America’s Oil and Gas Supply:

“American Innovation Creating American Energy, American Jobs, and American Wealth”

A Roadmap to America’s Oil and Gas Resources

October 2008

Report from the Republican Committee on Natural Resources Staff
Rep. Don Young, Alaska, Ranking Member

“Let us develop the resources of our land, call forth its powers, build up its institutions, promote all its great interests, and see whether we also, in our day and generation, may not perform something worthy to be remembered.'' – Daniel Webster

This Webster quote is engraved in the marble above the Speaker’s Dais in the House of Representatives. Never in our nation’s history have the words, “Let us develop the resources of our land” been more poignant than today as Congress holds the keys that could open our domestic energy resources and free us from the yoke of foreign energy.

Never in our nation’s history has the importance of “build up its institutions” been more important than today when the U.S. House of Representatives is being torn down by parliamentary tactics to deny a clear Majority of Congress the right to vote on energy legislation.

This report will provide the roadmap of technology, resources, and prospects for American energy development creating more American Energy, more American Jobs, and more American Wealth.

I. Executive Summary

The great resources of the United States have powered our nation since its inception. Today, when our nation faces the growing challenge of maintaining our standard of living in an ever more competitive world, we can no longer wait to develop our domestic resources. This report will communicate the facts about what and where America's oil and gas resources are, into a simple conversational document answering the questions Americans are asking. **The United States is a nation rich in oil and gas resources and as the chart below shows, just the oil and gas discussed in this report could supply America more than 178 years of oil and 495 years of natural gas.**

This report is broken into 3 sections: American Resources, American Innovation, and American Opportunity.

American Resources will focus on the conventional oil and gas we are currently developing, hold in reserve, and have in undiscovered technically recoverable resources both onshore and offshore.

American Innovation will examine the new technologies that have opened what were unconventional resources making what was long thought unavailable a conventional resource.

Source of American Energy	Millions of Barrels of Oil	Billions of Cubic Feet of Natural Gas
Known U.S. Reserves		
Total US [1]	20,972	651,917
Undiscovered Technically Recoverable Resources From Conventional Technology		
Federal Offshore [2]	85,880	419,880
Federal Onshore [3]	24,200	214,100
State and Private Onshore [4]	17,800	146,900
Future Development		
Tar Sands [5]	11,000	
Improved Enhanced Oil Recovery [6]	127,000	
Oil Shale [7]	1,000,000	
Methane Hydrates [8]		10,000,000
Total	1,286,852	11,432,797
American Annual Consumption [9]	7,201	23,057
Supply at Current Rates	**178 YEARS**	**495 YEARS**

Finally, American Opportunity will examine what the future could hold if America is willing to reach out by developing our own domestic sources and advancing American technology.

[1] From Energy Information Administration (www.eia.doe.gov)
[2] Figures from Minerals Management Service Testimony
[3] Figures from Bureau of Land Management EPCA Phase III Study (http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/EPCA_III.html)

[4] Figures from USGS "Mean Conventional Oil Resources" (http://certmapper.cr.usgs.gov/data/noga00/natl/graphic/2007/mean_conv_oil_07.pdf)
[5] DOE – Office of Petroleum Reserves (http://www.fossil.energy.gov/programs/reserves/index.html)
[6] DOE – Office of Fossil Energy Report "Game Changer Improvments could dramatically increase domestic oil recovery efficiency" (http://www.fossil.energy.gov/)
[7] Figures from DOE – Office of Petroleum Reserves (http://www.fossil.energy.gov/programs/reserves/index.html)
[8] Figures based on 5% recovery of the low resource figure (200,000 Tcf) from USGS – Actual recovery rates or actual resource may be significantly higher than this conservative estimate.
[9] Figures from Energy Information Administration, DOE (www.eia.doe.gov)

American Resources – Domestically America's oil and gas resources are plentiful and unavailable. Only 3% of America's federal offshore and 6% of America's federal onshore lands are available for development. Moreover, due to Congress' historic willingness to lock away our domestic energy we do not exactly know what we have in reserve.

Offshore, on our Outer Continental Shelf (OCS) according to testimony last year from Walter Cruickshank, Acting Director, Minerals Management Service (MMS), "the Outer Continental Shelf (OCS) inventory requirements of the Energy Policy Act of 2005, MMS completed an assessment of the potential quantities of undiscovered technically recoverable oil and gas resources that may be present on the OCS. According to this assessment, we estimate (at the mean level) that the **OCS contains 86 billion barrels of oil (as oil and natural gas liquids/condensate) and 420 trillion cubic feet of natural gas**."[10] Of these amounts an estimated **18 billion barrels of oil** and **76 trillion cubic feet of natural gas**[11] have been left undiscovered in off-limits portions of the OCS.

Our **onshore** resources are equally rich; our undeveloped oil resources under our onshore **Federal lands total 30.5 billion barrels of oil,**[12] comprising 24.2 billion barrels of undiscovered technically recoverable resources and 6.3 billion barrels of reserves growth. Most of this is under the lands of Alaska, however there remain some significant resources under the lower 48 states. Equally important, are the rich undeveloped natural gas resources under our Federal lands which total **231.0 trillion cubic feet**[13], comprising 214.1 trillion cubic feet of undiscovered technically recoverable resources and 16.9 trillion cubic feet of reserves growth. A significant portion of these resources lie on federal lands in the Rocky Mountains.

American Innovation – All across America today we are seeing advancements in technology that are opening resources which we have known about, but have been unable to develop. Bakken Shale, Tight Sands Gas, Deepwater Gulf of Mexico, and Tar Sands are all resources which a decade ago seemed out of reach. Today with our technology developments we are opening these new sources to bring more domestic oil and gas online.

The Bakken Shale, which under lies Montana and North Dakota, has been known since the 1950s but has been undeveloped due to the technological challenge of developing the resource. Modern advancements have opened this resource and today estimates range from **4 to 12 billion barrels of oil**[14] could be recovered from this "new" domestic energy source.

Tight Sands Gas is another "new" resource, yet already names like Barnett Shale, Piceance Creek, and Appalachian basin are springing to mind as development in tight gas fields increase the

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[10] From Testimony of Acting MMS Director, Walter Cruickshank, before the House Committee on Natural Resources, June 28, 2007
[11] Ibid
[12] BLM EPCA Phase III Study
[13] Ibid
[14] National Assessment of Oil and Gas Fact Sheet, Assessment of Undiscovered Oil Resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, 2008 (http://pubs.usgs.gov/fs/2008/3021/)

supply of domestic natural gas. Today, tight-gas sands now account for about 19% of U.S. production and the U.S. Geological Survey estimates tight-gas sands and shales may contain up to **460 trillion cubic feet (Tcf)** of gas[15] in the U.S. alone.

Tar Sands are a combination of clay, sand, water, and bitumen, a heavy, black, asphalt-like hydrocarbon. The largest deposits are found in Utah (almost 30 billion barrels), Alaska (almost 20 billion barrels), Alabama (more than 6 billion barrels), and Texas and California (5 billion barrels each). Bitumen from tar sands can be upgraded to synthetic crude oil and refined to make asphalt, gasoline, jet fuel, and value-added chemicals. U.S. tar sands resources are estimated at 60 to 80 billion barrels of oil in place, with an estimate of at least **11 billion barrels recoverable.**[16]

Deepwater Gulf of Mexico (GOM), which the Minerals Management Service (MMS) defines deepwater as deeper than 1,312 feet (400 meters), and ultra-deep water as deeper than 5,249 feet (1,524 meters). The first deepwater production in the GOM took place in 1979, but it took until 1992 before more than 10% of the oil production in the GOM was in the deepwater, and until 1998 before more than 10% of the natural gas production in the GOM was in the deepwater. By 2006, those percentages had increased to 72% for oil and 38% for natural gas. This dominance of deepwater production in the Gulf of Mexico will continue and has recently attracted approximately $3.7 billion in high bonus bids for the federal government.[17]

<u>**American Opportunity**</u>**, Oil Shale -** Could America have more oil supply than Saudi Arabia? Possibly if we can unlock our oil shale resources! America is the world's leader in oil shale, the richest deposits are in the Green River Formation in Utah, Colorado, and Wyoming. America's oil shale resources could exceed 6 trillion barrels of oil equivalent. As much as **1 trillion barrels of oil** [18]could be recovered economically at today's prices with today's technology.

Methane Gas Hydrates, may be the most important resource that many American's have never heard of trapped, are off the coasts. Gas hydrates are ice-like crystalline substances occurring in nature where a solid water lattice accommodates gas molecules (primarily methane, the major component of natural gas) in a cage-like structure. Gas hydrates form in the shallow subsurface along continental margins in the outer Continental Shelf and below the permafrost in polar regions, where pressure and temperature conditions provide a zone of hydrate stability.[19] Gas hydrate resources may be one of the Nation's most promising energy supply sources. The U.S. Geological Survey (USGS) notes that if one percent of the expected in-place resource can be accessed (1% of 320,000 trillion cubic feet); the Nation

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[15] Data from USGS "US Natural Gas Availability" (www.usgs.gov)
[16] DOE – Office of Petroleum Reserves
[17] MMS Central Gulf of Mexico Lease Sale 206
[18] Data From USGS and Department of Energy
[19] "Preliminary Evaluation of In-Place Gas Hydrate Resources: Gulf of Mexico Outer Continental Shelf", Executive Summary, OCS Report MMS 2008-004, February 1, 2008.

could more than double its technically recoverable natural gas resource base (currently estimated at 1,200 trillion cubic feet).[20]

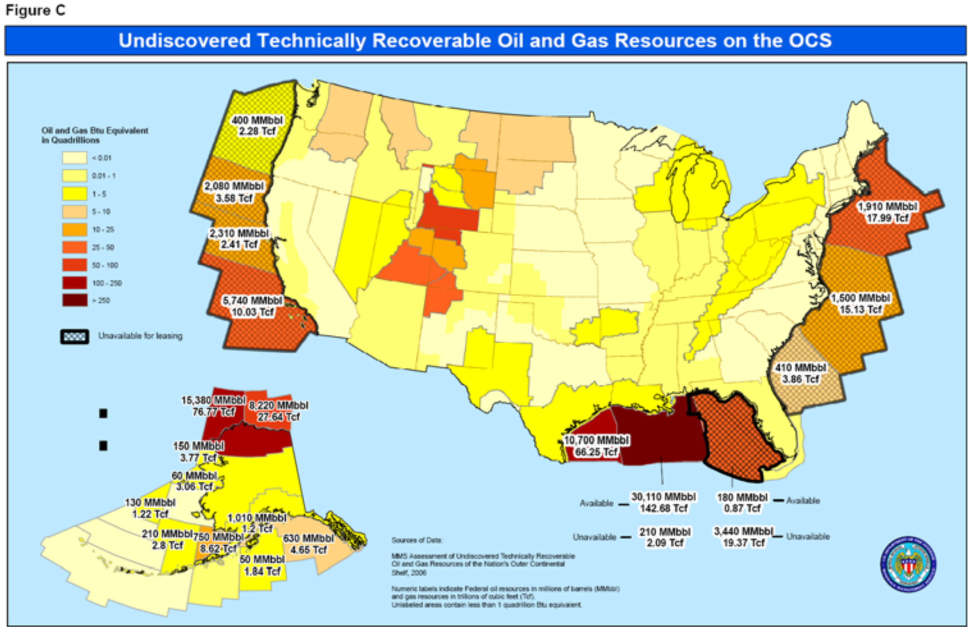
II - American Resources – Plentiful, Yet Unavailable

America has a rich history of producing oil and natural gas. Today, America is the ***3rd largest producer*** of oil in the World. Since the first oil field was developed in Pennsylvania during the 1850's, America's oil and gas resources have been a critical component to our national and economic security. The Department of the Interior is primarily responsible for the management, administration, and accounting of these resources through the Bureau of Land Management (BLM), MMS, and the USGS.

Offshore Resources -

According to testimony from Acting MMS Director, Walter Chruickshank, "Managing access has resulted in OCS production of almost 11 billion barrels of oil and more than 116 trillion cubic feet of natural gas since MMS's creation in 1982. To date since 1982, the number of active OCS leases has increased by 172 percent and oil production is about 59 percent greater, in spite of the drop in production from the 2004-2005 hurricane seasons."[21]

Figure C



Furthermore, from the same testimony we learned that, as a result of "the OCS inventory requirements of the Energy Policy Act of 2005, MMS completed an assessment of the potential quantities of undiscovered technically recoverable oil and gas resources that may be present on the OCS. According to this assessment, we estimate (at the mean level) that the OCS contains **86 billion barrels of oil and 420 trillion cubic feet of natural gas**. [See Figure C: Resource Assessment Map] Of the 1.76 billion acres of Federal offshore lands on the OCS, about 600 million acres are not available for oil and gas leasing. When the 2006 resource assessment was completed, areas under congressional moratoria or Presidential withdrawal

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[20] "MMS Report to Congress: Energy Policy Act of 2005 – Section 353(e) Gas Hydrate Production Incentive Review", August 2006, page 1.

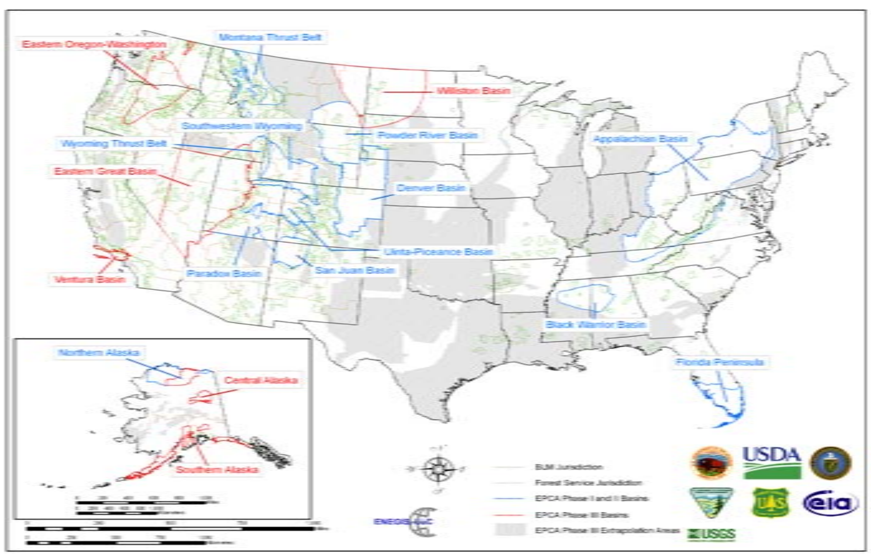
[21] Cruickshank Testimony, House Subcommittee on Energy and Mineral Resources, June 28, 2007

included the; the Atlantic, the Eastern Gulf of Mexico, the North Aleutian Basin off Alaska, and the Pacific. The potential resource in these areas is estimated to be approximately **18 billion barrels of oil and 76 trillion cubic feet of gas**, or approximately 20 percent of the undiscovered technically recoverable resources in the OCS. There is great uncertainty regarding the resource potential in areas where leasing has been prohibited and where the last geophysical surveys and drilling exploration occurred more than 25 years ago."[22]

When MMS states that there is great uncertainty regarding the resource potential, this has been borne out in the past. In the 1970's, USGS predicted that the Gulf of Mexico held 6 billion barrels of recoverable oil, since then we have pumped 15 billion barrels out of the Gulf, and today we estimate that there are 45 billion barrels remaining. Combined the produced oil and reserves are nearly 10 times the amount which USGS "knew" was available. More recently, in the Central Gulf of Mexico, technology advancements have increased our reserve estimates 6-times since 2000.

But like the USGS in 1970, we don't know what we don't know, and only through modern seismic scanning, exploration, and development will we be able to get a true picture of the resources available on our OCS. It is entirely possible that America could again multiply our undiscovered resources the same way we have multiplied our supply and reserves in the Gulf of Mexico. Without further exploration in OCS areas that do not currently have access, it is impossible to tell exactly what amount of oil and gas reserves the United States is neglecting in the OCS.

Onshore – Our Western and Alaskan Federal Lands producing for America:



The Energy Policy Act of 2005 included Section 364 which expanded the Energy Policy and Conservation Act of 2000 study, directed the Department of the Interior to expand its report on our inventory of onshore oil and gas. This generated what is referred to as the Bureau of Land Management EPCA Phase III report[23], from that report we learned:

> "For each of the eighteen comprehensively studied areas examined. The aggregate results for all of the study areas and extrapolated areas are summarized below.

[22] Ibid

[23] EPCA Phase III inventory from the Bureau of Land Management

• Federal lands with potential for oil or natural gas resources, including split-estate minerals, total 279.0 million acres.

• Undeveloped oil resources under these Federal lands total 30.5 billion barrels, comprising 24.2 billion barrels of undiscovered technically recoverable resources and 6.3 billion barrels of reserves growth.

• Undeveloped gas resources under these Federal lands total 231.0 trillion cubic feet, comprising 214.1 trillion cubic feet of undiscovered technically recoverable resources and 16.9 trillion cubic feet of reserves growth.

• Total proved reserves under these Federal lands total 5.3 billion barrels of oil and 68.8 trillion cubic feet of natural gas.

• Approximately 60 percent (165.9 million acres) of the Federal land is inaccessible. Based on resource estimates, these lands contain about 62 percent of the oil (19.0 billion barrels) and 41 percent of the natural gas (94.5 trillion cubic feet).

• Approximately 23 percent (65.2 million acres) of the Federal land is accessible with restrictions on oil and gas operations beyond standard stipulations. Based on resource estimates, these lands contain 30 percent of the oil (9.3 billion barrels) and 49 percent of the gas (112.9 trillion cubic feet).

• Approximately 17 percent of the Federal land in these areas (48.0 million acres) is accessible under standard lease terms. Based on resource estimates, these lands contain 8 percent of the oil (2.3 billion barrels) and 10 percent of the gas (23.6 trillion cubic feet)."

Overall the study shows that oil and gas resources are most concentrated in Northern Alaska and the Interior West. More importantly, 60 percent of the lands, 62 percent of the oil, and 41 percent of our natural gas resources are inaccessible due to federal law or restrictions. When examining the resources onshore, the Coastal Plain region of the Arctic National Wildlife Refuge (ANWR)[24] is one of the most interesting, available and rich. According to a report issued in 2002 by the Department of Energy, this area, "which comprises approximately 8 percent of the 19 million-acre ANWR, is along the geologic trend that is productive in the Prudhoe Bay area, 60 miles west. This is the largest unexplored, potentially productive onshore basin in the United States."[25]

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[24] The Arctic National Wildlife Refuge was established in 1960 by a Public Land Order, under which ANWR was available for oil and gas leasing. In 1980, Congress enacted the Alaska National Interest Lands Conservation Act (ANILCA). Section 1002 of this Act set aside the 1.5 million-acre Coastal Plain of ANWR for study of its oil and gas resources. ANILCA closed the Coastal Plain until Congress authorizes it. The section 1002 study was subsequently completed by the Reagan Administration, which endorsed an environmentally-safe leasing in the 1002 Area. It is worth noting there are 93,000 acres of Native land privately owned within the Coastal Plain, but Congress has prohibited the Inupiat Eskimo owners of this land from developing and producing oil until the entire federal area is opened.

[25] Department of Energy, "Potential Oil Production from the Coastal Plain of the Arctic National Wildlife Refuge: Updated Assessment"

The Coastal Plain of ANWR is of special interest for its giant energy potential, with estimated oil resources that could make it the largest-ever discovery of oil in the United States. The USGS estimates the Coastal Plain holds 5.7 billion to 16 billion barrels of recoverable oil, with a mean estimate of 10.4 billion barrels. These estimates are based on highly conservative assumptions as to the recovery rate of oil. In reality, through continually improving technology, there is considerably higher success in recovering much more oil in Alaska's arctic than is assumed in these estimates. There could be up to 42 billion barrels “in-place” in the Coastal Plain. Even at 10.4 billion barrels, the Coastal Plain’s resources would be greater than those of the nearby Prudhoe Bay supergiant oil field at its discovery. Prudhoe Bay is the largest oil field ever discovered onshore in the United States.

Applying modern technology and methods first applied and perfected on Alaska’s North Slope (and under a strict limit routinely included in ANWR legislation), a cumulative total of no more than 2,000 acres within the entire ANWR would be necessary to produce all oil from the Coastal Plain. This small footprint would ensure that wildlife would be fully protected. Experience has shown that caribou, fish, birds, polar bears and wildlife species are unharmed by more than three decades of oil continuous development in Alaska’s arctic. For example, the Central Arctic Caribou herd in and near the Prudhoe Bay facilities has grown from a population of 3,000 right before development began to 27,000 (using available data from the State of Alaska) during two decades in which Prudhoe Bay and the satellite oil fields have delivered more than 14 billion barrels of oil to the American people.

Our onshore resources are in many cases the easiest and most cost effective to recover. The onshore oil and gas industry in America is populated by small operators and is one of the most competitive industries in America.

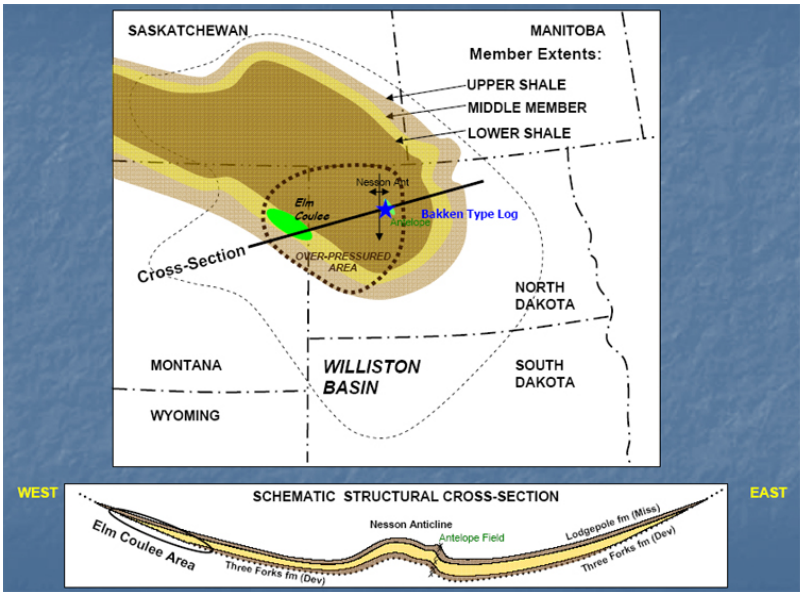
III - American Innovation – New Advancements Open Supply

America has long been a world leader in advancements in technology. Our innovations and creations have moved and advanced the world. Few places is this more evident than advancements in drilling and mining technology. This section will review a few of the newest breakthroughs in modern drilling technology that have allowed our nation to tap "new" energy resources, many of which we have known of for decades. It is these new advances in technology that will help expand our reserves and create more American energy.

A. Bakken Shale

The story of Bakken Shale development is truly one of American innovation generating domestic energy, American jobs, and American wealth.

Originally discovered in the early 1950s, the formation known as the Bakken Formation, officially the Upper Devonian-Lower Mississippian Bakken Formation in the U.S. portion of the Williston Basin of Montana and North Dakota, has long frustrated oil developers.

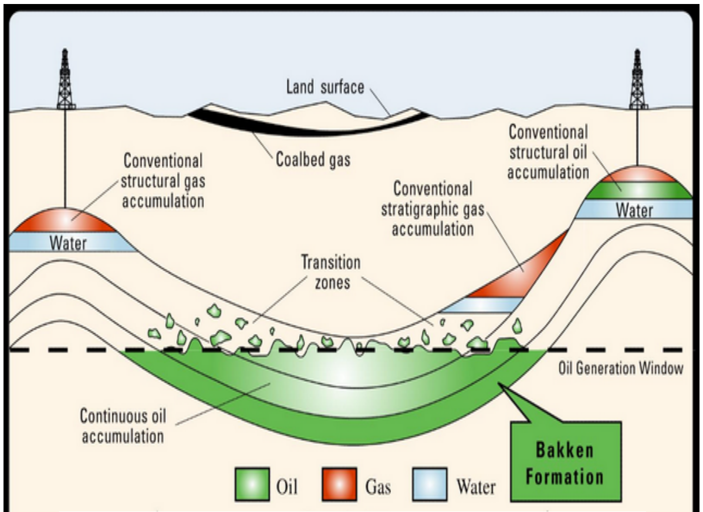


Historically, efforts to extract economically successful quantities of oil have failed. However, American innovation and modern developments in directional drilling have changed the entire assessment of the region.

An April 2008 report from the USGS has predicted, "continuous oil resources, the USGS estimated a total mean resource of 3.65 billion barrels of oil" and a recoverable 1,850 Billion Cubic Feet of Natural Gas. [26]

Today, the majority of Bakken oil production comes from the Elm Coulee Oil Field, Richland County, Montana, where production began in 2000 and is expected to ultimately total 270 million barrels of oil total. In 2007, production from Elm Coulee reached an average of 53,000 barrels per day, more than the entire state of Montana just a few years ago.

[26] National Assessment of Oil and Gas Fact Sheet, Assessment of Undiscovered Oil Resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, 2008 (http://pubs.usgs.gov/fs/2008/3021/)



USGS 2008

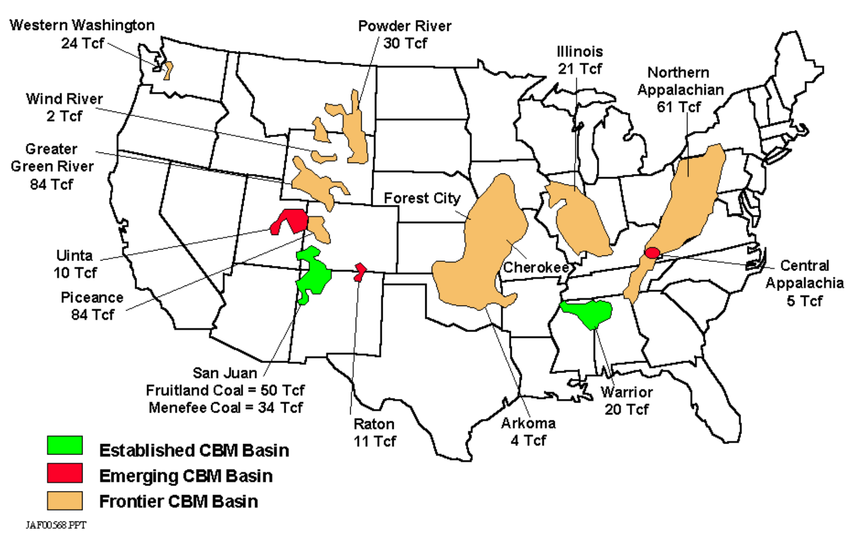
More recently, EOG Resources of Houston, Texas, one of the largest independent oil and gas companies in the United States, reported that a single well it had drilled into an oil-rich layer of shale below Parshall, North Dakota is anticipated to produce 700,000 barrels of oil. Ultimately, estimates for oil contained in the entire Bakken development range from between "271 billion to 503 billion barrels, with a mean of 413 billion barrels of technically recoverable and irrecoverable oil. A conservative estimate of the Bakken's technically recoverable oil would be 1% to 3% percent, or between 4.1 and 12.4 billion barrels of oil"[27]

In June of 2008, there were numerous news reports highlighting the changing dynamic of the population of Western North Dakota where as many as 1/3 of the people in a single county could be made millionaires due to the mineral resources on their property.

B. Tight Sands Gas

Expanding our domestic supply of natural gas is increasingly important, as our conventional sources of natural gas are shrinking; America has needed to develop unconventional sources. Fortunately, technological developments have opened a whole new field of resources for the U.S. through natural gas found in tight gas sands and shales. [28]

Figure 4C-2: Resources of U.S. Lower 48 Coalbed Methane Basins



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27 http://bakkenoil.com/faq/
28 The 4C image series is from DOE-EIA, Courtesy of Advanced Resources International

Historically, these resources were either unreachable or economically unavailable; however research funding through the Department of Energy and investment by private industry have combined to break open a tremendous new resource for America. According to the U.S. Geological Survey "potentially producible gas from low-permeability horizons in the Northern Great Plains of Montana and the Dakotas could exceed 100 trillion cubic feet." In addition, "[a]lthough future technology and economics cannot be predicted very well, USGS analyses assume that technology will improve significantly and gas prices will be competitive with other energy sources. Estimates of gas contained in five Rocky Mountain basins indicate that over 100 trillion cubic feet of gas is recoverable under conditions of higher gas prices using current technology. Studies in the Piceance Creek and Greater Green River basins indicate that estimates of gas recoverable with advanced technology exceed previous estimates by as much as six times. Advanced technology assumes exotic drilling and well-completion methods, some of which are currently being tested with reasonable success."[29]

Figure 4C- 3: Principal U.S. Tight Gas Basins

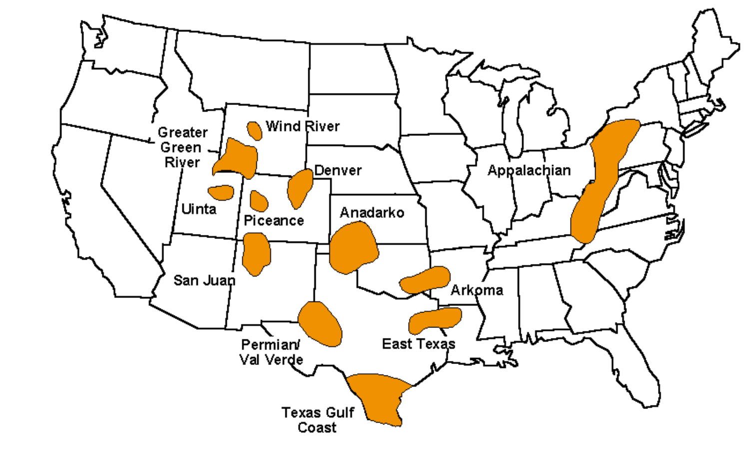
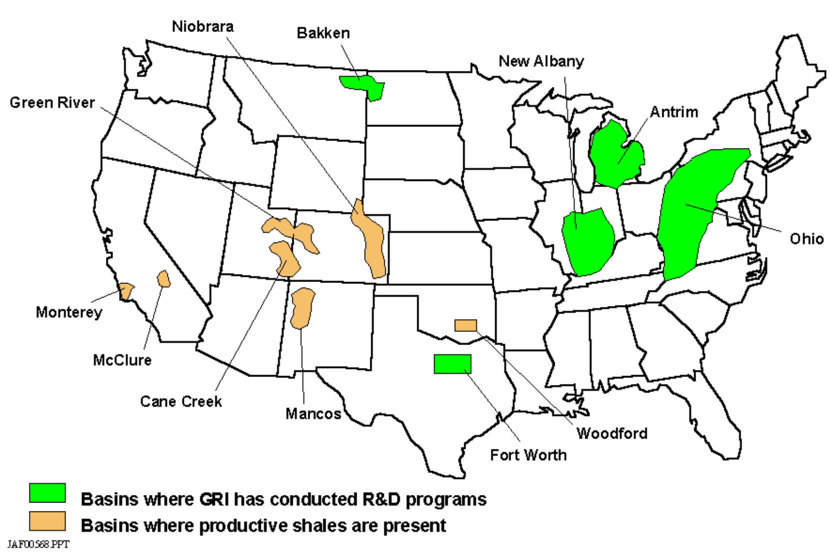


Figure 4C-4: Locations of U.S. Gas Shale Basins



Overall the U.S. Geological Survey estimates tight-gas sands and shales may contain up to **460 trillion cubic feet (Tcf)** of gas in the U.S. alone. This estimate would nearly triple the amount of currently proven gas reserves in the United States. Of this amount, nearly **135 Tcf** may be technically recoverable with current technologies.

[29] U.S. Geological Survey, Energy Resource Surveys Program, Fact Sheet-fS 20-97

Already, tight-gas sands now account for about 19% of U.S. production. Natural gas from tight reservoirs is produced from wells similar to those producing from conventional reservoirs - the well is drilled, cased, and perforated, and the pressure drop between the reservoir and the wellbore causes the natural gas to migrate through the reservoir to the well and then to the surface.

In tight gas fields there are a number of technical challenges to drilling and techniques necessary to develop the resources, these include:

- Directional Drilling: Horizontal wells are used to expose more of the formation to the wellbore and to intersect natural fracture systems more efficiently. In addition, directional techniques allow for the drilling of multiple wells from one drilling pad, mitigating the environmental impact.
- Measurement while drilling: Downhole sensors near the bit, which gather and relay information to the surface, are used to help steer the bit through portions of the reservoir with the greatest potential.
- Underbalanced drilling: In underbalanced drilling, conventional drilling mud is replaced with fluids such as foams and inert gasses. The hydrostatic pressure exerted by these fluids is less than the reservoir pressure, inhibiting fluid invasion and the consequent formation damage prevalent with tight reservoirs.
- Advanced fracturing techniques: Advances in fracturing technology provide more job-specific fracturing, but also allow for multiple fracture jobs and more accurate proppant placement.

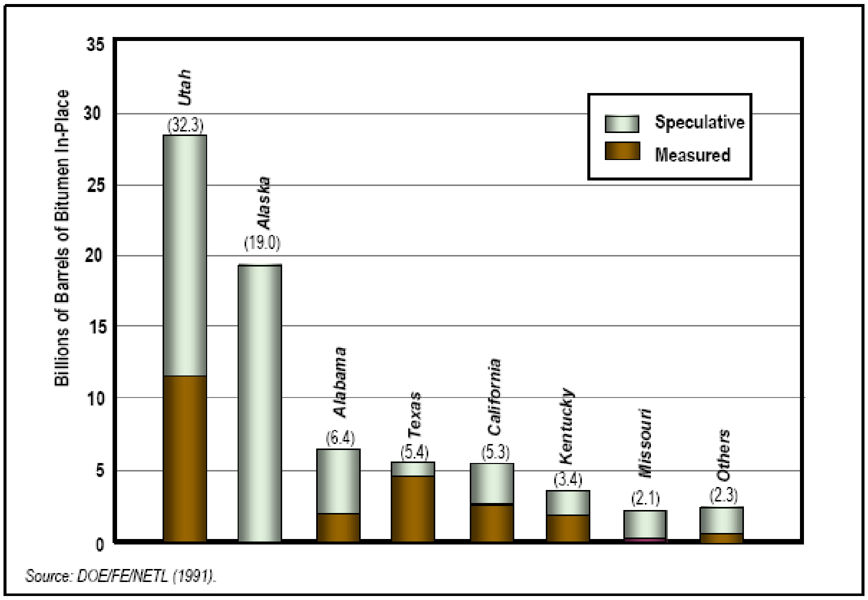
C. Tar Sands

Tar sands (referred to as oil sands in Alberta, Canada) are a combination of clay, sand, water, and bitumen, a heavy, black, asphalt-like hydrocarbon.[30] Bitumen from tar sands can be upgraded to synthetic crude oil and refined to make asphalt, gasoline, jet fuel, and value-added chemicals. U.S. tar sands resources are estimated at 60 to 80 billion barrels of oil in place, with an estimate of at least 11 billion barrels recoverable. This resource could support 500,000 barrels per day of production. The largest deposits are found in Utah (almost 30 billion barrels), Alaska (almost 20 billion barrels), Alabama (more than 6 billion barrels), and Texas and California (5 billion barrels each).

Recovery technology options depend on grade, viscosity, and depth. Shallow, colder resources are more viscous, but maybe surface mineable. Deeper, warmer resources are less viscous, but may require in-situ processes to produce. Steam injection, including Steam Assisted Gravity Drainage (SAG-D), has been the favored in-situ method in Alberta. Bitumen may be separated from the sands by hot-water or cold-water or hot-water extraction processes, depending on the composition of the resource, but neither may work on U.S. tar sands that are "oil-wet", and consolidated. New technology solutions,

[30] All data, except where noted, from "DOE Office of Petroleum Reserves – Strategic Unconventional Fuels Fact Sheet: U.S. Tar Sands Potential".

or adaptations of those used in Alberta, may be necessary to produce oil from U.S. tar sands. About two tons of tar sands yield one barrel (42 gallons) of oil – roughly 90% of the bitumen is recoverable.



U.S. tar sands production costs are expected to be similar to or higher than costs in Canada. Alberta oil sands costs declined steadily as lessons learned made project design, construction, and operations more efficient. Projects require large capital investments.

Bitumen and syncrude manufacture produces a slate of gases that included carbon dioxide, sulfur dioxide, and nitrous oxides. Technology is available to control and reduce emissions. The area of land disturbance for production depends on mining versus in-situ processing. A 50,000 barrel per day surface mining operation would require 10,000 acres, which would later be reclaimed. Depending on the process, a large volume of water may be needed to extract and process tar sands and bitumen, albeit because of favorable mineral composition, less than the 3 barrels of water for 1 barrel of bitumen is required in Alberta. Some U.S. deposits of tar sands are located in areas of abundant water, while others are in more arid areas.

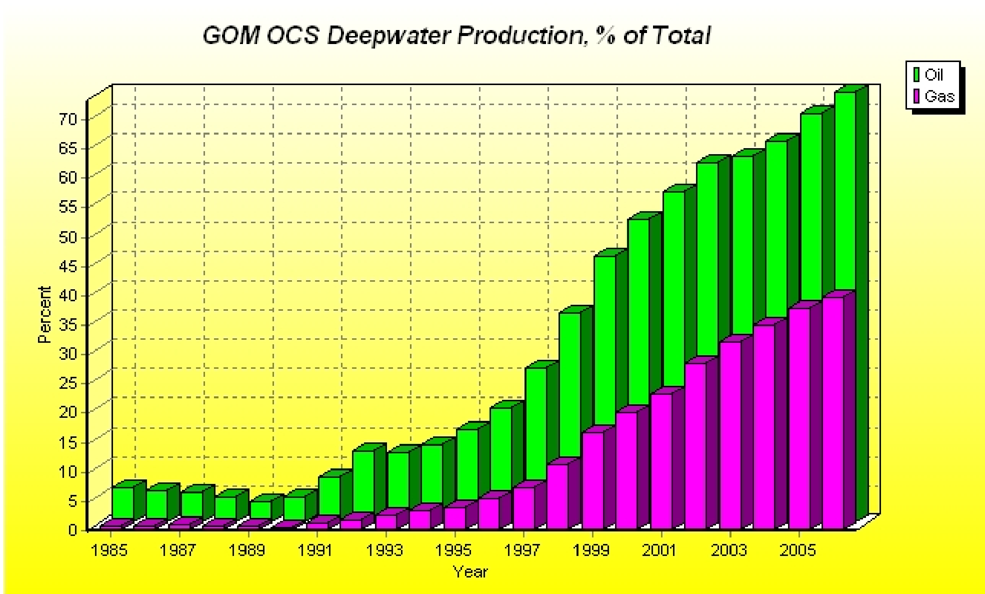
D. Deepwater Gulf of Mexico Oil and Natural Gas Development

The Minerals Management Service (MMS) defines[31] the deepwater Gulf of Mexico (GOM) as deeper than 1,312 feet (400 meters), and ultra-deep water as deeper than 5,249 feet (1,524 meters). The first deepwater production in the GOM took place in 1979, but it took until 1992 before more than 10% of the oil production in the GOM was in the deepwater, and until 1998 before more than 10% of the natural gas production in the GOM was in the deepwater. By 2006, those percentages had increased to 72% for oil and 38% for natural gas.

This dominance of deepwater production in the Gulf of Mexico will continue, as reinforced by the most recent lease sales. The spring of 2008 saw GOM Central Gulf Sale 206 shatter all prior records. This sale attracted approximately $3.7 billion in high bids. About 67 percent of the blocks receiving bids were located in the deepwater, with approximately 34 percent of the blocks bid upon in

[31] MMS OCS Report 2008-013, “Deepwater Gulf of Mexico 2008: America’s Offshore Energy Future”

ultra-deep water. The sum of the high bids for deepwater blocks was over 93 percent of the total. The ultra-deep water blocks accounted for about 54 percent of the total high bids.



At the end of 2007, there were 130 producing projects in the deepwater GOM, up from 122 at the end of 2006. 15 deepwater fields, including Atlantis, Shenzi, and several fields associated with the Independence Hub, began production in 2007. When Independence Hub reaches full capacity, it will represent over 10 percent of the total GOM gas production. In 2007, a record number of 15 drilling rigs were drilling for oil and natural gas in water depths of 5,000 feet or more in the GOM. At least 13 new drilling rigs are being built and contracted for use in the ultra-deep water of the GOM and will be ready for operation in the next 2-3 years. These rigs will be capable of operating in water depths up to 12,000 feet and drilling to total depths up to 40,000 feet. Also, all 13 of these new drilling rigs are being built with dynamic positioning systems and will not have to be moored to the seafloor. Additionally, several drilling contractors have committed to building new ultra-deep water drilling rigs that have not yet been contracted, and some of these new rigs are expected to operate in the GOM.

In 1986, the first discovery in the GOM in water depths greater than 5,000 feet occurred with Mensa. Since that time, there have been 60 additional discoveries in the ultra-deep provinces of the GOM.

Development Cycles in the GOM

As MMS notes, "There is often a considerable lag between leasing and first production. These lags are not unusual with complex deepwater developments. Figure 55 (below) demonstrates average lags associated with deepwater operations. This figure uses data from only productive deepwater leases and illustrates the lags between leasing and qualification, and from qualification to first production. The decreasing lags for leases issued after 1997 are partially the result of continued lease evaluation by industry and subsea tiebacks to existing hubs. Figure 55 indicates that, as industry gains experience in the deepwater areas of the Gulf, the time between leasing and production is reduced. Noteworthy is the reduction in time from lease acquisition to first well drilled from the 1980s to the 1990s. Developments near accessible infrastructure and the use of proven development technologies can also reduce the lag between leasing and production. However, as new discoveries move into dramatically deeper water depths, and with many new discoveries being far from existing infrastructure, an increase in lag time between leasing and production should be anticipated. Conditions such as high temperature and high pressure in wells will complicate drilling and development operations, resulting in longer lags as well."[32]

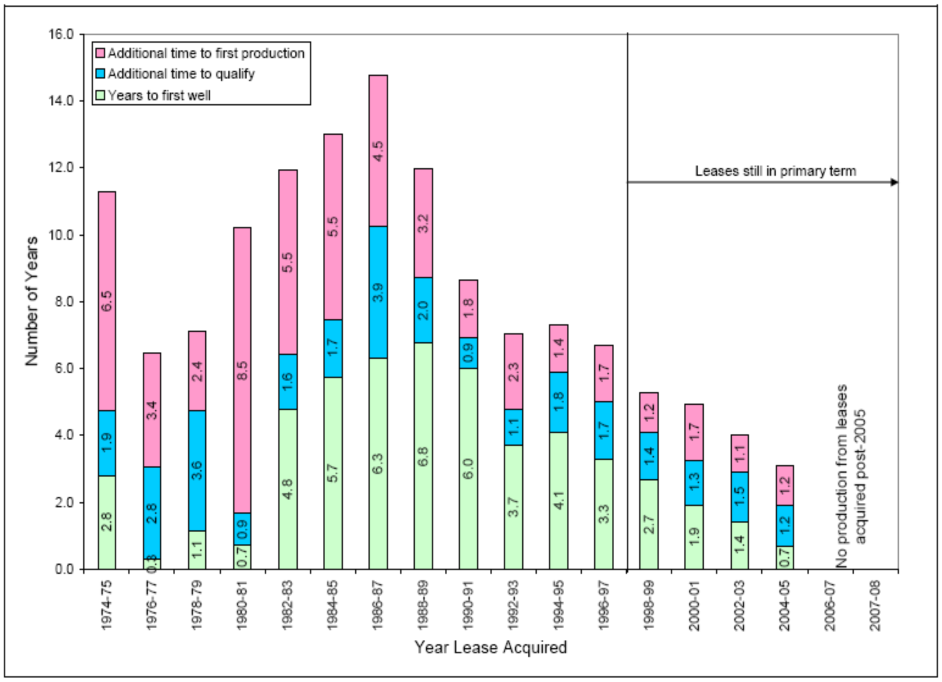


Figure 55. Lag from leasing to first production for producing deepwater fields.

Future Production Estimates

MMS estimates, in its "full potential" scenario, that the daily production of oil in the GOM will rise from 1.25 million barrels per day in 2006 to 2.1 million barrels per day in 2016. Further, MMS estimates, in its "full potential" scenario, that the daily production of natural gas in the GOM will rise from 7.93 billion cubic feet per day in 2006 to 9.5 billion cubic feet per day in 2016.[33]

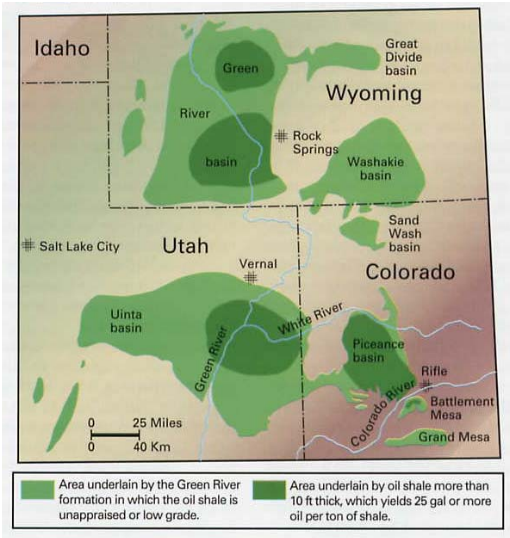
IV. American Opportunity – Future Holds Rich Resources for America to Produce

Oil Shale

Could America have more oil supply than Saudi Arabia? Possibly if we can develop our oil shale resources!

[32] MMS OCS Report 2008-013, "Deepwater Gulf of Mexico 2008: America's Offshore Energy Future", pp. 76-77.
[33] MMS OCS Report 2007-020, "Gulf of Mexico Oil and Gas Production Forecast: 2007-2016", pp. 13-16.

Oil shale is carbonate rock rich in an organic material called "kerogen." Essentially, it is oil in a "younger" geologic form. Eventually, natural forces of pressure and temperature would convert the rock into crude oil, but instead of waiting those millions of years, man has developed the technology to speed up the process and take the kerogen from the rock and use it for fuel. Kerogen can be converted to superior quality jet fuel, #2 diesel, and other high value by-products.



America is the world's leader in oil shale, the richest deposits are in the Green River Formation in Utah, Colorado, and Wyoming. While those are the key areas of focus today, other deposits exist in the Devonian, Antrim, and Chattanooga shale formations in eastern and southern states and parts of Alaska.

America's oil shale resources could exceed 6 trillion barrels of oil equivalent. As much as **1 trillion barrels of oil** could be recovered economically at today's prices with today's technology.[34] That reserve would give America more than double the proven oil reserves of Saudi Arabia (260 billion bbl), Iran (136), Iraq (115), Kuwait (99), United Arab Emirates (97), Venezuela (80), Russia (60), Libya (41.5), and Nigeria (36.2) combined. It has been said that the development of the oil shale resource could change the geopolitical dynamic of the world oil markets for the rest of the century.

The Rand report on Oil Shale Development in the United States highlights the "processes for producing shale oil generally fall into one of two groups: mining followed by surface retorting and in-situ retorting." [35]

- "**Mining and Surface Retorting**. Oil shale can be mined using one of two methods: underground mining using the room-and-pillar method or surface mining. The current state of the art in mining—both room-and-pillar and surface techniques, such as open pit mining—appears to be able to meet the requirements for the commercial development of oil shale. The current commercial readiness of surface retorting technology is more questionable. Development of surface retorts that took place during the 1970s and 1980s produced mixed results. Technical viability has been demonstrated, but significant scale-up problems were encountered in building and designing commercial plants. Since then, major technical advances have occurred but have not been applied to surface retorts. Incorporating such advances and developing a design base for full-scale operations necessitates process testing at large but still subcommercial scales. Cost information

[34] Department of Energy Office of Petroleum Reserves – Strategic Unconventional Fuels, Fact Sheet: U.S. Oil Shale Resources (http://www.fossil.energy.gov/programs/reserves/npr/npr_oil_shale_program.html)
[35] Rand Report on "Oil Shale Development in the United States Prospects and Policy Issues," 2005

available from projects and design studies performed in the 1980s can be escalated to give a very rough estimate of the anticipated capital costs for mining and surface retorting plants. Using this approach, a first-of-a-kind commercial surface retorting complex (mine, retorting plant, upgrading plant, supporting utilities, and spent shale reclamation) is unlikely to be profitable unless real crude oil prices are at least $70 to $95 per barrel (2005 dollars)."[36]

Shell's experimental in-situ oil shale facility, Piceance Basin, Colorado, USA.

- "**In-Situ Retorting.** In-situ retorting entails heating oil shale in place, extracting the liquid from the ground, and transporting it to an upgrading or refining facility. Because in-situ retorting does not involve mining or aboveground spent shale disposal, it offers an alternative that does not permanently modify land surface topography and that may be significantly less damaging to the environment. Shell Oil Company has successfully conducted small-scale field tests of an in-situ process based on slow underground heating via thermal conduction. Larger-scale operations are required to establish technical viability, especially with regard to avoiding adverse impacts on groundwater quality. Shell anticipates that, in contrast to the cost estimates for mining and surface retorting, the petroleum products produced by their thermally conductive in-situ method will be competitive at crude oil prices in the mid-$20s per barrel. The company is still developing the process, however, and cost estimates could easily increase as more information is obtained and more detailed designs become available."[37]

America has had a back and forth love-hate affair with oil shale over the last half century. In the 1960s, Interior Secretary Stewart Udall promoted and advocated using our shale resources, unfortunately technological challenges and costs did not make shale development practical. During the oil crisis of the 1970s industry turned attention to developing this vast resource. Oil companies led the process by obtaining leases and pushing for research and development. However, by the mid-1980s dropping oil prices made such research less cost effective and by the early 1990s most companies had abandoned the development of oil shale. Since then development of shale has been on the back burner, as low fuel prices made shale development uneconomical. Today, in light of higher fuel prices, there is a new examination of shale development. Modern technologies and experimental procedures could economically unlock this vast resource and free America from our dependence on foreign oil.

The Congressional Research Service describes the modern oil shale process as starting in 2005,[38] with hearings to promote "environmentally friendly development of oil shale and oil sands resources."

[36] Ibid
[37] Ibid
[38] "Oil Shale: History, Incentives, and Policy", Congressional Research Service • April 13, 2006 • RL33359

This series of hearings, led to development of Section 369 (Oil Shale, Tar Sands, and Other Strategic Unconventional Fuels) of the Energy Policy Act of 2005 (P.L. 109-190). This section directed the Secretary of the Interior to establish a leasing and research and development program for leasing oil shale on public lands for the purpose of commercially developing oil shale.

Since passage, the BLM has established eight proposals from six companies to develop RD&D leases for oil shale technologies. These leases are 160 acres but can be expanded into a 4,960 acres commercial lease. However, these research and development leases are being cut short by restrictions placed on developing final rules for commercial development of oil shale included by the Democrat Leadership in the FY 2008 Interior Appropriations. On July 22, 2008, the BLM published proposed draft rules for Commercial Oil Shale development in the Federal Register.[39] On October 1, 2008, the moratoria restricting BLM from publishing final rules was lifted and there is a possibility the rules may be finished by the end of the year.

Methane Gas Hydrates

Could America have hundreds of thousands of trillions of cubic feet of gas and no one know it? The resource of the future few Americans know exists.

Gas hydrates are ice-like crystalline substances occurring in nature where a solid water lattice accommodates gas molecules (primarily methane, the major component of natural gas) in a cage-like structure. Gas hydrates form in the shallow subsurface along continental margins in the Outer Continental Shelf and below the permafrost in Polar Regions, where pressure and temperature conditions provide a zone of hydrate stability.[40] Gas hydrate resources may be one of the Nation's most promising energy supply sources. The USGS notes that if one percent of the expected in-place resource can be assessed (1% of 320,000 trillion cubic feet), the Nation could more than double its technically recoverable natural gas resource base (currently estimated at 1200 trillion cubic feet).[41] Approximately 600 Tcf are expected to be in-place onshore the North Slope of Alaska, while approximately 170,000 Tcf are expected to be in-place in the outer Continental Shelf surrounding Alaska. Approximately 150,000 Tcf are expected offshore the lower-48, with at least 120,000 Tcf of that off-limits to leasing because of the Congressional annual appropriations moratoria.[42] This includes vast quantities of gas hydrate resources in both the Atlantic and Pacific Oceans, and in the eastern part of the Gulf of Mexico.

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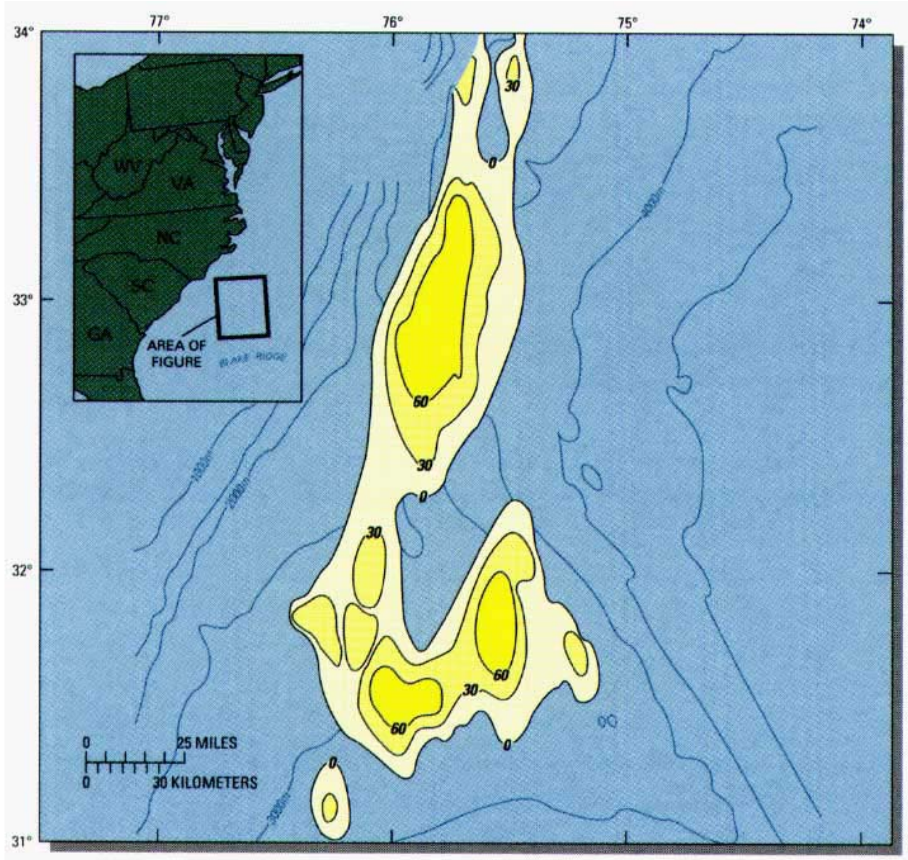
[39] Federal Register, Vol. 73, No. 149, Pages 42926–42975 [E8–16275], Friday, August 1, 2008

[40] "Preliminary Evaluation of In-Place Gas Hydrate Resources: Gulf of Mexico Outer Continental Shelf", Executive Summary, OCS Report MMS 2008-004, February 1, 2008.

[41] "MMS Report to Congress: Energy Policy Act of 2005 – Section 353(e) Gas Hydrate Production Incentive Review", August 2006, page 1.

[42] "USGS 1995 National Oil and Gas Resource Assessment", February 14, 1995.

As part of extensive world-wide research efforts, partially funded by the United States, the Mallik 2002 Research Well Program drilled three wells in the Mallik Gas Hydrate Field on Richard's Island, in the Mackenzie Delta, Northwest Territories, Canada. Even though gas hydrates are known to occur in numerous marine and Arctic settings, little was known prior to the Mallik 2002 Program about the technology necessary to produce gas from hydrates. The response of gas hydrates to heating and depressurization was evaluated, with the overall goal of combining the science and production program to allow for calibration and refinement of reservoir simulation models capable of predicting long-term reservoir response.



Gas Hydrate Resource Location Example in the Atlantic off North and South Carolina (thickness in meters)

"The Mallik 2002 production research well program has *proven for the first time that gas production from gas hydrates is technically feasible*."[43] Further, the Mallik research consortium found, "The realization of production from natural gas hydrates could provide an opportunity to develop a potentially very large and 'environmentally' friendly fuel resource that could benefit various national economies throughout the world. The development of gas hydrate is also important for the future supply of gas in the North American market."[44]

U.S. government agencies have continued to build on the Mallik foundation of knowledge about production of gas hydrates. On February 1, 2008, the MMS issued its preliminary report, "Preliminary Evaluation of In-Place Gas Hydrate Resources: Gulf of Mexico Outer Continental Shelf", OCS Report MMS 2008-004. The preliminary report estimates that gas hydrates in-place within the Gulf of Mexico rand from 11,112 Tcf to 34,423 Tcf, with a mean estimate of 21,444 Tcf. The MMS found that almost 7,000 Tcf of this resource base is located in sandstone reservoirs that are more favorable to production. Regarding production of gas from hydrates, the MMS noted on page 3, "The energy value of the produced gas is ten times what is needed for the dissociation of hydrate." Further, on page 87, "Recent

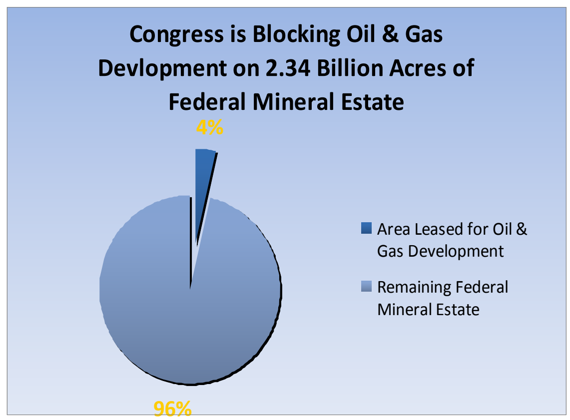
[43] "The Mallik 2002 Gas Hydrate Production Research Well Program – Press Release", page 3, December 10, 2003.
[44] Mallik Press Release, page 4, December 10, 2003.

laboratory research and onshore field-based production testing indicate that porous and permeable *sandstone reservoirs have the capacity to produce gas from hydrate using existing technologies*." The MMS estimates that the in-place hydrate resource in the Gulf of Mexico may be 30 to 300 times greater than conventional oil and gas reserves.

V. Ending – Simple Choices

The development of a greater domestic American energy supply is critical to freeing America from our dependence on foreign energy. While many in Congress can call the expansion of drilling for oil and natural gas in the Outer Continental Shelf a "hoax" the truth is that America has rich oil and natural gas reserves. As shown in the opening graph in this report, our supply of both conventional oil and natural gas and the future development of tar sands, oil shale and methane hydrates can supply America with steady energy for hundreds of years and many generations to come.

The question isn't can America develop these resources, this report has shown that time and time again, America can take the unconventional resources of the past and develop the technology to harness them for the future.



The real question is WILL America develop these resources? Will we have the courage to push forward with the development of oil shale? Will we open the OCS for conventional oil, gas, and methane hydrates? Will we choose to free ourselves and develop our own domestic oil and gas resources? This choice isn't however just about energy, the choice is will we create good American manufacturing jobs building the infrastructure to harness this energy.

Will we choose to direct the $700 billion we spend each year on foreign energy to creating American energy? Each productive new lease brings hundreds of jobs to Americans, when multiplied by the thousands of productive new leases, we could have a renaissance of American domestic manufacturing.

Finally, this new production brings with it financial rewards as well. Since a majority of these resources sit on federal lands, the federal and state governments will share in the wealth, not just through royalties and rents, but through payroll and income taxes, increased business development, and a stronger US dollar. This revenue flow to the states will bring greater benefits in education, transportation and health care for every American family. We can free America from foreign oil, we can free America from foreign natural gas, we can invigorate America's economy, by harnessing American innovation to create more American made energy with American jobs and build a future on more American wealth.