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THE ULTRA DEEPWATER RESEARCH AND DEVELOPMENT: WHAT ARE THE BENEFITS?

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND AIR QUALITY

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

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CONTENTS

THE ULTRA DEEPWATER RESEARCH AND DEVELOPMENT: WHAT ARE THE BENEFITS?

THURSDAY, APRIL 29, 2004

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ENERGY AND COMMERCE,
SUBCOMMITTEE ON ENERGY AND AIR QUALITY,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:30 a.m., in room 2123, Rayburn House Office Building, Hon. Ralph M. Hall (chairman) presiding.

Members present: Representatives Hall, Shimkus, Radanovich, Walden, Barton (ex officio), Boucher, and Allen .

Staff present: Mark Menezes, majority counsel; Bill Cooper, majority counsel; Peter Kielty, legislative clerk; Sue Sheridan, minority counsel; and Bruce Harris, minority professional staff.

Mr. HALL. All right, we will come to order. We do have a quorum here. We have the two main guys on the committee. They are here, and for most of you to know, there are no recorded votes today, and almost everybody is strapped to an airplane and went north, east, south and west last night. That is the reason it is not better attended. But it is taken down by a very capable young lady, and it will made available to everybody to read.

In the interest of time, Ranking Member Boucher and I have agreed to waive our opening statements at this time in order for Congressman Sandlin to go ahead and testify if he wants to, and I know he is probably running for an airplane.

So we recognize you, Max, at this time to take as much time as you would like. Mr. DeLay was supposed to be here, but I think he would like very much for you to be his substitute here. The Chair recognizes Max Sandlin.

STATEMENT OF HON. MAX A. SANDLIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. SANDLIN. Thank you, Mr. Chairman. Mr. Chairman, ranking member Boucher, distinguished members of the subcommittee, first I want to thank you for the opportunity to appear before the subcommittee today. It is indeed a pleasure to join with the distinguished majority leader, Mr. DeLay, who is to be here, in advocating what we all know to be a truly nonpartisan policy goal, a comprehensive and innovative national energy strategy.

This morning, in particular, I am here to express my support for the ultradeep water and unconventional natural gas and other petroleum resources program, which is included in the conference report on H.R. 6 as passed by the House last year.

This provision is substantially the same as that contained in the bill that I was proud to co-sponsor with Chairman Hall in the last Congress. I commend you, Mr. Chairman, for your persistent efforts to pass this provision through the Congress. I believe it is important to the Nation for economic and security reasons to develop our domestic resources to limit as best we can our dependence on imported energy.

The measure we discuss this morning would establish and fund new programs of research, development, demonstration, and commercial application of technologies for unconventional onshore and ultradeep water natural gas and other petroleum resource exploration and production, including safe operations and environmental mitigation.

The legislation authorizes the Department of Energy, in partnership with industry, to advance the science and technology available to domestic onshore unconventional natural gas and oil producers, particularly independent producers, through advances in technology for production of unconventional resources.

The legislation also establishes a program to benefit small producers by resolving issues associated with complex geology, low reservoir pressure, and unconventional oil and gas reserves.

In addition, the legislation authorizes a program to develop technologies to produce natural gas and oil reserves in the ultradeep water of the central and western Gulf of Mexico with a focus on improving, while lowering costs and reducing environmental impacts, the safety and efficiency of the recovery of ultradeep water resources and subsea production technology used for such recovery.

These new programs are designed to help the Nation meet its growing energy supply needs in the near and mid-term. In the 1st District of Texas there are many independent producers and many small producers who could produce much more oil and gas if they could afford the research and development that is needed to resolve the technical issues that they now face in the field.

This legislation will dramatically improve their opportunities to be successful and deliver new domestic natural gas and oil supplies to the Nation.

Natural gas and other petroleum resources in unconventional onshore and ultradeep water reserves can provide a significant portion of the incremental supply of energy needed to meet growing demand over the next 20 years if the economic and technical impediments to development are minimized.

Modeling by the Bureau of Economic Geology at the University of Texas shows that over the next 15 years, with a well funded program to develop advanced technology to increase production from the unconventional onshore and ultradeep water resources, we could economically add average productive capacity of at least 4.3 Tcf of natural gas per year.

To offer another perspective on the extent of the resource, the unconventional onshore and the deep water and ultradeep water Gulf of Mexico resources are the largest opportunities remaining in the United States in areas that are currently available to be developed.

There is clear and significant public purpose for the development of domestic resources. The costs and risks associated with this development are sufficiently high that, without a strong and focused public-private partnership, these resources will not be economically producible to meet our mid-term energy needs.

In order for our industry to develop these domestic resources to meet the Nation's energy requirements over the next 10 to 20 years, it is critical that we provide Federal R&D investment through public-private partnerships to lower the costs, increase safety, and mitigate the environmental impact of producing from these areas.

For these reasons, Mr. Chairman, among many others, I hope that we are able to enact this critically important legislation as soon as possible, and I appreciate you, Mr. Chairman, and Mr. Boucher for having this hearing today, and appreciate the opportunity to appear.

[The prepared statement of Hon. Max A. Sandlin follows:]

PREPARED STATEMENT OF HON. MAX A. SANDLIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. Chairman, Ranking Member Boucher, distinguished members of the subcommittee: First, I want to thank you for the opportunity to appear before the Subcommittee today. It is indeed a pleasure to join with the distinguished Majority Leader, Mr. DeLay, in advocating what we all know to be a truly non-partisan policy goal—a comprehensive and innovative national energy strategy.

This morning, in particular, I am here to express my support for the Ultra-deepwater and Unconventional Natural Gas and Other Petroleum Resources Program included in the Conference Report on H.R. 6 as passed by the House last year. This provision is substantially the same as that contained in the bill that I was proud to co-sponsor with Chairman Hall in the last Congress. I commend you, Mr. Chairman, for your persistent efforts to pass this provision through the Congress. I believe that it is important to the Nation for economic and security reasons to develop our domestic resources to limit, as best we can, our dependence on imported energy.

The measure we discuss this morning would establish and fund new programs of research, development, demonstration, and commercial application of technologies for unconventional onshore and ultra-deepwater natural gas and other petroleum resource exploration and production, including safe operations and environmental mitigation. The legislation authorizes the Department of Energy, in partnership with industry to advance the science and technology available to domestic onshore unconventional natural gas and oil producers, particularly independent producers, through advances in technology for production of unconventional resources. The legislation also establishes a program to benefit small producers by resolving issues associated with complex geology, low reservoir pressure and unconventional oil and gas reservoirs. In addition, the legislation authorizes a program to develop technologies to produce natural gas and oil reserves in the ultra-deepwater of the Central and Western Gulf of Mexico, with a focus on improving, while lowering costs and reducing environmental impacts, the safety and efficiency of the recovery of ultra-deepwater resources and sub-sea production technology used for such recovery.

These new programs are designed to help the nation meet its growing energy supply needs in the near and mid-term. In the 1st District of Texas there are many independent producers and many small producers who could produce much more oil and gas if they could afford the research and development that is needed to resolve the technical issues that they face in the field. This legislation will dramatically improve their opportunities to be successful and deliver new, domestic natural gas and oil supplies to the nation.

Natural gas and other petroleum resources in the unconventional onshore and ultra-deepwater reserves can provide a significant portion of the incremental supply of energy needed to meet growing demand over the next 20 years if the economic and technical impediments to development are minimized. Modeling (by the Bureau of Economic Geology at the University of Texas) shows that, over the next 15 years, with a well-funded program to develop advanced technology to increase production from the unconventional onshore and ultra-deepwater resources, we could economically add average productive capacity of at least 4.3 Tcf of natural gas per year. To offer another perspective on the extent of this resource: the unconventional onshore and the deepwater and ultra-deepwater Gulf of Mexico resources are the largest opportunities remaining in the United States in areas that are currently available to be developed.

There is a clear and significant public purpose for the development of domestic resources. The costs and risks associated with this development are sufficiently high that without a strong and focused public/private partnership these resources will not be economically producible to meet our mid-term energy needs. In order for our industry to develop these domestic resources to meet the nation's energy requirements over the next ten to twenty years, it is critical that we provide federal R&D investment through public/private partnerships to lower the cost, increase the safety and mitigate the environmental impact of producing from these areas.

For these reasons, among so many others, I hope that we are able to enact this critically important legislation as soon as possible.

Mr. HALL. Thank you, Congressman Sandlin. I would note the presence of the chairman of the Committee on Energy and Commerce, Mr. Barton. We waived our opening statement. Mr. Chairman, if you have an opening statement you want to give.

Chairman BARTON. Mr. Chairman, I just thank you for holding this hearing. I want to thank Congressman Sandlin for testifying. I think this is an important issue and your leadership and Mr. Boucher's leadership is a good example of what bipartisanship should be all about.

I ask unanimous consent that my formal statement be included in the record.

Mr. HALL. Without objection, it will be included.

[The prepared statement of Hon. Joe Barton follows:]

PREPARED STATEMENT OF HON. JOE BARTON, CHAIRMAN, COMMITTEE ON ENERGY AND COMMERCE

Thank you, Mr. Chairman, for holding this hearing on ultradeep water research and development. There have been enormous technological advances in oil and gas exploration and production in recent decades. Offshore drilling and production platforms are so technologically advanced that one platform on the surface of the water can handle production from several different wells several miles apart, house a myriad of technologically advanced computer systems, employ scores of personnel, generate electricity, enable people to face and conquer the adversities of living in the middle of the ocean, and do so 24 hours a day, 7 days a week; all without so much as losing a gum wrapper over the side of the platform. It is truly amazing.

However, with all of the latest technologies, more research is needed as companies are forced into ever-deeper water to meet our nation's energy needs. Ultradeep water has been characterized as water depths of 1,500 meters or deeper—roughly 5,000 feet of water. Who would have ever imagined that a driller would have to string together 5,000 feet of pipe just to get to the dirt? Drilling at such depths will present a whole host of impediments to production that must be resolved through technology. American ingenuity will find the solutions.

We need to explore the proper role of government in a program that advances cutting-edge technology to provide our nation's energy needs. I look forward to hearing the testimony from the panelists today—including my friend from Texas, the distinguished Majority Leader, Mr. DeLay—and thank them for their participation on this important topic.

Mr. HALL. Are there any questions of Mr. Sandlin? All right, Max. Looks like you presented it very well, and thank you very much for your time, and thank those that accompanied you.

Mr. BOUCHER. Mr. Chairman, I don't have an opening statement. I agree with you that in order to expedite our proceedings this morning, it is best to move along. However, I would ask that you give Mr. Allen an opportunity to make a statement, if he desires to do so. I think he may have a few comments for us.

Mr. HALL. Well, I will certainly agree to that. Will you allow me to make my opening statement? Then you might make yours, or put it in the record.

Good morning to all of you, and I welcome everyone to this hearing on ultradeep research and development: what are the benefits?

Actually, according to the Department of Energy, their Energy Information Administration, the United States will remain principally dependent on natural gas and oil for the foreseeable future to meet its needs. EIA projections show that natural gas and oil will provide for about 65 percent of domestic energy over the next several decades, and the demand for gas will rise 38 to 53 percent by 2025.

Over the long term meeting domestic natural gas demand will require diversity of supply sources and behavioral changes. Most commonly mentioned are demand reduction; increased use of liquified natural gas; development of Arctic natural gas; improvement in the development of lower 48 resources; improvements in the development of offshore natural gas.

First, demand reduction is unsustainable for our economy, the Nation's consumers, and the environment. We will increase our use of LNG, and we will need to develop the natural gas resources of the Arctic.

These items are long term solutions, and near and mid-term the ultradeep and unconventional onshore natural gas and oil research and development program will bring unbelievable improvements in the development of the lower 48 gas resources, particularly in the unconventional resources, and will improve our ability to develop offshore natural gas resources.

The program has been developed in response to the conclusions of the National Petroleum Council's 1999 natural gas study and other communicators that additional technologies need to be developed to produce incremental quantities of oil and natural gas. The program is a major component of the research and development title of the pending energy bill.

The ultradeep water and unconventional onshore natural gas and oil research and development program is a 10-year, $2 billion R&D program to develop the technologies necessary to substantially increase the production of natural gas and oil in the ultradeep waters of the central and western Gulf of Mexico and certain onshore areas of the United States.

I am deeply concerned by the recent Standard & Poor's industry report card of last Friday, April 21, 2004. That report concludes, "It is unclear that producers are investing enough to grow production materially" and that such companies, "appear to be reinvesting only 30 percent to 40 percent of their domestic cash-flow in the U.S. have made strategic decisions to allow their shallow water and onshore natural gas production to deplete to deploy capital to international, mainly to oil, projects." I do not say this to criticize the business decisions of the industry. Rather, I say it to make the point that we must take action to create incentives for the industry to invest in the development of our domestic natural gas and oil resources. This new R&D program, by developing new technologies, will significantly lower the cost of finding and developing new natural gas and oil resources in this country. This additional production would come from areas already in production with infrastructure in place. So the environmental impact would be negligible.

The continental U.S. has significant amounts of oil and natural gas in the ground and beneath the sea bed that cannot be produced due to limitations of technology. The ultradeep water and unconventional natural gas and petroleum R&D program is a fast paced technology program led by industry and academic consortia with government and industry sharing and doing a cost sharing program.

Taking some advanced technologies off the shelf and accelerating developing of others could lead to increased domestic oil and gas production within 3 years. A study by petroleum experts at the University of Texas estimated that this program as we introduced it in the House could yield 86.7 trillion cubic feet of natural gas and 6,143 barrels of oil by 2025.

The R&D program that we passed in the conference report is still large enough to generate significant new natural gas and oil production. The government's independent Energy Information Administration estimated that the R&D program would pay for itself form the increased royalty payments to the Treasury from production on Federal lands.

I am looking forward to hearing from the panel this morning, and certainly look forward to hearing from the ranking member, Mr. Boucher, if he has an opening statement.

Without objection, the Chair proceeds pursuant to committee Rule 4(e) and recognizes members for 3 minutes in opening statements. If they defer, this time will be added to their opening round of questions. With this attendance, we will be very generous with the time each of these members requires.

Now is Mr. DeLay here? All right, we will start with the second panel. The Chair recognizes Mr. Allen for 5 minutes.

Mr. ALLEN. Thank you, Mr. Chairman. I appreciate the opportunity to speak briefly, simply because my schedule today leads me to. I will need to gather what happened at this event through my staff and others. But I did want to make a short statement to indicate some of the concerns and issues that I think we ought to be addressing. I want to thank you for holding this hearing.

As the co-chair of the House Oceans Caucus, which is a bipartisan group interested in the future of our oceans here in the House, I am happy this subcommittee is holding a hearing on ocean research. I am a strong advocate of research in our oceans.

Just last week the U.S. Commission on Ocean Policy issued their preliminary report in which the authors state: "Over the past two decades the declining health of our oceans and coasts has become evident. In those same two decades, however, Federal investment in ocean research has stagnated, while funding for other scientific program areas has increased. Ocean research efforts have fallen from 7 percent of the total Federal research budget 25 years ago to just 3.5 percent today. A strong commitment is needed to support and conduct high priority research and exploration, develop and enhance the needed technology, create ocean science infrastructure, and integrate data management facilities." That is all from the Commission.

Ocean and gas research is important, but I hope the witnesses will address the broader needs for ocean research in their testimony. Both the Pew Report on Ocean Policy and the U.S. Commission report emphasize that the oceans are an ecosystem and need to be managed as such.

If we discuss oceans only as the location from which to extract resources, we risk perpetuating past destructive policies. The offshore oil and gas industry has annual production valued at $25-$40 billion a year, but the commercial fishing industries' total annual value exceeds $28 billion annually, and the recreational salt water fishery is valued at over $20 billion. I hope the witnesses will address how their exploration will affect these industries.

We do need gas. This week Federal Reserve Chairman Allen Greenspan again called for a major expansion in U.S. imports of natural gas to prevent the continued increase in energy prices. Mr. Greenspan reminded us that rising prices for oil and natural gas can significantly alter the path of the U.S. economy and could alter the magnitude of and manner in which the United States consumes energy.

I ask our witnesses to address the following questions. First, can ultradeep oil and gas extraction reduce our dependence on foreign sources of oil and gas? Second, are government incentives necessary, considering the profits to be made and the significant private sector investment already underway? Third, what risks would ultradeep water oil and gas drilling pose to the ocean ecosystem?

I thank you for your time and, Mr. Chairman, I thank you very much for allowing me to make this statement.

Mr. HALL. I thank the gentleman for his time and for his presentation.

All right. At this time, we will get underway with the panel, the third panel. I would ask you all, if you would consent, to allow the majority leader to interrupt. He has been in a meeting with people from all over the United States since about 9 o'clock this morning, and he is scheduled to be here at this time. If he comes in, I hope you would not object to us interrupting your presentation, but at the end of your presentation, in between the presentations, to ask the majority leader to come and make his presentation.

Is that agreeable to the members present? Without objection, we will do it that way. All right. The Chair asks the following members, the members of the second panel, to come forward: Mr. Howard Gruenspecht, Deputy Administrator, Energy Information Administration, for panel 3; Dr. Arthur B. Weglein, Director, Mission Oriented Seismic Research Program, Professor, Department of Physics, University of Houston; Dr. Michelle Foss, Executive Director, Assistant Research Professor, Institute for Energy, Law and Enterprises, University of Houston; and Mr. John Riordan, President and CEO, Gas Technology Institute, of Des Plaines, Illinois. If you all would take your please. Thank you.

Mr. Gruenspecht, we recognize you for 5 minutes, would allow you the first 2 minutes to tell why I mispronounced your name, if I did, and we are honored to have you here.

We are having this meeting, even though I'd say 90 percent of the Congress is in an airplane, or in their districts right now or otherwise we would have a full panel to listen to you. In deference to your schedule and your changing your schedule to come here and be here present this day, we thought it would be better for you to go ahead and give us a testimony. It will be taken down. Everyone will receive a copy of it, just as if they were here. We appreciate you being here, and appreciate you staying the course.

Mr. Gruenspecht.

STATEMENTS OF HOWARD GRUENSPECHT, DEPUTY ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY; ARTHUR B. WEGLEIN, MISSION-ORIENTED SEISMIC RESEARCH PROGRAM, UNIVERSITY OF HOUSTON; MICHELLE FOSS, EXECUTIVE DIRECTOR, INSTITUTE FOR ENERGY, LAW & ENTERPRISE, UNIVERSITY OF HOUSTON; AND JOHN RIORDAN, PRESIDENT AND CEO, GAS TECHNOLOGY INSTITUTE

Mr. GRUENSPECHT. Thank you, Mr. Chairman and members of the subcommittee. I certainly appreciate the opportunity to be here today to discuss the Energy Information Administration's recent analysis of provisions related to research and development of ultradeep water and unconventional technologies incorporated in last year's conference energy bill.

EIA is a statistical and analytical agency within the Department of Energy. We are charged with providing objective, timely, and relevant data analysis and projections for use of the Department of Energy, other government agencies, the U.S. Congress, and the public. We do not take positions on policy issues, but we do produce data and analysis reports for use by policymakers. Our views should not be construed as representing those of the Department of Energy or the administration.

In addition to collecting energy data and issuing data reports and baseline energy projections, the EIA also prepares service reports that estimate the impacts of proposed policies at the request of the Congress or the administration. The analysis I will discuss today was included in a service report on the recent conference energy bill.

Before getting started, I should note that the Office of Fossil Energy has the lead responsibility for oil and gas technology research and development within the Department of Energy. Questions regarding the potential for technology advances or proposed funding to advance technologies in these areas are appropriately directed to that office rather than to EIA.

I should also note, because EIA is an agency full of caveats, that our projections are not meant to be exact predictions of the future, but represent a likely energy future, given technology and demographic trends, current laws and regulations, and consumer behavior as derived from known data.

Mr. HALL. Is that your reason for stating that you don't represent those folks that you said you didn't represent?

Mr. GRUENSPECHT. It is very complicated. We have an interesting relationship, but you know that much better than I do. I actually testified before you 12 years ago in a different capacity.

In any event, we recognize that projections of energy markets are highly uncertain and are subject to many random events that cannot be foreseen. Thus, our projections are not statements of what will happen but of what might happen, given certain assumptions.

So with that, let me first address some of the key challenges related to the assessment of energy R&D programs. There are several key uncertainties that characterize the effects of proposed Federal R&D programs.

First, the timing and level of the net change in Federal R&D spending is often different from the authorized amount, although in this program they may be different.

Second, a statistically reliable relationship between the level of R&D spending for specific technologies and the actual outcome of that R&D is very hard to develop. In other words, even if we could easily figure out what the net Federal incremental funding input was, it is difficult to relate "dollars in" to "better technology out." There is no simple relationship that you can plug in.

Even if both of those uncertainties could be definitively resolved, the analysis is complex because of the levels of private sector R&D expenditures that are usually unknown but often far exceed R&D spending by the Federal Government.

So really, for all of these reasons, EIA cannot provide an estimate of the incremental impact of an increase in Federal R&D spending on technological change. Because of that, we did not include any R&D provisions in the main policy case, which we refer to as the "CEB" for conference energy bill case, that we developed for the service report on the conference energy bill. However, we did include the results of a sensitivity case using an assumption regarding the technological impact resulting from increases, basically, to the program you are looking at, the ultradeep water and unconventional R&D program that is contemplated in the conference energy bill, or included in the conference energy bill.

Again, in those sections of the bill which are the subject of today's hearing, $150 million annually would be allocated into a fund for federally-sponsored R&D. The money, as we understand it, is to come from Federal royalty payments that are going to be allocated in each fiscal year from 2004 to 2013, and would not go through the annual appropriations process.

So dedicated funding outside the annual appropriations process implies relatively low funding related uncertainty for the program. That was one of the uncertainties that I mentioned earlier. However, you still have the issue of relating increased Federal spending, the input of dollars to the output of better technology.

We turned to experts in the Office of Fossil Energy, and they suggested to us that the additional R&D funding, which is substantial, could plausibly be associated with an acceleration of technological progress for the technologies used to develop the affected resources—that is the ultradeep and the unconventional—by 50 percent over the value assumed in our reference case and our conference energy bill case, resulting in technological change rates that are roughly comparable to what we would consider to be a high technology case.

So we basically turned to those people. We then ran the CEB case with the added FE assumptions regarding accelerated technological change, and we refer to that as the FE/CEB case, to look at what that technological change would mean.

In this scenario we had the acceleration begin to affect natural gas for production and technology for onshore 2 years after the beginning of the program, and for the ultradeep offshore technologies it began to affect things in the field 5 years after the start of the program.

So we have the CEB case, and then we have the FE/CEB case, and the way we get insight into what the impact might be is to compare the two of them. So let me turn now to our results.

Certainly, the pattern of natural gas wellhead prices in production in the FE/CEB case is what one might expect. If you have successful research and development for those technologies, you are going to increase the supply from the ultradeep and unconventional resources, and that is going to result in a lowering of wellhead prices in our forecasts.

Again, I will just cite a few of the numerical results in the report. We provided as part of the testimony the summary table of some of those results. So let me just cite some of them.

Mr. HALL. If you can, be winding down.

Mr. GRUENSPECHT. In 1 minute, I should be done.

Natural gas wellhead prices are as much as 30 cents per 1,000 cubic feet lower than in the reference case and as much as 20 cents per 1,000 cubic feet lower than in the CEB case. Between 2009 and 2025, cumulative crude oil production from offshore is more than 850 million barrels higher than in the reference case.

During this period cumulative offshore natural gas production is 3.8 trillion cubic feet higher than in the reference case, and onshore is 11 trillion cubic feet higher than in the reference case.

So that is a summary of some of the main results. Obviously, if these FE assumptions regarding technological impacts prove to be accurate, the program could substantially increase offshore and unconventional onshore production.

This in turn could have significant implications for Federal and State royalty revenues. Again, it is important to note that technological improvements assumed in this case could also have an impact in producing areas outside the U.S.

As noted at the start of the testimony, there is significant uncertainty and, for reasons I described, there is an especially high degree of uncertainty with R&D.

I thank you, Mr. Chairman and members of the subcommittee, and I will be happy to answer any questions you have.

[The prepared statement of Howard Gruenspecht follows:]

PREPARED STATEMENT OF HOWARD GRUENSPECHT, DEPUTY ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee: I appreciate the opportunity to appear before you today to discuss the Energy Information Administration's (EIA) recent analysis of provisions related to ultra-deepwater and unconventional technologies incorporated as Sections 941-949 of last year's Conference Energy Bill (CEB).

EIA is the statistical and analytical agency within the Department of Energy. We are charged with providing objective, timely, and relevant data, analysis, and projections for the use of the Department of Energy, other government agencies, the U.S. Congress, and the public. We do not take positions on policy issues, but we do produce data and analysis reports that are meant to help policymakers determine energy policy. Because the Department of Energy Organization Act gives EIA an element of independence with respect to the analyses that we publish, our views should not be construed as representing those of the Department of Energy or the Administration.

In addition to collecting energy data and issuing data reports and baseline energy projections, including the *Annual Energy Outlook (AEO)* with projections of domestic markets through 2025, the EIA also prepares Service Reports that estimate the impacts of proposed policies or review current energy issues at the request of the Congress or the Administration. In February 2004, in response to a request from Senator Sununu for an analysis of the CEB passed by the House in the Fall of 2003, EIA issued a report entitled *Summary Impacts of Modeled Provisions of the 2003 Conference Energy Bill.*

While my testimony will focus on EIA's analysis, it should be noted that the Office of Fossil Energy (FE) has the lead responsibility for oil and gas technology research and development (R&D) within the Department. Questions regarding potential for technology advances or proposed funding to advance technology in these areas are appropriately directed to that office rather than EIA.

EIA projections are not meant to be exact predictions of the future but represent a likely energy future, given technological and demographic trends, current laws and regulations, and consumer behavior as derived from known data. EIA recognizes that projections of energy markets are highly uncertain, subject to many random events that cannot be foreseen. Thus, the projections are not statements of what will happen but of what might happen, given certain assumptions.

In the interests of brevity, my testimony today does not review in detail the provisions of Sections 941-949 of the CEB that are the subject of this hearing. Rather, it starts with a brief discussion of the challenges inherent in modeling the impacts of R&D programs. Then, it describes the analysis of the Section 941-949 program included in EIA's recent Service Report.

CHALLENGES RELATED TO THE ASSESSMENT OF ENERGY R&D PROGRAMS

Two types of uncertainty characterize the effects of proposed authorizations of Federal R&D investments. First, the timing and level of the net change in Federal R&D spending is often different from the authorized amount. Second, a statistically reliable relationship between the level of R&D spending for specific technologies and the actual outcome of that R&D has not been developed. Even if both of these uncertainties could be definitively resolved, the analysis is complex because the levels of private sector R&D expenditures are usually unknown but often far exceed R&D spending by the Federal government. Consequently, EIA cannot provide an estimate of the incremental impact of an increase in Federal R&D spending on technological change. Because of the limitations outlined above, EIA did not include any R&D provisions in the main policy case, referred to as the CEB Case, developed for its Service Report on the CEB.

However, EIA also provided the results of a sensitivity case using an assumption of the technological impact resulting from the increases in Federal spending on Ultra-Deepwater and Unconventional R&D contemplated by Sections 941 to 949 of the CEB. These sections of the bill would allocate $150 million annually into a fund (the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund) for Federally-sponsored R&D. The money is to come from Federal royalty payments that are allocated in each fiscal year from 2004 through 2013 and would not go through the annual appropriations process. The R&D is to be targeted for the development of ultra-deep (greater than 1,500 meters water depth) offshore, unconventional natural gas, and other petroleum resources. Unconventional natural gas and other petroleum resources are "natural gas and other petroleum resources located onshore in an economically inaccessible geological formation, including resources of small producers."

Dedicated funding outside of the annual appropriations process implies relatively low funding-related uncertainty for this program. However, the uncertainty in relating increased Federal spending to technological progress remains important. Experts in FE believe that the new R&D funding would accelerate technological progress for the affected resources (ultra-deep offshore oil and natural gas and unconventional natural gas production) by 50 percent over the value assumed in EIA's Reference and CEB Cases. They arrived at this conclusion by verifying that the proposed additional R&D funding would bring total Federal R&D spending back to the levels represented in the Reference Case of *AEO1997,* which used the same rates. (Coincidently, the Reference Case of *AEO1997* has technological change rates that are comparable to the *AEO2004* High Technology Case.) The CEB Case with the added FE assumptions regarding accelerated technological change due to the Section 941-949 program, referred to as the FE/CEB Case, assessed the impact of the assumed accelerated technological change on oil and natural gas supply and prices. This acceleration is assumed to begin 2 years after the onset of R&D funding for unconventional technologies and 5 years after the onset for ultra-deep offshore technologies.

IMPACTS OF THE ULTRA-DEEPWATER AND UNCONVENTIONAL R&D PROGRAM IN THE CEB

Comparisons between the FE/CEB Case and the main CEB Case provide insight into the impact of the Ultra-Deepwater and Unconventional R&D program based on the FE assumptions regarding the technology impacts of that program. The pattern of natural gas wellhead prices and production in the FE/CEB Case is as expected. Successful R&D increases supply from the ultra-deep and unconventional resources and lowers wellhead prices throughout the forecast. Natural gas wellhead prices are as much as $0.30 per thousand cubic feet lower than in the Reference Case and as much as $0.20 per thousand cubic feet lower than in the CEB Case.

Between 2009 and 2025, cumulative crude oil production from the ultra-deep offshore is more than 850 million barrels higher than in the Reference Case and over 800 million barrels higher then the CEB Case. Cumulative natural gas production is 3.8 trillion cubic feet higher than in the Reference Case and 3.2 trillion cubic feet higher than in the CEB Case. Obviously, if the FE assumptions regarding technological impacts prove to be accurate, the expanded Ultra-Deepwater and Unconventional R&D program could substantially increase offshore and unconventional production. This, in turn, could have significant implications for Federal and State royalty revenues. It is important to note that the technological improvements assumed for this case would also have an impact in producing areas outside the United States, which would potentially affect world oil markets.

The table below summarizes key comparisons between the FE/CEB Case, the CEB Case, and the *AEO2004* Reference Case. As noted at the start of my testimony there is significant uncertainty surrounding all energy projections. For reasons discussed above, there is a particularly high degree of uncertainty surrounding estimates related to the impacts of programs intended to promote improvements in technology.

Thank you, Mr. Chairman and members of the Committee. I will be happy to answer any questions you may have.

Impact of Increased R&D Funded by Royalty Payments on Natural Gas and Oil Supply Using Office of Fossil Energy Assumptions Regarding the Impact of Increased Federal R&D Spending

	2002	2010			2015			2025		
		AEO 2004	CEB	FE/ CEB	AEO 2004	CEB	FE/ CEB	AEO 2004	CEB	FE/ CEB
Lower 48 Average Wellhead Gas Price (2002 dollars per thousand cubic feet)	2.95	3.40	3.41	3.32	4.19	4.10	3.90	4.40	4.40	4.35
Natural Gas Production (trillion cubic feet) Lower 48 Production	18.62	19.90	20.25	20.42	20.98	21.01	22.00	21.29	21.54	22.20
Onshore Conventional	7.83	7.20	7.16	7.17	7.44	7.37	7.26	7.09	7.13	6.98
Onshore Unconventional	5.93	7.28	7.51	7.75	8.67	8.74	9.66	9.16	9.46	10.06
Offshore	4.86	5.41	5.57	5.50	4.87	4.91	5.09	5.03	4.96	5.16
Alaska Production	0.43	0.60	0.60	0.60	0.64	0.64	0.64	2.71	2.71	2.71
Natural Gas Consumption	22.78	26.15	25.94	26.04	28.03	27.92	28.30	31.41	31.54	32.09
Lower 48 Dry Gas Reserve Additions	24.0	21.2	21.0	22.8	20.8	20.6	23.1	19.2	19.9	20.0
Onshore Conventional	6.9	7.0	7.0	6.9	7.5	7.4	7.2	6.6	6.7	6.6
Onshore Unconventional	11.5	9.0	8.7	10.2	8.9	8.9	11.2	7.8	8.1	8.2
Offshore	5.6	5.3	5.4	5.7	4.3	4.3	4.6	4.8	5.1	5.1
Lower 48 Offshore Crude Oil Production(million barrels per day)	1.53	2.40	2.42	2.42	2.21	2.20	2.31	2.06	2.09	2.10

Sources: National Energy Modeling System date codes aeo2004.d101703e, nrgbill00.d011304d, and nrgbill50.d010904a.

Mr. HALL. All right, we thank you.Dr. Weglein has agreed for the majority leader, who has appeared on the scene here, to give his testimony now, and we are honored to have Tom DeLay, my fellow Texan and Majority Leader of the U.S. Congress. We are honored to extend to you such time as you might use.

STATEMENT OF HON. TOM DeLAY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. DELAY. Well, thank you, Mr. Chairman. I really appreciate you for holding this hearing and, Mr. Boucher, it is great that you are here, too.

With today's energy issues utmost in the American people's minds, this hearing is vitally important, and I hope that people will see how important this hearing is, if we are ever going to get a handle on our energy policy for the future.

As you know, Mr. Chairman, I am here today to speak in support of the ultradeep and unconventional natural gas and other petroleum supply R&D provisions of the Comprehensive Energy Bill, as included in the conference report passed by the House late last year.

I want to personally thank you, Mr. Chairman, for all your personal work on this provision. If it weren't for you, I don't think we would have this provision in this form in the conference report, and I greatly appreciate it.

These important provisions will establish a new research and development program for these technically challenged domestic resource provinces, unconventional resources such as coalbed methane, tight gas sands, and gas shales, as well as the ultradeep water of the central and western Gulf of Mexico to help the U.S. meet its mid-term gas demands. And most importantly, they would put the United States on a path toward greater energy independence, which is the clearest reason we need a comprehensive energy policy in the first place.

Natural gas, of course, is a critical component of the Nation's energy security. Its use spans our entire economy. Natural gas was the broadest set of applications—or has the broadest set of applications of any of the fossil fuels. it heats our homes and runs out appliances.

It is an important feedstock for our industry. It provides the United States with almost 20 percent of its electricity. It supplies heat and fuel for much of rural American, and it is a major energy source for the Nation's commercial sector.

Today gas prices are at a historic high. Imports of products of which natural gas is a significant component such as fertilizer and ammonia are up 50 percent over the last 2 years, and major industrial facilities are shutting down or moving overseas.

These numbers are not theoretical, Mr. Chairman. American workers and consumers are paying the price. The United States is at a critical energy crossroads. Every day, we are growing more and more dependent on foreign sources of energy. Gas and oil supplies are tight. Infrastructure is constrained, and domestic production is flat.

At the same time, the Energy Information Administration says demand for natural gas will rise significantly in the next two decades. We need more natural gas, and we have it.

Let's be clear about our supply. The United States is not running out of natural gas. We have a significant natural gas resource base, more than 50 years of technically recoverable reserves at current found reserves and rates of consumption, but let us also be clear about the nature of these remaining reserves.

Many of them are on Federal lands and are off limits to production by virtue of rules and regulations, and these legal access restrictions are addressed elsewhere in H.R. 6. But almost all of these reserve regions, with the exception of the shallow and deep water regions under various moratoria, are subject to technological access restrictions.

Without new investment in research and development, physical access to these regions will not produce a single cubic foot of natural gas. We have an opportunity here to address this challenge through the ultradeep water and unconventional onshore natural gas supply research and development program in H.R. 6.

This program would establish a unique partnership between government and industry to help ensure we meet mid-term gas demand through the development of technically challenged but potentially prolific provinces. Further, this new program would address the inadequacy of current research models, particularly in applied energy R&D.

Too often, government research programs are limited in size and scope by the vagaries of the budget cycle and by the lack of adequate incentives of public-private partnerships. So in the energy arena especially, Mr. Chairman, industry leadership and input is critical.

Modeling of the program by both EIA and the Bureau of Economic Geology at the University of Texas indicates a significant supply response from this investment, as well as moderation in prices.

Finally, Mr. Chairman, the program is sunsetted after 10 years and would at a minimum pay for itself. The increased production as a result of this R&D program would generate significant increases in royalties to the Federal treasury. A healthy royalty stream is critical to the future of other programs that rely on royalty funding, including those states, Wyoming, New Mexico, Colorado and Utah, for example, where there is a significant production on Federal lands.

It is our job in Congress to help ensure that energy supplies will be abundant, responsible and reliable. We owe this to our energy consumers, Mr. Chairman, industry, commercial businesses, and individual households.

It is also our job to make certain that every Federal dollar is spent wisely and accountably. The ultradeep water and unconventional gas supply R&D provisions in H.R. 6 would, in short, add significant new natural gas and oil supplies to help ensure our Nation's energy security, provide for maximum industry input, pay for themselves, and maximize the value of Federal resources in the form of additional royalties to the Federal treasury.

So I just urge the subcommittee to support this program. Thank you very much, Mr. Chairman, for this opportunity.

[The prepared statement of Hon. Tom DeLay follows:]

PREPARED STATEMENT OF HON. TOM DELAY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Thank you very much, Chairman Hall, for holding this hearing on the benefits of Ultra-deepwater Research and Development.

As you know, Mr. Chairman, I am here today to speak in support of the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Supply R&D provisions of the comprehensive energy bill as included in the conference report passed by the House late last year.

These important provisions would establish a new research and development program for these technically challenged domestic resource provinces—unconventional resources such as coal-bed methane, tight gas sands, and gas shales, as well as in the ultra-deepwater (1500 meters of water or greater) of the Central and Western Gulf of Mexico—to help the US to meet its mid-term gas demand.

And most importantly, they would put the United States on a path toward greater energy independence, which is the clearest reason we need a comprehensive energy policy in the first place.

Natural gas, of course, is a critical component of the nation's energy security.

Its use spans our entire economy. Natural gas has the broadest set of applications of any of the fossil fuels—it heats our homes and runs our appliances.

It's an important feedstock for industry: it provides the United States with almost 20 percent of its electricity, it supplies heat and fuel for much of rural America, and it's a major energy source for the nation's commercial sector.

Today, gas prices are at historic highs. Imports of products of which natural gas is a significant component—such as fertilizer and ammonia—are up 50 percent over the last two years, and major industrial facilities are shutting down or moving overseas.

These numbers are not theoretical: American workers and consumers are paying the price.

The United States is at a critical energy crossroads. Everyday, we're growing more and more dependent on foreign sources of energy. Gas and oil supplies are tight, infrastructure is constrained, and domestic production is flat.

At the same time, the Energy Information Administration says demand for natural gas will rise significantly in the next two decades.

We need more natural gas . . . and we have it.

Let's be clear about our supply: the United States is not running out of natural gas. We have a significant natural-gas resource base—more than 50 years of technically recoverable reserves at current found reserves and rates of consumption.

But let's also be clear about the nature of these remaining reserves. Many of them are on federal lands and are off-limits to production by virtue of rules and regulations.

These *legal* access restrictions are addressed elsewhere in H.R. 6.

But almost all of these reserve regions—with the exception of the shallow and deepwater regions under various moratoria—are subject to *technological* access restrictions.

Without new investment in research and development, physical access to these regions will not produce a single cubic foot of natural gas.

We have an opportunity to address this challenge through the *Ultra-deepwater and Unconventional Onshore Natural Gas Supply Research and Development* program in HR 6.

This program would establish a unique partnership between government and industry to help ensure we meet mid-term gas demand through development of technically challenged but potentially prolific provinces.

Further, this new program would address the inadequacy of current research models, particularly in applied energy R&D.

Too often, government research programs are limited by size and scope, by the vagaries of the budget cycle, and by the lack of adequate incentives for public/private partnerships.

In the energy arena especially, industry leadership and input is critical. Modeling of the program by both EIA and the Bureau of Economic Geology at the University of Texas indicates a significant supply response from this investment, as well as a moderation in prices.

Finally, the program is sunsetted after 10 years and would, at a minimum, pay for itself. The increased production as a result of this R&D program will generate significant increases in royalties to the federal treasury.

A healthy royalty stream is critical to the future of other programs that rely on royalty funding, including those states—Wyoming, New Mexico, Colorado, and Utah, for example—where there is significant production on federal lands.

It is our job in Congress to help ensure that energy supplies will be abundant, responsible, and reliable.

We owe this to our energy consumers—industry, commercial businesses, and individual households. It's also our job to make certain that every federal dollar is spent wisely and accountably.

The Ultra-deepwater and Unconventional Gas Supply R&D provisions in HR 6 would, in short:

- add significant new natural gas and oil supplies to help ensure our nation's energy security;
- provide for maximum industry input;
- pay for themselves;
- and maximize the value of federal resources in the form of additional royalties to the federal treasury.

I urge the subcommittee to support this program and thank you again for this opportunity.

Mr. HALL. Mr. Leader, we thank you for your time, and we know how pressed you are for time, and we thank Mr. Gruenspecht for allowing you to move in between the two speakers, and Dr. Weglein, to give you this opportunity.

I thank you especially for your statement that this is a payback program that the feds put the money in, the private sector does the work, and reserves and known reserves that are there will do the payback.

I have heard figures even approaching $10 billion for the initial outlay that H.R. 6 would spawn. Now that has been cut back in conference committee for about how many months now. We don't really know what is going to come out, if anything does. But thank you for your part and your pushing that.

It is certainly great to push, and all of you on the panel there who are doing your part to give us an energy solution, which is probably the most important buzz word that is going across the country right today. Thank you for your time, Mr. Leader.

Mr. DELAY. Thank you, Mr. Chairman.

Mr. HALL. All right. Dr. Weglein, thank you for letting us intervene there. We recognize you at this time for 5 minutes or as much time as you will take. Thank you.

STATEMENT OF ARTHUR B. WEGLEIN

Mr. WEGLEIN. Mr. Chairman, thank you for the opportunity to testify before your committee today. The purpose of my testimony is to raise issues and propose actions that would enhance the probability of H.R. 6 receiving the petroleum industry partnership and support required by the ultradeep water model.

Before I start, a word about my background. After 22 years working as a researcher in the petroleum industry, I joined the University of Houston in 2001 and founded the Mission-Oriented Seismic Research Program. That program addresses problems whose solutions would have the biggest positive impact on the ability to locate and produce hydrocarbon.

Our sponsors include all the major publicly traded petroleum companies worldwide; in addition, 4 foreign national petroleum companies and the largest service companies. Located in Houston, the energy capital of the world, we benefit from and leverage the highest concentration of brainpower in the industry. We partner with world class industry experts through working teams that focus on research projects within our program.

Now how does this relate to deep water H.R. 6? The industry trend to deep and ultradeep water has an immediate associated increase in cost and every phase of exploration and production. For example, drilling costs are significantly higher in deep water. Hence, there is a reduced tolerance for dry holes as water depth and drilling expense rises.

In addition, there are new and serious technical challenges occurring specifically in the deeper marine environment. When combined with higher deep water costs, this confluence of technical and economic factors provides a strong impetus for achieving greater technical capability and the support for fundamental R&D efforts directly aimed at those challenges.

Heightened cost demands that fuel wells define and delineate reservoirs, and this must occur in the face of new geologic and geophysical challenges. The idea is, if this R&D is successful, it will deliver reduced risk and increased reliability in the prediction of new and definition of current reservoirs.

In seeking an ultradeep partnership with petroleum companies in both manpower and resources, several points are worth keeping in mind. One, the challenges that deep and ultradeep water E&P face are best understood by the petroleum industry. Two, the experts are, for the most part, in the petroleum industry and, when they are not, they are already currently funded by the petroleum industry. Three, there is a great reluctance on the part of big oil and gas companies to partner with academic, government lab, and Federal agencies, and often for good reasons. Four, that reluctance and level of scrutiny increases with the amount of funding, or matching contribution being requested.

Why this hesitation on the part of industry to partner? It certainly isn't that industry is risk averse, nor is it hesitant to try new ideas that aim to solve real problems, nor is industry against partnership. In fact, it is rare for any E&P player in the real world to have a single corporate player. So they clearly understand partnering.

So why the hesitation when it comes to large scale Federal and academic cooperation? One is that the petroleum industry has its own brand of leaders, bureaucracy, motivation and responses, and rarely appreciate the added different form that Federal and academic bureaucracy can take.

Two, there is also a view that academic and government labs often march to a different drummer than industry research, and that academic and government researchers often measure success in terms of number of published papers and reports. Industry measures success by the positive impact the research has on E&P effectiveness, and counting published papers is rarely a measure of that impact.

Research that is directed, fundamental and impactful is the central objective and serves the aligned interests of forefront science and the petroleum industry's need for step improved prediction and reliability. A goal with that high bar can benefit from the pooling of industry and government resources, and that objective is what H.R. 6 is meant to facilitate.

One of the key points and strengths of H.R. 6 is its explicit recognition of these issues reflected in the ultradeep water program being administered by DOE but managed by a consortium of academic-industry professionals.

I would respectfully recommend that the management be under the authority and responsibility of industry experts with academics involved where appropriate to carry out the plan and help provide deliverables.

Another factor to consider is that industry is already well aware of all academics who seek industry support and already selects to fund those considered capable of addressing their concerns.

A reasonable question is—and Congressman Allen raised this—why should the Federal Government support R&D that can impact bottom line profit of the petroleum industry? Our response is that the technical challenges facing the large oil and gas producers in ultradeep water is of such a magnitude today that they can, and will at some point, shift their investment and exploration portfolio toward other opportunities; for example, the Middle East and Russia where other issues are present but not perhaps of such a daunting technical nature.

The interests of the United States in energy, national security, economic growth and stability dictate a maximum amount of domestic reserves and production at an overall diversity of sources of hydrocarbon. Our U.S. Government investment in ultradeep water R&D truly partnered and managed by the best minds in the petroleum industry would, if carried out in an effective manner, help serve the near and long term interests of our country.

That new capability would also benefit the entire global energy landscape and allow currently inaccessible resources to become accessible.

Again, Chairman Hall, thank you for the opportunity to testify before your committee. I look forward to your questions.

[The prepared statement of Arthur B. Weglein follows:]

PREPARED STATEMENT OF ARTHUR B. WEGLEIN, UNIVERSITY OF HOUSTON

Mr. Chairman, thank you for the opportunity to testify before your committee today.

My purpose and objectives in this testimony are to convey my impression of various factors that can influence the chances of H.R. 6 receiving the petroleum industry partnership and support required by the Ultra-deep water research administration and management model. I will also make specific suggestions that would support and guide a successful execution of the important and worthwhile national energy objectives that this bill represents.

In my career, I spent 22 years as a seismic research scientist and technical advisor in the petroleum industry before joining the University of Houston in 2001, where I founded the Mission-Oriented Seismic Research Program and industry consortium. The purpose of that educational and research program is to address and solve fundamental seismic problems whose solutions would produce the biggest positive step change in our ability to locate and produce hydrocarbons. Our sponsors include all the major publicly traded petroleum companies world-wide, four foreign national petroleum companies and the largest service companies. Located in the City of Houston, the energy capital of the world, we benefit from and leverage the highest concentration of brainpower in the industry. We partner with world-class industry experts through working teams that focus on research projects within our program.

The industry trend to deep and ultra-deep water has an immediate associated increase in cost for every stage of exploration and production. For example, drilling costs and production facility investment are significantly higher in deep water. Hence, there is a reduced tolerance and lower ceiling for the number of dry holes as their expense rises.

In addition, there are new and serious technical challenges and obstacles occurring specifically in the new deeper marine environment. When combined with intrinsic higher deepwater costs this confluence of technical and economic factors provides a strong impetus for greater technical capability and the support for fundamental R&D efforts directed at those challenges. Heightened cost demands that fewer wells define and delineate reservoirs, and this must occur in the face of new geologic and geophysical challenges. The idea is if this R&D is successful, it will deliver reduced risk and increased reliability in the prediction of new and definition of current reservoirs.

In my particular technical area, deep water can all by itself cause the failure of certain traditional coherent noise reduction methods for removing multiply reflected events from seismic data. A complex subsurface adds another hurdle; e.g., the inability to accurately locate and define hydrocarbon targets beneath salt, basalt and other complex overburdens is a major obstacle to effective E&P in the Gulf of Mexico and elsewhere. Sub-sea sediments are often unconsolidated in ultra-deep water and can be markedly different from those in shallower depths, causing major drilling problems; and this is often not discernable using current seismic data analysis.

In seeking an ultra-deep partnership with petroleum companies in both manpower and resources several points are worth keeping in mind:

(1) The challenges that deep and ultra deep water E&P faces are best understood by the petroleum industry;
(2) The experts are for the most part in the petroleum industry or outside and are already funded by the petroleum industry;
(3) There is a high level of hesitation and reluctance on the part of big oil and gas companies to "partner" with academic, government labs and federal agencies and often for good reasons;
(4) That reluctance and level of scrutiny increases with the amount of funding or matching contribution being requested.

There are two basic types of funding channels in petroleum-academic partnership: (1) smaller essentially educational/research support grants that are often combined for impact as part of a consortium with other companies, and (2) larger investments which derive from a business unit or corporate strategic decision, and invite a greater scrutiny, oversight of direction, and clarity of managing the progress in providing impactful deliverables. The H.R. 6 Ultra-deep program falls in the second category.

Why this hesitation on the part of industry to partner? It certainly isn't that industry is risk averse nor is it hesitant to try new ideas that aim to solve real problems. There is a view that academic and government labs often march to a different drummer than industry research, and can measure success in terms of number of published papers and reports. Industry measures success by the positive impact the research has on E&P effectiveness and counting papers is rarely a measure of that value and significance. Research that is directed, fundamental and impactful is the central objective, and serves the aligned interests of forefront science and the petroleum industry's need for step improved prediction and reliability. A goal with that high bar can benefit from the pooling of industry and government resources, and that objective is what H.R. 6 is meant to facilitate.

There is a view in industry that these partnerships were often window dressing where industry was called in at the beginning to provide an imprimatur of solving real world problems, but never consulted afterward or kept informed. Technical service projects supported at universities were also generally frowned upon as inappropriate and inconsistent with their educational mandate, and better suited for commercial service companies. Petroleum companies have plenty of their own bureaucracy, and rarely see the need of additional federal bureaucracy unless a significant and unique overriding benefit can be delivered.

One of the key points and strengths of H.R. 6 is its explicit recognition of these issues reflected in that the Ultra-Deep water program would be administered by DOE but managed by a consortium of academic/industry professionals. I would respectfully suggest that the management be under the authority and the responsibility of industry experts, with academics involved where appropriate to carry out the plan and help provide deliverables. A critical point in the success of H.R. 6 would be the quality of the industry people chosen to manage this program. Another factor to consider is that industry is already well aware of academics who seek industry support and already selects to fund those considered capable of addressing their concerns.

A reasonable question is: Why should the federal government support R&D that can impact the bottom-line profit of the petroleum industry? A response is that the technical challenges facing the large oil and gas producers in ultra-deep water is of such a magnitude today, that they can and will, at some point, shift their investment and exploration portfolio towards other opportunities, e.g., the Mid-east and Russia, where other issues are present, but not perhaps of such a daunting technical nature. The interests of the United States in energy, national security, and economic growth and stability dictate a maximum amount of domestic reserve and production and an overall diversity of sources of hydrocarbons. A US government investment in ultra-deep water R&D, truly partnered and managed by the best minds in the petroleum industry, would, if carried out in an effective manner, help serve the near and long-term interests of our country. That new capability would benefit the entire global energy landscape and allow currently inaccessible resources to become accessible.

Chairman Hall: Again, thank you for the opportunity to testify before your committee. I look forward to your questions.

Mr. HALL. Thank you, and you said it very well. Thank you very much.

The Chair now recognizes Dr. Michelle Foss; we are honored to have Ms. Foss here. She is Executive Director of the Institute for Energy, Law and Enterprise, but more important to me than that, she was a Director at Simmons & Company, and my friend, and this Congress's friend, Matt Simmons, who is probably one of the foremost authorities on OPEC expectations. We are honored to have you and recognize you at this time for 5 minutes.

STATEMENT OF MICHELLE FOSS

Ms. FOSS. Thank you, and I must say, it is very nice to see you looking so well, Mr. Hall. Thank you for inviting me to participate in the hearing today.

I would like to take a different look at things and offer some points from a bigger picture view of the United States' energy requirements and what we are dealing with in this hearing.

First, I would like to state, the geological setting within the deep water subprovince is very favorable to the existence of large commercial hydrocarbon accumulations. As the oil and gas technology pathway continues to advance and costs and risks are reduced on a unit basis, deep water development projects in the Gulf of Mexico will continue to become more feasible, allowing companies to look to the ultradeep waters where depths exceed 5,000 feet.

I would like to point out that the oil and gas technology pathway in the United States has been critical to sustaining domestic production. There is no way to ignore the role of technology and what we have been able to achieve in this country. On a barrel of oil equivalent basis, cumulative production in the United States continues to increase, and this is a really, really important fact to acknowledge for such a mature oil and gas province in the world.

The oil and gas technology pathway has always rested on both industry entrepreneurship and government participation. I would like to point out for the subcommittee's consideration that this role of government includes not just research and development and government support of that through both direct and indirect ways, but also appropriate fiscal regimes for offshore regulatory arrangements and access.

The U.S. Minerals Management Service is forecasting daily oil production rights of between 2 and 2.5 million barrels by the end of 2006, and daily gas production rates of between roughly 10 and 17 billion cubic feet by the end of the same year. I submit that these are not small numbers, given where we are in our energy markets today.

These outlooks hinge on continued access to prospective areas for development, and they are driven by expectations with regard to the natural gas market. I agree totally with Mr. DeLay, the Majority Leader, on that point.

The MMS has already taken some actions that will help spur development and innovation by allowing the use of floating production, storage and offloading systems. I also would like to observe that the Outer Continental Shelf Deep Water Royalty Relief Act represents an initiative or a type of government initiative that has had a significant impact on Gulf of Mexico activities.

A few general points as well: U.S. energy security and access for exploration and production in this country are intrinsically linked. For both onshore and offshore activities, companies need to be able to get into prospective areas. I urge Congress to at least put on the table for discussion the offshore moratoria that are currently in place.

I would like to point out that regulatory regimes for energy in general in the United States require attention. Demand side response is essential to be able to use energy wisely and efficiently, and in order to be able to do that, customers need to be able to get price signals in a very transparent and meaningful way.

Fiscal regimes to support oil and gas development, not just offshore but onshore, are essential. There are several things under consideration right now, both for the offshore regime but also for onshore areas, nonconventional gas production, coal seam gas, deep coal production, and that sort of thing.

Environmental management and transparency are critical. I am very sympathetic with Mr. Allen's points on those. I would like to point out that, in my view and based on my own scientific credentials, that deep water and ultradeep water oil and gas production can be very compatible with the environmental values we have in the United States.

I would like to urge the committee to consider the impact on the oceans from coastal land use and urbanization. I think those things are actually as critical, if not more critical, than what we do directly in the ocean environments.

Gas transportation corridors will be essential to make deep water and ultradeep water production work. We need to be able to land our products, get it to the beach, get it into the systems.

I believe that also all of these transportation corridors are compatible with everything we are discussing now for liquified natural gas. LNG will be essential in helping to stabilize offshore production flows as we move into the deeper water environments.

The continued effort to restructure, stabilize, provide effective oversight for natural gas markets also plays a role in this. Everything that is being done to provide and encourage ethical behavior in natural gas markets, restore credibility and creditworthiness for the energy merchant companies also plays a role in everything that we are doing with oil and gas production, because these companies have provided funding and capital support for all of the essential upstream and midstream activities that we have undertaken in the past few years.

We believe there is a direct link between our ability to deliver natural gas, in particular, to the United States and the ability to have creative energy merchant capital flows into the industry.

Those are my major observations. I thank you very much for your time.

[The prepared statement of Michelle Foss follows:]

TESTIMONY BEFORE THE HOUSE SUBCOMMITTEE ON ENERGY
Ultra-Deep Oil and Gas
April 29, 2004

Dr. Michelle Michot Foss
Institute for Energy, Law & Enterprise, University of Houston

SUMMARY

Members of the House Subcommittee, thank you for your invitation to participate in this important hearing to discuss the role of ultra-deep oil and gas development in the United States. I have several points to submit in this testimony.

For the GOM, the following conclusions can be reached.

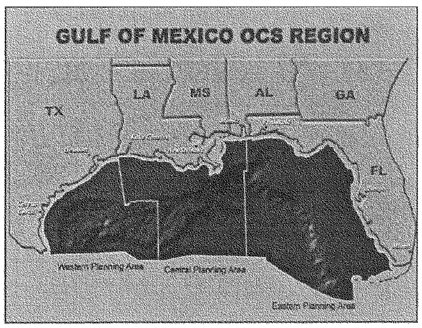
- The geological setting within the deepwater sub-province is very favorable for the existence of large, commercial hydrocarbon accumulations.
- As the oil and gas technology pathway continues to advance and costs and risks are reduced on a unit basis, deepwater development projects in the GOM will continue to become more feasible, allowing companies to look to the ultra-deep waters where depths exceed 5,000 feet.
- The U.S. Minerals Management Service (MMS) is forecasting a daily oil production rate of between 2.00 and 2.47 million barrels by the end of 2006, and a daily gas production rate of between 10.97 and 16.39 billion cubic feet by the end of the same year. These represent high case and low case estimates.
- These outlooks assume access to federal offshore acreage for exploration and development and favorable natural gas market and price conditions.
- The U.S. MMS has approved the use of floating production, storage, and offloading systems in the central and western GOM.
- The OCS Deep Water Royalty Relief Act had a significant impact on deepwater GOM activities.

Clearly, GOM E&P activity rests on broader domestic energy and economic indicators and policies. These include the following.

- U.S. energy security and access for E&P are linked. For Lower 48 onshore and offshore oil and gas reserve replenishment and production to be sustained, the industry must be able to gain access to prospective areas. Offshore moratoria should be re-visited. The history of offshore E&P activity suggests that oil and gas production can be accelerated while ensuring safety and environmental protections.
- Regulatory regimes for energy, in general, require attention. Customers should detect and be able to respond to real prices. Demand side response is an essential component of sound energy policy and energy security. Fiscal regimes to support the deepwater frontier, sustainable production mature areas, and non-conventional resources like coal seam gas (especially to encourage new plays targeting deeper coals) merit consideration.
- Environmental management and transparency should be achieved through flexible approaches that, if not market-based, will be compatible with market operations.
- Gas transportation corridors and capacity, including those needed to support LNG, should be facilitated through efficient permitting and certification as should new LNG receiving facilities.
- Natural gas market oversight in U.S. is essential to encourage ethical practices, continued efficiency, optimization of both our natural resource base essential infrastructure and yet flexible and compatible with the competitive markets that have been created and are being facilitated.
- Electric power restructuring in U.S. is necessary to bring the same competitive efficiencies to both infrastructure development and operations, and to facilitate demand side response.

- Sound oversight and creative solutions to encourage ethical market behaviors will go a long way to restoring credibility and credit worthiness of the critical energy merchant sector. The loss of capital flows associated with the collapse of energy merchants has directly impacted both upstream and midstream investment in the U.S.
- Finally, the U.S. should maintain and improve relationships with Mexico and Canada, our most important external partners for energy development, trade and security.

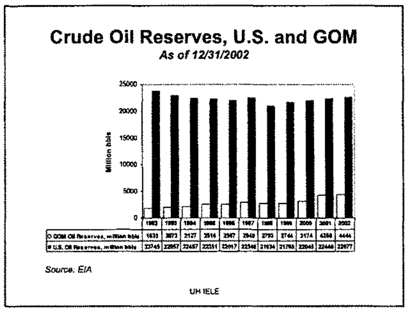
OVERVIEW

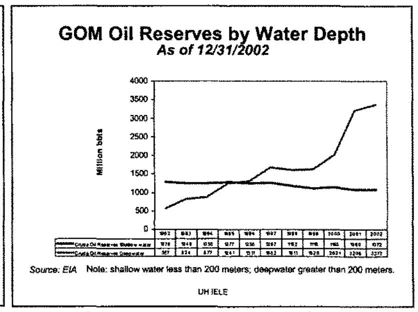


The U.S. Gulf of Mexico (GOM) is a major oil and gas upstream province, not only for our domestic resource base but by worldwide standards. Participation is undertaken by both U.S.-based and international exploration and production (E&P) operators. The GOM is partially landlocked with the deepest point being 17,070 feet below sea level. Initial exploration began in shallow waters on the continental shelf, with the first offshore well in 1937. The first commercial production was achieved in 1947. As fields have matured and operators sought larger and higher return prospects, E&P activity has progressively moved to deeper waters.

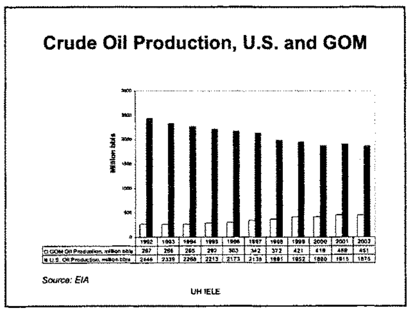
GOM production peaked in 1970, then declined and rose again briefly in the mid 1980s. By 1988, with production falling, it was believed the GOM was in permanent decline. Conventional wisdom was that GOM constituted a "Dead Sea" for upstream activity, and both E&P and service companies shifted attention and investment overseas. New play concepts (for example, the sub-salt) and continuous improvement in seismic and drilling technologies led companies to re-enter or expand GOM upstream positions. A new initiative in the form of the Deep Water Royalty Relief Act was implemented in 1995. These events led to renewed activity and interest. In 2001, the GOM led the U.S. in total discoveries in with 702 million barrels (Mbbls) or 55 percent. Major discoveries included fields like Thunder Horse (BP), with a water depth of 6,000 feet and Manatee (Shell) with a water depth of 1,940 feet. Overall, the GOM is now the largest producing area in the U.S. with roughly 24 percent of crude oil output and 23 percent of the U.S. dry gas output.

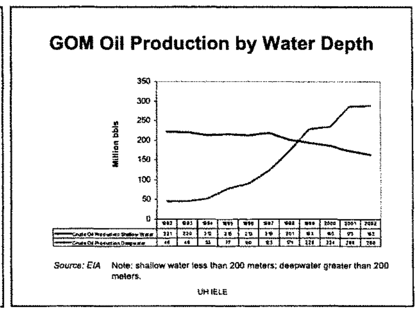
GOM PERFORMANCE: A CLOSER LOOK



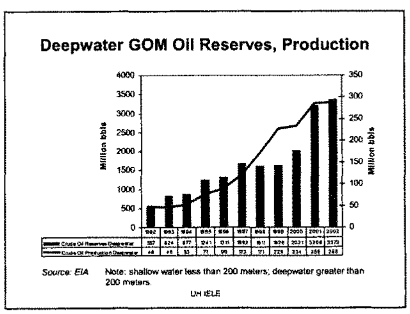


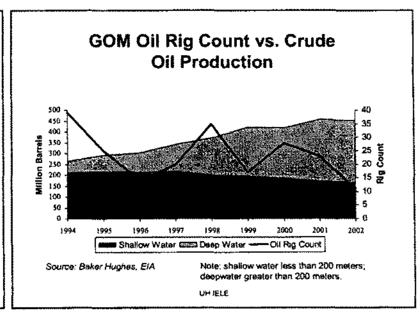
As proved GOM crude oil reserves reached 4.4 billion barrels (Bbbls), the preponderance of new reserves have come from water depths of greater than 200 meters (roughly 660 feet).



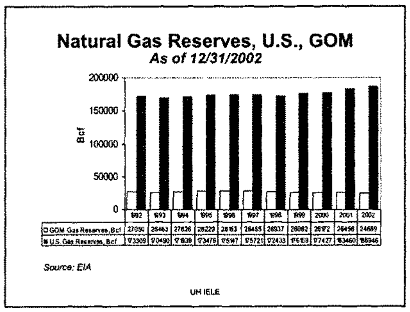


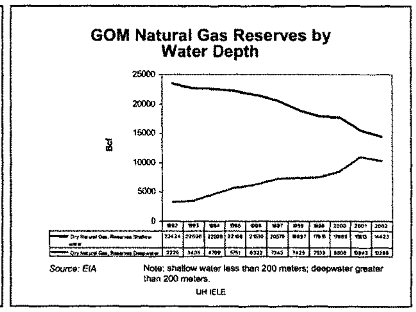
Likewise, an increasing proportion of the growth in GOM crude oil production has come from water depths in excess of 200 meters.



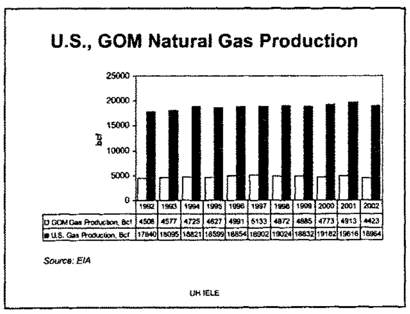


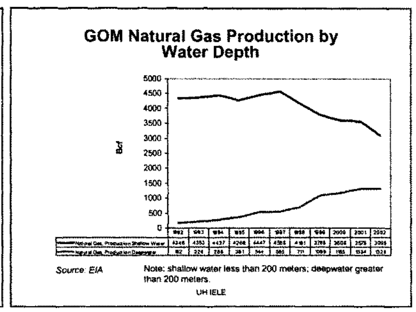
As activity for GOM crude oil reserves replacement and production shifted to deeper waters, rig activity targeting oil has been flat to declining. This is largely a function of increased risk and cost, as well as new technology and offshore service requirements and logistics necessary to enable E&P activity in deeper waters.



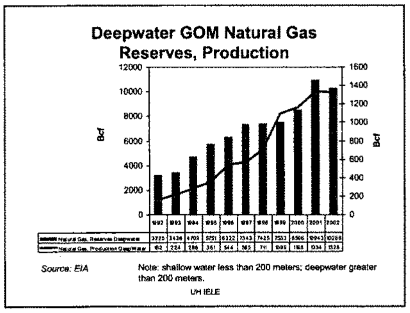


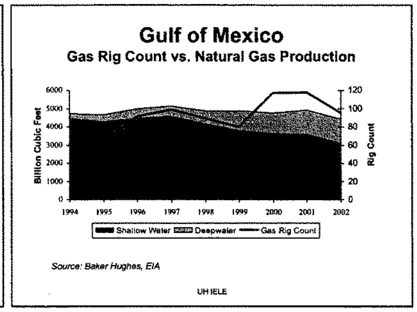
Similar patters are at work for natural gas, albeit with a number of caveats. GOM natural gas reserve replacement has been relatively flat, while the decline in reserves from shallow water fields has been much steeper than for oil.



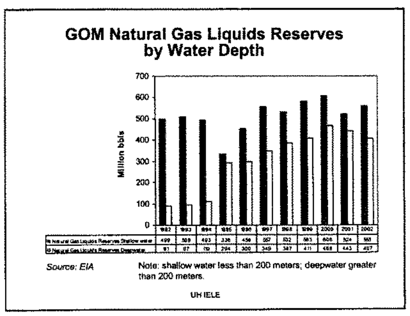


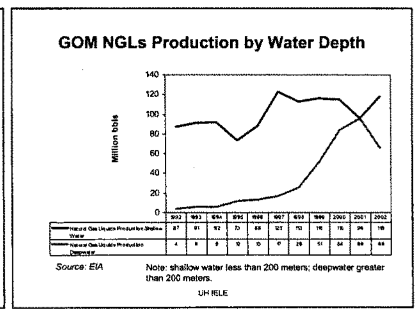
Likewise, natural gas production from deeper water blocks has not been as strong as for oil. Overall, the GOM has tended to be "oil prone" for known fields, a function of both geology and the fact that subsurface well depths remain in the "oil window." In addition, infrastructure to support gas production from deeper water fields is only now beginning to have impact.



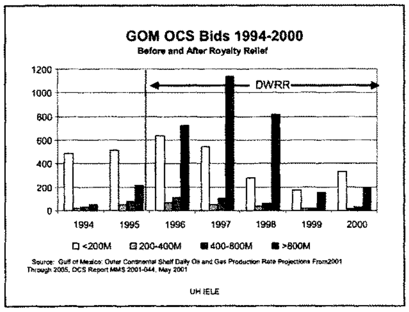


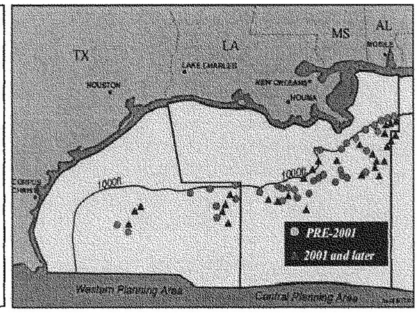
However, in contrast to oil-directed drilling, rig activity for gas has been much more pronounced. Thus, while current and potential GOM hydrocarbon is prospective and important for crude oil, the hunt for vital natural gas resources to serve critical U.S. demand has been a stronger factor in investment decisions.



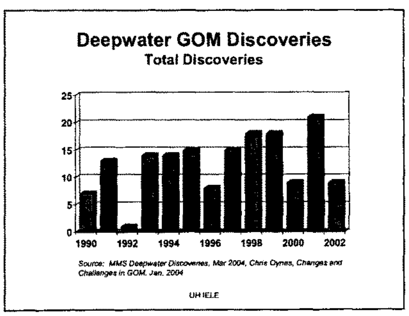


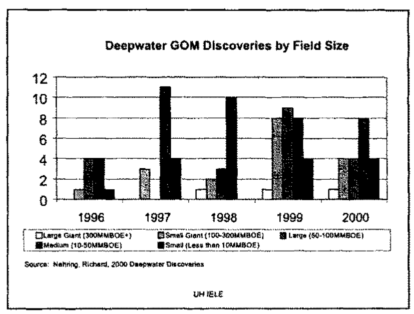
Natural gas liquids (NGLs) reserves and production are also vital components of the GOM hydrocarbon resource base. Stabilizing these flows is an important consideration from the perspective of Gulf Coast downstream (petrochemical) operations.





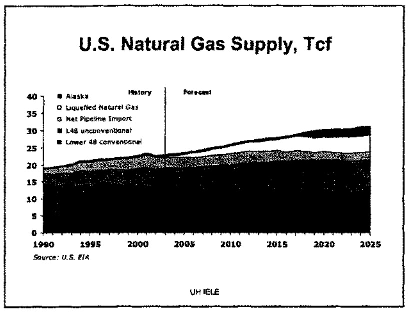
The snapshot in time from 1994-2000 illustrates the added effect of the Deepwater Royalty Relief Act (DWRR). The DWRR has helped to support extension of the GOM resource base as E&P operators pushed investment and technology to offshore blocks in water depths exceeding 3,000 feet. Geographically, this also has meant greater distance from onshore base support. The huge engine provided for generation and entrapment of hydrocarbons – the Mississippi River delta system – along with geological favorable conditions of the large Gulf of Mexico embayment suggest that the outer continental shelf and continental slope will provide the frontier conditions needed for new, large discoveries of oil and gas pools.

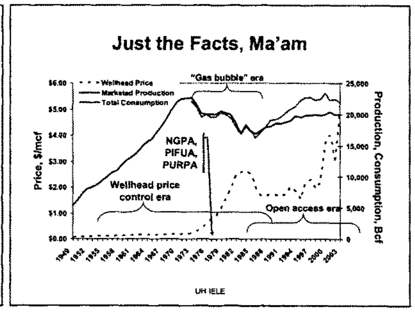




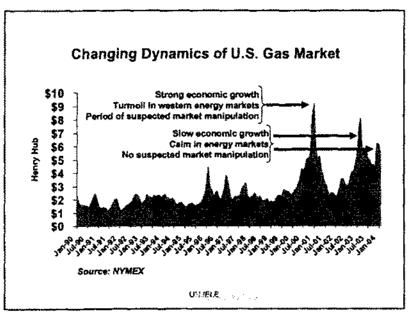
Indeed, size of oil and gas pool is critical to large, competitive E&P operations. As risk and uncertainty increase, larger reserves are needed to spread the cost of finding and delivering new volumes. It is not simply the total number of deepwater discoveries, but the size of new fields and in particular the emergence of large and small giants yielding upwards of 300 million barrels of oil equivalent (BOE, oil and natural gas expressed in common terms according to energy content) that provides the incentive for risk taking in such a challenging environment.

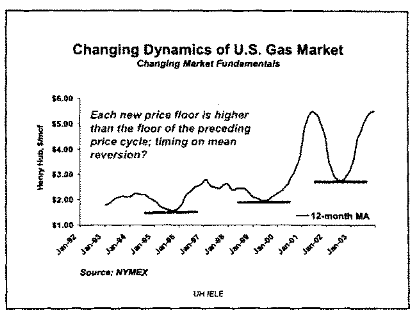
DRIVERS FOR FUTURE GOM ACTIVITY





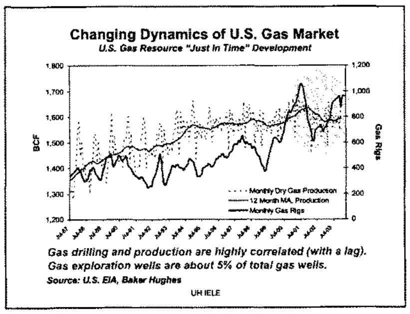
As mentioned above, while the GOM is vital for U.S. crude oil production, it has grown in importance as a prospective area for domestic natural gas resources. Oil is a global, fungible commodity while natural gas is largely a domestic energy source – nearly 80 percent of U.S. natural gas demand is satisfied with our own production, in stark contrast to crude oil. Liquefied natural gas (LNG) will increasingly serve U.S. and North American demand. But Lower 48 natural gas production from conventional reservoirs will serve as the foundation for our overall natural gas supply picture for some time to come. Sustaining Lower 48 production and will require careful attention to frameworks across the natural gas value chain. Policies and regulations affecting natural gas have subjected both producers and customers (including core consumers) to a roller coaster of mixed signals. The end result is a leaner, more competitive natural gas industry system, but one where price signals – especially to core consumers – continue to be opaque. Demand sensitivity to natural gas price changes resides mainly with large industrial and commercial consumers, including the impact of electric power generated with natural gas. Since the early 1990s, it has become more difficult for domestic production to meet native demand. We have come to rely on Canadian production and exports to close the gap between U.S. demand and U.S. production. LNG currently contributes about two percent of our supply.

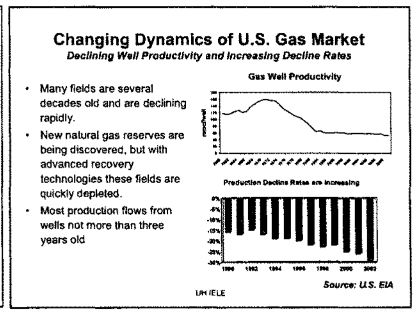




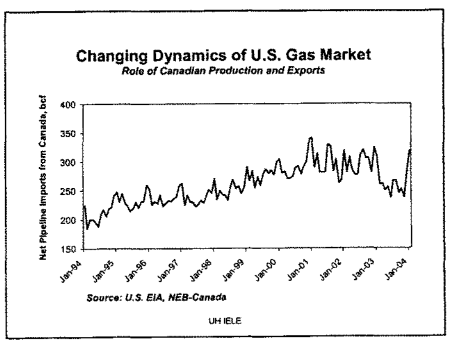
Of great interest are recent natural gas price spikes. Initially, rapid increases in natural gas prices in 2001 were attributed largely to market manipulation, triggering numerous investigations and considerable political conflict but also yielding conclusions that market manipulation had little to do with these events.

Subsequent price spikes in 2002 and 2003 were not attributed to market manipulation, nor did they occur during chaotic energy market conditions. Furthermore, when natural gas prices are smoothed it is clear that the U.S. has been on an upward price path for some time – the price floor of each price cycle since the inception of an open natural gas spot market and futures trading has been higher than the previous floor. To some extent, natural gas prices during the past three or so years reflect global oil market conditions and stronger crude oil prices and demand (particularly in the fast growing economies of China and India). However, the longer term natural gas price trend also suggests that natural gas supply-demand balances have fundamentally altered.



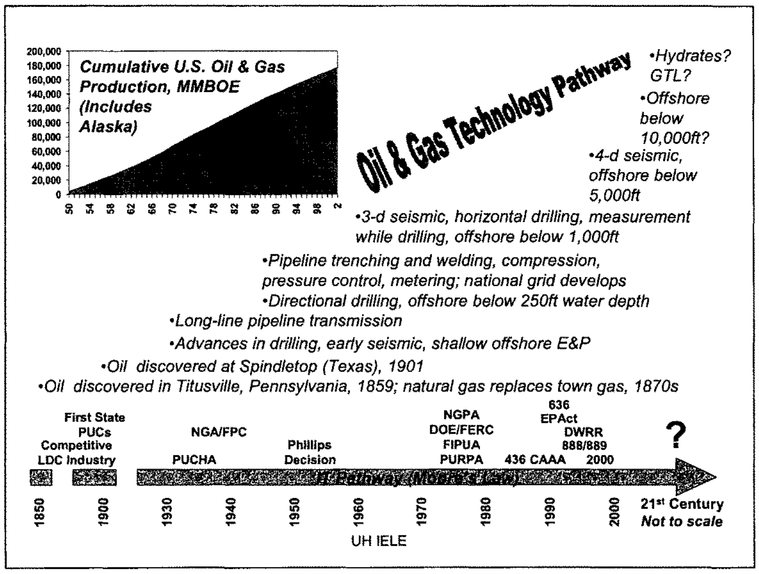


Natural gas production has become largely a "just in time" business, a function of price signals and the kinds of prospects targeted by producers. Price volatility and the cost of financing drilling operations encourage producers to maximize cash flow. The kinds of prospects that producers target are typically "fast gas" reservoirs that deplete quickly, so that reserve replenishment must be constant (the often-termed production "treadmill"). Interestingly, in spite of historically high prices for both crude oil and natural gas, the natural gas-directed rig count during 2003-2004 did not reach the previous peak established in 2001. The combination of rapid depletion from new, fast gas wells and aging older fields has accelerated overall declines. Gas well productivity has flattened, a result of both new, quickly depleted fields and maturity of prospects onshore and in shallow waters of the GOM.

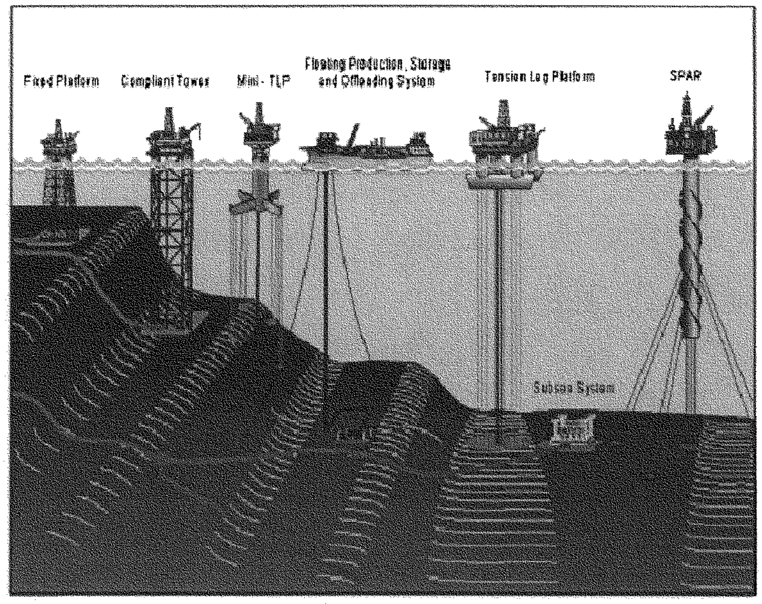


Finally, Canadian pipeline deliveries are flat to declining (albeit with a price-driven surge in exports during January 2004). Even the most optimistic outlooks for Canada tend to be conservative with respect to new production and exports. The most optimistic outlooks for increasing supplies in the form of LNG imports suggest the 2005-2007 time frame before meaningful expansions to receiving terminal capacity can be installed and in operation. Longer term, Alaska natural gas shipments may come into play, either via pipeline through Canada or as LNG from Alaska's Cook Inlet. Any or all of these options could contribute to U.S. natural gas supply security in the future. However, none of these prospective and potential sources of natural gas supply address the key question of sustaining the essential Lower 48 domestic production.

KEY ISSUES



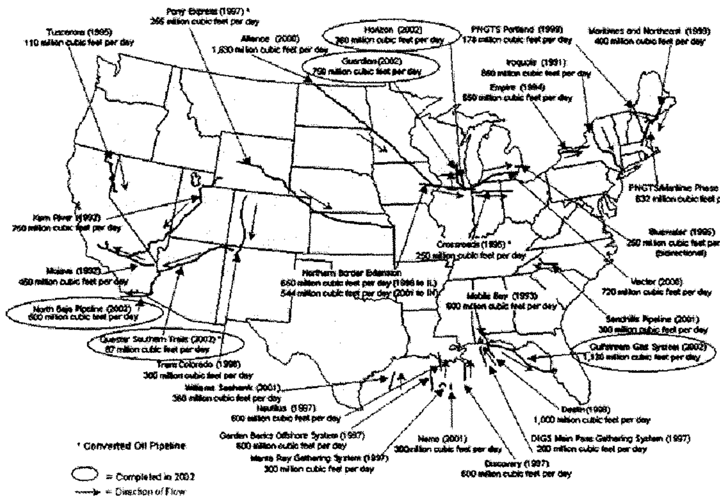
Through out the history of the U.S. oil and gas industry, technology has played a critical role in helping to sustain reserve replenishment and production. The "soft" technologies associated with information and data processing contributed to great strides in "hard" technology development and deployment for everything from "smart drill bits" to advanced seismic interpretation. Indeed, on a barrel of oil equivalent basis, the impact of technology has been to sustain cumulative oil and gas production at fairly steady rates, quite a feat for a country that is the most heavily explored and developed in the world. To a large extent, Alaskan hydrocarbon production has helped to sustain domestic reserves and production. But the GOM has also played a critical role. Of note are the rapid advances into deeper waters. To meet these challenges, the E&P and service industries have developed entirely new offshore systems that combine state-of-the-art technologies ranging from new materials to global positioning. The goal is to achieve cost structures that can sustain deepwater operations into the future as well as ensure safety and environmental protections that are essential for the new ultra-deep frontier.



To a considerable degree, much of the development and deployment of hard and soft technologies is accomplished by private risk taking within the oil and gas industry. The role of government must be acknowledged in two ways. One is the contribution of fiscal incentives. For example, government support of the oil and gas technology pathway has been both direct – through public spending for research and development – or indirect – through tax and other policies that facilitate private investment in oil and gas R&D as well as R&D in key industrial sectors that contribute components like information technology. Fiscal incentives to support infrastructure investment were critical in the early years of the U.S. natural gas pipeline industry, and fiscal incentives have been used to launch new upstream frontiers (like non-conventional gas). To sustain Lower 48 conventional oil and gas production and reserve replenishment, and continue the push into new frontiers and technologies to support non-conventional resource development, a constructive public-private interface will continue to be imperative. The second way in which the role of government has been vital is in devising policy and regulatory frameworks that maintain the integrity of industry competition and facilitate commercial strategies that can accommodate the risk and uncertainty associated with challenging offshore environments. Energy policy and regulation in the U.S. are complex activities with far-reaching and often unanticipated outcomes, not always beneficial to either producers or customers. Yet, with considerable interaction between public and private sectors, major accomplishments have been achieved. For example, natural gas has come into its own as a commodity with intrinsic value, flexible market arrangements and a vast array of new choices for both producers and customers. Policies like the 1990 Clean Air Act Amendments bolstered the role of natural gas as a clean burning fossil fuel. And experimentation with the open access regime and lighter handed regulation for natural gas pipelines has facilitated rationalization of the national grid while fostering sensible, market driven investment.

Pipeline infrastructure to support oil and gas production from deepwater fields is an essential component of ensuring success. New GOM pipeline capacity has been an active area for investment. Jurisdictional and regulatory issues have required resolution, but the result has been introduction of strategic new facilities that can accommodate flows from deepwater blocks. (Note that the U.S. EIA tracking of new pipeline capacity does not yet include some systems like BP's Mardi Gras pipeline.)

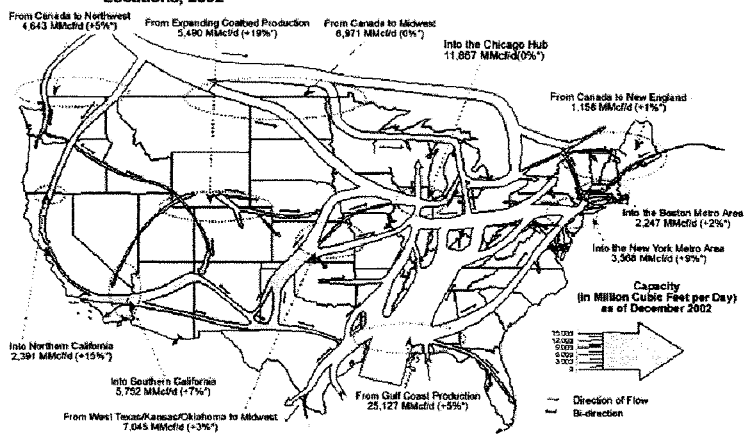
Figure 2. Major New U.S. Natural Gas Pipeline Systems, 1990 - 2002



Note: Routes are only approximations.
Source: Energy Information Administration, GasTran Gas Transportation Information System, Natural Gas Pipeline Database

Pipeline capacity to support Gulf Coast oil and gas production increased five percent between 2000 and 2002. Importantly, the vast system of pipelines serving GOM production will also support increased LNG import terminal capacity. Further into the future, as oil and gas production operations are pushed into the ultra deep zones, new transportation strategies will be needed to aggregate and deliver volumes to the mainland. These could include floating production, storage and offloading systems (FPSOS), compressed natural gas ships and other innovations to safely and securely connect remote GOM producing locations with Lower 48 customers.

Figure 3. Major Natural Gas Transportation Routes and Capacity Levels at Selected Key Locations, 2002



*Percent change since 2000.
Source: Energy Information Administration, GasTran Gas Transportation Information System, Natural Gas Pipeline State Border Capacity Database.

CONCLUSIONS

For the GOM, the following conclusions can be reached.

- The geological setting within the deepwater sub-province is very favorable for the existence of large, commercial hydrocarbon accumulations.
- As the oil and gas technology pathway continues to advance and costs and risks are reduced on a unit basis, deepwater development projects in the GOM will continue to become more feasible, allowing companies to look to the ultra-deep waters where depths exceed 5,000 feet.
- The U.S. Minerals Management Service (MMS) is forecasting a daily oil production rate of between 2.00 and 2.47 million barrels by the end of 2006, and a daily gas production rate of between 10.97 and 16.39 billion cubic feet by the end of the same year. These represent high case and low case estimates.
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Clearly, GOM E&P activity rests on broader domestic energy and economic indicators and policies. These include the following.

- U.S. energy security and access for E&P are linked. For Lower 48 onshore and offshore oil and gas reserve replenishment and production to be sustained, the industry must be able to gain access to prospective areas. Offshore moratoria should be re-visited. The history of offshore E&P activity suggests that oil and gas production can be accelerated while ensuring safety and environmental protections.

- Regulatory regimes for energy, in general, require attention. Customers should detect and be able to respond to real prices. Demand side response is an essential component of sound energy policy and energy security. Fiscal regimes to support the deepwater frontier, sustainable production mature areas, and non-conventional resources like coal seam gas (especially to encourage new plays targeting deeper coals) merit consideration.
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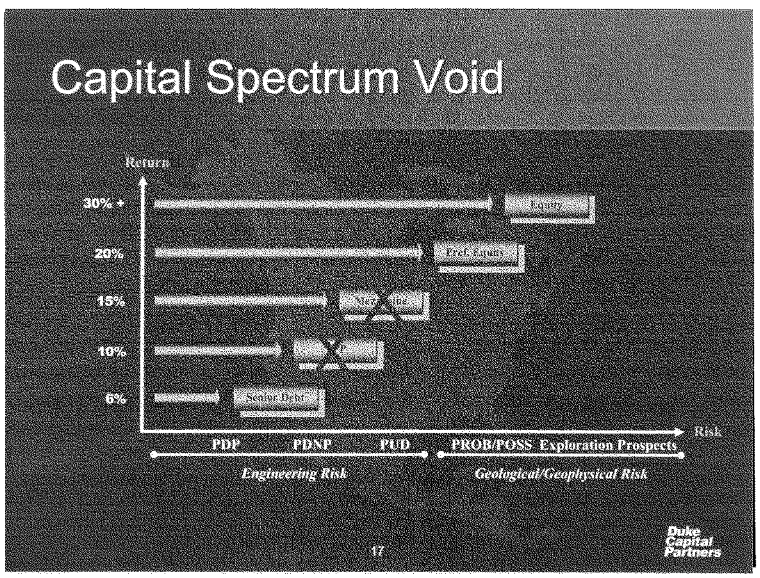
- Natural gas market oversight in U.S. is essential to encourage ethical practices, continued efficiency, optimization of both our natural resource base essential infrastructure and yet flexible and compatible with the competitive markets that have been created and are being facilitated.
- Electric power restructuring in U.S. is necessary to bring the same competitive efficiencies to both infrastructure development and operations, and to facilitate demand side response.
- Sound oversight and creative solutions to encourage ethical market behaviors will go a long way to restoring credibility and credit worthiness of the critical energy merchant sector. The loss of capital flows associated with the collapse of energy merchants has directly impacted both upstream and midstream investment in the U.S.



- Finally, the U.S. should maintain and improve relationships with Mexico and Canada, our most important external partners for energy development, trade and security.

Mr. HALL. Very well done, and thank you very much.

The Chair at this time recognizes Mr. Riordan, President and CEO of Gas Technology Institute for the long history of working in the industry as the CEO MidCon and senior executive at Occidental Petroleum, and has been a good advisor to this committee, and I thank him for his time.

I think at this time we will thank Charlie Cook who is present here, has done major work on H.R. 6 and has been very valuable to us, as has Melanie Kenderdane and Kyle Simpson. They are no strangers to this committee, nor to this energy thrust. We thank them and, of course, you four once again many times. Mr. Riordan, we will let you do the closing argument. I recognize you at this time for as much time as you take.

STATEMENT OF JOHN RIORDAN

Mr. RIORDAN. Thank you very much, Mr. Chairman, for this opportunity to testify today before your committee. I would like to commend you, as others have, for your leadership on addressing the critical need for new domestic gas supplies to meet growing U.S. demand.

Mr. Chairman, as you know, this need is not trivial. Sixty million homes in the U.S. are heated with natural gas. Natural gas is a major industrial fuel and feedstock. The processing of natural gas provides much of the propane that fuels rural America, and a growing percentage of our electricity comes from gas fired generation.

Finally, natural gas, as the cleanest burning fossil fuel, offers significant environmental benefits and lowers the cost of environmental compliance, benefits that will go unrealized if high gas prices and reduced supplies force us to switch to other fuel sources.

The U.S. demand for natural gas is outpacing domestic production. In 2003 domestic natural gas production increased by only 0.6 of 1 percent. The Energy Information Administration, EIA, forecasts similar production profile in 2004, and at the same time demand for natural gas in 2003 increased by 2.4 percent, and that trend is expected to continue.

As others have said, the U.S. is not—is not—running out of natural gas. We have got roughly 1250 Tcf of technically recoverable improved natural gas reserves in the lower 48. That is sufficient to meet 65 years of demand at the current rates of consumption, or 30-plus years of demand at 2025 forecast rates. We are, however, limited by those technologies that would enable us to actually produce those reserves at affordable prices.

To meet the growing demand for natural gas, we generally have four options: Dramatically increasing ports of LNG; the building of a pipeline to Alaska; increased access to Federal lands; and then increased production of unconventional resources, both onshore and offshore.

It is really critical that we resolve the issues associated with each one of those options, because we will ultimately need all of these sources of supply. In many respects, however, investing in research and development necessary to develop our unconventional ultradeep water offshore gas resources offers the most realistic and politically achievable option for helping to meet the midterm gas demand.

These resources are within our borders, made in America, close to demand centers, and do not require substantial new infrastructure investments to develop. They do, however, represent very complex technical problems.

These resources are large. The unconventional resources alone make up to 475 Tcf, more than one-third of the technically recoverable resources in the lower 48. As such, this option, to be successful, must embody programmatic and funding characteristics such as those found in the H.R. 6 conference version of the Ultradeep Water and Unconventional Natural Gas Supply Research Program.

This legislation would provide both the ways as well as the means of producing large volumes of domestic gas supplies at consumer friendly prices. Let me highlight what I believe will be the critical components of this program that will ensure its success.

First, the program is grounded in sound public policy. The National Petroleum Council's 1999 natural gas supply study identified deep offshore and nonconventional onshore resources as the most likely sources of new gas supplies.

It also recommended accelerated technology investments in these regions, and finally it recommended additional Federal collaborations with industry and academia to meet the gas demand. A 2003 NPC study also indicates significant price and supply benefits in high technology scenarios.

Second, a new research model is necessary for program success. It is a program designed to help meet the midterm gas demand which will require a singular focus, as well as a ruthless program execution. The gas supply R&D program in H.R. 6 encompasses these characteristics, to focus exclusively by meeting the midterm demand for the two most promising resource provinces, the ultradeep water, which is anything over 1500 meters, and the unconventional onshore, coalbed methane, tight gas sands, gas shales, and deep drilling.

Third, the establishment of a trust fund for the research program: The conference report passed by the House would establish a trust fund to pay for this research program. Specifically, it would place $150 million per year for 10 years from Federal oil and gas royalties into a trust fund program.

I believe that a dedicated funding source for this program is probably the single most important element for program success. In this type of highly focused, expensive, time limited R&D program in which the government lacks much of the necessary expertise, the participation and cost sharing of industry is very critical.

The program will not succeed without industry, and industry will not participate without stability and assurance of funds available.

Analysis by the Bureau of Economic Geology, BEG, at the University of Texas indicates a much, much larger supply response than EIA's analysis. BEG is analyzing a larger program, estimates that this new research program would generate nearly 87 Tcf of incremental gas production and more than 6 billion barrels of incremental oil production by 2025.

Finally, I would note that both EIA and BEG analysis indicate that the program would at a minimum pay for itself in the form of increased gas and oil royalties form production on Federal lands.

BEG analysis also indicates that it is going to pay for itself several times over.

Mr. Chairman, in closing I would like to make really one final point. The Gas Technology Institute, which is charged with developing and funding natural gas research, ultimately serves the natural gas consumer. In our Nation, the natural gas consumers and our economy are suffering from very, very high natural gas prices, which I think is very significant. It is imperative that public policymakers address these fundamental and critical concerns.

Some people have criticized this program as corporate welfare. I am personally against corporate welfare, but I disagree in this area. Without passing judgment on the value of the following programs, the clean coal programs are funded at around $250 million a year, energy and efficiency by roughly a billion dollar a year, nuclear energy research at around $70 million per year.

The FutureGen program cost a billion dollars, incentives for ethanol use far outstripped any other single energy incentive. I strongly believe that meeting domestic gas supply needs has value to the Nation on par with any of these other items and, if we are going to remain economically strong, we are going to have to have lower gas prices, and the only way we are going to get that is to have more supply. I think research and development can play a part in that.

Thank you very much, Mr. Chairman.

[The prepared statement of John Riordan follows:]

PREPARED STATEMENT OF JOHN RIORDAN, PRESIDENT AND CEO, GAS TECHNOLOGY INSTITUTE

Thank you for the opportunity to testify before your committee today. Mr. Chairman, I would like to commend you for holding this hearing and for your leadership on addressing the critical need for new domestic gas supplies to meet growing US demand.

Mr. Chairman, as you know, this need is not trivial. Sixty million homes in the US are heated with natural gas. Natural gas is a major industrial fuel and feedstock. The processing of natural gas provides much of the propane that fuels rural America. A growing percentage of our electricity comes from gas-fired generation. Finally, natural gas, as the cleanest burning fossil fuel, offers environmental benefits and lower costs of environmental compliance—benefits that will go unrealized if high prices and reduced supplies force us to switch to other fuel sources.

The US is not running out of natural gas. According to the Energy Information Administration's 2004 Annual Energy Outlook, "the volume of estimated technically recoverable resources is sufficient to support increased reliance on unconventional natural gas sources." We have roughly 1250 Tcf of technically recoverable and proved natural gas reserves in the lower 48, sufficient to meet 65 years of demand at current rates of consumption or 30-plus years of demand at 2025 forecast rates. We are, however, limited by those technologies that would enable us to actually *produce* those reserves at *affordable* prices.

First, let's examine the price side of this problem. On April 13 of this year, natural gas prices at Henry Hub were $5.92 per million btu. Looking forward, the price of the average natural gas futures contract for next year is $5.99. This compares to historical prices in the $2 range, as well as to this sampling of recent overseas gas prices: Western Europe, $3.20; North Africa, $0.40; and Russia, $0.70. Today's six-dollar gas prices racked up against these low-cost international options highlight the stark choice faced by gas-dependent US companies: do they stay here or move overseas? High prices are damaging our industrial base, hurting consumers, and inhibiting a more robust economic recovery.

Let's now look at the supply/demand side of the equation. In 2003, domestic natural gas production increased by six tenths of one percent. The Energy Information Administration (EIA) forecasts a similar production profile for 2004. At the same time, demand for natural gas in 2003 increased by 2.4%.

This trend is expected to continue. EIA forecasts a 38% to 53% increase in US gas demand by 2025, depending on the price of gas, yet gas recovery per well in both the US and Canada (our single largest supplier of imports) is declining rapidly and rising rig counts have resulted only in flat production at best. In other words, we are pushing harder but we are not advancing the ball.

If we are going to continue to reap both the energy and environmental benefits associated with natural gas consumption, we must address this imbalance. To meet growing demand for gas supply, we generally have four options: dramatic increases in imports of liquefied natural gas (LNG); the building of a pipeline to move stranded Alaskan gas to the lower 48; increased access to the roughly 213 Tcf of natural gas reserves on federal lands currently off limits to production; and increased production of unconventional resources, onshore and offshore resources at greater water depths.

Implementing each of these options is difficult and outcomes are very uncertain. Significant policy and political issues are raised by increased LNG imports as well as by opening up new federal lands to gas and oil production, particularly in those offshore regions that are under Congressionally- or state-directed production moratoria. The building of a gas pipeline from Alaska is not economic even at today's high prices and has a lengthy time horizon for development. Finally, development of unconventional resources is technically challenging.

It is critical that we resolve the issues associated with each of these options because we will ultimately need all sources of gas supply in order to meet demand. In many respects, however, investing in the research and development necessary to develop our unconventional and ultra-deepwater offshore gas resources offers the most realistic and politically achievable option for helping to meet mid-term gas demand. These resources are within our borders, close to demand centers, and do not require substantial new infrastructure investments to develop. They do, however, represent very complex technical problems. These resources are large. Unconventional resources alone make up 475 tcf, more than one-third, of the technically recoverable resources in the Lower-48.

As such, this option, to be successful, must embody programmatic and funding characteristics such as those found in the H.R. 6 conference version of the Ultra-deepwater and Unconventional Natural Gas Supply Research program. This legislation would provide both the ways—as well as the means—for producing large volumes of domestic gas supplies at consumer-friendly prices.

Let me highlight what I believe to be the critical components of this program that will ensure its success:

• *The program is grounded in sound public policy.* As I have noted, by 2025 the US will need between 38% and 53% more gas to meet demand. Domestic production has been flat for the last ten years and well depletion rates have increased from 25% to 45% annually. The US has a substantial gas resource base but these resources are increasingly difficult to produce at affordable prices.

The National Petroleum Council's 1999 natural gas supply study identified deep offshore and non-conventional onshore resources as the most likely sources of gas to meet growing demand. It suggested that technology investments in these regions must be accelerated in order to meet demand. Finally, it recommended additional federal collaborations with industry and academia to meet gas demand.

The 2003 update of the NPC Gas Supply Study, while highlighting the variety of options we must pursue in order to meet demand, identified both the supply and price benefits associated with high technology investment scenarios.

Further, EIA indicates that the delta between rapid and slow technology investments in unconventional onshore production is a 21% difference in supply.

The industry, for sound business reasons, is not investing in supply R&D sufficient to meet mid-term gas demand. The super-majors, while having large research budgets, have other more profitable options overseas. The service companies, which meet many of the research needs of large producers, do so at the direction of their clients. The smaller independents, which develop most of our onshore gas resources, do not have the money to invest in the R&D that will be required to further develop our unconventional onshore gas resources. Finally, the federal government's gas supply R&D budget of roughly $15 million per year is inadequate to alter the supply trajectory. Meeting the nation's mid-term gas supply needs will require a radically different approach.

A new research model is necessary for program success. A program designed to help meet mid-term gas demand will require a singular focus as well as "ruthless program execution." Such a program must necessarily and successfully graft the expertise and operational experience of the industry and the knowledge and creativity of academia onto an applied government research program, with all of its requirements and restrictions. It will also require that program managers integrate highly complex program pieces into new production architectures or production methods.

The natural gas supply research program in H.R. 6 addresses these needs in a manner that would optimize opportunities for its success. It is focused exclusively on meeting mid-term demand from the two most promising resource provinces, the ultra-deepwater (+1500 meters) and the unconventional onshore (coalbed methane, tight gas sands, gas shales, deep drilling). The program implicitly acknowledges that private industry R&D investments are appropriately guided by business, not public policy concerns, and would accelerate federal technology investments, consistent with NPC recommendations. Also consistent with NPC recommendations, the program promotes maximum collaboration between the federal government, industry, and academia and it establishes a program that is an order of magnitude larger than the Department of Energy's existing gas supply R&D program. In addition, this program will address the geologic and other production issues that limit the capacity of small producers to efficiently develop their resources.

More specifically, the program in H.R. 6 would establish two different research management models. The ultra-deepwater program would be administered by the DOE but managed by a program consortium of academic/industry professionals, similar to the DOE's existing management and operation contracting structure; this construct acknowledges that the federal government has never managed an ultra-deepwater R&D program and that the management expertise resides outside the government. While allowing for appropriate government oversight, this management model will provide the program with maximum flexibility in meeting its program goals.

Given its history of managing unconventional onshore research, the Department of Energy would directly manage this program component. Provisions in H.R. 6 would, however, require that DOE manage this program element largely through research consortia, seeking to replicate historically successful research models, such as the one that enabled the development of domestic coalbed methane resources.

• *The Establishment of a Trust Fund for the Research Program.* The conference report on this provision of H.R. 6 would establish a Trust Fund to pay for the research program. Specifically, it would place $150 million per year for ten years from federal oil and gas royalties into a fund for this program. Further, it would authorize an additional $50 million per year, subject to annual appropriations.

A dedicated funding source for this program is perhaps the single most important element for program success. The nation needs additional, adequate and affordable gas supplies for both economic and energy security reasons. As has been already noted, the annual appropriations process for natural gas supply R&D has never resulted in funding levels sufficient to dramatically alter the gas supply trajectory through research investments.

A fast-paced applied technology program requires predictable and readily available funding. Further, program success is highly dependent on the expertise and participation on the part of industry. The major technology investments envisioned for the program, particularly for the new architecture component of its ultra-deepwater component, requires extensive, commercial-type contracting and substantial cost sharing by industry (up to 40%). These necessary conditions for success will not be present without predictable and stable federal funding. In short, the program will not succeed without industry—and the industry will not participate without stability and assurance of funds availability.

This type of funding mechanism is not without precedent. The DOE Clean Coal Technology Program, arguably one of its most successful research efforts, was "forward funded" in the 1980s. This mechanism guaranteed program funds for the program's duration and offered the stability the industry needed for participation in the program, as well as for large industry cost-sharing.

Further, EIA, in analyzing the supply provisions of the conference report, noted that, "dedicated funding outside the annual appropriations process implies relatively low funding-related uncertainty for this program." It went on to observe, "the new R&D funding would increase the technological programs for the affected resources (ultra-deep offshore oil and gas and unconventional gas production) by 50% over its value in the Reference Case." This analysis shows additional gas production of four trillion cubic feet and oil production of 850 million barrels, assuming a program of one-third the size. Analysis by the Bureau of Economic Geology (BEG) at the University of Texas indicates a much larger supply response. BEG, analyzing a larger program, estimates that this new research program could generate nearly 29 Tcf of incremental gas production and more than 4 billion barrels of incremental oil production by 2025.

Finally, I would note that both the EIA analysis of this provision and similar analysis by BEG indicate that this program would, at a minimum, pay for itself in the form of increased gas and oil royalties from production on federal lands as a result of the program; the BEG analysis indicates that it would pay for itself several times over. This is not only important from the standpoint of the American taxpayer, but it is critical for "growing" the royalty stream in order to continue to pay for other important programs such as the Land and Water Conservation Program and the Historic Preservation Fund. Without the increased production and royalties from this supply program, the royalty stream will ultimately decline and be insufficient to fund these and other programs.

Mr. Chairman, in closing, I would like to make one final point. The Gas Technology Institute is charged with developing and funding natural gas research that ultimately serves the natural gas consumer. Consumers—and the nation's economic health as well as its energy security—are also the ultimate focus of policy makers. In our nation today, natural gas consumers and our economy are suffering from high natural gas prices—it is imperative that we address these fundamental and critical concerns.

Some people will criticize this program as corporate welfare. I disagree. Without passing judgment on the value of the following programs, I would note that the Congress funds clean coal programs at around $250 million per year, energy efficiency and renewable programs at around $1 billion per year, and nuclear energy research at around $70 million per year. Last year, the Administration announced its FutureGen program that would cost roughly $1 billion and is promoting a hydrogen research program of even greater size. Incentives for ethanol use far outstrip any other single energy incentive supported by the federal government. Comprehensive energy legislation includes a production tax credit for nuclear power and a similar credit for wind energy.

I strongly believe that meeting domestic natural gas supply needs has value to the nation on par with these other federally supported programs, and that Congressional and Administration program and funding priorities should reflect that importance. The federal government and its partners in industry and academia, in supporting the critical research program we are discussing today would be acknowledging the economic, energy and environmental benefits of natural gas to the nation, to consumers and to taxpayers. I urge the Congress to support this program and this legislation, and again, Chairman Hall, I commend you for your leadership and insight in moving this program forward. Thank you and I look forward to your questions.

Mr. HALL. Thank you, Mr. Riordan.

We have with the committee now Mr. Shimkus of Illinois and Mr. Walden of Oregon. Would you gentlemen care to make an opening statement or would you want to just put it in the record. I'll give you your option at that. I will recognize Mr. Shimkus first for 5 minutes.

Mr. SHIMKUS. Mr. Chairman, I will just waive, and we will go to questions, and I can address it then.

Mr. HALL. Fine. We will add that 5 minutes to your length of time for examination of those who testified.

The Chair recognizes Mr. Walden for 5 minutes.

Mr. WALDEN. Thank you, Mr. Chairman. I, too, will waive an opening statement. Appreciate your hearing today, and look forward to questions.

Mr. HALL. Thank you very much. All right, I thank the panel very much. We will get underway. I will ask some questions here, and I think I would start with Mr. Weglein.

In your testimony you asked the question, I think, that hits at the heart of this hearing. Why should the Federal Government support R&D that can impact the bottom line profit of the petroleum industry?

I think your short answer is the failure to do so will drive companies to easier places to drill, and even in foreign countries. Would you take some of my 5 minutes and elaborate on that, please, sir?

Mr. WEGLEIN. I would be glad to. The Federal Government has a different responsibility than an oil company responsibility. The responsibility of the oil company is to maximize profit for their shareholders. The government of the United States has a responsibility to look out for the betterment of the country. Those sometimes overlap, but not always.

When the U.S. Government feels that they can weigh in and help steer the priorities and the economic decisions of oil companies to be better aligned with the Federal mandate of betterment for the U.S., that is not a contradiction. They are each serving different objectives, and it is entirely appropriate to try to be a stakeholder in that process for the Federal Government.

Mr. HALL. All right. I thank you. I would ask Dr. Foss: in your testimony you state "the combination of rapid depletion from new, fast gas wells and aging older fields has accelerated overall declines. Gas well productivity has flattened, the result of both new, quickly depleted fields and the maturity of prospects onshore and in shall waters of the Gulf of Mexico."

In your view, how would a research and development program such as this and as envisioned by H.R. 6—How would that help and assist in our goal of being energy sufficient? The Chair recognizes you.

Ms. FOSS. I think I largely agree with Dr. Weglein on this point. As I said, throughout the history of our industry in the United States and our experience as a country in oil and gas production, I think it would be foolish to argue that we have done all of that totally through the private sector. There have been very, very key strategic relationships between the public sector and private sector to get all of this done.

I think that, as you move forward and look for larger resources, in particular—and that is the attraction of the Gulf of Mexico, the chance to find larger pools of hydrocarbons that can provide the kind of incentive and return on investment that companies need, as opposed to the smaller pools, faster producing pools that the companies go after now.

So I think that a creative partnership, a role for government, a way to look at advancing and pushing the technology envelope a little bit to get this done, coupled, as I said, with appropriate frameworks that make companies feel like it is worth it to go into these new environments in the first place, I think, can actually do a great deal in adding to our asset base for the country as a whole.

Mr. HALL. I thank you. I would ask Mr. Riordan, how will a research and development program help production in areas not only like east Texas but all over the country, and talk to us a little about the spin-off benefits that might indirectly help other industries in other parties of the country besides the oil and gas industry? Would you do that?

Mr. RIORDAN. Mr. Chairman, before I answer that question, I wonder if I could insert the Bureau of Economic Geology analysis for the record?

Mr. HALL. Without objection, it will be inserted.

[The report appears at the end of the hearing.]

Mr. RIORDAN. Ten percent of the funds in this program would go to small producers. For instance, in east Texas we have shale oil in that particular area. Other areas around the country would be Rocky Mountains, the Appalachian region, some areas in southwest

Texas and Illinois. So there is a wide area where gas sands and, of course, with the ultradeep area we would be looking at the Gulf of Mexico, and also some of this technology could be used some day in Alaska.

In terms of where the technology, there is no doubt that we want the initial effort to come with natural gas produced domestically in the United States, and I think that is what happened, but this technology certainly would benefit companies around the world.

We would get a leg up, and I think it takes about 18 months to move those technologies into other parts of the area. So we would get a big head start, but I think it is a benefit to the United States, even though some of that gas—A major focus of this is the produced gas and oil in the United States, but it is a benefit to the United States to see oil and gas production increase on a worldwide basis, too.

Mr. HALL. All right. I think my time probably has expired. The Chair recognizes the gentleman from Virginia, Mr. Boucher, for 8 minutes.

Mr. BOUCHER. Well, thank you very much, Mr. Chairman. I will not take 8 minutes. I want to join with you in thanking the witnesses for joining us here this morning and sharing their expertise with us on what I would agree with the chairman is a very important subject.

I just have a couple of questions. I note that there are something on the order of 12 rigs in the Gulf today that are drilling to a depth of 5,000 feet or greater. Presumably, gas is being produced from these rigs. I guess it is gas, as opposed to petroleum, is being produced from these rigs.

That is a commercial operation, and I don't mean to suggest any hostility to the R&D provision that is in H.R. 6 by asking this question. I was actually a major supporter of H.R. 6, and I hope that steps can be taken to conclude the conference and bring that measure to passage, and I supported the R&D provisions for deep water oil and gas research that are contained within H.R. 6, but I need to ask you, because some people undoubtedly will question this.

Given the fact that you have 12 rigs drilling to a depth of 5,000 feet or greater in a commercial capacity now, what is the appropriate role for the government to fund R&D in that environment, if this is a commercial technology and we are now drilling to that depth and producing that oil. What is your response to the question that some will ask about why we should be continuing to put research and development funding into an application that has achieved commercial status?

Just a brief answer, I think, would be sufficient. Who would like to answer the question? Dr. Weglein.

Mr. WEGLEIN. One way to respond is I am hearing from the largest petroleum companies in the world throughout their sponsorship that they are losing patience with the number of dry holes they are drilling in the deep and ultradeep, and that is something that affects my program, because we are aiming new techniques for seismic.

So they support us, because they are looking for new capability. It isn't coming fast enough. In other words, they have a certain tolerance for these dry holes, and the tolerance is waning, and the urgency of that only became clear to me very recently, in other words, through direct communication with their technical experts. I was surprised that it had reached that point.

Mr. BOUCHER. Well, I understand that their patience may be waning with regard to drilling dry holes. How does the government provision of research and development funding provide an answer? What is the use of R&D funds that would increase their level of patience or perhaps assist them with the technology that some might argue was already commercial?

Mr. WEGLEIN. Yes. We need to first clearly define what the technical obstacles are, and then seek and fund those with a record of solving that level of difficulty. That is ongoing. That could be increased. It is going to take not only a new vision of seismic processing but a new level of computation. IBM and HP are weighing into this.

So the government has a role in that as well.

Mr. BOUCHER. I heard Dr. Foss earlier suggest that perhaps there is a need for a more refined and more appropriate technique for field characterization, so that you can identify to a higher degree of certainty where reserves are found. Is that the primary role for R&D or is it in the actual drilling and development technology?

Mr. WEGLEIN. I think drilling is making more progress than the location. The drilling technology is advanced. It is not my specialty, but my impression. The exploration obstacles to seeing beneath complex media—Much oil and gas occurs beneath salt or basalt, and in salt there is a very rugose boundary. In basalt it is very heterogeneous, and they can't locate with their seismic techniques what is underneath to know where to drill.

What we are trying to do is develop techniques which can lift the requirement to know what is above the target to well identify what the target is and the extent of its value.

Mr. BOUCHER. So your answer would be that characterizing the field and being able to determine with greater precision where the reserves are located would be the primary target of R&D funding.

Mr. WEGLEIN. That is my sense.

Mr. BOUCHER. All right. Thank you. Does anyone disagree with that? All right, thank you.

The other question I have, and I would ask this of anyone who wants to answer, is the potential effect that utilizing up to $150 million per year for 10 years for R&D for this endeavor might have on the pool of Federal royalties from development that now fund other programs, and some of the other programs funded are land and water conservation efforts, the Historic Preservation Fund. There are other targets of funding from this pool of Federal royalties that come from development.

Also contained in H.R. 6 is a royalty relief provision that applies to deep water oil and gas development, if certain conditions are met, if you achieve a certain depth level to production, etcetera.

So teamed with a draw of an additional $150 million from the revenue pool is a revenue relief provision. So in effect, the fund is diminished in two ways, from the vantage point of other programs that rely upon this pool for funding.

Do you have any comment about how we could have the level of assurance we need that, if this provision becomes law, there would be adequate funding for land and water conservation, for historic resources and other purposes? Who would like to comment? Mr. Riordan.

Mr. RIORDAN. At about $3.20 a 1,000, you generate somewhere between $5 and $6 billion and, as we all know, gas prices are higher than that now. Looking at all of the areas that are covered by the royalties, it looks to us like there is about $2 to $3 billion left over for the general fund, if you keep that number at $5 to $6 billion.

Mr. BOUCHER. Okay. Any other comment? Dr. Weglein?

Mr. WEGLEIN. Yes. I would like to say that I don't believe going into a problem you can decide 150 million is the solution. I think that the experts, industry experts coupled with government, DOE experts, need to sit down in a conference and decide what can money do, and how much would it take.

Just putting more money in doesn't solve a problem. It is like asking for more people to rapidly increase—A child, it still takes a certain amount, 9 months roughly. So what money can do—I think that needs to be—There should be an amount, but it shouldn't be that that has to be spent. I think it should be prudent. I think it should be judicious, and it should be aimed at true delivery rather than we have this money, let's go spend it.

Mr. BOUCHER. Okay. Thank you very much. Let me thank each of the witnesses and, Mr. Chairman, I yield back.

Mr. HALL. I thank the gentleman, and recognize at this time the gentleman from Illinois, Mr. Shimkus, for 5 minutes.

Mr. SHIMKUS. Thank you, Mr. Chairman. A great hearing, and important. I think it highlights a couple of things.

First, I want to thank the ranking member. He does do his homework, and he asked some very good questions and issues that I think are important to get out.

I want to welcome Mr. Riordan from Illinois, being an Illinois member, obviously, in some of the comments that have been made here. The importance of a comprehensive energy plan in H.R. 6, I think, was evident, whether it was meant to be, and we have a lot of incentives for a diversified fuel mix.

People who follow this committee process, and I am now in my 8 years, know that I say multiple fuels, multiple generation, competitive marketplace, everyone benefits. If we through legislation or lack of legislation identify a fuel of choice, we distort the market, and we cause great problems.

Not enacting a comprehensive energy plan continues in that method, because what we have now, I believe, is a distorted natural gas market, because of our inability to really effectively incentivize others.

So we don't want to have our opponents divide us and conquer on this fuel, that fuel. What we want to do is incentivize through research and development, through new technologies, all our fuels and encourage all our different generations to meet the standards that we have set to keep our environment in the condition, or in a better condition. But we don't want to be divided and conquered.

Of course, when you mentioned—again, the ranking member and coal. We fight a lot of coal battles together, soy diesel, and I am an ethanol provision guy, and natural gas has a big role at the table.

I think in the testimony—A couple of things, and I just scratched it out—I am not an expert—but demand. The demand for natural gas, if we don't pass a comprehensive energy plan—and the testimony talked about available supply now is plateauing here, if we don't have access. Demand will increase. Then we have this.

We have the United States paying $5 and Russia paying 70 cents. When we talk about the manufacturing sector of our country today, you know, we limit the political debate to the political causes du jour, which could be foreign competition, which could be wage rates. We don't talk about energy costs. We don't talk about litigation. We don't talk about siting provisions and those costs incurred.

If we want our manufacturing to be competitive, we have got to address the fuel component now, and that is why these provisions are so important. That is why a comprehensive bill is critical.

I know the debate from which the ranking member addressed, because, I mean, that is part of—That is why it is gone from the "energy life" provisions, and that is why a comprehensive plan has to be enacted so that we have that concern.

The question, I think—One last example, and this is not natural gas, but the chairman would appreciate the fact that the largest operating oil well in the lower 48 is in my district. Mr. Chairman, did you know that?

Mr. HALL. I will check on it. You know, President Reagan said, Trust but verify. Yes, I recognize the importance of your production. Thank you.

Mr. SHIMKUS. But the issue is new technology, horizontal drilling, vertical insertion—We are now producing 1,000 barrels a day under a State wildlife refuge. I mention it all the time, because we can have access to our natural resources through research, technology and development.

We have available crude oil supplies, natural gas supplies, to meet the demand if we would only move to get access, and again do the research for the strata and the looking. I think that was a great answer, one that I am now going to use as I get asked that question.

So my questions aren't really a question, since I missed the opening statements—we had another hearing on spyware. But I wanted to encourage and thank the chairman for this hearing, and I wanted to make sure that we do all we can in this Congress to really push for a comprehensive plan, so that the country will benefit and, again, for the record say that in a competitive market you want multiple fuels, multiple generation capabilities, and then allow private sector to compete to provide the best service at the lowest price.

If we, through any litigation or legislation, distort that market, we are the ones—we harm ourselves. So, Mr. Chairman, I will use that as my closing statement. Thank you for the hearing, and I yield back.

Mr. HALL. Thank you, Mr. Shimkus. The Chair recognizes the gentleman from Oregon, Mr. Walden.

Mr. WALDEN. Dr. Foss, in your testimony you mentioned discoveries like Thunder Horse and Manatee. Do you have any production estimates for what those might be?

Ms. FOSS. No, I'm sorry, I don't have them right on hand, but it is available in the industry literature, and I would be happy to get back to you with all of that information.

Mr. WALDEN. But these are pretty big. Does anybody have any estimates of what we are talking about in those?

Ms. FOSS. What I would do is point you to graphics that I did include in the testimony that shows distribution of fuel sizes offshore, so that you can see the pattern of discoveries and the extent to which, as the industry has pushed out into projects like those—What they have been able to do, again, is find the larger pools, and it is the larger pools that we are after here that help to stabilize our domestic production base.

Mr. WALDEN. Okay. Thank you. Howard, I guess I would have a question for you. I believe you testified the experts of the Department of Energy's Office of Fossil Energy believe new R&D funding would accelerate technological progress by 50 percent over your base cases determined without R&D. Is that a pretty fair assessment, do you think? You want to hit your mike? I'm not sure it is on.

Mr. GRUENSPECHT. Yes. I would not want to characterize those estimates as being either conservative or optimistic. In the testimony I talked about the high degree of uncertainty surrounding these type of things.

The 50 percent is similar to, actually close to, what we have at our high technology case. So what they seem to be saying is, at least in those areas, the unconventional and the ultradeep water, this amount of additional R&D funding might take you in some sense from our base case to our high technology case.

Mr. WALDEN. Does anybody quantify what we are looking at in terms of shoving jobs offshore if we don't do a better job here of developing a domestic supply? We hear a lot, and my colleague from Illinois, Mr. Shimkus, talked about a little bit the job losses. Do any of you all look at that as you make your arguments?

Mr. RIORDAN. We have not looked at it, but I think it is something that we ought to look at. As far as I know, Melanie, we have not looked at that, but I think it is a good point, and we will.

Mr. WALDEN. I hope you do, and I hope you do soon, because we are trying to pass an energy bill that gives us this—We have all talked access to our own domestic supply. I am tired of being held hostage, literally, by countries who are not necessarily friendly to us at critical moments, and our economy is being ravaged as a result sometimes of our own actions or lack of actions.

On the one hand, we hear about jobs being shoved overseas, and on the other hand we never look at what are the base causes, and your map one of you had here, that John had, you know, when you are looking at the disparity in gas prices, why would you make a decision to stay onshore when you can pay 6 bucks here or 30 cents somewhere else and ship it back.

Mr. SHIMKUS. Would the gentleman yield?

Mr. WALDEN. Yes, sure.

Mr. SHIMKUS. I was trying to find this also, the U.S. natural gas wellhead price: In January 1999, $1.85; December of 2003, 5.08. I think that is the number we have listed in this sheet. We are not doing better. We are doing worse.

Mr. WALDEN. It gets worse. April 13 of this year, 5.92 at the Henry Hub.

Mr. SHIMKUS. And that is part of the concern, and there is really a need for us to move. What I didn't address was in your ag sector, of course, fertilizer for my farmer going into the field, they tripled the price. We are lucky we have got good commodity prices now, but if we were 2 years, my farmers would be closing shop. They wouldn't be able to fertilize their fields, because natural gas is a primary commodity for fertilizers. I yield back.

Mr. WALDEN. I think we are probably preaching to the choir here, but I hope somebody out there listens to this, because when you begin to analyze what is not working, you get right to core energy issues, and it is not that we have a lack of supply. It is that we are unwilling to go after it. Yes, Doctor? Go ahead.

Mr. WEGLEIN. I would like to add a word. Someone might get the impression that this R&D is going to affect the ultradeep. The ultradeep is in great need of better capability, because of the expense. So the technology has to rise to a high level. But we have had experience where, because of that need in the deep, very deep water, that technology is then brought to shallower and provides value to unseen and poorly located identified targets that the technology was not originally meant for.

So this is—Even though the ultradeep drives it, the spread of accessible is not just in the ultradeep.

Mr. WALDEN. Sometime in the middle of the night last night, I flipped on the History Channel, and there was the space race with the Sputnik and the U.S. It strikes me that are we not in a—We just don't know we are not in the race right now when it comes to trying to compete when it comes to energy against, in some cases, our competitors, certainly from a trade standpoint and sometimes from a geopolitical security standpoint.

Mr. WEGLEIN. Well, the French support their companies through national institutes of research, IPG it is called.

Mr. WALDEN. Are they working on this type of technology?

Mr. WEGLEIN. Yes.

Mr. WALDEN. Who else is?

Mr. WEGLEIN. But we need a competitive position.

Mr. WALDEN. What other countries are engaged in this?

Mr. WEGLEIN. Italy, Brazil. They have national programs, a combination of the Brazilian government and Petrogas setting up centers of research all over the country. They have for years, to better their own capability and their ability to locate hydrocarbon elsewhere. So there are models.

Why do they do it? They see it as an investment in their country.

Mr. WALDEN. It is ironic. We do it for health care. We do it for agriculture.

Mr. WEGLEIN. Yes.

Mr. WALDEN. Why wouldn't we do it for a base element that underpins our economy? I mean, we have to work out the dollars and all that.

Mr. WEGLEIN. I think part of the reason is that big oil has resisted it. I think, though, H.R. 6 is a first step at acknowledging and responding to their concern, meaning they want to be real partners rather than some kind of initial window dressing and then people go off and they never hear from them again.

In other words, there have been experiences in the past where industry is brought into some conference with National Labs and academics to give some kind of imprimatur that it is practical they are after, and then industry never hears again, and things are done.

This bill is meant to avoid that pitfall, and that is why I am enthused.

Mr. WALDEN. Very good. Yes, Dr. Foss?

Ms. FOSS. If I could just add to something here, because I think there is a lot of—I think there may be a bit of a narrow view with regard to the industry's position on this.

What I would urge everybody to think about is, first of all, as our oil and gas technology pathway, our energy technology pathway for the country has proceeded, we have multiple technologies at work. We haven't been able to always predict where the advances come from.

Mr. WALDEN. Sure.

Ms. FOSS. Investment in R&D is an investment, period. In fact, a lot of what the oil and gas industry use right now comes not from direct investment in energy R&D but from investment in other things.

All of the global positioning technologies that are used to be able to operate in deep waters, be able to navigate, to be able to position drilling activities and so on—that comes from other places.

I think that the other thing that everybody needs to keep in mind as well, is that a large—a significant goal for the industry in these arenas is to reduce cycle time. What you want is to be able to get your knowledge faster, get your information faster, have your results come in faster, know where you stand with regard to the cost structure for the project, and that is really what the investment in R&D does.

It is not just to be able to grease the wheels, I suppose, to get industry out there in the first place. It is to help them to be able to stay there in a sustainable way.

I think your point about investment outside of the United States—One of the things I would like to note is that all of the very fine organizations outside of the United States that have done and have excellent reputations in oil and gas and energy technology research, whether it is Institute Francais de Petrol in Paris or everything that has been funded in Brazil, they would like to come here, actually. They would like to partner here. They would like to partner with us.

Some of their companies, their national companies, participate here. We get the benefit not only of our U.S. industry base, but the global industry base. I think it is important to bear that in mind as well.

Mr. WALDEN. All right. Thank you, and thank you, Mr. Chairman.

Mr. HALL. Thank you. The last member just departed. So we will wind up by thanking you.

I just have one last thing of Mr. Gruenspecht. You amply warned us that, and I quote you, "there are significant uncertainties surrounding all energy projections." There is also a lot of uncertainty about whether or not we are going to have an energy bill, and I apply that to that.

I think you testified that experts at the Department of Energy's Office of Fossil Energy believe, "new R&D funding would accelerate technological progress by 50 percent" over your base case determined without R&D. Is that a fair statement?

Mr. GRUENSPECHT. Yes. In the deep water and in the unconventional, again we increase the technological progress rates.

Mr. HALL. All right. I thank you very much for your appearance here, and I know it took time to prepare. It took time away from your thrust at your entities to give us this information.

This is the way we write legislation. We ask people that know a lot more about it than we do to come and impart their information, and we thank you for it. Particularly, I thank these men and women who are no longer here who stayed for the committee. About four or five of them did, but the others had to depart because they had things that were set in their district for today.

So with that, thank you very much, and appreciate what you have done.

We are adjourned.

[Whereupon, at 12:03 p.m., the subcommittee was adjourned.]

FINAL REPORT

ECONOMIC ANALYSIS FOR A NATIONAL ULTRA-DEEPWATER AND UNCONVENTIONAL OIL AND GAS SUPPLY RESEARCH FUND

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SUBMITTED TO GTI

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CONTENTS

Figures

Tables

EXECUTIVE SUMMARY

This study provides an analysis of future incremental Federal lands and U.S. oil and gas production, and its associated economical benefits, that could be achieved through the establishment of a supply research fund. The supply research fund is based on H.R. 6, Subtitle E —Fossil Energy, Part 1, Sec. 21501(b) and Part 3—Ultra-deepwater and Unconventional Natural Gas and Other Petroleum Resources, submitted to the 108th U.S. Congress. The legislation provides for the establishment of a supply research fund from a percentage of the amount of royalties, rents, and bonuses derived from Federal onshore and offshore oil and gas leases issued under the Outer Continental Shelf Lands Act and the Mineral Leasing Act for each of fiscal years 2003 through 2010. This report is an update to a previous report, *Benefit/cost analysis of GRI's gas supply research initiative* (Kim and others, 2000), which contains an analysis of the benefits and costs of a gas supply research fund.

The value of technology developed and advanced through the supply research fund was examined in terms of resulting incremental production. Incremental production was expected to be greatest among complex and new resource areas such as the deepwater offshore and unconventionals. Federal lands incremental oil and gas production forecast by technological advancements achieved by the supply research fund during the period from 2003 through 2025 was calculated as 4,202 million bbl and 28.79 Tcf, respectively. The resulting incremental production and royalty revenue was $204,233 million and $28,749 million, respectively.

Incremental production response for the technologically dependent resources is great, and the resources do, in fact, increase quickly because they are currently not exploited or the production levels are limited by current technology. Creation of a robust research, development, demonstration, and commercialization program for oil and gas such as the supply research fund outlined in this study would allow for accelerated work on many promising technologies and make it possible to address multiple challenges to incremental production of deepwater and unconventional oil and gas resources. The results of this new supply research fund, according to our analysis of past research and development (R&D) and the resulting supply response, will be quick and dramatic increases in Federal lands and U.S. oil and gas production.

INTRODUCTION

This study provides an analysis of future incremental Federal lands and U.S. oil and gas production, and its associated economic benefits, possible through the establishment of a supply research fund. It provides an update to a previous report, *Benefit/cost analysis of GRI's gas supply research initiative* (Kim and others, 2000), that contains analysis of the benefits and costs of a gas supply research fund. The previous report analyzes past gas projection trends on Federal lands and describes not only the impact of technological advancements on those trends, but also the impact of GRI (Gas Research Institute, the predecessor of GTI)-funded technology research on historical gas production. It forecasts the economic value of continued GRI research on future production and revenue streams. In the report, annual gas production from Federal lands was forecast to increase from 7.3 to 10.2 Tcf by 2015. Increased production, however, depended on continued development and application of technology. By 2015, the value of technology in terms of incremental gas production on Federal lands was estimated to be 45 Tcf from deepwater/ subsalt and unconventional resources alone. This technology-dependent production represented a potential incremental royalty revenue of more than $22 billion. Past GRI programs were estimated to account for approximately 15 percent of total gas R&D in the United States; for unconventional natural gas resources, GRI's contribution has been even greater. By 2015, continued technological R&D by GRI was expected to deliver more than 10 Tcf in incremental production to the total U.S. gas supply. On Federal lands, GRI's impact was estimated to achieve an incremental production of more than 6.7 Tcf. These scenarios assumed a fully funded GRI program throughout this period. A benefit/cost (B/C) analysis of a proposed GRI gas technological research program, funded by a 10-percent annual nomination of royalty revenue from Federal Outer Continental Shelf (OCS) natural gas production, showed positive economics. Using a base-price case of $3/Mcf, escalating it 1 percent annually, and a discount rate of 10 percent, this program was projected to produce an internal rate of return (IRR) of 101 percent, with a net present value (NPV) of $5 billion. This amount was based on projected incremental gas production and royalty revenue on Federal lands alone. In the context of the broader impact of GRI technological R&D on total U.S. gas production, and using the same project economics, the program was projected to produce IRR of 143 percent, with an NPV of $8 billion.

The supply research fund analyzed in this study originates from H.R. 6, Subtitle E — Fossil Energy, Part 1, Sec. 21501(b) and Part 3—Ultra-deepwater and Unconventional Natural Gas and Other Petroleum Resources, submitted to the 108th U.S. Congress. In summary, the legislation provides for the establishment of the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund (hereafter referred to as the supply research fund) from a percentage of the amount of royalties, rents, and bonuses derived from Federal onshore and offshore oil and gas leases issued under the Outer Continental Shelf Lands Act and the Mineral Leasing Act for each of fiscal years 2003 through 2010. The study focuses on analysis of

(1) Compilation and management of production and economic data.

(2) Records of historical Federal lands and U.S. oil and gas production.

(3) Forecasts of oil and gas production and royalty revenue from Federal lands and the United States.

(4) The potential impact of technology targeted at increasing oil and gas production and royalty payments from Federal lands and the United States.

(5) Economic effects of incremental oil and gas production attained through establishment of the supply research fund.

FEDERAL LANDS OIL AND GAS RESOURCES, PRODUCTION, AND ASSOCIATED MINERAL REVENUES

Federal lands are divided into Federal offshore, Federal onshore, and American Indian. American Indian lands are administered by the Bureau of Land Management (BLM), whereas the Federal offshore and onshore are administered by the Minerals Management Service (MMS). The total onshore component of the Federal lands comprises approximately 29 percent of total land area of the United States (BLM, 1996). Geographic distribution of the onshore component of Federal lands is very uneven. States having a large percentage of Federal lands include Nevada, Alaska, Utah, Idaho, Oregon, Wyoming, California, and Arizona. The Federal offshore comprises four OCS provinces managed by MMS: Alaska, Atlantic, Pacific, and Gulf of Mexico (GOM).

For Federal lands oil and gas resources evaluated as of 2001, the Energy Information Administration (EIA) compiled latest estimates generated from the U.S. Geological Survey (USGS), the National Petroleum Council (NPC), and the MMS (table 1). As seen in figures 1 through 4, unconventional and offshore resource components compose a large majority of both oil and gas resources on Federal lands. Most undiscovered conventional resources on Federal lands are in northern Alaska, the Powder River Basin of Montana and Wyoming, and the Wyoming Thrust Belt. Continuous-type gas accumulations (those pervasive throughout a large area that is not significantly affected by hydrodynamic influences and for which the standard methodology for assessment of sizes and numbers of discrete accumulations is not appropriate) on Federal lands, largely in southeast Wyoming, as well as coalbed methane, largely in the Uinta-Piceance Basin of Utah and Colorado and the San Juan Basin of New Mexico, account for a large proportion of undiscovered unconventional gas resources.

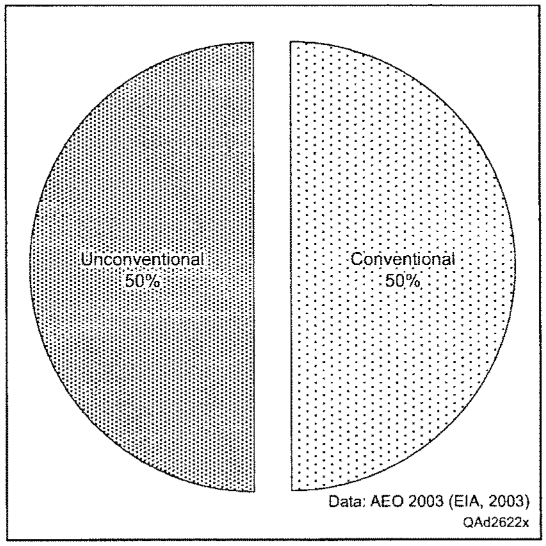

Figure 1. Conventional vs. unconventional technically recoverable oil resources on Federal Lands.

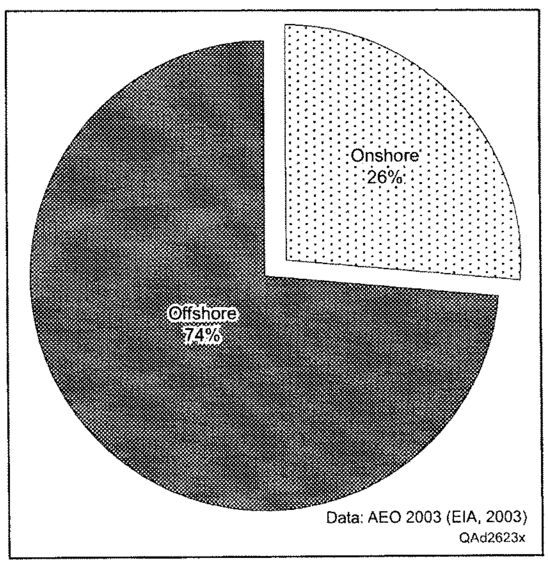

Figure 2. Onshore vs. offshore technically recoverable oil resources on Federal Lands.

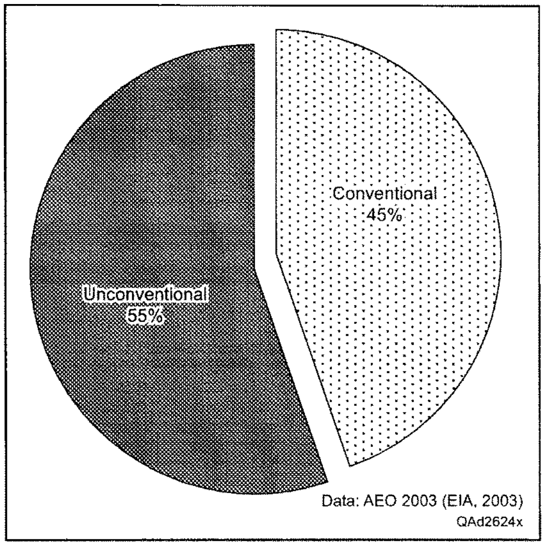

Figure 3. Conventional vs. unconventional technically recoverable gas resources on Federal Lands.

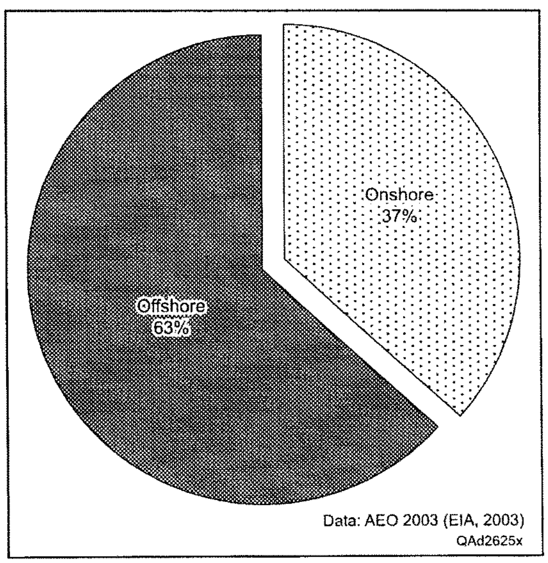

Figure 4. Onshore vs. offshore technically recoverable gas resources on Federal Lands.

Table 1. Technically recoverable oil and gas resources on Federal Lands.

	Oil (Bbbl)	Gas (Tcf)
Undiscovered Conventional Offshore	75.0	362.2
Undiscovered Conventional Onshore	9.3	57.9
Discovered Conventional Offshore	7.7	68.0
Discovered Conventional Onshore	19.3	118.7
Undiscovered Unconventional Offshore	82.2	430.2
Undiscovered Unconventional Onshore	30.4	319.8
Total	223.9	1356.8

Data: AEO 2003 (EIA, 2003)
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The Federal offshore comprises the bulk of current Federal lands oil and gas production (figs. 5 and 6). Although a large resource base exists in the Alaska OCS, economically recoverable resources are minor because of transportation and access problems. Most Federal OCS production and remaining reserves are from the GOM OCS.

Significant mineral revenues are derived from Federal lands. In 2000, more than $7 billion was collected as Federal lands mineral revenues (table 2). Components of mineral revenues include royalties, rents, bonuses, and other revenue (fig. 7). Historically and in the present, oil and gas royalties make up most of the mineral revenues from Federal lands (table 3). Although rents and bonuses are a significant component of mineral revenues on Federal lands, they are not divided according to whether they are derived from oil, gas, coal, or other royalty lands. Assuming that the royalty collected from each component of royalty lands is representative of the rents and bonuses collected, oil and gas rents and bonuses have been calculated. However, when compared historically in terms of oil and gas royalties, no discernible trend can be established. For example, in 1992, oil and gas rents and bonuses were calculated to compose 8 percent of oil and gas royalties, whereas in 1998 the amount surged to 51 percent,

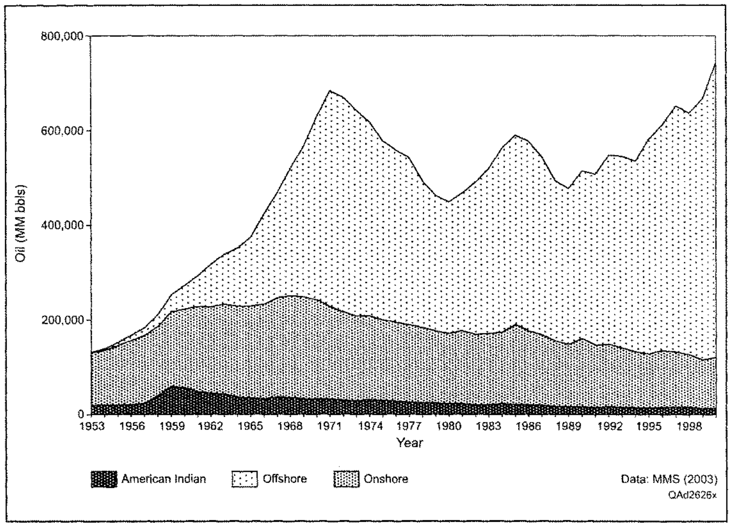

Figure 5. Historical Federal Lands oil production.

Table 2. Federal Lands 2000 mineral revenues.

	Offshore	Onshore	American Indian	Total
Coal Royalties		$329,566,786	$58,383,154	$387,949,940
Gas Royalties	$2,451,875,964	$703,994,981	$124,684,429	$3,280,555,374
Oil Royalties	$1,642,700,114	$263,851,425	$57,888,348	$1,964,439,887
Other Royalties	$141,221,225	$107,954,462	$14,688,708	$263,864,395
Rents	$207,828,582	$44,504,085	$726,339	$253,059,006
Bonuses	$441,798,474	$134,376,053		$576,174,527
Other Revenue	$324,238,283	$60,999,723	$12,481,681	$397,719,687
Total	$5,209,662,642	$1,645,247,515	$268,852,659	$7,123,762,816

Data: Mineral Revenues 2000 (MMS, 2001)
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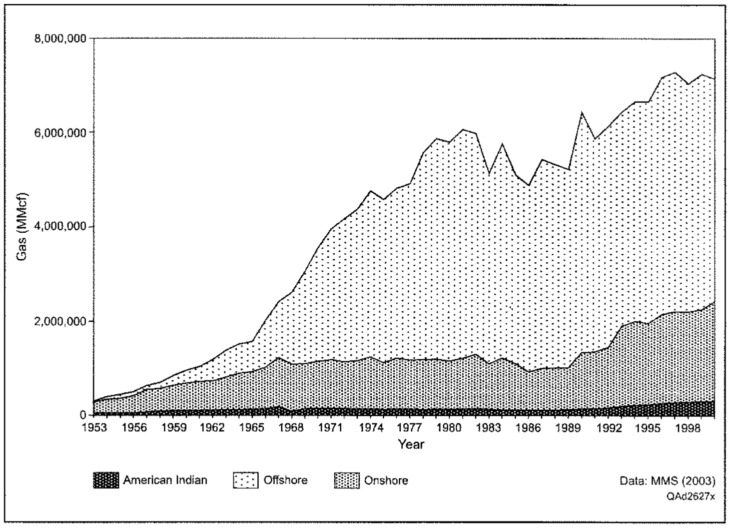

Figure 6. Historical Federal Lands gas production.

and in 2000 it dropped back down to 15 percent. Oil and gas royalty rates for Federal lands have remained relatively constant, and their averages are shown in table 4. In terms of resource area, the Federal offshore comprises 79 percent of the total oil and gas royalty revenue (fig. 8).

Three significant recent developments in terms of Federal lands mineral revenues are the OCS Deep Water Royalty Relief Act of 1995, the proposed new incentive for deep shelf gas, and royalty-in-kind programs. Under amendments to the OCS Act, the OCS Deep Water Royalty Relief Act of 1995 provides royalty relief for new production of as much as 17.5 million barrels of oil equivalent (boe) in water depths of 200 to 400 meters, 52.5 million boe in 400 to

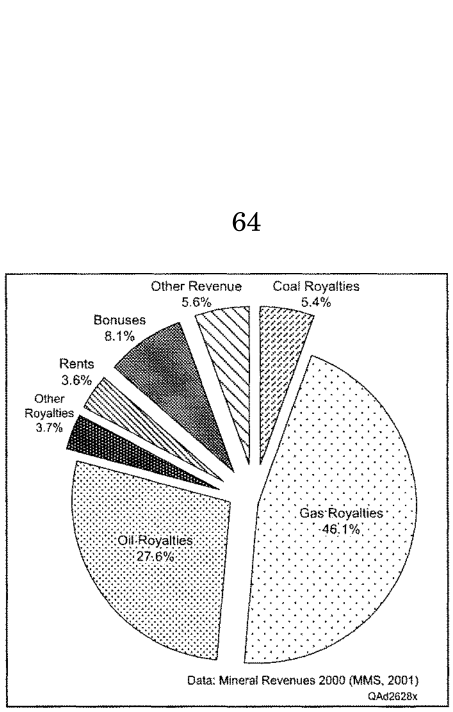

Figure 7. Components of 2000 mineral revenue from Federal Lands.

Table 3. Historical Federal Lands mineral revenues.

Year	Coal Royalties	Gas Royalties	Oil Royalties	Other Royalties	Rents	Bonuses	Other Revenue	Total	% of Total for Oil and Gas Royalties	Calculated Oil and Gas Rents & Bonuses	Oil and Gas Rents & Bonuses as % of Oil and Gas Royalties
1992	325,462,818	1,612,052,771	1,294,794,084	166,703,578	96,837,548	142,970,711	50,501,169	3,689,322,679	86%	225,786,488	8%
1993	328,991,951	1,999,819,793	1,148,553,538	164,112,874	74,751,577	203,573,631	152,517,006	4,072,320,370	86%	268,202,845	9%
1994	360,175,024	1,934,866,134	1,014,553,730	146,494,922	72,924,538	428,821,887	264,521,209	4,222,357,444	85%	491,055,536	17%
1995	369,295,252	1,462,764,791	1,176,250,348	174,753,380	121,668,163	501,035,526	23,905,151	3,829,672,611	83%	601,908,191	23%
1996	364,948,773	2,223,895,262	1,499,523,768	180,370,999	197,135,800	965,734,373	62,376,077	5,493,985,052	87%	1,137,686,611	31%
1997	352,178,744	2,657,964,734	1,605,762,863	203,276,680	266,017,564	1,496,659,928	139,926,121	6,721,786,634	88%	1,732,016,507	41%
1998	345,734,171	2,290,930,934	1,072,675,622	148,923,817	298,645,651	1,454,514,764	-3,040,955	5,608,384,004	87%	1,714,871,839	51%
1999	372,392,664	2,183,314,452	1,094,333,400	154,021,752	248,995,621	439,316,723	67,817,605	4,560,192,217	86%	653,855,788	20%
2000	387,949,940	3,280,556,607	1,964,438,654	263,864,395	253,059,006	576,174,527	397,719,687	7,123,762,816	89%	801,261,206	15%
Average	*356,347,704*	*2,182,907,275*	*1,318,987,334*	*178,058,044*	*181,115,052*	*689,866,897*	*128,471,452*	*5,035,753,759*	*86%*	*847,405,001*	*24%*

Data: Mineral Revenues 2000 (MMS, 2001)
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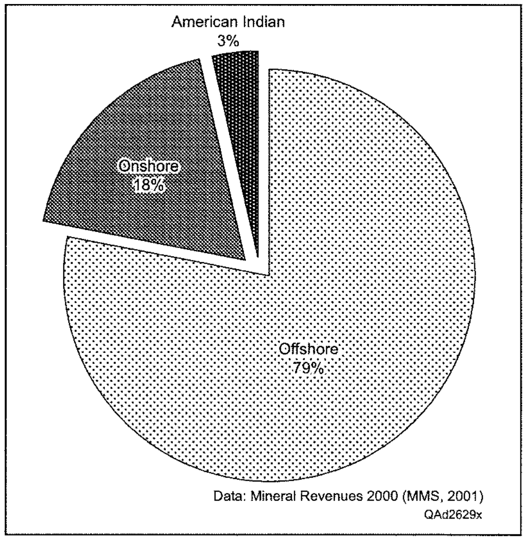

Figure 8. Federal Lands 2000 oil and gas royalty revenues.

Table 4. Federal Lands royalty rates.

	Oil			Gas		
Average Royalty Rates:	Offshore	Offshore	Amercan Indian	Offshore	Offshore	Amercan Indian
3-year Average	14.22%	9.69%	16.58%	15.60%	11.60%	14.52%
5-year Average	14.51%	9.86%	16.57%	15.70%	11.56%	14.38%
10-year Average	14.80%	10.77%	16.43%	15.88%	11.69%	14.14%
Historical Average	16.78%	12.35%	13.78%	15.84%	12.22%	13.65%

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800 meters of water, and 87.5 million boe in water depths greater than 800 meters to promote deepwater drilling and production. Royalty relief is provided in any year during which the arithmetic average of the closing prices on the New York Mercantile Exchange for light sweet crude oil and gas is less than $28 per barrel and $3.50 per MM btu, respectively.

With gas prices climbing sharply and gas production in the GOM shelf declining, MMS announced on March 26, 2003, proposed new incentives to increase deep shelf gas production. Under the proposal, the MMS would provide royalty suspension incentives when companies take the risk of exploring and developing deep shelf gas. A royalty suspension is offered on the first 15 Bcf of gas produced from a well drilled and completed from 15,000 feet to less than 18,000 feet below sea level or on the first 25 Bcf of gas from a well drilled and completed 18,000 feet or deeper below sea level. Moreover, as many as two royalty suspension supplements of 5 Bcf each, applied to future production of oil or gas from any drilling depth on that lease, are allowed for an unsuccessful well drilled to a target reservoir 18,000 feet or deeper below sea level.

Historically, most of the royalties collected by MMS have been in the form of royalty in value (RIV). A feasibility study conducted by MMS in 1997 documents that taking royalty in kind (RIK) and marketing the minerals through competitive sales or other means could be revenue neutral or positive. On the basis of the early successes of RIK pilot projects, MMS has decided to proceed with RIK starting in December 2003, after a 3-year evolvement process under its *Road Map to the Future* (MMS, 2001a). Currently, MMS receives 160,000 bbl/day of oil and 400 MMcf/day of gas in RIK (Oil & Gas Journal Online, 2003).

FORECAST OF U.S. AND FEDERAL LANDS OIL AND GAS PRODUCTION

U.S. oil and gas production has been forecast by a variety of organizations. The EIA's Annual Energy Outlook (AEO) 2003 was used in this study to forecast Federal lands future production, royalty revenues, and the effects of technology on maintaining and increasing current production levels since it was determined to be the most current, widely utilized, and extensive forecast available. The reference oil and gas production case of AEO 2003 was utilized to forecast Federal land oil and gas production. Components of the U.S. oil production forecast are shown in figure 9. A steady decline for lower 48 onshore oil production, increased lower 48 offshore oil production to 2007, and an increase in Alaskan oil production from 2010 is

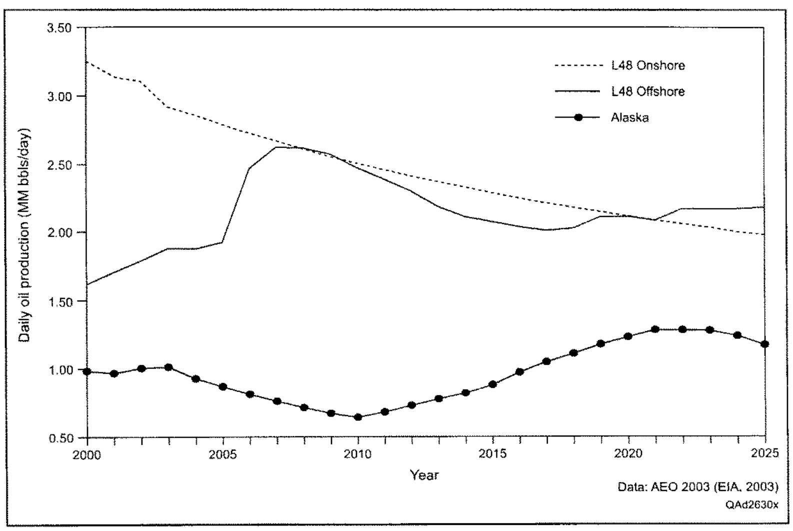

Figure 9. Components of U.S. oil production forecast.

forecast. Total U.S. oil production and average wellhead price forecasts assumed by AEO 2003 are given in figure 10. Oil production declines to 2005, increases thereafter until 2007 as the deepwater GOM OCS production increases, and declines significantly until 2015 as Alaskan production increases. Relatively modest oil prices are forecast with the 2025 average wellhead price forecast at slightly higher than $26/bbl. Components of the U.S. gas production forecast are shown in figure 11. Lower 48 onshore conventional gas production increases slightly; lower 48 onshore unconventional gas production significantly increases; lower 48 offshore production remains relatively stable; and an increase in Alaskan gas production from 2020 is forecast as transportation issues are forecast to be resolved. Total U.S. gas production and

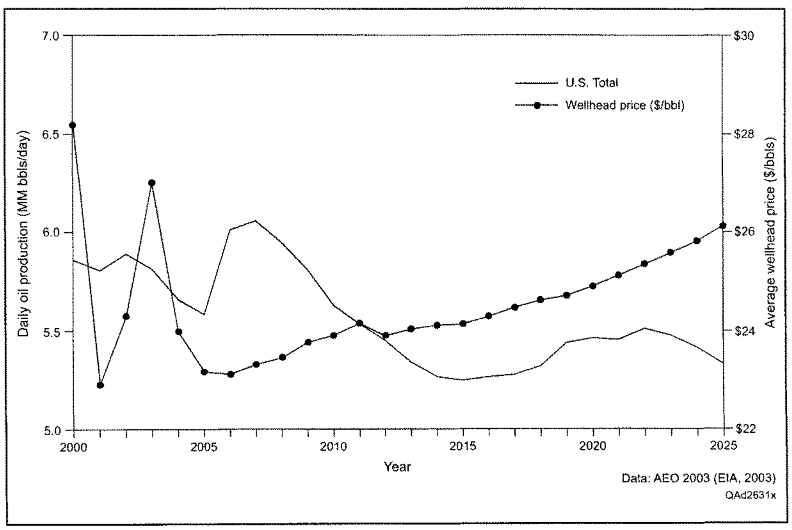

Figure 10. U.S. oil production vs. price forecast.

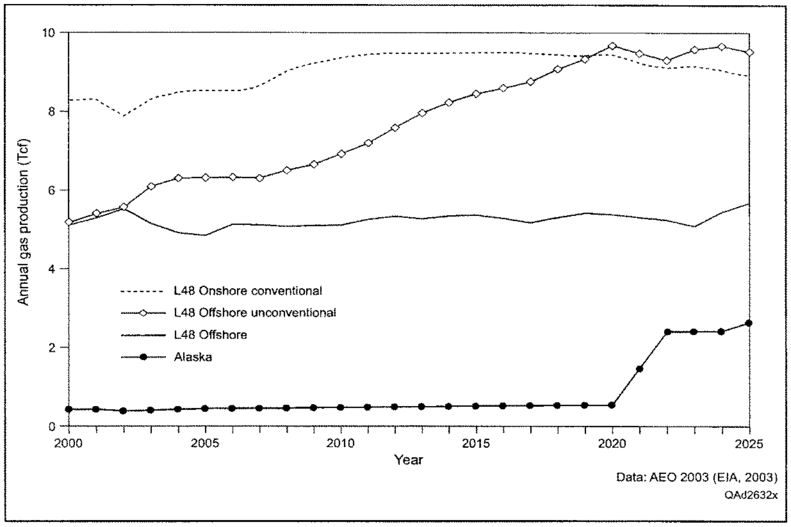

Figure 11. Components of U.S. gas production forecast.

average wellhead price forecasts assumed by AEO 2003 are given in figure 12. A steady increase in gas production and average wellhead prices are forecast.

For the Federal offshore, onshore, and American Indian lands, it is assumed that oil and gas production will mirror U.S. production trends forecast in AEO 2003. The annual percentage increases/decreases for U.S. oil and gas production onshore and offshore are assumed to hold true also for oil and gas production on Federal lands. This assumption was used by MMS to calculate future Federal lands oil and gas production and projections of Federal onshore revenues (MMS, 2000). The annual percentage increases/decreases forecast by AEO 2003 for the onshore

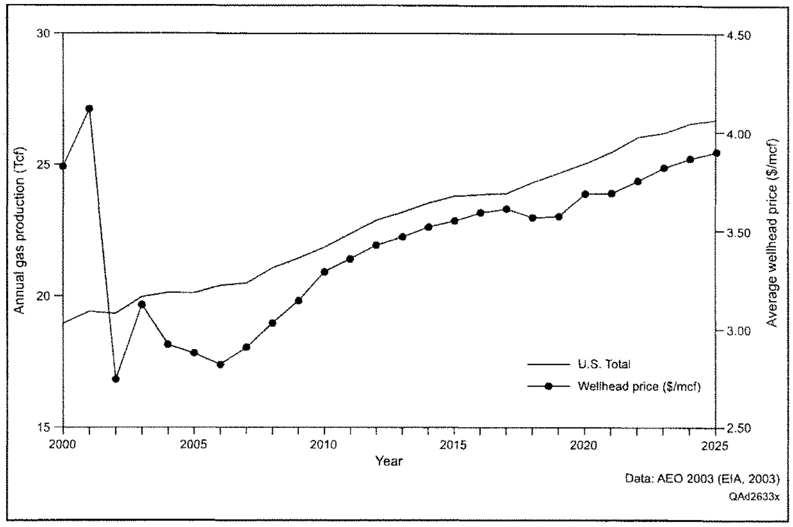

Figure 12. U.S. gas production vs. price forecast.

component of U.S. lower 48 oil and gas production can be applied to historical Federal onshore and American Indian lands oil and gas production to obtain a future production forecast. Likewise, the U.S. lower 48 oil and gas offshore component's percentage increase/decrease of future natural gas production can be applied to historical Federal offshore oil and gas production. For each year, the percentage increase/decrease is multiplied by the current year's production to forecast the following year's production. Combining these results, U.S. Federal lands future oil and gas production forecasts can be derived as in figures 13 and 14.

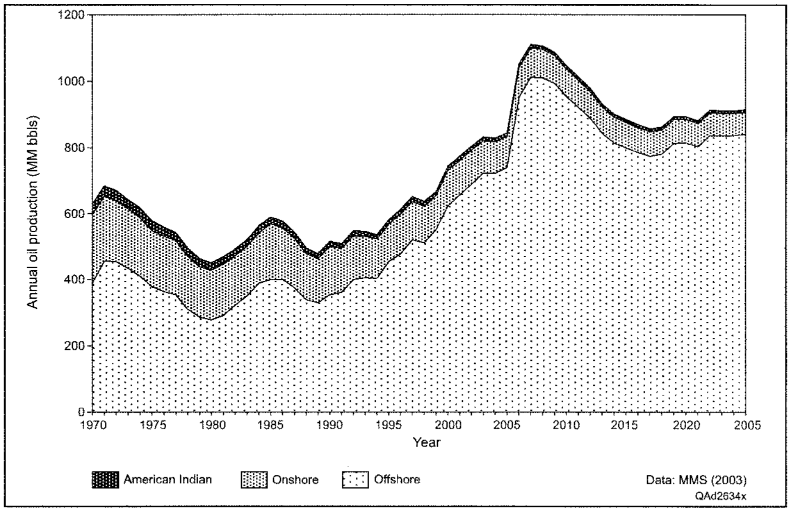

Figure 13. Federal Lands oil production forecast.

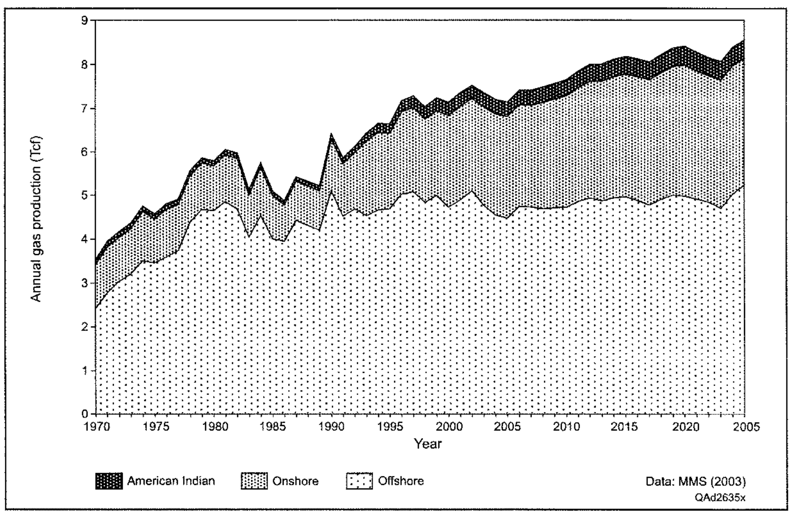

Figure 14. Federal Lands gas production forecast.

FORECAST OF ROYALTY REVENUE FROM OIL AND GAS PRODUCTION ON FEDERAL LANDS

Future royalty revenues from oil and gas production on Federal lands can be calculated by multiplying annual production, price, and royalty rates. Annual oil and gas production forecasts for the Federal offshore, onshore, and American Indian lands were discussed in the previous section. Royalty rates are estimated through data provided by MMS (table 4). Annual average oil and gas royalty rates for the Federal offshore, onshore, and American Indian lands were calculated by dividing the royalty revenue by the sales value. A 3-year average royalty rate from 1998, 1999, and 2000 was utilized as the royalty rate for the projection period because it was assumed to be the most recent level of royalty rates and no programs or actions that should materially change this figure could be foreseen. Oil and gas prices of the reference case in AEO 2003 were used, along with high- and low-price scenarios (tables 5 and 6). Oil and gas prices are extremely difficult to forecast, and the AEO reference prices are relatively conservative. However, it should be noted that the AEO 2003 reference price case for gas seems relatively lower than other forecasts, and even the high-price scenario would be lower than the current consensus views of gas prices especially for the near and short term.

On the basis of the above assumptions, a reference case Federal lands oil and gas royalty revenue forecast was made (figs. 15 and 16). It can be seen that most of the royalty revenues, especially for oil, are forecast from the Federal offshore. To more finely disaggregate the Federal offshore, historical Federal GOM OCS oil and gas production values (figs. 17 and 18) were utilized to extrapolate future production by water depths of less than 200 meters, 200 to 400 meters, 401 to 800 meters, and greater than 800 meters. Additionally, for the gas production and royalty revenue forecast, Federal onshore and American Indian onshore totals

Table 5. Oil-price scenarios.

Year	Reference Price ($/bbl)	Low Price (-25%) ($/bbl)	High Price (+25%) ($/bbl)
2001	$22.91	$17.18	$28.63
2002	$24.29	$18.21	$30.36
2003	$26.99	$20.24	$33.74
2004	$23.99	$17.99	$29.98
2005	$23.17	$17.37	$28.96
2006	$23.11	$17.33	$28.89
2007	$23.31	$17.48	$29.14
2008	$23.45	$17.59	$29.31
2009	$23.76	$17.82	$29.70
2010	$23.90	$17.93	$29.88
2011	$24.15	$18.11	$30.18
2012	$23.89	$17.92	$29.87
2013	$24.03	$18.02	$30.04
2014	$24.11	$18.08	$30.13
2015	$24.13	$18.10	$30.17
2016	$24.28	$18.21	$30.35
2017	$24.46	$18.35	$30.58
2018	$24.61	$18.46	$30.76
2019	$24.70	$18.52	$30.87
2020	$24.89	$18.67	$31.12
2025	$25.12	$18.84	$31.40
2022	$25.34	$19.01	$31.68
2023	$25.57	$19.18	$31.97
2024	$25.81	$19.36	$32.26
2025	$26.12	$19.59	$32.65
Average:	$24.40	$18.30	$30.50

Data: Reference price from AEO 2003 (EIA, 2003)
QAd2650x

in terms of conventional versus unconventional gas were disaggregated through the use of the U.S. production divisions made in AEO 2003.

Table 6. Gas-price scenarios.

Year	Reference price ($/Mcf)	Low Price (-25%) ($/Mcf)	High Price (+25%) ($/Mcf)
2001	$4.12	$3.09	$5.15
2002	$2.75	$2.06	$3.43
2003	$3.13	$2.34	$3.91
2004	$2.92	$2.19	$3.66
2005	$2.88	$2.16	$3.60
2006	$2.82	$2.12	$3.53
2007	$2.91	$2.18	$3.64
2008	$3.03	$2.28	$3.79
2009	$3.15	$2.36	$3.93
2010	$3.29	$2.47	$4.12
2011	$3.36	$2.52	$4.20
2012	$3.43	$2.57	$4.28
2013	$3.47	$2.60	$4.34
2014	$3.52	$2.64	$4.40
2015	$3.55	$2.66	$4.44
2016	$3.59	$2.70	$4.49
2017	$3.61	$2.71	$4.52
2018	$3.57	$2.68	$4.46
2019	$3.58	$2.68	$4.47
2020	$3.69	$2.77	$4.61
2025	$3.69	$2.77	$4.62
2022	$3.75	$2.82	$4.69
2023	$3.82	$2.87	$4.78
2024	$3.87	$2.90	$4.84
2025	$3.90	$2.93	$4.88
Average:	$3.42	$2.56	$4.27

Data: Reference price from AEO 2003 (EIA, 2003)
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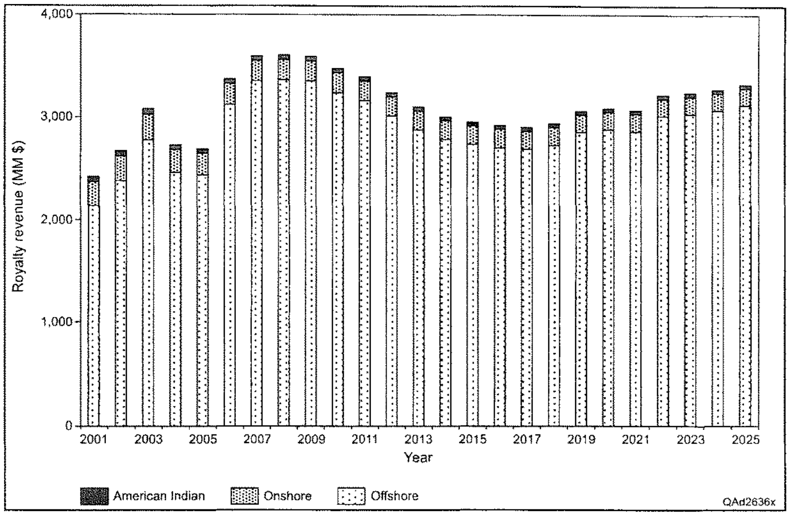

Figure 15. Reference Federal Lands oil royalty revenue forecast.

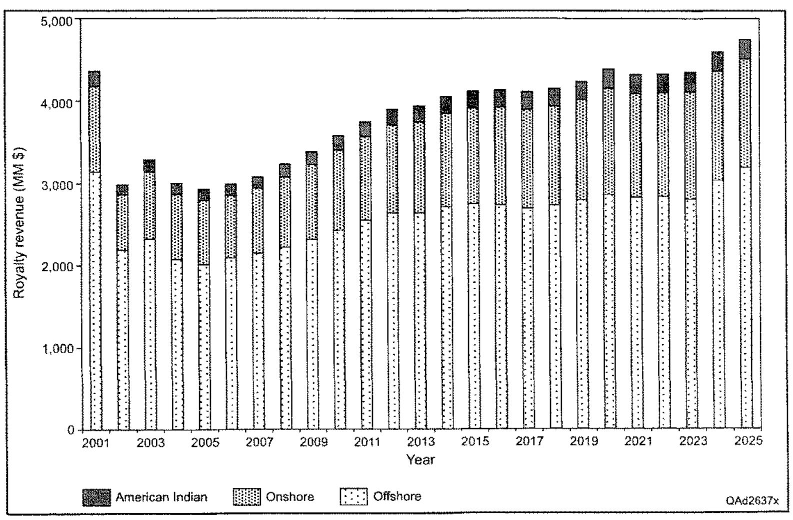

Figure 16. Reference Federal Lands gas royalty revenue forecast.

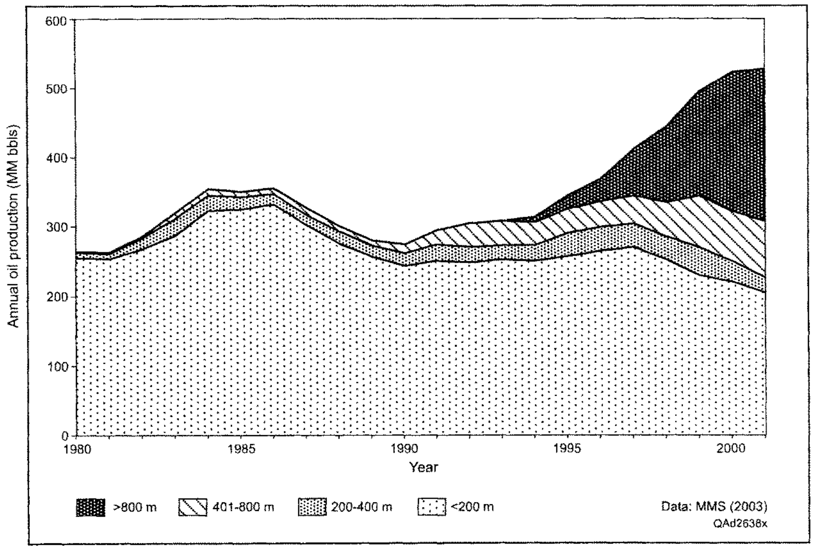

Figure 17. Historical Federal GOM OCS oil production by water depths.

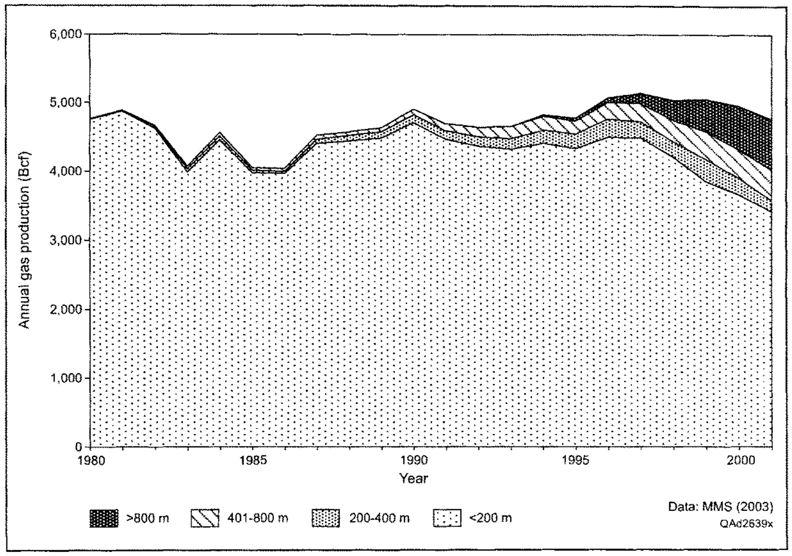

Figure 18. Historical Federal GOM OCS gas production by water depths.

ENHANCING THE VALUE OF FEDERAL OIL AND GAS RESOURCES: THE ROLE OF TECHNOLOGY IN INCREASING PRODUCTION AND SUPPLY

In a time of tightening supplies of oil and gas, it is critical that models for projecting future domestic oil and gas resources assess the supply impacts of technology advancements. Such modeling and analysis will both inform policymakers about the efficacy of public investment in supply technologies and inform the government about the value of technology for maximizing its resources on Federal lands.

The U.S. Government, through the EIA, produces annual projections of oil and gas resource supply growth, using rapid, slow, and reference case technology assumptions. Although the EIA projections provide valuable data for policymakers and the marketplace, more dynamic analysis is required to assess the impacts of specific supply research programs, such as the one found in H.R. 6. This supply research fund would establish a significant, multiyear R&D program to develop U.S. oil and gas resources that are currently uneconomic to produce but have the greatest potential for significant future growth, the offshore ultra-deepwater and unconventional onshore oil and gas resources.

This section begins with a brief overview of how models have accounted for and valued the impacts of new technology on the availability and production of oil and gas supplies. It then examines the data on how major investments in new oil and gas technology over the past two decades have led to significant growth in gas resources and production. The data show that new technologies are adopted and used at a rapid rate to develop previously inaccessible or uneconomic new oil and gas fields and extract additional oil and gas from fields that were previously thought to be exhausted.

The section concludes with a discussion of a dynamic model that the University of Texas' Bureau of Economic Geology (BEG) has developed and employed to more accurately forecast the incremental oil and gas production that will result over time from the supply research fund that would be established by H.R. 6. The model is focused on offshore ultra-deepwater and unconventional onshore resources, and it provides the basis for an analysis of the impacts of such a program on production on Federal lands and on royalties associated with that production.

Statistically Based Resource Assessments

Statistically based resource assessments, mainly through the highly publicized works of M. King Hubbert (1962, 1967, 1974), viewed U.S. oil and gas as a rapidly depleting resource and provided the basis for the warning call in the1980's that U.S. oil and gas supplies would be exhausted by the end of the century. Hubbert's analyses, in their failure to account for the impacts of technology advancements on increases in the resource base, actually underscore the substantial value of technology to oil and gas supply.

When based on extrapolation of historic data alone, as was done in Hubbert's analyses, U.S. oil and gas resources were considered to be rapidly depleting. Hubbert's analyses, however, were hindered by the critical and inaccurate assumption that the oil and gas resource base was limited by known technologies; they did not assume technology advances.

Indeed, Hubbert's analyses of resource depletion, depicted in a bell-shaped life cycle curve, would have been essentially correct if oil and gas production growth from offshore deepwater and unconventional resources (two provinces for which advanced technologies were critical to development) were omitted. The actual picture of oil and gas production looks quite different, however, because technological advancements have resulted in significant resource production in areas that were considered physically or economically unreachable at the time of Hubbert's analyses.

The National Petroleum Council on the Need for Technology Investment

Offshore deepwater and unconventional resources are forecast to provide the bulk of future production growth and are crucial to meeting the forecasted growth in gas demand of 54 percent by 2025. The National Petroleum Council's (NPC) gas supply study of 1999 concluded that "Technology improvements are particularly important given the difficult conditions accompanying new resources." The NPC study identified the following examples of technological advances that have enabled substantial additional oil and gas production:

- Three-dimensional (3-D) seismic imaging techniques now allow geologists to image underground rock formations in graphic detail and to reduce drilling risk by more accurately predicting locations for oil and gas accumulations.
- Improved drilling techniques enable producers to drill targets and reach otherwise difficult formations more accurately through the use of directional/horizontal drilling and offshore deepwater production systems.
- Advancements in stimulation, fracturing, and completion techniques have resulted in tremendous production increases in unconventional gas resources such as tight gas, coalbed methane, and gas shales. Deepwater production technologies now enable producers to access oil and gas in excess of 1,500 feet of water depth.

Looking forward, the NPC study also concluded that "deeper wells, deeper water and unconventional sources will be the key to future supply." According to the NPC, developing these two components of future U.S. oil and gas supply will be extremely dependent on technological advancements, which play a major role in the increase of oil and gas supply by

(1) improving efficiency of drilling, equipment, operating, and other costs;

(2) increasing recovery factors of discovered oil and gas in place;

(3) improving success rates by reducing the number of dry holes; and

(4) revealing new areas and types of resources for exploitation through innovative geologic and engineering concepts.

Further, the NPC concluded that the pace of technology development will be critical to the availability of gas supplies at affordable costs. The NPC study noted that "investment in research and development is needed to maintain the pace of advancements in technology." Also, the NPC study indicated that meeting gas demand by 2015 will require "driving research and technology at a rapid rate."

Advances in technology do not happen in a vacuum. The U.S. Department of Energy has produced the *Offshore Technology Roadmap for the Ultra-deepwater Gulf of Mexico* (DOE, 2000), which lays out a path for future technology development in the ultra-deepwater environment. During the producer workshops for this road-mapping effort, consensus views were that a $2 billion Government effort over 5 years would be necessary for a significant step change to be demonstrated. Moreover, the path for future technology research and development for unconventional onshore development was detailed in the *Unconventional Onshore Technology*

Roadmap (New Mexico Institute of Mining and Technology & GTI, 2002). If the investment is made to implement these roadmaps, new technologies that could have a significant impact on future U.S. oil and gas production include improved seismic techniques; deep wireline measurements; integrated well planning; improved drilling systems; improved stimulation techniques; advances in deepwater drilling technology; and formulation of new geologic frontiers.

The Impacts of Technology on Production: Historical Experience

Forecasts that demonstrate production increases in offshore deepwater and unconventional resources assume continued deployment and advances in technology. Conversely, forecasts that do not assume additional technology development and deployment demonstrate flat or declining production levels.

The EIA's AEO 2003 oil and gas supply projection provides forecasts assuming both a "rapid" and "slow" technology improvement. The rapid technology case assumes some technology improvement and shows modest production increases. The slow technology case, however, forecasts a decline in production over time. The delta between EIA's rapid and slow technology case forecasts for all gas production in the United States is 12 percent; for unconventional onshore gas production there is a supply delta of 21 percent between rapid and slow technology cases.

However, even the rapid technology case forecast assumes only modest technology improvements when compared with the programs of technology R&D laid out in the ultra-deepwater and unconventional onshore roadmaps. The EIA's AEO 2003 forecast is not predicated on the institutionalization of a focused, well-funded R&D program. As we will discuss, the

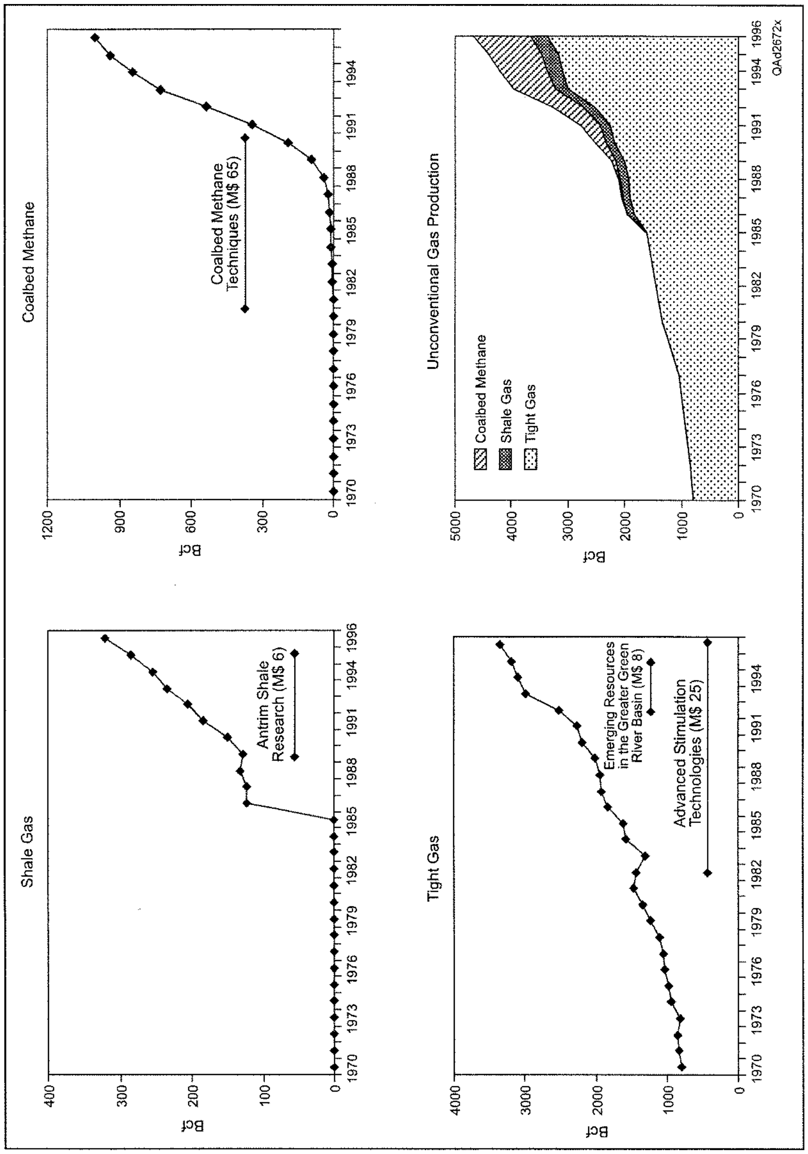

Figure 19. GRI/GTI's major historical programs and unconventional gas production.

BEG's analysis of the GRI/GTI technology program for the development of unconventional gas resources, a set of sustained and focused collaborative R&D efforts, yielded dramatically greater gas production than the EIA rapid technology case (fig.19). GTI is a natural gas research organization formed by the merger of two corporations: the Gas Research Institute (GRI) and the Institute for Gas Technology. The development of unconventional gas supplies represents a major GRI (and now GTI) research thrust.

Many unconventional gas resources were uneconomic prior to GRI/GTI's technology research, development, and deployment programs. GRI/GTI's coalbed methane program is especially noteworthy for transforming coalbed methane from a nuisance or hazard of coal production into a natural gas resource that now constitutes more than 1.5 Tcf of annual U.S. gas production. More than 11 Tcf of coalbed methane had been produced in the United States through 1999.

A more detailed profile of the GRI/GTI coalbed methane R&D program reveals the following: the program cost about $140 million over 10 years; production began to increase shortly after the start of the program; and annual production of coalbed methane continues to increase and currently supplies around 7 percent of U.S. domestic annual gas production. Coalbed methane research programs now exist in at least 13 countries worldwide.

The measurable impacts of technology on gas supply are also demonstrated in GRI/GTI's research on gas shales. Modern gas shale production was initially spurred by the Section 29 nonconventional fuels production tax credit, but that tax credit expired in 1992, and operators have continued to expand gas shale programs. Today, more than 28,000 gas shale wells produce nearly 380 Bcf of gas annually from 5 basins: Appalachian, Michigan, Illinois, Ft. Worth, and

San Juan. In 1998, fractured shale gas reservoirs supplied 1.6 percent, or 0.3 Tcf, of total U.S. gas production and contained 2.3 percent, or 3.9 Tcf, of total U.S. gas reserves.

Antrim shale in the Michigan Basin was the first to maximize the use of technology. In 1989, the year GRI/GTI's antrim shale research program was launched, production was around 130 Bcf per year. Steady incremental production growth occurred each subsequent year, and antrim shale production levels represented a 150-percent incremental production growth, or 321 Bcf, in 1996. GRI/GTI's advanced stimulation techniques catalyzed this production. GRI/ GTI's supply programs in advanced stimulation techniques and emerging resources in the Greater Green River Basin have also contributed to the substantial growth in tight gas production.

The utilization of GRI/GTI's technology on gas supply is specifically demonstrated in its research on Barnett shales. The Barnett was first drilled in 1981. Gas was found, but it was not economic to produce. In 1985, gas production from Barnett shales was less than 1 Bcf of gas annually from 25 wells. By 1995, 19.2 Bcf of gas was being produced annually from 306 wells. During the past 5 years alone, production has more than doubled to 40.6 Bcf from more than 500 wells (Shirley, 2001, 2002).

The value of technology advances on gas supply can be measured in terms of incremental production—the difference between current forecasts and forecasts that estimate the impact of new technology on production levels. Incremental production increases are frequently the result of the deployment and advancement of new technologies. Incremental production is expected to be greatest in complex and new resource areas such as the deepwater offshore and unconventionals. Incremental production can be calculated for each component of unconventional natural gas resources for which there was a GRI/GTI R&D program by measuring the growth from the production levels prior to program implementation.

Development and deployment of advanced technologies will provide access to new resources, as well as enhance production in more mature regions. Although technology is important in the production of conventional and shallow offshore resources, its role in these regions is relatively small compared with its tremendous impact on increasing production from offshore deepwater and unconventional resources. Nevertheless, technologies developed for the offshore deepwater and unconventional resources will trickle down to assist in the more efficient development and production of conventional and shallow offshore oil and gas resources as well.

Production responses due to technology generally occur very quickly, especially in more geologically and technically complex resource areas. For example, production responses occur almost immediately after a new hydraulic fracturing technology is applied to tight gas reservoirs or expandable tubing technology is used to drill in the ultra-deepwater. Today's new oil and gas production technologies will not necessarily have long lead times to develop. New technologies will mainly arise from advancements in different industries applied with new ideas—for example, high-intensity design; cycle-time reduction; and nanotechnology. However, the new technologies and processes are typically expensive to develop, and initial deployment and/or implementation can involve economic risk that producers deem too great to undertake on their own.

Moreover, the positive impacts of new R&D or incentive programs can be demonstrated relatively quickly even prior to deployment. Typically, when a new research or incentive program is announced, industry will book reserves that were previously deemed uneconomic; the simple announcement of a program focused on changing the economics of production of a certain type or in specific regions is often sufficient for the industry to book reserves.

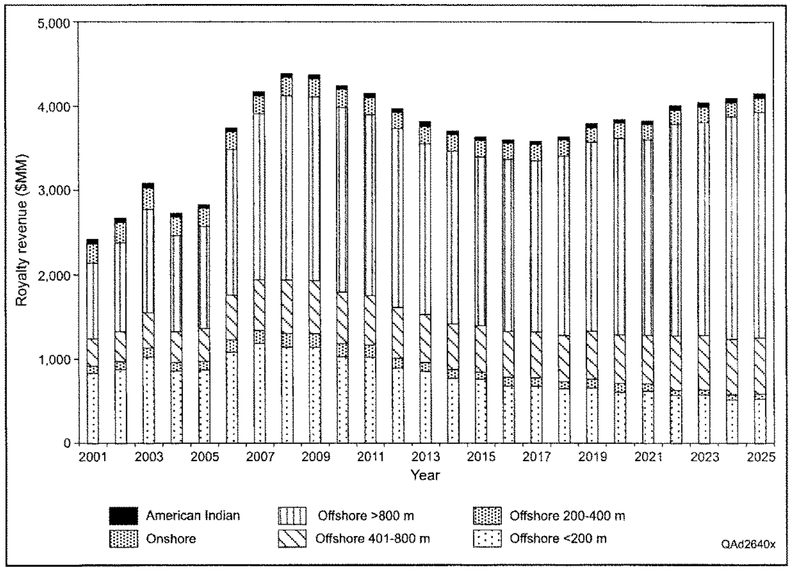

Figure 20. Royalty revenue from technology advancement oil production on Federal Lands.

Modeling the Value of Technology for the Supply Research Fund

The BEG has developed a model for the dynamic analysis of the value of technology to incremental oil and gas production over time. The BEG has employed this model to assess the economics of a supply research fund based on the supply R&D program included in H.R. 6, Subtitle E—Fossil Energy, Part 1, Sec. 21501(b) and Part 3—*The Ultra-deepwater and Unconventional Natural Gas and Other Petroleum Resources Supply Research and Development Program.*

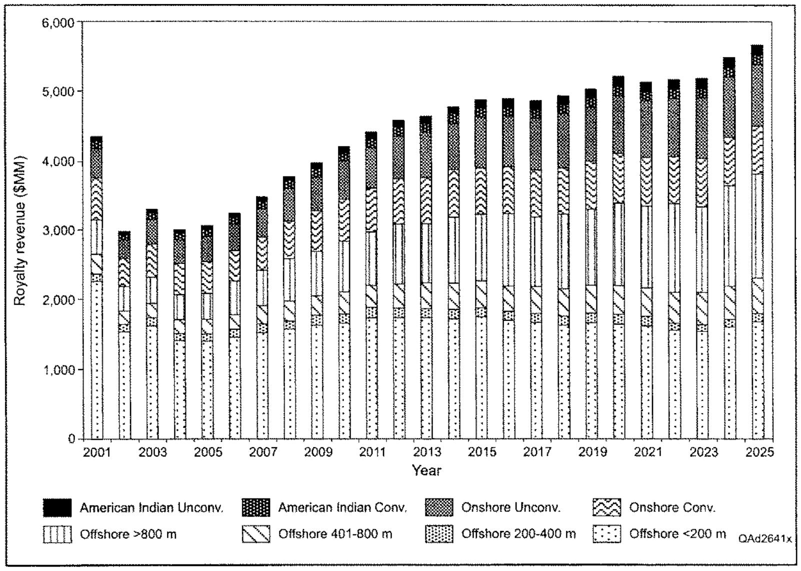

Figure 21. Royalty revenue from technology advancement gas production on Federal Lands.

Specific features of the legislation relevant to the BEG analysis are

- o A focused, large-scale R&D program, funded from a percentage of Federal offshore and onshore oil and gas royalties;
- o An R&D program focused on two specific regions or types of resource: ultra-deepwater offshore and unconventional onshore for both oil and gas;
- o A program sunset 9 years after the enactment date of the legislation.

Two key data sets were also employed in the BEG model: (1) the most current national production and price forecast used in EIA's AEO 2003 and (2) annual Federal lands oil and gas

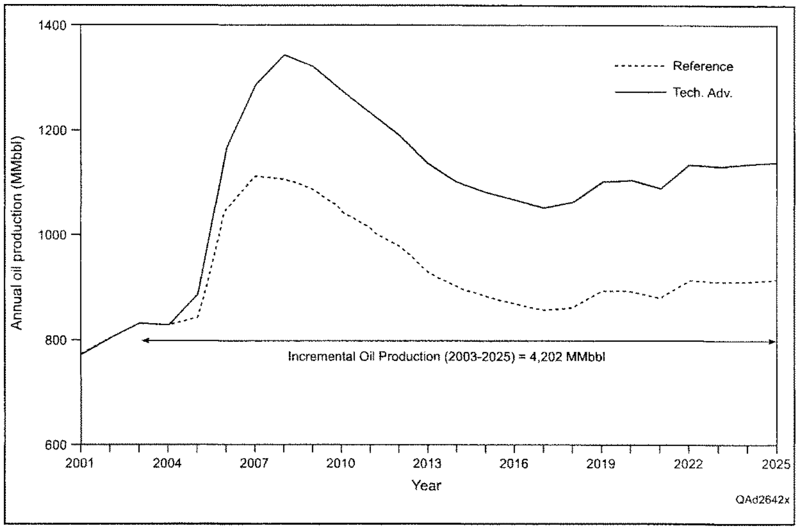

Figure 22. Federal Lands oil production forecast by technology advancements.

production data from the MMS. The MMS data are further broken down into production from Federal Offshore, Onshore, and American Indian lands.

The BEG analysis

- o Divides the Federal Offshore into water depth intervals of <200 m, 200–400 m, 401–800 m, and >800 m as maintained by MMS;
- o Divides the Federal Onshore and American Indian into conventional and unconventional production utilizing the national production divisions as specified in EIA's AEO 2003;
- o Expresses the effect of technology as a percentage incremental increase over the production forecast;

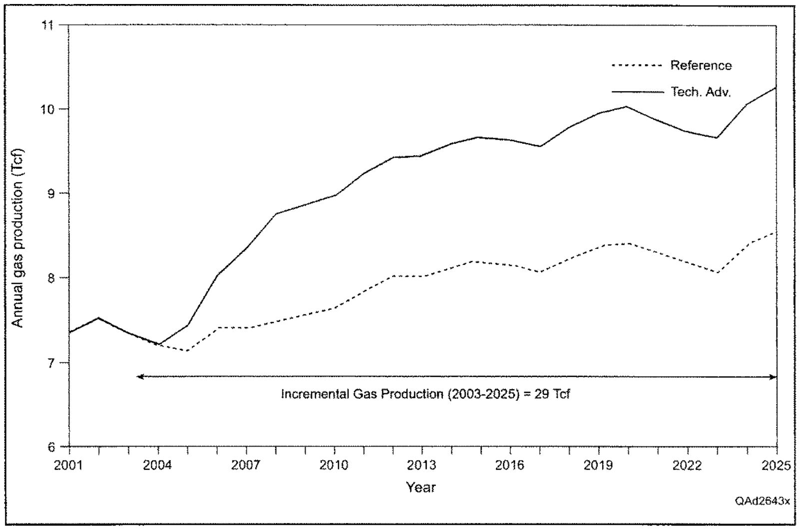

Figure 23. Federal Lands gas production forecast by technology advancements.

- o Calculates Federal royalties by multiplying the current 3-year average royalty rate specific to the Federal Offshore, Onshore, and American Indian lands by the production forecast. This calculation was performed in two ways: (1) as a reference case where the supply research fund was absent (fig. 20) and (2) as a technological advancement case where the supply research fund was present (fig. 21). The difference between the two cases was viewed as the benefits of the supply research fund (figs. 22 through 25).

The BEG model assumes the following:

- o Oil and gas production on Federal lands will grow at the same rate as production nationwide;

Table 7. Federal Lands economic analysis of the supply research fund.

Year	Federal Lands incremental production (MMbbl, Tcf)		Federal Lands incremental production revenue ($MM)			Federal Lands incremental royalty revenue ($MM)		
	Oil	Gas	Oil	Gas	Total	Oil	Gas	Total
2001	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-
2003	0	0.00	$0	$0	$0	$0	$0	$0
2004	0	0.00	$0	$0	$0	$0	$0	$0
2005	43	0.30	$997	$854	$1,851	$139	$120	$260
2006	115	0.62	$2,649	$1,760	$4,408	$372	$249	$621
2007	176	0.93	$4,108	$2,714	$6,822	$577	$384	$961
2008	238	1.27	$5,585	$3,865	$9,450	$785	$546	$1,332
2009	234	1.29	$5,566	$4,057	$9,623	$783	$573	$1,356
2010	229	1.33	$5,474	$4,367	$9,841	$770	$616	$1,386
2011	221	1.36	$5,346	$4,584	$9,930	$752	$647	$1,399
2012	217	1.42	$5,196	$4,870	$10,067	$731	$687	$1,418
2013	207	1.43	$4,970	$4,963	$9,933	$699	$699	$1,397
2014	203	1.48	$4,895	$5,196	$10,091	$688	$732	$1,420
2015	199	1.49	$4,812	$5,298	$10,111	$676	$746	$1,422
2016	199	1.50	$4,834	$5,408	$10,242	$680	$761	$1,440
2017	196	1.49	$4,803	$5,395	$10,198	$675	$757	$1,432
2018	201	1.55	$4,943	$5,540	$10,483	$695	$779	$1,474
2019	209	1.58	$5,158	$5,663	$10,821	$726	$796	$1,522
2020	212	1.62	$5,285	$5,969	$11,254	$744	$838	$1,582
2021	209	1.59	$5,254	$5,873	$11,128	$740	$825	$1,565
2022	221	1.59	$5,611	$5,965	$11,576	$790	$840	$1,630
2023	221	1.58	$5,648	$6,026	$11,675	$796	$845	$1,641
2024	225	1.66	$5,795	$6,432	$12,227	$817	$907	$1,724
2025	225	1.69	$5,890	$6,614	$12,504	$830	$936	$1,766
Total (2003-2025)	4,202	28.79	$102,819	$101,414	$204,233	$14,465	$14,284	$28,749

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Table 8. U.S. economic analysis of the supply research fund.

Year	U.S. incremental production (MMbbl, Tcf)		U.S. incremental production revenue ($MM)		
	Oil	Gas	Oil	Gas	Total
2001	-	-	-	-	-
2002	-	-	-	-	-
2003	0	0.00	$0	$0	$0
2004	0	0.00	$0	$0	$0
2005	72	0.89	$1,662	$2,551	$4,213
2006	165	1.80	$3,809	$5,097	$8,906
2007	254	2.71	$5,917	$7,889	$13,806
2008	338	3.73	$7,924	$11,307	$19,231
2009	331	3.80	$7,862	$11,946	$19,808
2010	323	3.91	$7,726	$12,879	$20,605
2011	316	4.03	$7,628	$13,526	$21,153
2012	312	4.19	$7,466	$14,346	$21,812
2013	303	4.29	$7,274	$14,872	$22,146
2014	299	4.40	$7,215	$15,493	$22,708
2015	297	4.47	$7,160	$15,887	$23,047
2016	298	4.52	$7,247	$16,248	$23,496
2017	297	4.55	$7,277	$16,427	$23,704
2018	303	4.69	$7,453	$16,733	$24,186
2019	312	4.78	$7,700	$17,104	$24,804
2020	316	4.91	$7,864	$18,109	$25,973
2021	314	4.91	$7,884	$18,116	$26,000
2022	324	4.95	$8,222	$18,569	$26,790
2023	323	5.00	$8,258	$19,113	$27,370
2024	324	5.11	$8,363	$19,762	$28,126
2025	322	5.12	$8,401	$19,975	$28,376
Total (2003-2025)	6,143	86.73	$150,310	$305,949	$456,259

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Table 9. Federal Lands economic analysis of the supply research fund (high-price scenario).

Year	Federal Lands incremental production (MMbbl, Tcf)		Federal Lands incremental production revenue ($MM)			Federal Lands incremental royalty revenue ($MM)		
	Oil	Gas	Oil	Gas	Total	Oil	Gas	Total
2001	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-
2003	0	0.00	$0	$0	$0	$0	$0	$0
2004	0	0.00	$0	$0	$0	$0	$0	$0
2005	43	0.30	$1,246	$1,067	$2,314	$174	$150	$325
2006	115	0.62	$3,311	$2,200	$5,511	$465	$311	$777
2007	176	0.93	$5,134	$3,393	$8,527	$722	$480	$1,202
2008	238	1.27	$6,981	$4,831	$11,813	$982	$683	$1,665
2009	234	1.29	$6,957	$5,071	$12,028	$978	$716	$1,694
2010	229	1.33	$6,843	$5,459	$12,301	$962	$770	$1,733
2011	221	1.36	$6,682	$5,730	$12,412	$940	$809	$1,748
2012	217	1.42	$6,495	$6,088	$12,583	$913	$859	$1,773
2013	207	1.43	$6,213	$6,203	$12,417	$873	$873	$1,746
2014	203	1.48	$6,119	$6,494	$12,614	$860	$915	$1,775
2015	199	1.49	$6,016	$6,623	$12,639	$846	$932	$1,778
2016	199	1.50	$6,043	$6,760	$12,803	$849	$951	$1,801
2017	196	1.49	$6,004	$6,743	$12,747	$844	$947	$1,791
2018	201	1.55	$6,179	$6,925	$13,104	$869	$973	$1,842
2019	209	1.58	$6,447	$7,079	$13,526	$907	$995	$1,902
2020	212	1.62	$6,606	$7,461	$14,067	$930	$1,048	$1,978
2021	209	1.59	$6,568	$7,341	$13,909	$925	$1,032	$1,956
2022	221	1.59	$7,013	$7,457	$14,470	$988	$1,050	$2,038
2023	221	1.58	$7,061	$7,533	$14,593	$995	$1,057	$2,052
2024	225	1.66	$7,244	$8,040	$15,283	$1,021	$1,134	$2,155
2025	225	1.69	$7,362	$8,268	$15,630	$1,038	$1,170	$2,208
Total (2003-2025)	4,202	28.79	$128,524	$126,768	$255,292	$18,081	$17,855	$35,936

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Table 10. U.S. economic analysis of the supply research fund (high-price scenario).

Year	U.S. incremental production (MMbbl, Tcf)		U.S. incremental production revenue ($MM)		
	Oil	Gas	Oil	Gas	Total
2001	-	-	-	-	-
2002	-	-	-	-	-
2003	0	0.00	$0	$0	$0
2004	0	0.00	$0	$0	$0
2005	72	0.89	$2,077	$3,189	$5,266
2006	165	1.80	$4,761	$6,371	$11,133
2007	254	2.71	$7,396	$9,862	$17,258
2008	338	3.73	$9,905	$14,134	$24,039
2009	331	3.80	$9,827	$14,933	$24,760
2010	323	3.91	$9,657	$16,099	$25,756
2011	316	4.03	$9,535	$16,907	$26,441
2012	312	4.19	$9,332	$17,933	$27,265
2013	303	4.29	$9,092	$18,590	$27,682
2014	299	4.40	$9,019	$19,366	$28,385
2015	297	4.47	$8,950	$19,858	$28,809
2016	298	4.52	$9,059	$20,310	$29,370
2017	297	4.55	$9,096	$20,534	$29,630
2018	303	4.69	$9,316	$20,917	$30,232
2019	312	4.78	$9,624	$21,380	$31,005
2020	316	4.91	$9,830	$22,636	$32,466
2021	314	4.91	$9,855	$22,645	$32,500
2022	324	4.95	$10,277	$23,211	$33,488
2023	323	5.00	$10,322	$23,891	$34,213
2024	324	5.11	$10,454	$24,703	$35,157
2025	322	5.12	$10,501	$24,968	$35,470
Total (2003-2025)	6,143	86.73	$187,887	$382,437	$570,324

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Table 11. Federal Lands economic analysis of the supply research fund (low-price scenario).

	Federal Lands incremental production (MMbbl, Tcf)		Federal Lands incremental production revenue ($MM)			Federal Lands incremental royalty revenue ($MM)		
Year	Oil	Gas	Oil	Gas	Total	Oil	Gas	Total
2001	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-
2003	0	0.00	$0	$0	$0	$0	$0	$0
2004	0	0.00	$0	$0	$0	$0	$0	$0
2005	43	0.30	$748	$640	$1,388	$105	$90	$195
2006	115	0.62	$1,987	$1,320	$3,306	$279	$187	$466
2007	176	0.93	$3,081	$2,036	$5,116	$433	$288	$721
2008	238	1.27	$4,189	$2,899	$7,088	$589	$410	$999
2009	234	1.29	$4,174	$3,043	$7,217	$587	$430	$1,017
2010	229	1.33	$4,106	$3,275	$7,381	$577	$462	$1,040
2011	221	1.36	$4,009	$3,438	$7,447	$564	$485	$1,049
2012	217	1.42	$3,897	$3,653	$7,550	$548	$516	$1,064
2013	207	1.43	$3,728	$3,722	$7,450	$524	$524	$1,048
2014	203	1.48	$3,672	$3,897	$7,568	$516	$549	$1,065
2015	199	1.49	$3,609	$3,974	$7,583	$507	$559	$1,067
2016	199	1.50	$3,626	$4,056	$7,682	$510	$571	$1,080
2017	196	1.49	$3,602	$4,046	$7,648	$506	$568	$1,074
2018	201	1.55	$3,707	$4,155	$7,862	$521	$584	$1,105
2019	209	1.58	$3,868	$4,248	$8,116	$544	$597	$1,141
2020	212	1.62	$3,964	$4,477	$8,440	$558	$629	$1,187
2021	209	1.59	$3,941	$4,405	$8,346	$555	$619	$1,174
2022	221	1.59	$4,208	$4,474	$8,682	$593	$630	$1,223
2023	221	1.58	$4,236	$4,520	$8,756	$597	$634	$1,231
2024	225	1.66	$4,346	$4,824	$9,170	$612	$680	$1,293
2025	225	1.69	$4,417	$4,961	$9,378	$623	$702	$1,325
Total (2003-2025)	4,202	28.79	$77,114	$76,061	$153,175	$10,849	$10,713	$21,562

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Table 12. U.S. economic analysis of the supply research fund (low-price scenario).

Year	U.S. incremental production (MMbbl, Tcf)		U.S. incremental production revenue ($MM)		
	Oil	Gas	Oil	Gas	Total
2001	-	-	-	-	-
2002	-	-	-	-	-
2003	0	0.00	$0	$0	$0
2004	0	0.00	$0	$0	$0
2005	72	0.89	$1,246	$1,913	$3,160
2006	165	1.80	$2,857	$3,823	$6,680
2007	254	2.71	$4,438	$5,917	$10,355
2008	338	3.73	$5,943	$8,480	$14,423
2009	331	3.80	$5,896	$8,960	$14,856
2010	323	3.91	$5,794	$9,659	$15,454
2011	316	4.03	$5,721	$10,144	$15,865
2012	312	4.19	$5,599	$10,760	$16,359
2013	303	4.29	$5,455	$11,154	$16,609
2014	299	4.40	$5,411	$11,620	$17,031
2015	297	4.47	$5,370	$11,915	$17,285
2016	298	4.52	$5,436	$12,186	$17,622
2017	297	4.55	$5,458	$12,320	$17,778
2018	303	4.69	$5,589	$12,550	$18,139
2019	312	4.78	$5,775	$12,828	$18,603
2020	316	4.91	$5,898	$13,582	$19,480
2021	314	4.91	$5,913	$13,587	$19,500
2022	324	4.95	$6,166	$13,926	$20,093
2023	323	5.00	$6,193	$14,334	$20,528
2024	324	5.11	$6,272	$14,822	$21,094
2025	322	5.12	$6,301	$14,981	$21,282
Total (2003-2025)	6,143	86.73	$112,732	$229,462	$342,195

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Table 13. Additional economic impact of the supply research fund from Federal Lands incremental production.

	Oil	Gas	Total
Incremental production, Tcf and MMbbl	4,202	29	
Incremental production revenue ($MM)	**$102,819**	**$101,414**	**$204,233**
Incremental royalty revenue ($MM)	**$14,465**	**$14,284**	**$28,749**
Severance tax rate from wellhead value	0.075	0.046	
Severance taxes ($MM)	**$7,711**	**$4,665**	**$12,376**
Ad valorem tax rate from wellhead value	0.0395	0.0395	
Ad valorem taxes ($MM)	**$4,061**	**$4,006**	**$8,067**
Franchise tax rate from economic value	0.0018	0.0018	
Franchise taxes ($MM)	**$539**	**$531**	**$1,070**
Sales tax rate from economic value	0.02	0.02	
Sales taxes ($MM)	**$5,984**	**$5,902**	**$11,886**
Economic value (2.91 × production revenue)	**$299,203**	**$295,115**	**$594,318**
Jobs created (19.1 per $MM wellhead value)	**1,963,843**	**1,937,007**	**3,900,850**

Based on the Texas Railroad Commission's "General Model of Oil and Gas Impact on the Texas Economy" derived from the Texas Comptroller's Input/Output model of the Texas economy.

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- Modest percentage incremental production increases from technology advancements will generally track historical and current trends as outlined in the previous section. More specifically, the model assumes

  - a 10-percent production increase for *conventional* gas onshore and for offshore water depths <200 m;

  - a 20-percent production increase for offshore water depths of 200–400 m;

  - a 25-percent production increase for offshore water depths 400–800 m;

  - and a 30-percent production increase for offshore water depths >800 m, as well as for unconventional onshore production;

- Zero incremental production growth due to technologies developed through the research supply fund in years one and two of the program (2003 & 2004) due to lag time required to develop and apply technologies;

Table 14. Additional economic impact of the supply research fund from U.S. incremental production.

	Oil	Gas	Total
Incremental production, Tcf and MMbbl	6,143	87	
Incremental production revenue ($MM)	**$150,310**	**$305,949**	**$456,259**
Severance tax rate from wellhead value	0.075	0.046	
Severance taxes ($MM)	**$11,273**	**$14,074**	**$25,347**
Ad valorem tax rate from wellhead value	0.0395	0.0395	
Ad valorem taxes ($MM)	**$5,937**	**$12,085**	**$18,022**
Franchise tax rate from economic value	0.0018	0.0018	
Franchise taxes ($MM)	**$787**	**$1,603**	**$2,390**
Sales tax rate from economic value	0.02	0.02	
Sales taxes ($MM)	**$8,748**	**$17,806**	**$26,554**
Economic value (2.91 × production revenue)	**$437,402**	**$890,312**	**$1,327,714**
Jobs created (19.1 per $MM wellhead value)	**2,870,921**	**5,843,626**	**8,714,547**

Based on the Texas Railroad Commission's "General Model of Oil and Gas Impact on the Texas Economy" derived from the Texas Comptroller's Input/Output model of the Texas economy.

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- More technologically dependent resources (deepwater offshore and unconventional) will show greater *incremental* production increases than less technologically dependent resources (shallow offshore and conventional);
- A "scaled-up" effect of technology for the early years of the program: 25 percent impact in 2005, 50 percent impact in 2006, 75 percent impact in 2007 are assumed as technology is first deployed in the early years;
- A 100-percent impact of technology in years 2008–2025 as technology is deployed and fully applied and primary production response is achieved.

The BEG analysis determined that incremental production responses for technologically dependent resources are significant and increase quickly. As demonstrated by a review of the impacts of technology on development of unconventional gas resources, key technology developments greatly increased the portion of the resource base that could be economically and technlogically exploited. As illustrated in figure 19, production from these resource areas most commonly

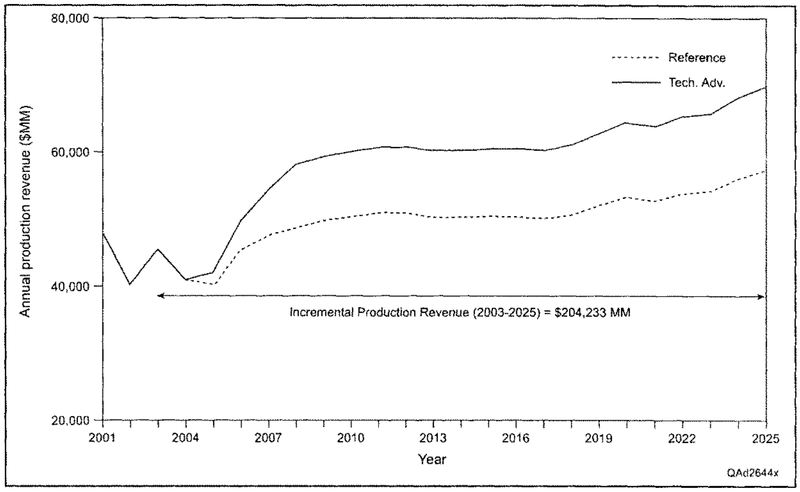

Figure 24. Federal Lands production revenue forecast by technology advancements.

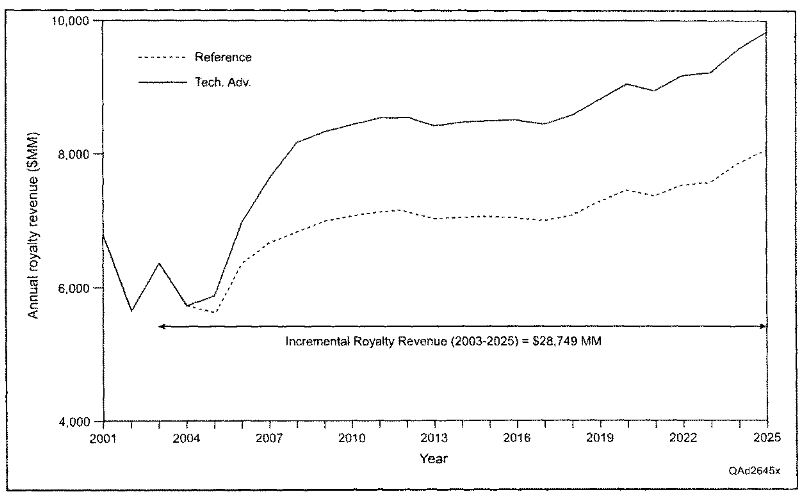

Figure 25. Federal Lands royalty revenue forecast by technology advancements.

starts at zero or is very minimal. When technologies are applied, production increases rapidly.

Economic analysis of the supply research fund in terms of Federal lands incremental production revenue under the reference price case revealed positive economics (table 7). Moreover, when the entire U.S. incremental production revenue was taken into consideration, economic benefits were greatly increased (table 8). The economic analysis results of the high and low price scenarios are given in tables 9 through 12. Furthermore, the Texas Railroad Commission's *"General Model of Oil and Gas Impact on the Texas Economy"* derived from the Texas Comptroller's input-output model of the Texas economy was utilized to examine additional economic impacts of the supply research fund. Such additional economic impact from taxes, economic value, and jobs created was examined in the case of both Federal lands and U.S. incremental production resulting from the supply research fund (tables 13 and 14). Although this model was developed on the state level for use in Texas, it reveals some important potential additional economic impacts of the supply research fund.

The methodology of calculating the value of technology in terms of incremental production has been frequently utilized in projects conducted at the BEG, such as the State of Texas Advanced Oil and Gas Resource Recovery and the University Lands Advanced Recovery Initiative. The fundamental basis of how technology application leads to incremental production is also given in several articles as those by Hickman (1995) and Sneider and Sneider (1998). It should be noted that additional Federal mineral revenues from bonuses and rents were not assessed, and the impact of current and proposed tax-related legislation such as the deepwater royalty relief act, deep-shelf gas tax incentives, and RIK programs was not analyzed in this report.

CONCLUSIONS

The U.S. oil and gas resource base is vast and will contribute significantly to rising oil and gas demand with continued technological advancements. Major increases in oil and gas supply are attributable to successes in the technologically difficult and complex offshore deepwater and unconventional resource areas. These oil and gas resource areas are very dependent on continued technological advancements for their incremental production growth and economic recovery.

In the past, GRI/GTI's multiyear, high-risk, high-cost gas supply research programs such as coalbed methane, advanced stimulation technologies, Antrim shales, and emerging resources in the Greater Green River Basin resulted in significant economic increases in gas production. Incremental gas production achieved through these gas supply research programs has contributed greatly to increased Federal royalty revenue and, in fact, has provided an excellent rate of return on the Federal investment.

On the basis of current legislation the previous study, *Benefit/cost analysis GRI's gas supply research initiative* (Kim and others, 2000), has been updated. Through compilation and management of production and economic data an analysis of historical U.S. and Federal lands oil and gas production was undertaken. On the basis of this analysis forecasts of oil and gas production and royalty revenue from Federal lands were made. The potential impact of technology targeted at increasing oil and gas production on Federal lands as well as in the U.S. was determined through various parameters such as incremental production, production revenue, and royalty revenue. Additional economic impacts such as taxes, economic value, and jobs created further revealed the benefits of the proposed supply research fund.

A supply research trust fund is a critically important and economically viable R&D investment. It establishes a balanced approach for responsibly developing the nation's oil and gas resource base by driving research and technology development at a rapid rate necessary to meet the nation's increasing future oil and gas demands. The consequences of decreasing investment in technological developments would severely limit potential incremental production and Federal mineral revenues from difficult and complex resource areas such as the offshore deepwater and unconventionals.

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