the OCS. Undiscovered, technically recoverable mean natural gas resources total 743 trillion cubic feet onshore and in State waters (or 657 trillion cubic feet, exclusive of the recent natural gas hydrates assessment), and 420 trillion cubic feet for the OCS. These resources have the potential to be added to reserves, but are not yet proven and may or may not be economic at current or future prices. For example, according to the 2006 MMS national assessment (<http://www.mms.gov/revaldiv/PDFs/NA2006BrochurePlanningAreaInsert.pdf>), of the 86 billion barrels of undiscovered, technically recoverable oil resources in the OCS, 54 billion barrels of that is estimated to be economically recoverable at \$46/barrel. Of the 420 trillion cubic feet of undiscovered, technically recoverable natural gas resources in the OCS, 215 trillion cubic feet is estimated to be economically recoverable at \$6.96/million cubic foot."

These numbers can be compared to proved reserves numbers (EIA): proved U.S. petroleum reserves (for 2007) are 22 billion barrels of oil and proved world petroleum reserves are 1,317 billion barrels; proved natural gas reserves for the U.S. are 204 trillion cubic feet and for the world are 6,124 trillion cubic feet.

Unconventional Oil and Gas Resources

In April 2007, the USGS received funding for a two-year project to reassess oil shale deposits of the Eocene Green River Formation of Colorado, Utah, and Wyoming. The new assessment will incorporate considerable data acquired by the USGS following the collapse of the oil shale industry in the 1980's. It will subdivide the oil shale section into various subunits that will be assessed separately and the data will be made available on-line in a manner that can be easily utilized by modern computer models. This will allow simulations of various development scenarios for open pit mining, underground mining, and in-situ retorting, should oil shale development ever get underway.

Coal

Coal dominates the U.S. fossil energy endowment and accounts for 48% of domestic electricity generation. The USGS has recently completed an assessment of coal resources and reserves in Wyoming's Gillette coalfield, the most prolific coalfield in the country. This assessment is part of the National Coal Resource and Reserve Assessment, which is systematically evaluating the domestic coal resource and reserve base. By utilizing an abundance of new data from coalbed methane development in the region, the USGS was able to produce the most comprehensive assessment to date. The Gillette area accounts for nearly 40 percent of the Nation's current coal production making it the single most important coalfield in the United States. A total of 164 billion tons of original coal resources was found in the six coal beds included in the evaluation. Of that original resource, 10.1 billion tons (6 percent) can be classified as reserves at the current average estimated sales price. Substantial additional resources could be recoverable assuming increased market prices will support the higher costs needed to recover deeper coal. Coal is currently the most important fuel for electricity generation and the USGS studies will determine what portion of the resource base is technically and economically recoverable.

Renewable Energy

In addition to petroleum and coal resources, the USGS also evaluates renewable resources such as geothermal energy. The USGS recently completed a national geothermal resource assessment, the first one in more than 30 years. The USGS evaluated 241 moderate- and high-temperature geothermal resources capable of producing electricity. The USGS assessment estimates (1) 9,057 Megawatts-electric (MWe) of power potential from 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 Enhanced Geothermal Systems (EGS) resources. The results indicate that full

development of the conventional, identified systems could expand geothermal power production by approximately 6,500 MWe, or about 260 percent of the currently installed geothermal total of more than 2,500 MWe. The resource estimate for unconventional EGS is more than an order of magnitude larger than the combined estimates of both identified and undiscovered conventional geothermal resources and, if successfully developed, could provide an installed geothermal electric power generation capacity equivalent to about half of the currently installed electric power generating capacity of the United States.

America's oceans may also provide potential new renewable energy sources to support our Nation's growing energy needs, and MMS is developing a program for managing their uses. Resources on the OCS can be used to generate electricity in a variety of ways. To date there is no comprehensive evaluation for the available renewable energy potential in all offshore waters, but researchers have begun to examine the resource potential in specific areas of interest. DOE's National Renewable Energy Laboratory has a program to produce validated wind resource maps for priority offshore areas, and the results show that the offshore wind resource potential is vast and has the potential to meet a significant amount of the Nation's future energy needs. Although significant wind, wave, tidal and current resources exist in close proximity to coastal population centers—areas that consume the majority of the Nation's electricity generation—the technologies used to generate this energy are relatively new and untested in the offshore environment of the U.S. OCS. Wind, wave and ocean current technologies have been demonstrated at the pilot scale, and wind has been developed at the commercial scale outside the United States—e.g., offshore Denmark, the United Kingdom and Germany.

U.S. Geological Survey International Energy Studies

Our Nation depends heavily on imported energy resources: about 58 percent of the oil and 16 percent of the natural gas consumed in the US come from imports. Given the significance of imported oil and gas to the U.S. energy mix, scientifically robust, unbiased assessments of the world's remaining endowment of petroleum accumulations are of the utmost importance. For this reason, global petroleum resource assessments are a core USGS research activity and have significant global visibility. The USGS world oil and gas resource estimates are used as a standard reference by many organizations including the EIA and the International Energy Agency (IEA).

The overall objectives of USGS studies of international petroleum resources are to continue providing high-quality, comprehensive petroleum assessments and to update previous assessments as needed. A major focus of recent USGS research in this area is the Circum-Arctic Resource Appraisal (or CARA), the primary emphasis of which is to provide a comprehensive, unbiased probabilistic estimate of potential future additions to conventional oil and gas reserves in the high northern latitudes. The Arctic is an area of high petroleum resource potential, low data density, high geologic uncertainty and sensitive environmental conditions. The assessment is the first publicly available petroleum resource estimate of the entire area north of the Arctic Circle.

The results of the assessment, released last July, estimate that the area north of the Arctic Circle has 90 billion barrels of undiscovered, technically recoverable oil, 1,670 trillion

cubic feet of technically recoverable natural gas, and 44 billion barrels of technically recoverable natural gas liquids in 25 geologically defined areas thought to have potential for petroleum. These resources account for about 22 percent of the undiscovered, technically recoverable resources in the world. The Arctic accounts for about 13 percent of the undiscovered oil, 30 percent of the undiscovered natural gas, and 20 percent of the undiscovered natural gas liquids in the world. About 84 percent of the estimated resources are expected to occur offshore.

Conclusion

During the next decade, the Federal government, industry, and other groups will need to better understand the domestic and global distribution of, genesis of, use of and consequences of using geologically based energy resources to address pressing environmental problems such as climate change, national security issues, manage the Nation's domestic supplies wisely, predict future needs, anticipate as well as guide changing patterns in use, and facilitate creation of new industries. Energy resources research and assessments are a traditional strength of the USGS and the MMS, and these activities provide impartial, robust information necessary for the many needs just outlined. As the Nation's energy mix evolves, the USGS and MMS will continue to work with other Federal agencies such as DOE to ensure that our research and assessment portfolio ties into a comprehensive suite of assessments to inform policymakers about energy choices. Future USGS and MMS assessments are anticipated to include hydrocarbon-based (for example, unconventional gas from coal and shale, gas hydrates, oil shale) and nonhydrocarbon-based sources (for example, geothermal resources and uranium) and address the effects of such resource use on land use, ecosystem health, and human welfare. USGS resource assessments and research play an important role in the public and government discourse about the energy resource future of the Nation so that science can inform, advise, and engage decision makers. The USGS and MMS stand ready to assist Congress as it examines these challenges and opportunities.

Thank you for this opportunity to provide an overview of USGS and MMS research and assessments of geologically based energy resources. I would be happy to answer your questions.