AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

ENERGY OUTLOOKS, AND THE ROLE OF FEDERAL ONSHORE AND OFFSHORE RESOURCES IN MEETING FUTURE ENERGY DEMAND

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

Thursday, March 5, 2009

Serial No. 111-8

Printed for the use of the Committee on Natural Resources

Available via the World Wide Web: http://www.gpoaccess.gov/congress/index.html
or
Committee address: http://resourcescommittee.house.gov

U.S. GOVERNMENT PRINTING OFFICE

47-755 PDF WASHINGTON : 2009

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON NATURAL RESOURCES

NICK J. RAHALL, II, West Virginia, *Chairman*
DOC HASTINGS, Washington, *Ranking Republican Member*

Dale E. Kildee, Michigan
Eni F.H. Faleomavaega, American Samoa
Neil Abercrombie, Hawaii
Frank Pallone, Jr., New Jersey
Grace F. Napolitano, California
Rush D. Holt, New Jersey
Raúl M. Grijalva, Arizona
Madeleine Z. Bordallo, Guam
Jim Costa, California
Dan Boren, Oklahoma
Gregorio Sablan, Northern Marianas
Martin T. Heinrich, New Mexico
George Miller, California
Edward J. Markey, Massachusetts
Peter A. DeFazio, Oregon
Maurice D. Hinchey, New York
Donna M. Christensen, Virgin Islands
Diana DeGette, Colorado
Ron Kind, Wisconsin
Lois Capps, California
Jay Inslee, Washington
Joe Baca, California
Stephanie Herseth Sandlin, South Dakota
John P. Sarbanes, Maryland
Carol Shea-Porter, New Hampshire
Niki Tsongas, Massachusetts
Frank Kratovil, Jr., Maryland
Pedro R. Pierluisi, Puerto Rico

Don Young, Alaska
Elton Gallegly, California
John J. Duncan, Jr., Tennessee
Jeff Flake, Arizona
Henry E. Brown, Jr., South Carolina
Cathy McMorris Rodgers, Washington
Louie Gohmert, Texas
Rob Bishop, Utah
Bill Shuster, Pennsylvania
Doug Lamborn, Colorado
Adrian Smith, Nebraska
Robert J. Wittman, Virginia
Paul C. Broun, Georgia
John Fleming, Louisiana
Mike Coffman, Colorado
Jason Chaffetz, Utah
Cynthia M. Lummis, Wyoming
Tom McClintock, California
Bill Cassidy, Louisiana

James H. Zoia, *Chief of Staff*
Rick Healy, *Chief Counsel*
Todd Young, *Republican Chief of Staff*
Lisa Pittman, *Republican Chief Counsel*

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

JIM COSTA, California, *Chairman*
DOUG LAMBORN, Colorado, *Ranking Republican Member*

Eni F.H. Faleomavaega, American Samoa
Rush D. Holt, New Jersey
Dan Boren, Oklahoma
Gregorio Sablan, Northern Marianas
Martin T. Heinrich, New Mexico
Edward J. Markey, Massachusetts
Maurice D. Hinchey, New York
John P. Sarbanes, Maryland
Niki Tsongas, Massachusetts
Nick J. Rahall, II, West Virginia, *ex officio*

Don Young, Alaska
Louie Gohmert, Texas
John Fleming, Louisiana
Jason Chaffetz, Utah
Cynthia M. Lummis, Wyoming
Doc Hastings, Washington, *ex officio*

CONTENTS

OVERSIGHT HEARING ON "ENERGY OUTLOOKS, AND THE ROLE OF FEDERAL ONSHORE AND OFFSHORE RESOURCES IN MEETING FUTURE ENERGY DEMAND."

Thursday, March 5, 2009
U.S. House of Representatives
Subcommittee on Energy and Mineral Resources
Committee on Natural Resources
Washington, D.C.

The Subcommittee met, pursuant to call, at 2:00 p.m., in Room 1324, Longworth House Office Building, Hon. Jim Costa [Chairman of the Subcommittee] presiding.

Present: Representatives Costa, Holt, Sablan, Heinrich, Sarbanes, Lamborn, Gohmert, Fleming, Chaffetz, Lummis, and Hastings.

STATEMENT OF THE HON. JIM COSTA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. COSTA. The Subcommittee on Energy and Mineral Resources will now come to order.

For this afternoon's hearing, we are meeting today with regard to energy outlooks and the role that Federal onshore and offshore resources play in meeting future energy demands.

Under Committee Rule 4(g), the Chair and the Ranking Member may make an opening statement. And then, if any other Members have statements, they can be included in the hearing record under unanimous consent.

I will allow the Ranking Member of the Full Committee, Doc Hastings, who is also with us today, to provide some thoughts. And we appreciate your participation.

Additionally, under Committee Rule 4(h), any material submitted for inclusion in the hearing record must be submitted no later than 10 days following this hearing.

Members of the Subcommittee, our witnesses, and those of you in the audience, this is the first energy hearing for the Energy and Mineral Resources Subcommittee in this Congress dealing with the big picture. I always try to refer to that, in previous hearings that were held by the Full Committee and in the last Congress, because I think, to really talk about developing a new energy policy in this country, we have to look at, as I have said before, the big picture and utilizing all the energy tools in our energy toolbox.

We have three distinguished witnesses today, the leading international and United States sources of energy statistics and forecasts, who are well-respected throughout the country and throughout the world, I might add.

Dr. Fatih Birol is the Chief Economist of the International Energy Agency. They are responsible for writing the organization's

annual "World Energy Outlook," which looks at energy trends throughout the world to the year 2030. I don't know if we can accurately predict that, but obviously we have to try. The outlook also focuses on some topics that are of particular interest to the Subcommittee that we will discuss this afternoon as it relates to oil and gas production.

Dr. Howard Gruenspecht—did I pronounce that properly? Dr. Gruenspecht is the Acting Administrator of the U.S. Energy Information Administration, which puts out a continuous wealth of energy analysis and forecasts, for both short-term and long-term forecasts, that include the "Annual Energy Outlook," which focuses on trends in America, again, to the year 2030.

Last, but certainly not least, is Ms. Brenda Pierce. She heads the Energy Resources Division of the United States Geological Survey, which is the world's leading source on oil and gas resources.

And we are glad that you are here.

Members of the Subcommittee and those of you in the audience, I hope the discussion today is on how we can figure out ways in which we can come together to achieve clean and sustainable domestic energy that will address our Nation's short-term and long-term needs. I think that is everyone's goal.

As I said in a hearing we had last month, while we can agree on the goal, we have a number of different views on how we reach those goals. Obviously, we want to reduce the dependency on foreign sources of energy that we import, reduce it significantly, so that we are not held hostage and so that America's economy can remain stable. We also want to reduce our dependency, as we move into the 21st century, on fossil fuels. We want to be able to have a greater reliance on renewable sources of energy.

But that is what we have to focus on, in terms of how we use all the energy tools in our energy toolbox, knowing that both our petroleum and our fossil fuels will continue to play a very important role as we deal with our long-term energy needs in the 21st century and as we transition.

So I am hopeful that today's hearing will set the discussion in what we need to do in terms of the short term in using all these energy tools in our energy toolbox; in the near term, by that I mean the next 5 to 10 years; and then the long term, and by that I mean 20 years and beyond.

I am a strong believer that we can be successful in achieving these goals. We know that oil and gas and coal are absolutely essential today, and they will be for a long time. But that should not allow us to rest at ease or to take any comfort in the fact that, if we don't lead the world in clean, renewable energy or energy efficiency, because conservation is an ethic that I think we all embrace—and so, therefore, we need to also look at other sources that have been successful. For me, that includes nuclear energy, coal to liquids, advanced biofuels and, in short, all the tools, again, in our toolbox.

The jurisdiction, of course, of this Subcommittee on how energy can be produced on public lands, both traditional and alternative forms of energy, we must keep in mind what the jurisdiction of this Subcommittee is.

But, also, I think it is timely, as this hearing will certainly play out. And every day, every Member of Congress is mindful of the fact that our economic recovery is dependent upon putting together a comprehensive energy plan. I think everyone feels that is incumbent and, therefore, we have to focus on that today. We need, when we discuss energy legislation in the coming year, to think about how this best invests in future jobs in America, builds on new markets, promotes new technologies, as it relates to our energy long-term needs.

Another pressing need in this country is obviously a lower-carbon economy. This week, the United Nations' top climate officials are in Washington. In China, Secretary of State Clinton has engaged China, the world's biggest emitter, along with ourselves, in regard to energy and the impacts that the carbon emissions have with regard to the energy that we consume.

The President has signaled that he is placing the United States at the forefront of the international effort to deal with these climate issues. And his chief climate negotiator said last week, according to a report in the New York Times on Sunday, that the United States would be involved in the negotiations of a new international climate change treaty, hopefully to be signed in Copenhagen in December of this year. We hope that that is successful.

The hearing today focuses on those areas that we know relate to our choices, the choices we have to make as it relates to the impacts on our climate. So I look forward to hearing from our witnesses not only about their long-term visions of the big picture of energy production, on public lands, but both how we ensure that onshore and on the Outer Continental Shelf we can do everything possible to provide a balanced energy future that I think we all strive for.

With that, I would like to now recognize my colleague and Ranking Member of the Subcommittee, Congressman Doug Lamborn of Colorado.

STATEMENT OF THE HON. DOUG LAMBORN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Mr. LAMBORN. Thank you, Mr. Chairman. And I want to thank you also for calling today's hearing.

This hearing will continue our focus on the Nation's Outer Continental Shelf, as well as onshore oil and gas resources. Our witnesses today will share with us the energy outlook for the United States and the world through 2030, based on the best information they have.

Their testimony, while tremendously helpful, is still only a projection and not the reality that we may face. No one could have predicted $150-a-barrel oil last year or 30-some-dollar-a-barrel of oil today. Such tremendous swings in prices have dramatic impact upon our economy, as the current recession has shown. Professor James Hamilton from UCSD has written that, quote, "Nine out of 10 of the last U.S. recessions since World War II were preceded by a spike up in oil prices."

As we work to get our economy moving again, we must be prepared to face rising energy prices. The President's budget recently proposed massive tax increases on the oil and gas industry of

America starting in 2011, and upon electricity from cap-and-trade in 2012. These massive tax increases coincide with the projections by EIA of a return to $100-a-barrel oil.

If energy price spikes are what got us into this recession and nine out of 10 recessions since World War II, what will happen if we face another price spike, as well, when we begin to pull ourselves out of this recession? Couldn't that have a similar negative impact?

This hearing will focus, again, on what resources may be available in the OCS. While I believe we can all agree that the OCS moratoria areas are a fairly unknown commodity, the truth is that we have companies willing to gamble billions of their own dollars to explore these unknown areas at no risk and no cost to the taxpayer.

It was stated at a previous hearing that, if the estimates in the Atlantic—currently 3.8 billion barrels of oil and 37 trillion cubic feet of natural gas—which were last surveyed in the 1970s, were to expand in the same fashion that Gulf of Mexico resources have expanded since the 1970s, we will have more than 18 billion barrels of oil and 89 trillion cubic feet of gas in the Atlantic alone.

More importantly is the fact that the resources off the coast of California are probably some of the most accessible in the world. In many places on the California coast, we have leases which could be slant-drilled from shore from existing coastal infrastructure. In addition, the resources off the coast of California are fairly well-known, and we could develop much of that area within just a few years, creating American jobs and reducing our dependence on foreign energy, not to mention having more accessible energy for America's working families.

Our dependence on foreign energy, sadly, is not something that we will reduce any time soon. Based on current law, the projections in the EIA outlook show that we will still be importing a tremendous amount of oil in 2030. Reducing our dependence on these imports should be a major focus of this committee.

An increase of 1 million barrels per day of domestic production would reduce our imports by a million barrels a day. In today's economy, that means adding nearly $13 billion per year to the American economy that we currently ship overseas to foreign governments. So, as we talk about potential oil and gas resources in the U.S. as a few million barrels here and a few million barrels there, let's remember that those barrels add up to billions of dollars for the U.S. economy, for U.S. jobs, and for the U.S. Treasury.

EIA's analysis also shows that, while we close our import dependence on natural gas, we will remain dependent on foreign gas to meet our demands. Developing the Atlantic OCS region will help to further shrink that gap, as it is primarily believed to be a gas-rich area rather than an oil-rich area.

Finally, I am concerned that the EIA outlook presented here today projects that we will become dependent on imported biofuels, such as from Brazil, to meet the renewable fuel mandate passed last year. One of the goals of biofuels development was to reduce our dependence on foreign energy. If that mandate will suddenly make us more dependent on foreign energy by simply changing our

dependence from oil to more costly biofuels, then we will need to re-examine this issue much more closely.

Finally, Mr. Chairman, we must remember throughout our focus on the OCS development that this just isn't about drilling or pumping oil and gas. Opening the OCS is about retooling our energy economy to focus on creating American manufacturing jobs, and good-paying jobs at that, and building the infrastructure to harness our domestic energy.

We all agree that America is too dependent on foreign governments for our energy supply. We can and should determine the most responsible way to develop our OCS resources. However, in the end, finding solutions to developing these resources should be our ultimate goal. America is a nation rich in resources. Developing these resources will free us from our dependence on foreign oil.

I look forward to hearing from our witnesses. And I yield back, Mr. Chairman.

[The prepared statement of Mr. Lamborn follows:]

Statement of The Honorable Doug Lamborn, Ranking Mmber, Subcommittee on Energy and Mineral Resources

Mr. Chairman, I want to thank you for calling today's hearing. This hearing will continue our focus on the nation's Outer Continental Shelf (OCS) as well as onshore oil and gas resources. Our witnesses today will share with us the energy outlook for the United States and the world through 2030, based on the best information they have. Their testimony, while helpful, is still only a projection and may or may not be the reality that we will face. No one could have predicted $150 oil last year, or $30 oil today. Such tremendous swings in prices have dramatic impact upon our economy as the current recession has shown.

Economy

Professor James Hamilton from the University of California San Diego (UCSD) has written that "nine out of ten of the U.S. recessions since World War II were preceded by a spike up in oil prices." The President's budget recently proposed massive tax increases on various sources of energy in America starting in 2011. These massive tax hikes coincide with projections by the Energy Information Administration (EIA) of a return to $100 oil. If energy price spikes are what got us into this recession, and 9 out of 10 recessions since World War II, what will happen if we face major tax hikes as we begin to pull ourselves out of this recession? Couldn't that have a similar negative impact?

Resources

This hearing will focus again on what resources may be available in the OCS. The bottom line is that we have companies willing to commit billions of their own dollars to explore these unknown areas, at no cost to the taxpayer.

It was stated at a previous hearing that surveys from the 1970's revealed 3.8 billion barrels of oil and 37 trillion cubic feet of natural gas in the Atlantic Ocean. If Atlantic supply estimates were to expand in the same fashion that Gulf of Mexico resource estimates have expanded since the 1970's, America would have more than 18 billion barrels of oil and 89 trillion cubic feet of natural gas in the Atlantic alone.

Resources off the coast of California are probably some of the most accessible in the world. In many places on the California coast we have areas which could be slant drilled from shore using existing coastal infrastructure. In addition, the resources off the coast of California are fairly well known. They could be developed within just a few years, creating American jobs and reducing our dependence on foreign energy.

Projections

Based on current law, the projections in the EIA outlook show that we will still be importing a tremendous amount of oil in 2030. Reducing our dependence on these imports should be a major focus of this committee. An increase of one million barrels per day of domestic production would reduce our imports by a million barrels a day. In today's economy, that means adding nearly $13 billion per year to the American economy that we currently ship overseas to foreign governments. So as we talk about potential oil and gas resources in the U.S. as a few million barrels

here and a few million barrels there, let us remember that those barrels add up to billions of dollars for the American economy and the U.S. Treasury.

EIA's analysis also shows that while we reduce our import dependence on natural gas from an estimated 54% of total U.S. domestic demand down to 41% of total U.S. domestic demand, we will remain dependent on foreign gas to meet our needs. Developing the Atlantic OCS region will help to further promote U.S. energy self sufficiency, as the Atlantic OCS region is primarily believed to be rich in gas rather than oil.

Finally, I am concerned that the EIA outlook presented today projects that we will become dependent on imported biofuels to meet the renewable fuel mandate passed last year. One of the stated goals of biofuels development was to reduce our dependence on foreign energy. If that mandate will suddenly make us more dependent on foreign energy by simply changing our dependence from oil to more costly biofuels, then we may need to reexamine the issue of biofuels much more closely.

Closing

Finally, Mr. Chairman, we must remember throughout our focus on OCS development that this isn't just about drilling or pumping oil and gas. Opening the OCS is also about retooling our energy economy to focus on creating good-paying American manufacturing jobs and building the infrastructure to harness our domestic energy.

We all agree that America is too dependent on foreign governments for our energy supply. We can and should determine the most responsible way to develop our OCS resources. Finding solutions to developing those resources should be our ultimate goal.

America is a nation rich in energy resources. There's absolutely no question that developing those resources will help free us from our dependence on foreign oil.

I look forward to hearing from our witnesses.

Mr. COSTA. I thank the gentleman from Colorado.

It is the intention of the Chair to recognize the Ranking Member of the Full Committee, the gentleman from Washington State. But before I do, I want to suggest to Members that, following his statement, we will then defer to our witnesses. We are going to make an exception and allow each of the witnesses 10 minutes in their presentation because of the detail and depth of their subject matter and their presentation. And I think we obviously want to get to our witnesses.

I might also add, with votes sometime after 4 o'clock, the Chair will certainly try to ensure that everyone has 5 minutes for comments or questions. And whether or not we are able to achieve a second round will be dependent upon our time.

The gentleman from Washington State, the Ranking Member of the Full Committee, Doc Hastings.

STATEMENT OF THE HON. DOC HASTINGS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WASHINGTON

Mr. HASTINGS. Thank you, Mr. Chairman. And I appreciate the courtesy you have given me to make a statement. And let me just add parenthetically, sometimes 5 minutes is too short. I think this is probably a good idea, to allow the witnesses to go on longer, because there is a lot of information to digest.

Mr. Chairman, I just want to say there are certainly two front-page issues that have a significant impact on our Nation's energy outlook. One is the production of more American-made energy, both offshore and on Federal lands. There is no question that the creation of more energy in our Nation will help create new jobs and make us more secure by lowering our dependence on foreign oil.

The development of our OCS resources is critically important to both our energy future and our economic future. While we are discussing possible future development, later this month the Department of the Interior will conduct a lease sale in what is believed to be one of America's best untapped areas, the 181 South Area of the Gulf of Mexico.

Today, I and a number of my colleagues are sending a letter to Secretary Salazar stressing the importance of moving forward with this critical lease sale. And I say that for this reason: because of the Secretary's recent actions by revoking leases in Utah, reinstituting the moratoria on the OCS by delaying the 5-year plan, and stopping oil shale research in its tracks in the mountain West, to me that shows a clear trend against oil and gas development and job creation.

So my colleagues and I are concerned that, should the Department act to delay the Central Gulf Oil and Gas Lease Sale 208, it will further establish a dangerous trend of blocking new American-made energy and the creation of new American jobs. Additionally, a delay of this sale would throw obstacles in the way of providing Americans oil and gas that the Energy Information Administration says that the Nation will need well past 2030 and also discourage energy companies from pursuing new opportunities in our country.

And the other front-page issue affecting our Nation's energy outlook is the cap-and-trade tax plan—the Chairman alluded to that briefly in his opening remarks, regarding the carbon releasing—but that cap-and-trade plan that was proposed by President Obama in his budget last Thursday.

As a conservative estimate in that budget, this is a $646 billion cost that is being imposed on our economy. And anyone who uses energy—families, schools, factories, farms and so forth—will be affected.

When you boil it right down, what a cap-and-trade tax means is that the Federal Government is going to purposely increase energy prices. In these difficult times, we need to keep a focus on growing our economy, not imposing additional taxes that will drive up the cost of energy for all Americans and potentially further push our economy in the wrong direction.

I know that EIA has extensively examined the impacts of cap-and-trade programs that they will have on our economy, and I look forward to listening and learning from these witnesses and the other witnesses.

So, Mr. Chairman, once again, thank you very much for your consideration. And I yield back my time.

[The prepared statement of Mr. Hastings follows:]

Statement of The Honorable Doc Hastings, Ranking Member, Committee on Natural Resources

I want to thank the Chairman for holding this hearing so we can examine the energy outlook for our nation. There are certainly two front-page issues that have a significant impact on our nation's energy outlook. One is the production of more American-made energy both offshore and on federal lands. There's no question that the creation of more energy in our nation will help create new jobs and make us more secure by lowering our dependence on foreign oil.

The development of our OCS resources is critically important to both our energy future and our economic future. While we are discussing possible future development, later this month the Department of Interior will conduct a lease sale in what

is believed to be one of America's best untapped areas, the 181 South Area of the Gulf of Mexico.

Today, I lead a number of my colleagues in sending a letter to Secretary Salazar stressing the importance of moving forward with this critical lease sale. The Secretary's recent actions: revoking leases in Utah, reinstituting the moratoria on the OCS by delaying the 5-year plan, and stopping oil shale research in its tracks, show a clear trend against oil and gas development and job creation. My colleagues and I are concerned that should the Department act to delay the Central Gulf Oil and Gas Lease Sale 208, it will further establish a dangerous trend of blocking new American-made energy and the creation of new American jobs. Additionally, a delay of this sale would throw obstacles in the way of providing American oil and gas that the Energy Information Administration says the Nation will need well past 2030 and also discourage energy companies from pursuing new opportunities in our country.

And the other front-page issue affecting our nation's energy outlook is the cap-and-trade tax plan proposed by President Obama in his budget from last Thursday. At the conservative estimate included in the budget, this is a 646 billion dollar cost being imposed on our economy and on anyone who uses energy, from families to schools to hospitals to factories to farmers.

When you boil it right down, what a cap-and-trade tax means is that the federal government is going to purposefully increase energy prices.

In these difficult economic times, we need to keep a focus on growing our economy, not imposing tax schemes that will drive up the cost of energy for all Americans and push our economy further in the wrong direction.

I know that EIA has extensively examined the impacts that cap-and-trade programs will have on our economy and I look forward to listening and learning from the Administrator and the other witnesses.

Thank you.

Mr. COSTA. I thank the gentleman from Washington State very much for your comments.

Now we will begin with recognizing our witnesses, who we appreciate very much, first Dr. Fatih Birol.

Did I pronounce that properly? Thank you.

He is the Chief Economist for the International Energy Agency.

And we look forward to your testimony. You probably know the system here. A green light will be on, and that will remain green for 9 minutes and then, at the 9th minute, it will turn yellow. When it turns red, you are in real trouble if you are still speaking. No, you have an easy Chair here; I will cut you a little slack—if I find it interesting.

Please begin.

STATEMENT OF FATIH BIROL, CHIEF ECONOMIST, INTERNATIONAL ENERGY AGENCY

Mr. BIROL. Chairman Costa, members of the Committee, thank you for the opportunity to appear before you today to discuss the views of the International Energy Agency, IEA, on the outlook for global energy markets over the medium and longer term.

By way of background, the IEA is an intergovernmental organization based in Paris which acts as an advisor to 28 member countries, including the United States, in their effort to ensure reliable, affordable, and clean energy for their citizens.

We were founded during the oil crisis of 1973-1974, and our initial role was to coordinate measures in times of oil supply emergencies. However, as energy markets have changed, so has the IEA. Our mandate now incorporates work on climate change policies, market reform, energy technological collaboration, and outreach to the rest of the world, especially major consumers and pro-

ducers of energy, including China, India, Russia, and key OPEC countries.

As you said, Mr. Chairman, last November the IEA released the 2008 edition of its "World Energy Outlook," the WEO 2008. Our report concludes that it is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the twin energy challenges facing us today—twin energy challenges.

The first one of these challenges is securing the supply of reliable and affordable energy, the first challenge; and second, effecting a rapid transformation to a low-carbon, efficient, and environmentally benign system of energy supply.

The current trends point to rising imports of oil and gas into all OECD regions and developing Asia while the growing concentration of production in an ever-smaller number of countries threatens to increase our vulnerability to supply disruptions and sharp price hikes.

On the climate change front, in the absence of stronger policy action, rising consumption of fossil fuels will drive up emissions and atmospheric concentration of greenhouse gases, putting the world on the perfect track for an eventual global temperature increase of up to 6 degrees Celsius, which will have, as we all know, dramatic effects on our planet and on human beings.

Let me turn to oil. Our report provides a more detailed assessment of oil supply prospects than has ever been before released by the IEA. In our reference scenario, the base scenario, in which we assume the government policies do not change, oil demand continues to grow, mainly coming from China, India, and Middle East countries.

And the fundamentals are there. Today in China, 18 persons out of 1,000 persons own a car. And in the United States, 850 persons out of 1,000 persons own a car. In Europe, 680 persons out of 1,000 persons own a car. So, with the increasing income levels in China, India, and other countries, oil demands will grow, and this will put pressure on the demand side.

On the supply side, the bulk of the increase we expect to come from in the future from key OPEC countries. The share of OPEC, which is about 40 percent today, will increase over 50 percent in 2030. And the bad news for the non-OPEC countries is that oil production has peaked in most of the non-OPEC countries and it will peak in most others before long.

Coming back to the United States, in the absence of new policies, we see that the U.S. oil imports will be around 12 million barrels per day in 2030, very similar to what we have today.

These are not the only changes that we see in the future. Perhaps the most crucial change is that there will be a sea change in how the oil industry is being formed. If I may say so, the time of the Big Oil, international oil companies are passé, because the reserves, what they have today are declining, and they have major difficulties in access to new reserves, mainly in the hands of the national oil companies. And we expect the bulk of the growth of the production of oil and gas in the future, if it comes, it will come mainly from the national oil companies under different rules, what

we have seen in the past when the international oil companies were dominating the game.

Based on our field-by-field analysis of the 800 top fields of the world—we analyzed 800 top fields of the world, which make more than three-fourths of the global reserves—we see that the existing fields are declining in the world significantly. And this decline will accelerate in the future, especially in the non-OPEC countries, including Mexico, a key supplier of crude oil to the United States.

Let me give you an example, ladies and gentlemen, of how important it is to understand the issue of declining oil fields. We do not know, as one of the members of the Committee said, how much oil demand will grow exactly in the next years to come. But even if we assume that global oil demand, which is about 85 million barrels per day today, will stay like this in the next 20 years, even then there will be no growth in the global oil demand. In order to compensate the decline in the existing fields, just to compensate the decline, we have to bring four new Saudi Arabias in the next 20 years just to compensate the decline. And I can tell you that this is a major challenge.

Here, I would like to highlight, in addition to this geological challenge, another challenge which is a key one, namely the challenge of investments, especially nowadays. The credit crisis and deepening economic downturn is leading to a scaling back of all types of investment in most countries along the oil supply chain. While demand is also falling with the economic slump, there is a danger that the investment in the coming months and years is reduced too much, leading to a shortage of capacity and another spike in prices several years later when the economy is on the road to recovery, due to the long lead times in completing large upstream and refining projects.

These trends I told you about, the declining security of supply and climate change, are definitely sobering and alarming trends. However, I can tell you that they are not set in stone. Indeed, there is much that can and is being done in many parts of the world to address these twin energy-related threats.

In the past, the IEA has noted that very significant room remains to increase fuel-efficiency standards for trucks and cars in the United States, which would immediately contribute to energy and environmental security. In that respect, we commend the new American Recovery and Reinvestment Act.

We believe consideration could also now be given to taking advantage of the recent slide in the world oil price to review the gasoline and diesel taxes and thereby lock in the efficiency gains that resulted from last year's price surge.

Similarly, I believe efforts to maximize the production of U.S. domestic oil and natural gas resource, including through an expansion of drilling on the Offshore Continental Shelf, could form a crucial part of a comprehensive strategy to enhance the Nation's energy security.

To finish, looking at the global picture, the only possible solution to a long-term sustainable future is to strive for an energy mix that uses all options simultaneously. We need to combine greater energy efficiency improvements with more renewables and more nuclear power. We must seek to minimize our dependence on fossil fuels

while recognizing that they will need to continue to make a significant contribution for meeting our energy needs for several years to come. And I want to emphasize this, Mr. Chairman: It is not realistic to expect low-carbon technologies to replace fossil energies overnight.

Finally, it is also imperative that international collaboration on energy policy is enhanced. Perhaps the best demonstration of this is on the climate change front. Many countries, such as the United States or the European Union, make suggestions to reduce CO_2 emissions 20 percent, 15 percent. However, even if we assume that, as of tomorrow, U.S. emissions—forget the reduction in the emissions, but would go to zero, completely zero, and stay like that for the next 25 years, European emissions will go to zero and stay like that 25 years, Japan and the others, and if China and India would continue with their existing policies, we would be still perfectly in line with a 6-degrees increase in temperature. So there is a need for cooperation in getting China, India, and Russia on the books.

And even if the U.S. were to succeed in lowering its oil imports in the coming years, increasing import dependency in other major consuming regions, mainly in China and India, would still mean that any oil supply disruption anywhere in the world would result in severe knock-on effects for the U.S. market.

Mr. Chairman and members of the Subcommittee, this completes my statement. I would be happy to take any questions you may have. Thank you.

[The prepared statement of Mr. Birol follows:]

Statement of Dr. Fatih Birol, Chief Economist, International Energy Agency

Chairman Costa, members of the committee, thank you for the opportunity to appear before you today to discuss the views of the International Energy Agency (IEA) on the outlook for global energy markets over the medium and longer-term. My name is Fatih Birol and I am the Chief Economist and the Director of the office responsible for the economic analysis of energy policy at the IEA.

By way of background, the IEA is an intergovernmental organisation which acts as an advisor to 28 member countries including the United States in their effort to ensure reliable, affordable and clean energy for their citizens. Founded during the oil crisis of 1973-74, the IEA's initial role was to co-ordinate measures in times of oil supply emergencies. As energy markets have changed, so has the IEA. Its mandate now incorporates work on climate change-policies, market reform, energy-technology collaboration and outreach to the rest of the world, especially major consumers and producers of energy including China, India, Russia and the OPEC countries.

Last November, the IEA released the 2008 edition of its World Energy Outlook (WEO-2008). The report concludes that it is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the twin energy challenges facing us today: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply. Current trends in energy supply and consumption point to rising imports of oil and gas into OECD regions and developing Asia while the growing concentration of production in an ever smaller number of countries threatens to increase our vulnerability to supply disruptions and sharp price hikes. And, in the absence of stronger policy action, rising consumption of fossil energy will drive up inexorably emissions and atmospheric concentrations of greenhouse gases, putting the world on track for an eventual global temperature increase of up to 6°C.

The report provides a more detailed assessment of oil-supply prospects than has ever before been released by the IEA. In a Reference Scenario, in which government policies are assumed to be unchanged, oil demand continues to grow strongly over the medium and longer-term. All of the projected increase is expected to come from non-OECD countries, led by China, India and the Middle East. The bulk of the increase in supply is expected to come from OPEC countries, their collective share ris-

ing from 41% today to 51% in 2030. Production has already peaked in most non-OPEC countries and will peak in most of the others before long. With respect to the United States, in the absence of a change in policy, we expect it to be importing around 12 mb/d of oil by 2030, only slightly down on current levels.

These trends point to a sea change in the structure of the upstream oil and gas industry. The international oil companies, which have traditionally dominated the sector, will be increasingly squeezed by the growing power of the national companies and by dwindling reserves and production in accessible mature basins outside OPEC countries. The challenges confronting the oil sector will be further exacerbated by the prospect of accelerating declines in production at individual oilfields. Based on the WEO-2008's detailed field-by-field analysis of the historical production trends of almost 800 of the world's oilfields—the most comprehensive study of its kind ever made public—we expect decline rates to accelerate significantly. Declines are fastest at oilfields in non-OPEC countries, including Mexico—a key supplier of crude oil to the United States.

Our analysis demonstrates that projections of oil supply are far more sensitive to assumptions about decline rates than to the rate of growth in oil demand. For instance, even if global oil demand was to remain flat until 2030, some 45 mb/d of additional gross capacity—the equivalent of over four times the current capacity of Saudi Arabia—would need to be brought on stream simply to offset declining production at existing fields.

The world's total endowment of oil is large enough to support the projected growth in output. The immediate risk to supply, however, is a lack of investment where it is needed. There remains a real possibility that under-investment will cause an oil-supply crunch in the medium term. More immediately, the credit crisis and deepening economic downturn is leading to a scaling back of all types of investment in most countries along the oil supply chain. While demand is also falling with the economic slump, there is a danger that investment in the coming months and years is reduced too much, leading to a shortage of capacity and another spike in prices several years later when the economy is on the road to recovery, due to the long lead times in completing large upstream and refining projects.

Although the trends that I have outlined are a cause for serious concern, they are not written in stone. Indeed there is much that can and is being done in many parts of the world to address the twin energy-related threats. In the past, the IEA has noted that very significant room remains to increase fuel-efficiency standards for trucks and cars in the United States, which would immediately contribute to energy and environmental security. In this respect, the new American Recovery and Reinvestment Act, with its strong focus on reducing fossil fuel dependence and greenhouse gas emissions by pursuing more aggressive demand-side and clean energy policies, is to be commended. Indeed we believe it makes good sense to exploit the opportunity of the financial and economic crisis to effect a shift in investment to low-carbon technologies. For example, the $95 billion that the IEA estimates the United States must invest each year in the power sector to move onto a pathway consistent with limiting the increase in the average global temperature to 2°C would also create jobs and enhance energy security.

Consideration could also now be given to taking advantage of the recent slide in the world oil price to review gasoline and diesel taxes and thereby "lock-in" the efficiency gains that resulted from last year's price surge. Similarly, I believe efforts to maximize the production of the United State's domestic oil and natural gas resource—including through an expansion of drilling on the Offshore Continental Shelf which is thought to contain significant amounts of recoverable resources—could form a crucial part of a comprehensive strategy to enhance the nation's energy security.

However, at the global level, the only possible solution to a long-term sustainable future is to strive for an energy mix that uses all options simultaneously. We need to combine greater energy efficiency improvements with more renewables and more nuclear. We must seek to minimise our dependence on fossil fuels while recognising that they will need to continue to make a significant contribution to meeting our energy needs for several decades to come: it is not realistic to expect low-carbon technologies to replace fossil energy overnight.

It is also imperative that international collaboration on energy policy is enhanced. Perhaps the best demonstration of this on the climate change front is that even if all OECD Member countries were to immediately reduce their CO_2 emissions to zero, we would still not be on a sustainable path unless non-OECD countries such as China, India and Russia were also to curb their emissions. IEA countries must also work with non-Members to address energy security, because all countries trade oil in an interconnected global market. Even if the United States were to succeed in lowering it oil imports in the coming years, increasing import dependency in

other major consuming regions—notably China and India—would still mean that any oil supply disruption anywhere in the world would result in severe knock-on effects for the U.S. market.

Mr. Chairman, and members of the Subcommittee, this completes my statement. I would be happy to take any questions you may have.

Response to questions submitted for the record by Dr. Fatih Birol

Questions from Chairman Jim Costa, from the State of California

1. Dr. Birol, we hear a lot about the impact, or lack thereof, of additional drilling on oil prices. However, we hear less about the potential impact of drilling on natural gas prices. Does increased drilling in the former moratoria areas of the OCS have the potential to significantly impact natural gas prices, and if so, on what sort of timeframe?

The potential impact on natural gas prices would depend on the quantities of additional gas supply that these areas were able to produce and the supply-demand balance of the market at the time. Offshore exploration and development of both oil and gas resources typically takes several years before production can be marketed, so it is unlikely that there would be a substantial effect felt during the next few years.

2. Dr. Birol, the New York Times reported on March 15 about the steep decline in U.S. drilling activity, caused by the equally steep reduction in oil and natural gas prices since last summer. During last summer's high prices, a common argument was that increasing drilling in the U.S. Outer Continental Shelf and on federal lands out west would result in lower prices for consumers. However, it appears that instead of the amount of drilling being a determining factor on the price of oil and natural gas, in fact the price of oil and natural gas is the determining factor on the amount of drilling activity. In simpler terms: drilling doesn't drive prices, but prices do drive drilling. Are these accurate statements?

Prices are driven by the supply-demand balance of the market. The effect of drilling is to maintain and increase the supply, but the investment needed for drilling is funded (over a period of time) from the sale of oil and gas, hence prices and drilling are linked via the market.

3. Dr. Birol, we would like your thoughts on what our definition and goals should be for energy security, as this Committee works on energy policy this Congress. Sometimes we talk about energy security as meaning freedom from foreign oil. But there are broader ways to think about the term, and the World Energy Outlook puts it very well in the first sentence in the Executive Summary: "Current global trends in energy supply and consumption are patently unsustainable—environmentally, economically, socially." So can I ask you to give us your thoughts on what a "secure" energy future means? Should it be independence from foreign oil, or should it be something more?

I believe the concept of energy security is much broader than just reducing dependence on foreign oil. There are essentially five steps that need to be taken. Firstly, we need to create an investment environment where the private sector is willing and able to do its job of providing secure, affordable, clean energy. Secondly, we need to continue efforts to diversify our fuel mix, including the geographic sources of those fuels. Thirdly, we need to peruse stronger conservation and efficiency policies. Fourthly, we need to improve energy market transparency. And finally, we must ensure that we have appropriate emergency preparedness measures in place.

4. Dr. Birol, one of the issues this Committee has been trying to get a handle on is how much it costs oil and gas companies to do business here in the United States, and if that is significantly cheaper or more expensive elsewhere in the world. The GAO has put out a couple of reports saying that the amount of revenue the government brings in, as a percentage of the total revenue from the oil and gas, is one of the lowest percentages in the world. But on the other hand, some Members of Congress have said that it has to be that way because the costs of finding oil in the United States are so much higher than they are in other countries. Is it significantly more expensive to produce a barrel of oil in the United States, onshore and/or offshore, than it is in other countries?

Excluding fiscal burdens, the cost of production per barrel of oil depends on multiple factors including geology, location (onshore/offshore, water depth, type of ter-

rain, climate, accessibility, etc.), infrastructure, distance to market and others. There is limited data that could be used to provide a truly representative comparison, however overall production cost indices in the U.S. are higher than the worldwide averages.

5. Is there an estimate of the additional cost incurred by production companies as a result of complying with federal regulations?

I am not aware of an independent estimate, but no doubt some production companies have quantified the magnitude of various regulatory expenses.

6. Dr. Birol, USGS has noted in recent assessments that about 60% of the world's known oil shale is in Utah, Wyoming, and Colorado. And the figure "1 trillion barrels" is often used to discuss the amount of the oil shale resource. In addition, the U.S. has significant resources of tar sands, another unconventional resource. lEA stresses the need to undertake a major decarbonization of the world's energy systems; to what extent does it makes sense, relative to other energy options, for the U.S. to be pursuing oil shale beyond Research and Development leases right now?

It does make sense to pursue the development of non-conventional oil resources—including the vast deposits of oil shale in the United States—as they have the potential to make a significant contribution to energy security in the decades ahead. However, it is important to recognise that the production of non-conventional resources leaves a large environmental footprint, including significant carbon dioxide emissions. Therefore we must also support the research and development of technologies such as carbon capture and storage which offer the opportunity to continue using fossil fuels while still decarbonising the world's energy system.

7. Dr. Birol, in the 2009 Annual Energy Outlook, EIA points out that the oil fields in the areas formerly under moratoria are expected to be much smaller than the average undiscovered field size in the Gulf of Mexico. And the 2008 World Energy Outlook states that small fields decline at a much more rapid rate than large fields. So does this mean if we started drilling in frontier areas, companies would have to drill considerably more wells, over wider geographic areas, than they would in the Gulf of Mexico?

Yes. It is likely that more exploration wells would need to be drilled per barrel of oil found and more wells would need to be drilled for a given volume of oil produced. Or, put the other way round, well productivity—barrels produced per well—would be expected to be lower than in the Gulf of Mexico. As you point out, smaller fields tend to decline faster once peak is reached; they also peak sooner and have a higher peak relative to reserves than larger fields.

8. Dr. Birol, the World Energy Outlook says that the role of speculation on oil prices "remains unclear", but that was written last fall, before oil prices completed their spectacular fall to where they are today. Is there a better idea now on what role speculation played in these wild price swings?

It will never be possible to prove one way of another the precise impact of speculation on the historical movements in the price of any commodity. That said, we remain of the view that speculation may well have amplified the effect of market fundamentals in driving prices up but was not the principal cause of the price rise. Data that has become available in recent months provides strong support for the argument that we advanced last year in the World Energy Outlook and in the monthly Oil Market report that tight distillate markets—caused by a lack of refining capacity and exceptionally strong demand—were a major factor behind the surge in prices.

9. Dr. Birol, from an efficiency standpoint, how much sense does a hydrogen economy make? Particularly if you use electricity to create the hydrogen, it appears that the various steps of hydrogen formation, transportation, and recombination creates a number of opportunities for power loss in each of the steps, while direct electricity use just incurs transmission losses. So, energetically, does it make more sense to try to get cars that run on hydrogen, or to focus on plug-in hybrids, or purely electric cars?

Each conversion step has losses, and therefore the typical hydrogen-fuelled vehicle is disadvantaged in this respect to an electricity-fuelled vehicle. However a hydrogen fuelled vehicle could overcome the limited driving ranges of current pure electric vehicles, and would have lower CO_2 emissions than plug-in hybrids which run on pe-

troleum fuels for some part of their driving (assuming the hydrogen was produced using low CO_2 emission sources). Widespread penetration of hydrogen as a fuel has other challenges such as infrastructure and technology development of fuel cells, however some vehicle manufactures are putting much effort into RD&D of hydrogen vehicles.

10. Dr. Birol, the 2008 World Energy Outlook projects considerably higher levels of needed investment than the 2007 World Energy Outlook—over $4 trillion more, which is nearly a 20% increase. Why is that? What changed in that year to indicate that such higher investment levels would be needed?

The cost of bringing on new supply in the energy sector surged in 2007 and 2008, leading to the upward revision of $4.4 trillion for energy sector investment needs to 2030. However, as a consequence of the downturn in the global economy, there are signs that unit costs, including labour, concrete, steel and drilling rig day-rates, are now starting to fall back.

11. Dr. Birol, has your organization modelled the impact of the proposed Alaska Natural Gas Pipeline, if and when it gets built? Is there a sense of the impact that might have on U.S. natural gas supplies or prices?

We have not modelled in detail the impact of the pipeline as such, though our projections assume that a pipeline from Alaska to the lower-48 states is built and commissioned after 2015 and before 2030. We assumed the capacity would be around 4 billion cubic feet per day (roughly 40 billion cubic metres/year). Were such a pipeline to be built, the incremental supplies would certainly have some impact on gas prices, as it would relieve the pressure to either develop indigenous resources in the lower-48 states or import liquefied natural gas. Putting a precise figure on the price impact is very hard, as drilling costs and LNG prices are likely to continue to change over time.

12. Dr. Birol, the World Energy Outlook projects a major contribution from carbon capture and sequestration in order to meet lower carbon targets. The reference case of the outlook only has a minor contribution from CCS, but indicates that stronger policies, such as a carbon cap, would be needed to get significant amounts of CCS by 2030. Are there any other policies that could or should be adopted by the U.S., or other nations, besides a carbon cap, to accelerate the wide scale deployment of CCS? How quickly should we be doing those?

CCS is a technology that is very promising but there remains some uncertainty as to whether it will be viable on a cost-effective basis. While a carbon cap may play a central role in incentivising its deployment, there are research and development issues to be addressed before deployment can ever happen on the scale set out in our Climate Policy Scenarios. Consequently, there is an important role for the U.S. and other major economies to play in investing in CCS pilot projects in order to assess and develop the technology's potential. It is important that development of CCS technologies takes into account the likely future uses for the technologies, in the U.S. but also in key countries such as China and India, and across both power generation and industrial uses. Given the cost involved, a co-ordinated, international approach to CCS research, development and deployment may be most effective.

13. Dr. Birol, the World Energy Outlook projects that $1.1 trillion that would be needed in transmission and distribution investment in North America through 2030. How much of that would be needed specifically in the United States? Is that investment necessary to support additional capacity, or to provide access to new sources of renewable energy, or to replace aging transmission lines, or is it a combination of all of those?

About 80% of this amount (or $900 billion) is what the United States will need to invest in transmission and distribution networks through 2030. This investment is necessary to support additional capacity, to replace aging transmission lines and to integrate renewables. Please note that this is the investment needed in our Reference Scenario, which takes into account current policies only. Our low carbon scenarios show that this investment can in fact be lower because of lower electricity demand (as a result of greater energy efficiency in buildings and in industry), which results in fewer power stations being built. For example, in our 450 ppm Policy Scenario (which assumes stabilisation of greenhouse gas emissions at 450 parts per million in the long run) we estimate that the investment needed in networks is $530 billion.

14. Dr. Birol, in the low carbon projections of the World Energy Outlook, there are significant cost savings to making the necessary investments. For the 550 parts per million scenario, the additional investment in the world is $4.1 trillion, while the fuel savings from those investments and new policies end up saving the world over $7 trillion. Does this mean that instead of being a crushing blow to the world's, or the United States', economy, a carbon cap could actually end up making us money? Are there additional costs that the world, and the United States, would be expected to incur if no action was taken to address climate change?

There are indeed many investments in our Climate Policy Scenarios, which effectively pay for themselves, or generate net savings, as a result of energy efficiency improvements. These include more fuel-efficient vehicles, building insulation and more efficient appliances. Although in most cases, up-front costs will take several years to recover, savings globally in the 550 Policy Scenario do exceed additional investments.

For other investments, particularly in power generation and industry and those needed to achieve the 450 Policy Scenario will incur net financial costs. Certainly, no envisaged carbon cap looks like being a "crushing blow" to either the world's or the United States economy, particularly given the importance and benefit of taking early steps to transform the energy sector. The precise costs and benefits to the economy will ultimately depend on the level of the carbon cap and the effectiveness of policies to underpin it.

15. Dr. Birol, could you provide your thoughts about our ability to harness some of the potential of enhanced geothermal systems? Is enhanced geothermal likely to be feasible in the near future? How long would it take before people could start building EGS power plants?

While this technology has a great potential to provide cheap baseload electricity, I do not expect that it will make a major contribution in the short to medium-term as significantly more R&D is needed to bring costs down and to improve performance. Drilling represents a significant portion of the total cost; the technology could benefit from improvements in drilling in the oil and gas industry.

16. Dr. Birol, in the World Energy Outlook, there is a very comprehensive review of the potential for various ocean renewable energy technologies, including tidal and wave power. However, I don't believe there was anything on ocean thermal energy conversion or deep seawater air conditioning. These are both technologies that might be very useful for tropical islands, such as the U.S. territories that are under the jurisdiction of this committee. Do you have any thoughts about the potential of these technologies?

Ocean thermal energy conversion is a technology with a large potential, but for the longer term. I do not expect any major deployment before 2030, as it is still in its infancy and needs R&D support. Deep seawater air conditioning is already being used, although in just a few locations around the world. It can be a solution for small islands.

17. Dr. Birol, during the hearing, you indicated that there might be some countries that placed some restrictions on where oil and gas companies were allowed to drill offshore, but you were unable to name them at the time. Could you provide the Committee with a list of countries that do not provide complete and unfettered access to the entirety of their extended continental shelves for the purposes of oil and gas leasing, and describe the nature of whatever geographical restrictions or limitations are in place?

The IEA does not maintain a database on geographical restrictions on drilling. In many cases, restrictions exist in order to slow the pace of development of hydrocarbon resources. It is not always clear to what extent the limitations on drilling are the result of concerns about the environmental impact rather than a general goal of limiting the overall pace of development.

Questions from the Ranking Member Doug Lamborn, from the State of Colorado

1. In your own testimony you state that no global warming program can succeed without cooperation of China and India. Do you have any information on the number of coal plants that China and India have built and are planning to build?

Collectively China and India have about twice as many coal plants as the United States. Both countries plan to build many more. Without any additional efforts to

reduce GHG emissions, they could build over a thousand new coal plants by 2030, which is about three times more than the present number of coal plants in the United States. These new plants are expected to use more advanced technology than what they use now. China is already building more efficient (and therefore less polluting) power plants using the same technology as OECD countries and India is catching up. Moreover, both countries are participating in international programs to develop carbon capture and storage.

2. What kind of environmental standards does China impose on coal-fired or other power plants? Would these plants meet U.S. environmental standards for SOX and NOX?

China has introduced legislation to control air pollutants from power plants. The most important piece of legislation was introduced in 2003 and sets emission standards for power plants. Others concern incentives to operate flue gas desulphurisation (FGD), costs of installing and operating FGD, outdated equipment that is not to be used, and a trial scheme that introduces penalties for failing to operate FGD plant. Moreover, China plans to shut down older polluting plants. We expect sulphur emissions in China to rise only modestly in the future as a result of greater efficiency in electricity production and greater use of FGD. In contrast, we expect the absolute level of NOX emissions to continue to rise, although NOX emission per plant will decline.

3. What would happen to American jobs if the U.S. increased domestic energy costs by 100% as a result of restricting carbon emissions while the developing nations continue business as usual with no carbon controls?

There are many possible variations to such a scenario, so we are unable to quantify the employment impact. However, our analysis indicates that the transition to a low-carbon energy sector in the U.S. would be likely to result in a strong positive impact on employment. Such a scenario would operate as a demand stimulus, with positive impacts on a number of sectors—particularly construction, automobiles and high value-added technology.

4. The world leader in car purchases in January of this year was China. What sort of "CAFE" or mileage standards does China have? Does India have something similar to the U.S. CAFE standards? In addition, can you describe the modem pollution control requirements for these countries?

China has enacted fuel economy standards which are based on the weight of the vehicle split into 16 different weight classes. For example, Chinese fuel efficiency standards for passenger vehicles are currently around 30% more efficient than those of the United States. China also has emissions standards based on the EURO standards used in the European Union. India does not currently have mandatory fuel economy standards, however they have mandatory standards for pollutant emissions similar to those adopted in the European Union, which may also have the effect of improving fuel economy. For example EURO II standards were introduced nationwide in India in 2005, they were introduced in Europe in 1995. Also several of the largest cities in India have regulations regarding CNG vehicles due to local pollution concerns.

5. The development of the recent Nano by India's Tata motors means that the developing world intends for every family to have a car. What impact will this have on gasoline prices, green house gas emissions, and climate change going forward?

Increasing mobilisation helps to drive a countries economy and also improve the quality of life for its inhabitants. The introduction of low-price vehicles provides access to motorised mobility to more of the world's inhabitants, but it should be noted that it is increasing incomes in developing countries that also has a large effect on vehicle ownership, and that these low cost vehicles are often small and relatively efficient. The majority of the global oil demand growth in the mid- to long-term will come from the transport sector in developing countries. This demand growth will put upward pressure on oil prices, and we may see oil prices return to their highs of last summer over the mid-term.

6. What impact will a cap and trade system have on the domestic agriculture sector, particularly on those sectors which are heavily dependent on fertilizer? How about the domestic cement industry?

The impacts of a cap and trade system will depend on which sectors are included, which gases are included and how the system is designed, including how it links with international trade and other countries' cap-and-trade systems. Given these variables, it is not possible to go into specifics. However, as a general rule, cap-and-

trade will provide incentives for businesses in high-emitting industries to adopt more efficient, and less polluting, processes and technologies. At the same time, the price mechanism should create greater allocative efficiency, to allow those sectors that most need to pollute (due to a lack of viable alternatives) to continue to do so, while securing emissions reductions from those parts of the economy where it is more cost-effective to achieve them.

Mr. COSTA. Thank you very much, Doctor. You did go over time a little bit, but we found you interesting. So I appreciate that. And I do agree that we obviously have to cooperate and collaborate both at home and abroad.

Which brings us to our next witness, Dr. Howard Gruenspecht, to testify.

Mr. Gruenspecht?

STATEMENT OF HOWARD K. GRUENSPECHT, ACTING ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION

Mr. GRUENSPECHT. Mr. Chairman and members of the Subcommittee, I appreciate the opportunity to appear before you today to discuss the U.S. energy outlook to 2030 and energy resources on Federal onshore and offshore lands, focusing on the role of the Outer Continental Shelf, or OCS.

The Energy Information Administration is the independent statistical and analytical agency within the Department of Energy that produces data projections and analyses to assist policymakers, help markets function efficiently, and inform the public. We do not promote, formulate, or take positions on policy issues, unlike my colleague Mr. Birol, and our views should not be construed as representing those of the Department of Energy or the Administration.

Later this month, EIA will release the complete 2009 edition of our "Annual Energy Outlook." Notably, our reference case projects no growth in U.S. oil consumption, reflecting the combined effect of recently enacted corporate average fuel economy standards and requirements for increased use of renewable fuels, as well as a rebound in oil prices as the world economy recovers. That affects both domestic oil consumption and domestic oil production.

The net import share of total liquid supply, including biofuels, declines from 58 percent in 2007 to about 40 percent between 2025 and 2030. The world's crude oil price is projected again to rise as the global economy rebounds and global demand once again grows more rapidly than liquids production outside of the OPEC area. In 2030, the average real price of crude oil is about $130 a barrel in 2007 dollars, which is actually quite similar to the projection that the International Energy Agency has.

I should say that, unlike the International Energy Agency, we also prepare low- and high-oil-price cases because—and I think they would share this view—we are very uncertain about what oil prices will actually be, as recent history suggests.

Turning to natural gas, EIA has raised its projection for both U.S. production and consumption, reflecting increased availability of gas shale resources and higher demand for natural gas use in electric power generation, due in part to the apparent impact of concerns related to greenhouse gas emissions on power plant investment decisions.

With growing projected production of natural gas from gas shale and other unconventional onshore resources, the OCS and Alaska, the net import share of total natural gas use also declines from 16 percent in 2007, most of which comes from Canada, to less than 3 percent in 2030.

Total consumption of marketed renewable fuels grows by 3.3 percent per year in our reference case. This rapid growth reflects the renewable fuel standard provisions included in the Energy Independence and Security Act of 2007 and strong growth in the use of renewables for electricity generation that is spurred by renewable portfolio standards for electricity generators in many States. I think it is 28 States and the District of Columbia that have those policies.

Resources on Federal lands, both onshore and offshore, are important to U.S. oil and natural gas production. In 2007, roughly 32 percent of U.S. oil production and 29 percent of U.S. natural gas production were from Federal lands. Looking forward, which is always more uncertain, production from Federal lands is projected to reach 47 percent of total production for oil and 36 percent of total production for natural gas by 2030.

The rest of my testimony offers additional detail on current and projected OCS production, which provides a preponderant share of oil from Federal lands and, over time, a growing majority share of natural gas from Federal lands. I will also discuss some of the factors, including access conditions and prices that drive our estimates.

In 2007, the OCS areas produced 1.3 million barrels per day of crude oil, amounting to about 25 percent of total U.S. crude oil production, down from peak OCS production of 1.6 million barrels per day in 2003. Natural gas production in the OCS in 2007 was 2.8 trillion cubic feet, down from a peak of 5.1 trillion cubic feet in 1997. Although OCS production has fallen off in recent years, in the near term we expect OCS production of both oil and natural gas to rise, as new projects begin operation in OCS areas that have long been open.

Consistent with our practice at EIA of reflecting existing laws and regulations, our reference case that I have discussed reflects removal in 2008 of the moratoria for drilling in the Atlantic, Pacific, and parts of the eastern Gulf OCS areas.

Based on the average Minerals Management Service estimates for undiscovered resources and our own information on crude reserves and reserves appreciation, these areas held about 20 percent of the total OCS technically recoverable oil resource, exclusive of past production, as in the beginning of 2007, 18 billion barrels out of a total of more than 93 billion barrels.

For natural gas, the corresponding estimate of unproduced but technically recoverable OCS resources at the beginning of 2007 is 456 trillion cubic feet. Roughly 76 trillion cubic feet is estimated to be in areas under moratoria prior to 2008.

Assumptions about exploration, development, and production of fields such as growing schedules, costs, the type of platform you select, reserves-to-production ratios in the Pacific, Atlantic and eastern Gulf of Mexico, in the EIA's work are generally based on data for fields in the central gulf that are of similar water depth and

size. In addition, when we did our work, we assume that local infrastructure issues and other potential non-Federal impediments are resolved. Lack of resolution of those issues would, of course, affect our projections.

By 2030, total lower-48 offshore crude oil production, including very small amounts in State waters, is projected to nearly double from the current level to nearly 2.7 million barrels per day, while lower-48 offshore natural gas production is projected to rise by nearly two-thirds, to 4.9 trillion cubic feet a year.

Production from OCS leases in the Pacific begins in the next decade, with total crude oil production reaching nearly 500,000 barrels per day in 2030. And some of the opening statements have already referred to the oil-prone nature of the Pacific resource. Crude oil production from the Atlantic region begins somewhat later, reaching 200,000 barrels per day by 2030.

As part of this year's long-term outlook, which again will be released later this month, EIA also prepared a restored moratoria sensitivity case. OCS crude production in 2030, in that case, is about 565,000 barrels per day less than in the reference case. And cumulative domestic production of crude oil from all U.S. Federal and non-Federal sources between 2010 and 2030 is 4.2 percent lower than in the reference case.

Estimates of production from the OCS areas previously under moratoria are higher than in EIA's previous analysis that was presented in our 2007 energy outlook, primarily because the 2009 outlook has significantly higher oil and natural gas prices. Also, in this year's outlook, the assumed initial flow rates in the Pacific OCS fields in shallow waters were adjusted to better reflect the production potential from these oil-prone fields compared to the more natural-gas-prone fields in the central Gulf of Mexico that were used as the basis of earlier estimates.

Restoration of the previous OCS moratoria also affects the supply of natural gas but to a lesser extent. With the restored moratoria, production lower-48 offshore is 800 billion cubic feet lower in 2030 than it is in the reference case, but the resulting higher natural gas prices increase the projection for onshore natural gas production by 200 billion cubic feet in 2030. Overall, the difference, the cumulative natural gas production between 2010 and 2030, including both Federal and non-Federal, is about 1.3 percent lower in the moratoria-restored case than in the reference case.

Again, prices, as well as access, affect the reproduction from the OCS. In the oil price case—where oil prices remain about $50 in real terms, close to where it is today—projected OCS crude production under full access is 2.1 million barrels per day, slightly below the projected production under reference case prices in the restored moratoria case. So, again, access matters, but prices also matter. That is an important point.

In sum, the OCS is expected to remain a substantial contributor to domestic crude oil and natural gas supply under a range of access and price assumptions.

That concludes my statement, Mr. Chairman. I would be happy to answer any questions you or the other Members may have.

[The prepared statement of Mr. Gruenspecht follows:]

Statement of Dr. Howard Gruenspecht, Acting Administrator, Energy Information Administration

Mr. Chairman and Members of the Committee, I appreciate the opportunity to appear before you today to discuss the U.S. energy outlook to 2030, focusing on the role of the Outer Continental Shelf (OCS) in current and projected energy production.

The Energy Information Administration (EIA) is the independent statistical and analytical agency within the Department of Energy that produces objective, timely, and relevant data, projections, and analyses to assist policymakers, help markets function efficiently, and inform the public. We do not promote, formulate, or take positions on policy issues, and our views should not be construed as representing those of the Department of Energy or the Administration.

The Energy Outlook: The Big Picture

The full Annual Energy Outlook 2009 (AEO2009), which will be issued later this month, includes over 35 cases. The reference case and other AEO2009 cases provide the results discussed in this testimony.

Liquid Fuels Consumption and Import Dependence. For the first time in more than 20 years, the AEO2009 reference case projects no growth in U.S. oil consumption, reflecting the combined effect of recently enacted Corporate Average Fuel Economy standards, requirements for increased use of renewable fuels, and an assumed rebound in oil prices as the world economy recovers. With overall liquid fuel demand in the AEO2009 reference case growing by only 1 million barrels per day between 2007 and 2030, plus increased use of domestically-produced biofuels and rising domestic oil production spurred by higher prices, the net import share of total liquids supplied, including biofuels, declines from 58 percent in 2007 to less than 40 percent in 2025 before increasing to 41 percent in 2030.

Natural Gas Consumption and Import Dependence. The reference case raises EIA's projection for U.S. production and consumption of natural gas compared to the previous Annual Energy Outlook (AEO), reflecting increased availability of resources and higher demand for electric power generation, due in part to the apparent impact of concerns related to greenhouse gas emissions on power plant investment decisions. With growing production of natural gas from unconventional onshore sources, the OCS, and Alaska, the net import share of total natural gas use also declines, from 16 percent in 2007 to less than 3 percent in 2030.

Total Primary Energy Use and Energy-Related Carbon Dioxide Emissions. Recently-enacted efficiency regulations and higher energy prices in the AEO2009 reference case, compared to the last AEO, slow the rise in U.S. energy use, which is projected to grow from 101.9 quadrillion Btu in 2007 to 113.6 quadrillion Btu in 2030. When combined with the increased use of renewables and a reduction in projected additions of new coal-fired conventional power plants, this slows the growth in energy-related greenhouse gas emissions. Energy-related carbon dioxide emissions grow at 0.3 percent per year from 2007 to 2030 in the AEO2009 reference case, reaching a level of 6,414 million metric tons in 2030, compared with 6,851 million metric tons in the Annual Energy Outlook 2008 reference case.

Oil Prices. The assumption of a higher world oil price path in the AEO2009 reference case reflects tighter constraints on access to low-cost oil supplies in a setting where the forces driving growth in long-term demand in countries outside of the Organization for Economic Cooperation and Development remain as strong as previously expected. The world crude oil price is projected to rise as the global economy rebounds and global demand once again grows more rapidly than non-Organization of Petroleum Exporting Countries liquids supply. In 2030, the average real price of crude oil is $130 per barrel in 2007 dollars ($189 per barrel in nominal dollars).

Renewable Energy Use. Total consumption of marketed renewable fuels—including wood, municipal waste, and biomass in the end-use sectors; hydroelectricity, geothermal, municipal waste, biomass, solar, and wind for electric power generation; ethanol for gasoline blending; and biomass-based diesel—grows by 3.3 percent per year in the AEO2009 reference case. This rapid growth reflects the renewable fuel standard provisions included in the Energy Independence and Security Act of 2007 and strong growth in the use of renewables for electricity generation that is spurred by renewable portfolio standards for electricity generators in many States.

As requested by the Committee, the remainder of my testimony focuses more specifically on projections for oil and natural gas production from onshore and offshore resources, the factors that drive the projections, and sensitivity analyses under alternative access and price assumptions.

Federal Offshore and Onshore Resources in Context

Resources on Federal lands, both offshore and onshore, are important to U.S. energy production. Table 1 places onshore and offshore oil and natural gas production for 2007 in the context of total U.S. production and consumption. In 2007, roughly 32 percent of U.S. oil production and 29 percent of domestic natural gas production were from Federal lands.

Table 1. Oil and Natural Gas Production from Federal Lands in Perspective, 2007

	Petroleum (million barrels)	Natural Gas (trillion cubic feet)
Production from Federal Lands	596	5.6
Onshore	105	2.8
Offshore	491	2.8
Other U.S. Production	1,253	13.5
Total U.S. Production	1,849	19.1
Total U.S. Consumption	7,548	23.0

Source: **Federal Onshore Production**: Minerals Management Service, Minerals Revenue Management, MRM WebStats, Federal Onshore Reported Royalty Revenues; **Total U.S. and Federal Offshore Oil Production and Total U.S. Petroleum Products Consumption**: Energy Information Administration (EIA), *Petroleum Supply Annual 2007*, DOE/EIA-0340(2007) (July 2008); **Total U.S. and Federal Offshore Natural Gas Production**: EIA, *Natural Gas Annual 2007*, DOE/EIA-0131(2007) (January 2009); **U.S. Natural Gas Consumption**: EIA, *Annual Energy Review 2007*, DOE/EIA-0384(2007) (June 2008).

Looking forward, production from Federal lands is expected to play an increasingly important role in total U.S. oil and natural gas production. Through 2030 the share of production from Federal lands is projected to increase to 47 percent for oil and 36 percent for natural gas (Table 2).

Table 2. Projected Oil and Natural Gas Production on Federal Lands Compared to Projected U.S. Total Production

Year	Crude Oil (million barrels)			Natural Gas (trillion cubic feet)		
	Offshore Federal	Onshore[a] Federal	Total U.S.	Offshore Federal	Onshore[a] Federal	Total U.S
2008	468	116	1,808	2.9	3.0	20.5
2010	714	118	2,051	3.0	3.0	20.4
2025	953	228	2,633	4.9	3.5	23.2
2030	986	276	2,690	4.7	3.8	23.6

[a] Federal onshore production is not explicitly represented in the National Energy Modeling System. The volumes are estimated based on historical trends and the projected regional production from the reference case of the *Annual Energy Outlook 2009*.

Source: Energy Information Administration, *Annual Energy Outlook 2009*, DOE/EIA-0383(2009).

OCS Production: Historical Data and Near-Term Forecast

OCS areas in the Western and Central portions of the Gulf of Mexico (GOM) are an important source of oil and natural gas production. In 2007, the GOM OCS areas, which have been producing substantial volumes of oil since the 1970s, produced 1.3 million barrels per day, amounting to about 25 percent of total U.S. crude oil production and down from peak OCS production of 1.6 million barrels per day in 2003. There are small amounts (less than 70 thousand barrels per day) of additional production from the Pacific OCS. Dry natural gas production in the GOM OCS in 2007 was 2.8 trillion cubic feet, down from peak production of 5.1 trillion cubic feet in 1997.

In the near term, OCS production is expected to rise as projects already under development come into operation. By 2012, projected GOM OCS oil production is 2.1 million barrels per day of oil and 3.4 trillion cubic feet of natural gas. As discussed below, forward-looking OCS production estimates to 2015 and later years, beyond the commissioning of projects already under development, are necessarily less certain since they are sensitive to the actual resource available, future prices, and future access to resources. However, using information from the Department of Interior's Minerals Management Service (MMS) regarding undiscovered technically recoverable resources, EIA data and MMS estimates regarding known reserves

(proved reserves and projected reserve appreciation in known deposits), and assumptions regarding access policies, EIA develops projections of offshore oil and natural gas production through 2030.

Consistent with the AEO practice of reflecting existing laws and regulations, the AEO2009 reference case reflects the removal in 2008 of the moratoria for drilling in the Atlantic, Pacific, and parts of the Eastern GOM OCS areas. Timing issues constrain the impacts of increased access in the near term. The MMS began the process of developing a leasing program that includes selected tracts from these areas after the moratoria were removed, with a timeline calling for the first leases to be offered in 2010. Once offered, leases must be bid on and awarded, and the wining bidders must develop and get approved exploration and development plans before any wells can be drilled. Thus, even if leasing were to begin next year, conversion of these newly-available resources to production would require some time. The AEO2009 reference case assumes that the Pacific and Atlantic OCS regions are open for leasing starting in 2010 and that leasing begins in the Eastern GOM in 2022.

Based on the mean (50-percent probability) MMS estimate of undiscovered technically recoverable resources and estimates of known reserves and resources, the OCS areas that were until recently under moratoria in the Atlantic, Pacific, and Eastern GOM are estimated to hold about 20 percent of the total OCS technically recoverable oil resource (TROR)—18 billion barrels out of a total of more than 93 billion barrels, exclusive of past production as of January 1, 2007. The estimates of TROR in the GOM OCS areas open to leasing prior to 2008 and the Alaska OCS are 47 billion barrels and 27 billion barrels, respectively. According to MMS estimates, there is only a 5-percent chance that OCS areas formerly under moratoria have more than 27 billion barrels of TROR.

Based on the MMS mean estimate of undiscovered technically recoverable natural gas resources and estimates of known reserves and resources, total technically recoverable natural gas resources in the OCS are estimated at 456 trillion cubic feet as of January 1, 2007. Roughly 76 trillion cubic feet (or 17 percent) are estimated to be in areas formerly under moratoria in the Atlantic, Pacific and Eastern GOM—nearly half or 37 trillion cubic feet in the Atlantic, 18 trillion cubic feet in the Pacific, and 21 trillion cubic feet in the Eastern GOM.

Assumptions about exploration, development, and production of economical fields, such as drilling schedules, costs, platform selection, reserves-to-production ratios, etc., in the Pacific, Atlantic, and Eastern GOM are generally based on data for fields in the Central GOM that are of similar water depth and size. In addition, it is assumed that local infrastructure issues and other potential non-Federal impediments are resolved. Lack of resolution of these issues would, of course, affect the projections.

Lower-48 offshore crude oil production is projected to increase from 1.4 million barrels per day in 2007 to 2.7 million barrels per day in 2030. Production from new OCS leases in the Pacific is projected to begin in 2015, with total Pacific production reaching nearly 0.5 million barrels per day in 2030. Crude oil production from the Atlantic region is projected to begin in 2019, reaching 0.2 million barrels per day by 2030. Crude oil production in all areas of the GOM rises from 1.3 million barrels per day to 2.1 million barrels per day between 2007 and 2030.

Estimates of production from the OCS areas previously under moratoria are higher than in a previous analysis presented in the Annual Energy Outlook 2007 primarily because the AEO2009 has significantly higher oil and natural gas prices and because the assumed initial flow rate of Pacific OCS fields in shallow waters was adjusted to better reflect the production potential from these oil-prone fields compared to more natural-gas-prone fields in similar water depth and size in the Central GOM.

Lower-48 offshore natural gas production is projected to increase from 3.0 trillion cubic feet in 2007 to 4.9 trillion cubic feet in 2030. By 2030, Pacific natural gas production is projected to reach nearly 0.3 trillion cubic feet and production from the Atlantic region is projected to reach 0.5 trillion cubic feet.

EIA's OCS Estimates: Discussion and Comparison with Historical Experience

One way to gain perspective on EIA's estimates of production in OCS areas formerly under moratoria is to consider how the relationship between projected production and MMS indicators of resource levels and characteristics in those areas compares to that for the GOM OCS area that was open prior to 2008.

TROR Comparisons. Oil reserves in the GOM OCS area open before 2008, which has already been leased and developed extensively, are about 4 billion barrels, with an additional 9 billion barrels of expected reserve appreciation in discovered fields.

Adding the estimate of 34 billion barrels of undiscovered TROR, the mean estimate of total TROR in the GOM area open before 2008 is 47 billion barrels, which is more than 2.5 times the MMS mean estimate of 18 billion barrels of TROR in OCS areas formerly under moratoria.

Average Field Size Comparisons. Field size matters because larger fields are more attractive development targets than smaller ones. The average size across all existing GOM OCS oil and natural gas fields is 43 million barrels of oil equivalent. MMS has also developed field size distributions for undiscovered OCS fields that it used to prepare reports mandated under the Energy Policy Act of 2005. The MMS estimate of the average undiscovered field size in GOM OCS areas open to drilling prior to 2008 is 59 million barrels of oil equivalent, which is significantly greater than the average field size of 15 million barrels of oil equivalent for OCS areas formerly under moratoria.

Other Project Development Factors. Project development time frames and expected returns vary substantially across offshore projects depending upon such factors as: 1) size of the field; 2) relative proportion of oil, natural gas, and condensates in the field; 3) reservoir and oil characteristics,;4) water depth; 5) distance to nearest oil and/or natural gas pipelines; 6) whether there are other nearby fields to share in the expense of building new pipelines; and 7) the type of production system chosen for field development, e.g., anchored platform, tension-leg platform, tethered spar, or floating production storage, and offloading ship.

To the extent that information is available, the indicators of resource levels and characteristics for the OCS areas previously under moratoria are generally inferior to those for the GOM OCS open prior to 2008, as discussed above. This is reflected in EIA's view that, through 2030, access to the OCS areas formerly under moratoria adds only a fraction of the daily production volume provided by the GOM OCS area open prior to 2008.

EIA recognizes that all forward-looking production estimates are inherently uncertain. Some factors that could lead to higher daily production estimates for the OCS areas formerly under moratoria include the use of the 5-percent, or 1-in-20, probability estimate of TROR and the assumption of a more favorable field size distribution than that used by MMS in its recently published reports. Consideration of any long-term constraints on rig availability that reflect the prioritization of alternative offshore projects or the possibility that non-Federal impediments to production would persist over time could result in lower daily production estimates.

AEO2009 Access Sensitivity Case

As part of the AEO2009, EIA prepared a restored moratoria sensitivity case. U.S. OCS crude oil production in 2030 is projected to be 565,000 barrels per day lower in the restored moratoria case than in the reference case—2.2 million barrels per day compared to 2.7 million barrels per day. Cumulative domestic production of crude oil from both onshore and offshore sources between 2010 and 2030 in the restored moratoria case is projected to be 2.1 billion barrels, or 4.2 percent, lower than in the AEO2009 reference case.

As with oil, access to OCS resources affects the domestic supply of natural gas. However, because the volume of technically recoverable natural gas in the OCS areas previously under moratoria accounts for less than 5 percent of the total U.S. technically recoverable natural gas resource base, the volume impacts are smaller relative to the baseline supply level. Cumulatively, domestic natural gas production from both onshore and offshore sources between 2010 through 2030 is projected to be 1.3 percent lower in the restored moratoria case than in the AEO2009 reference case. Natural gas production from the Lower-48 offshore in 2030 is projected to be 4.1 trillion cubic feet in the restored moratoria case compared to 4.9 trillion cubic feet in the AEO2009 reference case. In contrast to the situation in oil, the reduction in offshore supply of natural gas in the restored moratoria case is partially offset by an increase in onshore production. Reduced OCS access in the restored moratoria case results in higher natural gas prices, which increase the projection for U.S. onshore gas production by 0.2 trillion cubic feet in 2030 compared to the level in the reference case.

AEO2009 Low Price Sensitivity Case

The impact of access to OCS resources on domestic production is lessened in the low price case, where oil prices are assumed to remain near $50 per barrel (2007 dollars) through 2030, rather than rising to $110 per barrel by 2015 and $130 per barrel (2007 dollars) by 2030 as assumed in the reference case. In 2030, total OCS crude oil production is projected to be 440,000 barrels per day higher in the low world oil price case than in the low oil price case with the OCS moratoria reinstated—2.1 million barrels per day compared with 1.7 million barrels per day. The

observation that U.S. OCS production in 2030 under reference case prices with full restoration of the OCS moratoria, at 2.2 million barrels per day, is projected to be higher than U.S. OCS production in the low price case with no moratoria underlines the importance of prices as a determinant of future production.

The OCS is expected to remain a major contributor to domestic crude oil and natural gas supply under a variety of price and access assumptions. Although a significant volume of undiscovered technically recoverable oil and natural gas resources has been added with access to the Pacific, Atlantic, and parts of the Eastern GOM OCS, there is a great deal of uncertainty surrounding the resource estimates as well as the timing and cost to explore and develop these resources.

This concludes my statement, Mr. Chairman. I will be happy to answer any questions you and the other Members may have.

Response to questions submitted for the record by Dr. Howard K. Gruenspecht

QUESTIONS FROM CHAIRMAN COSTA

Q1 Dr. Gruenspecht, we hear a lot about the impact, or lack thereof, of additional drilling on oil prices. However, we hear less about the potential impact of drilling on natural gas prices. Does increased drilling in the former moratoria areas of the OCS have the potential to significantly impact natural gas prices, and if so, on what sort of timeframe?

A1 Increased drilling in the former moratoria areas of the OCS is not expected to significantly impact natural gas prices between now and 2030. As part of the Annual Energy Outlook 2009 (AEO2009), the Energy Information Administration prepared a restored moratoria sensitivity case. Because the volume of technically recoverable natural gas in the OCS areas previously under moratoria accounts for less than 5 percent of the total U.S. technically recoverable natural gas resource base, results show that access does not significantly impact natural gas production or price levels.

Cumulatively, domestic natural gas production from both onshore and offshore sources between 2010 and 2030 is projected to be 1.3 percent lower in the restored moratoria case than in the AEO2009 reference case. Total U.S. production of dry natural gas is 210 billion cubic feet less in 2020 and 600 billion cubic feet less in 2030 in the restored moratoria case than projected in the reference case. The reduction in offshore supply of natural gas in the restored moratoria case is partially offset by an increase in onshore production of 170 billion cubic feet and a decrease in consumption of 360 billion cubic feet in 2030 compared to the levels in the reference case. The average U.S. wellhead price of natural gas in 2030 (per thousand cubic feet, in 2007 dollars) is 8 cents higher in 2020 and 21 cents higher in 2030 in the restored moratoria case, representing price increases of 1 percent and 3 percent, respectively. The increased onshore production and decreased consumption result from higher natural gas prices, which are seen mainly in the later years of the projection.

Q2 Dr. Gruenspecht, the New York Times reported on March 15th about the steep decline in U.S. drilling activity, caused by the equally steep reduction in oil and natural gas prices since last summer. During last summer's high prices, a common argument was that increased drilling in the U.S. Outer Continental Shelf and on federal lands out west would result in lower prices for consumers. However, it appears that instead of the amount of drilling being a determining factor on the price of oil and natural gas, in fact the price of oil and natural gas is the determining factor on the amount of drilling activity. In simpler terms: drilling doesn't drive prices, but prices do drive drilling. Are these accurate statements?

A2 Prices definitely drive drilling, but drilling can also drive prices. The processes involved in the formation of prices and the collective decisions to drill are interrelated and complex.

Prices respond not only to actual supplies made available by drilling, but to expectations of supplies that will or even that can be brought to market. In that sense, the first potential effect on crude oil prices of changing expectations about access to supply from the U.S. Outer Continental Shelf and on Federal lands would be a signal to raise expectations of global supply in the future. While the exact response of the market would be difficult to predict, an increase in expected future global supply availability could be expected to result in somewhat lower prices.

On the other hand, the drilling response to price declines in oil and natural gas we are seeing now is part of a business cycle that has occurred several times in the

past few decades. Lower price expectations make investments more difficult to justify on their own merits, thus leading to the cancellation of less profitable drilling prospects. In addition, when crude oil and natural gas prices fall, companies' cash flows decline. We are seeing a slowing of some capital projects in exploration and production as well as in other areas, including refinery investments.

A notable result of the drilling response to price is that by eliminating more marginal investment opportunities, the efficiency of the market increases. As a result, though drilling is dropping steeply, new production is falling less quickly. In effect, the best prospects are getting drilled and the less attractive are not. The same goes for the drilling equipment and crews. As the number of rigs running drops, only the most effective and efficient continue to work. Also, the base of production from already-drilled wells is large compared to the total. As a result, the drop in drilling does imply a proportional drop in production. Longer-term effects could be significant if the capacity of the industry to respond to stronger price signals in the future is reduced. This lagged market/investment response is what drives some of the price cycles in the oil and natural gas supply.

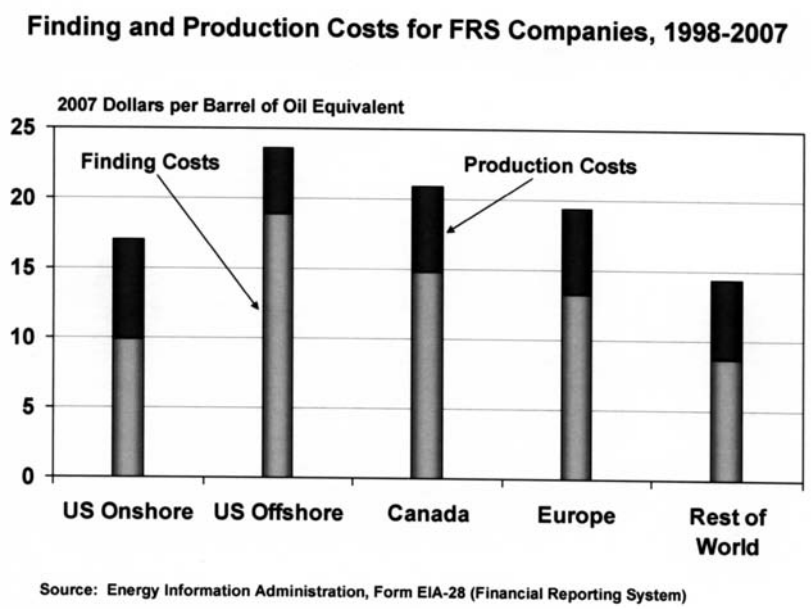
Q4 Dr. Gruenspecht, one of the issues this Committee has been trying to get a handle on is how much it costs oil and gas companies to do business here in the United States, and if that is significantly cheaper or more expensive elsewhere in the world. The GAO has put out a couple of reports saying that the amount of revenue the government brings in, as a percentage of the total revenue from the oil and gas, is one of the lowest percentages in the world. But on the other hand, some Members of Congress have said that it has to be that way because the costs of finding oil in the United States are so much higher than they are in other countries. Is it significantly more expensive to produce a barrel of oil in the United States, onshore and/or offshore, than it is in other countries? Is there an estimate of the additional costs incurred by production companies as a result of complying with federal regulations?

A4 The costs of finding and producing oil and natural gas vary considerably across world regions and can be quite volatile, but they tend to be higher in more mature producing areas such as the United States. The combined cost of finding and producing oil and natural gas also tends to be greater in the U.S. offshore areas than in the U.S. onshore. Costs have risen sharply and have been more volatile in recent years because of substantial increases in expenditures for property acquisition, exploration, and development of oil and natural gas resources. We do not have an estimate of the additional costs incurred by production companies as a result of complying with Federal regulations.

EIA collects data on the costs of finding and producing oil and natural gas in its Financial Reporting System (FRS) survey. EIA publishes finding costs (which include the costs of unproved property acquisition, exploration, and development of the oil and natural gas) and production costs (which include the costs of extracting or lifting the oil and natural gas). Finding costs are usually larger than production costs and tend to be more volatile.

The finding cost calculation is a ratio of expenditures for exploration and development to proved reserves found. The difference in timing between the expenditure of funds and the booking of proved reserves is one important reason for the volatility in finding costs. This is especially evident when changes occur rapidly, as has been the case in recent years. The large and rapid increase in oil prices since 2002 resulted in large increases in expenditures for exploration and development. Proved reserves have not increased to the same extent as yet, resulting in higher finding costs. Increased acquisition activity, which results in unusually large acquisition expenditures in the year the acquisition takes place, also causes volatility in finding costs.

One way to smooth this volatility is to average the data over several years. The figure below shows the costs of finding and producing oil and natural gas in the U.S. onshore and U.S. offshore regions and three international regions over the ten-year period from 1998 to 2007. Canada and Europe are more mature producing areas like the United States. Their combined finding and production costs were higher than the U.S. onshore but lower than the U.S. offshore. The "Rest of World" region, an average of the other regions of the world, had the lowest total finding-plus-production costs.



Q5 Dr. Gruenspecht, there were a lot of energy provisions in the recent stimulus bill (H.R. 1) that Congress passed and the President signed—this was a major commitment to developing new, cleaner forms of energy. Has EIA analyzed the bill and determined if it will have any effect on your short- or long-term projections? If there has not been a formal EIA analysis, are there any general expectations that EIA would have about some of the energy-related provisions in that legislation?

A5 EIA has prepared an updated Annual Energy Outlook 2009 reference case reflecting provisions of the American Recovery and Reinvestment Act (HR.1) and recent changes in the economic outlook. A copy of the paper, which is also available on EIA's website, is attached.

Q6a Dr. Gruenspecht, has EIA looked at the potential of federal lands to provide renewable energy?

A6a In 2001, EIA prepared maps showing Federal lands and total lands (lower-48 States) with renewable resources with high potential for generating electric energy. EIA has used the information in its analysis and forecasting products. The maps are based on resource data prepared by the National Renewable Energy Laboratory (NREL), the Pacific Northwest National Laboratory, and Southern Methodist University, collated with Geographic Information Systems (GIS) analysis by EIA. More recent data are now available from NREL, which could alter the assessment. Five renewable resources were mapped: wind, biomass, geothermal, concentrated solar power, and photovoltaic solar energy. The data showed that Federal lands contain almost half of the national endowment for geothermal resources (46 percent). In contrast, Federal lands contain only 38 percent of concentrating solar, 29 percent of wind, 27 percent of solar photovoltaic, and 13 percent of biomass resources.

Q7 Dr. Gruenspecht, in the Annual Energy Outlook reference case in 2008, EIA projected that carbon dioxide emissions from energy would grow at an average annual rate of 0.9 percent. In the 2009 Outlook, EIA projects that energy related CO_2 emissions grow by 0.3 percent per year. What are some of the reasons for that change, and do those reasons give us any direction as to how we could lower that even more?

A7 The projected slowdown in the growth in U.S. energy-related carbon dioxide emissions that occurred between the 2008 and 2009 versions of the AEO was driven by numerous factors including: higher energy prices that reduced growth in energy consumption, the growing use of renewable fuels in the transportation and elec-

tricity sectors, and growing concerns about greenhouse gas emissions that dampen the projected additions of new coal power plants.

For example, in the AEO2008 reference case, world oil prices were projected to rise to $72 per barrel (2006 dollars) in 2030 while in the AEO2009 reference case they are expected to rise to $130 per barrel (2007 dollars), more in line with the high price projections from the AEO2008. This change was driven by the belief that oil demand in developing countries would continue to grow rapidly while oil-rich countries would seek to control access to their low-cost resources and develop them more slowly than anticipated in the AEO2008. These higher oil prices lead to reduced transportation energy use and lower carbon dioxide emissions as consumers drive less and purchase more fuel efficient cars.

Carbon dioxide emission projections are also lower because of the expected reduced dependence on new coal plants. In the AEO2008 reference case, over 100,000 megawatts of new coal capacity was projected to be added to meet the growing demand for electricity, while in the AEO2009 reference case this projection was reduced by more than half because growing concerns about greenhouse gas emissions have dampened the interest of developers, regulators and the financial community in new coal plants. Over the past few years, as oil and natural gas prices rose, a large number of new coal plant projects were announced. However, while some new coal plants are under construction, many of the projects that had been announced have already been cancelled. This led to a reassessment of potential new coal plant additions in the AEO2009 and increased dependence on new natural gas and renewable plants.

Q8 Dr. Gruenspecht, the 2009 Annual Energy Outlook points out that oil imports are projected to fall, apparently by quite a bit, by 2025. This appears to be the result of increased production, some of which is on the OCS, and decreased consumption, partially through new car fuel economy standards. Which one of those has a bigger impact on the drop in imports: increased production from the OCS or increases in fuel economy standards?

A8 The new car fuel economy standards account for the larger portion of the impact on oil import reduction. Depending on the method used to calculate the energy savings from the new Corporate Average Fuel Economy (CAFE) standard, between 72 percent and 81 percent of the reduction in oil imports would be due to the new CAFE standard.

The U.S. offshore is estimated to contain substantial resources of both crude oil and natural gas, but there are uncertainties regarding potential leasing and development of the Outer Continental Shelf (OCS). Assuming that leasing goes forward as previously leasing programs have, conversion of available OCS resources will require considerable time and financial resources to develop. The Annual Energy Outlook 2009 (AEO2009) reference case projects that significant increases in OCS production occur after 2020. By 2030, EIA projects that lifting the ban on OCS drilling will increase domestic crude oil production by 8 percent (0.5 million barrels per day) and will increase domestic natural gas production by 3 percent (0.6 trillion cubic feet per year).

An evaluation of the energy impacts with and without the new CAFE standards was not included as part of the AEO2009. However, the AEO2008 did examine the energy impacts with and without the 35-mpg CAFE standard required under EISA. Although the AEO2008 estimates might not be directly comparable to a similar analysis using the AEO2009, they provide a reasonable expectation of the impacts of the new CAFE.

In the AEO2008 Early Release reference case (December 2007), which did not include the new CAFE standard in EISA, light-duty vehicle average fuel efficiency was projected to be 30.0 miles per gallon, significantly above the floor of approximately 26.4 miles per gallon set by the pre-EISA CAFE standard. Consumer behavior coupled with technology improvements resulted in vehicle owners choosing more efficient vehicles than those required by the CAFE standard of the time. In the full AEO2008 reference case (June 2008), which included the new CAFE standard, consumers do not purchase vehicles significantly more fuel efficient than the new CAFE standard of 35 miles per gallon.

With the new CAFE standard, light-duty vehicle consumption is 1.2 to 1.4 million gasoline-equivalent barrels per day (12.1 to 12.9 percent) less than in the case with the previous CAFE standard. Measured against a case where vehicle efficiency does not improve above the floor set by the previous CAFE standard (a frozen-efficiency case) the new CAFE standard reduces light-duty vehicle gasoline-equivalent barrels per day by between 2.1 and 2.2 million barrels per day (17.9 to 18.2 percent).

As a result, depending on the method used to calculate the energy savings from the new CAFE standard, a low estimate of the reduction of oil imports would be between 1.7 and 1.9 million barrels per day, with new CAFE standards accounting for approximately 72 percent of the reduction. A high estimate of the reduction in oil import would be between 2.6 and 2.7 million barrels per day, with CAFE standards accounting for approximately 81 percent of the projected reduction.

Q9 Dr. Gruenspecht, in your testimony you mention that there are local infrastructure issues regarding production from the former moratorium areas, and that your projections assume they are resolved. Could you give us a little more detail on what these issues are, and what their potential for impacting your projections would be?

A9 To produce oil and gas from former moratoria areas that have been closed to exploration and production for decades, considerable infrastructure will need to be built. Major infrastructure categories include platform fabrication yards, port facilities, shipyards and shipbuilding yards, support and transport facilities, waste management facilities, pipelines, pipe coating yards, natural gas processing facilities, natural gas storage facilities, and petrochemical facilities. States and local areas affected by offshore development activities have a say in the approval process and could hold up development. EIA assumes in the Annual Energy Outlook 2009 analysis that issues regarding local siting and permitting will be resolved by the producers and the State and local governments in an expeditious manner. Protracted permitting processes could add significantly to the time and/or cost to develop offshore resources in affected regions and possibly discourage development of associated offshore areas, resulting in less and/or more costly production from portions of the OCS.

Q10 Dr. Gruenspecht, in the 2009 Annual Energy Outlook, EIA points out that the oil fields in the area formerly under moratoria are expected to be small—much smaller than the average undiscovered field size in the Gulf of Mexico. And the 2008 World Energy Outlook states that small fields decline at a much more rapid rate than large fields. So does this mean if we started drilling in frontier areas, companies would have to drill considerably more wells, over wider geographic areas, than they would in the Gulf of Mexico?

A10 Yes. The Minerals Management Service estimates that the average field size in the Gulf of Mexico is almost 3 times greater than the average field size in the Outer Continental Shelf areas formerly under moratoria (43 million barrels of oil equivalent compared to 15 million barrels of oil equivalent). Because of the smaller size of the fields in the areas formerly under moratoria, in areas deemed profitable companies will need to drill more wells over a wider geographic area to achieve the same output as in the Gulf of Mexico where the average field size is considerably larger.

Q11 Dr. Gruenspecht, you mentioned in your testimony that various characteristics of the new OCS areas are generally inferior to those areas currently open. There are three separate areas that need to be considered, though: the Atlantic, the Pacific, and the Eastern Gulf of Mexico. Could you put those in order—which has the least inferior characteristics and which has the most inferior characteristics?

A11 While it is difficult to rank the areas of the Atlantic, Pacific, and Eastern/Central Gulf of Mexico (GOM) that were previously under moratoria based on their inferiority relative to those areas that were already open, certain generalizations can be made considering resource level, average field size, and proximity to existing infrastructure. The areas previously under moratoria rank differently depending on whether the emphasis is on oil or gas production.

Resources: The EIA relies on estimates of technically recoverable resources provided by the Minerals Management Service (MMS). The Pacific resource estimate for undiscovered oil (10.5 billion barrels) is almost three times as much as the estimate for either the Atlantic (3.9 billion barrels) or the Eastern/Central GOM (3.7 billion barrels), compared to 47 billion barrels of technically recoverable resources in the Central/Western GOM. The Atlantic resource estimate for undiscovered natural gas (36.5 trillion cubic feet or Tcf) is almost double that of the Eastern/Central GOM (21.5 Tcf) and the Pacific (18.4 Tcf), compared to 247 Tcf of technically recoverable resources in the Central/Western GOM.

Average Field Size: The MMS estimates of the average undiscovered field size in GOM Outer Continental Shelf (OCS) areas open to drilling prior to 2008 (59 million barrels of oil equivalent (mmBOE)) and in the Eastern GOM (43 mmBOE) are sig-

nificantly greater than the average field size for the Pacific (11 mmBOE) and Atlantic (16 mmBOE) OCS areas formerly under moratoria.

Infrastructure: The Eastern/Central GOM has the advantage of being closer to extensive existing infrastructure in the Central and Western GOM areas that have been open to exploration and development. Some infrastructure exists in the Pacific near currently producing leases. This suggests an assignment of the highest ranking to the Central/Western GOM, followed by the Pacific, then the Eastern/Central GOM, and last the Atlantic.

Q12 Dr. Gruenspecht, has EIA modeled the impact of the proposed Alaska Natural Gas Pipeline, if and when it gets built? Is there a sense of the impact that might have on U.S. natural gas supplies or prices?

A12 In the Annual Energy Outlook 2009 (AEO2009) reference case, an Alaska gas pipeline to the lower-48 States is projected to begin operation in 2020. The 2020 date is largely dictated by the 9 years required to design, permit, and construct this pipeline. Once completed, an Alaska gas pipeline is expected to take 2 years to achieve full operation, delivering 1.4 trillion cubic feet (Tcf) per year to the lower-48 States by the end of the second year.

The AEO2009 also includes a scenario entitled the "no Alaska pipeline case" in which an Alaska gas pipeline is precluded from going into operation. The no Alaska pipeline case projections of U.S. natural gas production, consumption, imports, and prices can be compared to those projected in the reference case to ascertain the impact of the pipeline.

After 2020, Alaska natural gas production is 1.6 Tcf per year lower in the no Alaska pipeline case than in the reference case. The lower Alaska production includes both the pipeline throughput to the lower-48 States and the natural gas consumed in the production, processing, and compression of the pipeline gas.

In the no Alaska pipeline case, later-period Henry Hub spot natural gas prices are higher than in the reference case. Regional prices may differ to greater or lesser extents. The greatest Henry Hub price difference occurs in 2022 at $0.69 per million Btu (2007 dollars), which is 9.5 percent higher than the reference case price. After 2022, the magnitude of the natural gas price impact gradually diminishes, as lower-48 natural gas supply grows and consumption declines. By 2030, Henry Hub gas prices are only $0.15 per million Btu or 1.6 percent higher in the no Alaska pipeline case relative to the reference case.

As a result of the higher natural gas prices projected in the no Alaska pipeline case, lower-48 natural gas production and imports are higher, while natural gas consumption is lower.

In the no Alaska pipeline case, the higher natural gas prices cause lower-48 production to increase by 800 billion cubic feet (Bcf) in 2021, and then level off to around 600 Bcf per year for the remainder of the projection. Of the lower-48 natural gas production categories, unconventional natural gas production posts the greatest increase, adding about 500 Bcf per year from 2022 through 2030.

Net natural gas pipeline imports are about 525 Bcf higher in the no Alaska pipeline case in 2028. LNG imports increase only slightly in the no Alaska pipeline case due to the high LNG prices relative to the less expensive U.S. and Canadian natural gas production.

The greatest impact on natural gas consumption occurs in 2026, when total natural gas consumption is about 760 Bcf lower than in the reference case, with the largest share of the decline—290 Bcf—occurring in the electric power sector.

Q14 Dr. Gruenspecht, could you provide your thoughts about our ability to harness some of the potential of enhanced geothermal systems? Is enhanced geothermal likely to be feasible in the near future? How long would it take before people could start building EGS power plants?

A14 It is EIA's understanding that current efforts related to enhanced geothermal systems (EGS, also known as "hot dry rock" systems) are limited to precommercial research and development efforts, with a few proof-of-concept projects and limited government-funded research efforts in several countries (including the U.S.). Given the lack of current commercial-scale experience with this technology, EIA does not believe that EGS technology is likely to contribute significantly to U.S. electricity production in the near future. The timing of its ultimate introduction to commercial service will largely depend on the ability of researchers and private investors to develop a cost-competitive product, and may also depend on future policies to support this technology specifically or to support renewable or carbon-free technologies in general.

EIA does not currently include projections for enhanced geothermal systems in our Annual Energy Outlook 2009. This is, in large part, because the technology is not sufficiently well developed to establish reasonable estimates of cost and charac-

terization of the resource base that could be used in our National Energy Modeling System. EIA expects that these data should develop in advance of significant commercial deployment.

Q15 Dr. Gruenspecht, in her testimony, Ms. Pierce states that "the EIA's 2009 forecast of significant increases in domestic oil production is partly owing to advances in enhanced oil recovery technologies." Could you provide additional detail regarding this statement? What is the growth of enhanced oil recovery (EOR) that EIA projects to 2030? Do these projections assume existing EOR technology or "next-generation" EOR? How much of the growth in EOR is driven by carbon dioxide-EOR, and how much is from other injectants? Does EIA project how much carbon dioxide used for EOR would be coming from anthropogenic sources versus natural sources?

A15 In the Annual Energy Outlook 2009 (AEO2009), EIA projects that oil production from enhanced oil recovery (EOR) will increase more than fivefold between 2007 and 2030, growing from 0.3 million barrels per day in 2007 to 1.7 million barrels per day in 2030. The projections assume some improvement in carbon dioxide (CO_2) EOR technology over existing technology, but not what might be considered "next generation" technology. The current National Energy Modeling System (NEMS) used for the AEO2009 only includes CO_2 flooding; other injectants were not competed in the model. The new Oil and Gas Supply Module of NEMS currently under development includes 4 EOR processes: CO_2 flooding, steam flooding, polymer flooding, and profile modification. Roughly 37 percent of the projected CO_2 used for EOR production in the AEO2009 is from anthropogenic sources versus natural sources.

Q16 Dr. Gruenspecht, please provide an update to the Committee on EIA's efforts to provide additional energy data for the U.S. insular areas (in particular the Commonwealth of the Northern Mariana Islands, Guam, American Samoa, and the U.S. Virgin Islands). When does EIA expect to be able to provide State Energy Profile pages for each of those territories?

A16 EIA plans to publish State Energy Profiles for the five U.S. insular areas (American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands) on the EIA web site by June 12, 2009. Each Profile consists of a map, a narrative section, and a data table. There are very limited EIA and other data available on the U.S. territories. Options to expand territory data collection are outlined in EIA's January 2009 report to Congress, State Energy Data Needs Assessment, prepared in response to the direction in section 805(d) of the Energy Independence and Security Act of 2007, P.L. 110-140. This report is on our website at http://www.eia.doe.gov/oiaf/service__rpts.htm.

QUESTIONS FROM RANKING MEMBER LAMBORN

Q1 UCSD Economics Professor James Hamilton has written that "nine out of ten of the U.S. recessions since World War II were preceded by a spike up in oil prices." Has the EIA examined the impact of the high energy prices Americans faced last year on our GDP and the recession?

A1 EIA has not formally examined the impact of the high energy prices on the recession. However, the most widely-cited reasons for the current recession include the inflated housing market and its impacts on financial institutions, and financial institutions' treatment of risk. The higher energy prices impacted the economy, although the impacts of housing price inflation, wealth deflation, global recession and the credit crunch probably outweigh impacts of high energy prices alone.

Q2 In your various studies and the Annual Outlook you address the impact high energy prices will have on our economy correct? Do these findings uniformly show that high energy prices are a drag on our economy?

A2 The results from EIA's analysis of the impacts of higher energy prices depend on the supply and demand responses to increased energy prices as well as the trajectory of higher prices. Initially, when faced with higher prices, the economy will experience a reduction in gross domestic product (GDP), a broad measure of economic output; however, if prices begin to stabilize the economy will begin to recover. With respect to higher oil prices, other important factors include to what extent domestic producers can increase their production and how much oil imports will fall. Typically, the economy will experience an early reduction in growth and, depending on the oil price trajectory and supply response, may return to the reference case growth trajectory over time.

Q3 Is it safe to say that a majority of the studies you have done on congressional proposals like Renewable standards and cap and trade proposals have shown that increases in the cost of energy result in a lower GDP going forward?

A3 Most of the past EIA studies on renewable energy standards have found very modest impacts on energy prices and the economy. However, EIA has found that under some circumstances, a greenhouse gas cap and trade policy could lead to significant energy price increases and a reduction in economic output. In an analysis of S. 2191, the Lieberman-Warner Climate Security Act, EIA found that total discounted gross domestic product (GDP) losses over the 2009 to 2030 time period range from $444 billion (-0.2 percent) to $1,308 billion (-0.6 percent) across the cases considered. Similarly, the cumulative discounted losses for personal consumption range from $546 billion (-0.2 percent) to $1,425 billion (-0.6 percent). GDP losses in 2030, the last year explicitly modeled in the analysis, range from $27 billion to $163 billion (-0.1 to -0.8 percent) while consumption losses in that year range from $58 billion to $149 billion (-0.4 to -1.1 percent). Economic impacts were largest when it was assumed that key low-emissions technologies including nuclear, fossil with carbon capture and sequestration, and various renewables are not developed and deployed in a timeframe consistent with the emissions reduction requirements, and international offsets are not available. Generally higher energy prices represent higher costs to the economy and the magnitude of the impacts depends on price impacts of the policies analyzed.

Q4 In January 2007, EIA was asked to analyze a generic cap and trade program by Sen. Bingaman and others, and in that analysis you were asked to consider options for both a partial auction and a full auction. A brief excerpt from that report, "GDP and consumption impacts in the Full Auction case are substantially larger than those in the Phased Auction case. Relative to the reference case discounted total GDP (in 2000 dollars) over the 2009-2030 time period in the Full Auction case is almost twice the estimated consumption loss in the Phased Auction case."

Q5 Can we assume based on this study that in most cap and trade schemes a full auction of carbon allowances will have a higher cost to the economy than a partial auction? Do you think, as analyzed in the January 2007 study, the costs of a full auction plan might be double a quarter auction plan? Could those costs be triple?

A4-5 The economic impacts of a greenhouse gas cap and trade policy will depend on many factors, including the stringency of the emissions cap, the speed of implementation, and the use of carbon allowance revenue. The January 2007 EIA analysis did show larger gross domestic product (GDP) and consumption losses in the full auction case compared to the partial auction case; however, it also stated that the economic impacts would be different if alternative revenue recycling assumptions were made, so a general conclusion that a full auction case would always have worse economic impacts than a partial auction case is not warranted. Likewise, a general conclusion that a full auction would have double or triple the negative economic impact of a quarter auction is not warranted.

Q6 In the EIA analysis of the Lieberman Warner Cap and Trade proposal the EIA findings say that energy costs will rise. Specifically, the report states that "The Consumer Price Index (CPI) for energy, a summary measure of energy prices facing households at the retail level, increases by approximately 18 percent above the Reference Case level by 2030. Industrial energy prices increase 10 percentage points more, at 29 percent above Reference Case levels."

Q7 So this finding says that consumers will see a nearly 20% rise in costs and industry, nearly a 30% rise in costs under the basic case presented by EIA of the Lieberman Warner bill. In addition, the EIA report states that in what it views as essentially the most restricted case "consumer energy prices increase as much as 62 percent and industrial energy prices by 100 percent."

Q8 What would be the impact on American industry if we increased our energy prices by 100% and other nations, without restrictions on carbon emissions, continued to reduce their energy costs?

A6-8 We have not estimated the impact on American industry if we increased our energy prices by 100 percent and other nations, without restrictions on carbon emissions, continued to reduce their energy costs. The April 2008 EIA analysis of the

Lieberman-Warner Climate Security Act (S. 2191) showed a range of industrial shipment impacts consistent with the projected increase in energy costs.

In the April 2008 analysis, the industrial shipment impacts ranged from 2.9 to 7.4 percent below reference case levels by 2030, depending on the assumptions used. Over the period of 2009 to 2030, industrial impacts in the analysis ranged from 1.3 to 3.6 percent below reference case levels.[1] The industrial impacts presented in the April 2008 report only included the manufacturing, construction, mining and agriculture sectors of the economy. It did not include the service sector, which is an increasingly important part of the U.S. economy.

Q9 In EIA's analysis of the Lieberman-Warner Climate Security bill last year, some of the key findings pointed out that "The electric power sector accounts for the vast majority of the emissions reductions, with new nuclear, renewable, and fossil plants with CCS [Carbon Capture and Sequestration] serving as the key compliance technologies in most cases. [And] Many existing coal plants without CCS are projected to be retired early because retrofitting with CCS technology is generally impractical."

Q10 This was in a bill which had only a "share of the allowances...auctioned, while the remainder would be distributed for transition assistance to covered entities, energy consumers, and manufacturers as incentives for carbon sequestration". Can you estimate for the Committee how much higher the costs might be under a similar regulatory scheme where 100% of the credits are auctioned at the beginning of the program?

A9-10 Since the EIA analysis of the Lieberman-Warner Climate Security Act used the allowance distribution called for in the bill, a 100-percent auction case was not prepared. A 100-percent auction case would lead to higher energy price impacts but the economic impacts could not be determined without knowing how the auction revenue was to be used.

Q11 In the assessment of Lieberman-Warner, EIA says "As energy prices increase, the energy-intensive sectors, including food, paper, bulk chemicals, petroleum refining, glass, cement, steel and aluminum, show greater losses compared to the rest of the industrial sectors, reaching between 5 and 10.2 percent" in most projections.

Q12 Do you believe these projections to be on the low side if we adopted a 100% auction of carbon allowances as proposed in President Obama's Budget?

Q13 Would we see a doubling of those projections? Meaning could we see 20%, 30% or 40% job losses in our industrial sector as a result of the Presidential proposal with 100% auctions?

A11-13 As noted in the previous answer, a 100 percent auction would lead to somewhat higher energy price impacts than what we estimated in our analysis of the Lieberman-Warner legislation, but the economic impacts could not be determined without knowing how the auction revenue would be used. The overall impacts on energy intensive industries would vary depending on how the overall economy reacts to the distribution of the carbon allowance revenue as well as the technologies used by firms to substitute away from or reduce their use of fossil fuels. However, larger impacts on energy-intensive industries in response to a carbon allowance price do not translate into the same impacts experienced by the U.S. industrial sector as a whole, since energy-intensive industries comprised approximately 20 percent of industrial (non-service) gross output from 2003 to 2007.

Q14 Can you elaborate on the subsidies for energy creation. It's a bit dated but EIA data shows that solar energy was subsidized at $24.34 per megawatt hour and wind at $23.37 per megawatt hour for electricity generated in 2007. By contrast, coal received 44 cents, natural gas and petroleum received 25 cents, hydroelectric power 67 cents, and nuclear power $1.59 per megawatthour.

A14 In 2008, EIA's most recent report on energy subsidies (Federal Financial Interventions and Subsidies in Energy Markets 2007) developed estimates of electricity subsidies by fuel, and then compared those subsidies to actual electricity output in Fiscal Year 2007. This approach yields a wide range of estimates when subsidies are expressed in proportion to the overall level of electric output. Technologies

[1] Cumulative impacts, present value calculated using a 4 percent discount rate

like solar and wind have relatively large subsidies per unit of output for two reasons. First, subsidies are often motivated by a policy goal of making new technologies more competitive, so subsidies may be directed disproportionately to these emerging technologies, rather than to more mature forms of production. Second, there are substantial differences in generation between established base-load generating technologies (primarily coal and nuclear), which account for 70 percent of all generation, and relatively new renewable technologies like wind and solar, which together accounted for 1.3 percent of total net generation in 2008. The per-unit measure of electricity production subsidies used in EIA's report may provide a better indicator of certain market impacts than the dollar amount of the subsidy. For example, even though coal receives higher subsidies in absolute terms than wind power, the use of wind is likely to be more dependent on the availability of subsidies than the use of coal. Other factors can also play an important role in determining the market impact of a particular production subsidy. For example, credits claimed by refined coal producers have lapsed since EIA's 2008 report, and the small amount of generation using refined coal as fuel has probably been replaced by steam coal. In contrast, generation from wind power, supported by renewable production tax credits, would likely be replaced with generation from a broad mix of fuels if that credit were unavailable.

Q15 The 2007 energy bill, the 2009 stimulus package, and the FY09 omnibus appropriations all included increased funding for renewable energy we [sic] would expect those numbers to be slightly higher than the 2007 data correct? Do you have any idea how much higher those numbers might be? Would you be willing to update those figures for this committee?

A15 EIA is able to provide an updated comparison to some of the programs itemized in EIA's report Federal Financial Interventions and Subsidies in Energy Markets 2007 by using the Treasury Department's tax expenditure estimates for Fiscal Year 2009 (FY09). These estimates are itemized in the Office of Management and Budget's (OMB) *Analytical Perspectives, Budget of the United States Government*—Fiscal Year 2009. The latest Treasury Department estimates also include revisions to FY07 and FY08 data contained in EIA's report. However, EIA cannot update the Joint Committee on Taxation (JCT) estimates of tax expenditures enacted in the Energy Policy Act of 2005 because they are not itemized by the Treasury Department. EIA is able to update its FY07 tax expenditures and provide a comparison of FY08 and FY09 estimated tax expenditures, but no updates are available at this time for direct expenditure programs, research and development programs, or Federal electricity programs.

Table 1 shows FY07 estimated tax expenditures contained in EIA's report, along with revised FY07 tax expenditures and FY08 and FY09 estimates reported in the FY09 budget documents. For these items, EIA previously reported $10.1 billion of tax expenditures (excluding tax expenditures scored by the JCT) for FY07, while the revised FY07 expenditures from the Treasury Department are about $300 million higher. The latest Treasury Department estimates show these energy-related tax expenditures declining approximately $700 million in FY08 and $1 billion in FY09.

Table 1. Estimates of Tax Expenditures by Fiscal Year, 2007-2009 (million 2007 dollars)

	2007	2007 REVISED	2008	2009
Tax Expenditures other than Volumetric Ethanol Excise Tax Credit (VEETC)	$7,100	$7,070	$5,530	$3,877
VEETC	$2,990	$3,320	$4,117	$4,753
Total	$10,090	$10,390	$9,646	$8,630

Sources: 2007: Energy Information Administration, *Federal Interventions and Subsidies in Energy Markets 2007*; 2007 revised, 2008, and 2009: Office of Management and Budget, *Analytical Perspectives of the Budget of the United States, Fiscal Year 2009, Table 19.1*

The decline reflects the expiration of certain tax expenditures and changes in the tax credit rates applied in certain other programs based on the tax law as it existed at the time the FY09 budget was submitted to Congress in February 2008. The Energy Independence and Security Act of 2007 (EISA), although it had been signed by that time, did not contain energy production-related tax expenditures. While Table 1 shows tax expenditures declining, energy legislation passed subsequent to the submission of the FY09 budget expanded and extended existing tax expenditures. The Energy Improvement and Extension Act of 2008 (EIEA), and the Amer-

ican Recovery and Reinvestment Act (ARRA) extended and expanded existing energy production tax credit and investment tax credit provisions, and appropriated significant funds for direct expenditures associated with the development of new energy infrastructure and end use energy efficiency.

The extended and expanded energy tax expenditures include:

- Long-term extension and modification of the renewable energy production tax credit. The credit is now available through 2012 for wind projects and through 2013 for other forms of renewable energy. It has been expanded to include marine and tidal projects.
- Allowing renewable energy producers to take the investment tax credit in lieu of production tax credits for those facilities placed in service in 2009 and 2010.
- Creation of a new tax credit for combined heat and power systems.
- Extension of the expiration date for solar energy, fuel cell and microturbine property tax credits through the end of 2016.
- Repeal of the double-dipping limitation to allow energy projects receiving subsidized financing to realize the full benefit of investment tax credits; and
- Authorizing an additional $1.6 billion of Clean Renewable Energy Bonds.

These items have not yet been quantified by the Treasury Department in terms of their estimated losses to the Treasury.

Q17 In your studies you say that many of our current coal fired power plants will be phased out as a result of their inability to meet carbon control requirements. What percentage of current plants do you estimate would be candidates for CCS technology?

A17 EIA has not performed a study of the potential to retrofit existing coal plants with Carbon Capture and Sequestration (CCS), rather than retiring and replacing them to meet carbon control requirements. Numerous factors would influence such a decision including the age and vintage of the plant, the technology employed at the plant, the plant's efficiency, the availability of space to install capture equipment and the proximity of suitable sequestration locations. The Department of Energy's National Energy Technology Laboratory (NETL) found in a recent study (see http://www.netl.doe.gov/energy-analyses/pubs/CO2%20Retrofit%20From%20Existing%20Plants%20Revised%20November%202007.pdf) that, while it was technically feasible to retrofit existing coal plants with CCS, it could be economically challenging.

Q20 What impact will a cap and trade system have on the domestic agriculture sector, particularly on those sectors which are heavily dependent on fertilizer?

Q21 How about the domestic cement industry?

A20-21 The impact of a cap-and-trade program on agriculture and other sectors will depend on the details of the program that is implemented. The allocation of allowances is a critical factor for all sectors, but agriculture will also be impacted by provisions that may allow farmers to receive offset credits for practices that reduce or sequester carbon dioxide and other greenhouse gases. The fertilizer and domestic cement industries are both classified as energy-intensive industries. Therefore, to the extent that a cap-and-trade program raises the cost of using fossil fuels, there industries would be expected to experience higher product costs.

QUESTION FROM REPRESENTATIVE BOREN

Q1 The Obama Administration proposes to increase taxes on the nation's oil and natural gas industry by 34 billion dollars. Most of the burden will fall on independent producers. Given that these independent producers currently drill 90% of new natural gas wells and produce more than 80% of the nation's natural gas, can you estimate the impact on domestic natural gas production that will result from the taking of so much capital from these producers?

A1 EIA has not done an analysis of this issue, so we cannot quantify the impacts. In December 2007, EIA produced a service report "Oil and Natural Gas Market Supply and Renewable Portfolio Standard Impacts of Selected Provisions of HR. 3221." That legislation also included some proposals impacting the taxation of the oil and gas industry. While EIA was not able to analyze those provisions, which are not the same as those presently proposed by the Obama Administration, our December 2007 report does provide some context on oil and gas industry cash flows that may be helpful.

[NOTE: The attachment, ″An Updated Annual Energy Outlook 2009 Reference Case Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook,″ April

2009 Report by Energy Information Administration, U.S. Department of Energy, has been retained in the Committee's official files.]

Mr. COSTA. We look forward to asking you questions when that time arrives, Dr. Gruenspecht. We do appreciate that. I am not sure I made it clear during your introduction that you are the acting administrator for the Energy Information Administration office at this time.

Our next witness is to present as the program coordinator on the Energy Resources Program for the U.S. Geological Survey within the U.S. Department of the Interior. We would very much welcome the testimony of Brenda Pierce.

Brenda, please present.

STATEMENT OF BRENDA S. PIERCE, PROGRAM COORDINATOR, ENERGY RESOURCES PROGRAM, U.S. GEOLOGICAL SURVEY

Ms. PIERCE. Mr. Chairman and members of the Subcommittee, thank you for the opportunity to appear here today to discuss with you the U.S. Geological Survey's role in studying, understanding, and assessing the undiscovered geologically based energy resources of U.S. onshore and State waters and the world and the Minerals Management Service's role in providing information on Federal resources of the Outer Continental Shelf.

Adequate, reliable, and affordable energy supplies obtained using environmentally sustainable practices are essential to economic prosperity, environmental and human health, and political stability. National and global energy demand and resource consumption are projected to increase over the next several decades, as you have heard. Thus, the volumes, quality, and availability of domestic and foreign energy resources are of critical importance to the United States.

The Nation continues to face important decisions regarding the competing uses of public lands and offshore waters, the supply of energy to sustain development and enable growth, and the environmental effects of energy resource development. The USGS provides the research and information needed to address these challenges by conducting scientific investigations of geologically based energy resources, such as oil, gas, and coal; emerging resources, such as gas hydrates; underutilized resources, such as geothermal; and unconventional resources, such as oil shale; and research on the effects associated with energy resource occurrence, production, and utilization.

The results from these geoscientific studies are used to evaluate the quality and distribution of energy resource accumulations and to assess the energy resource potential of the Nation and the world. As one example, the USGS recently produced the first-ever estimate of undiscovered, technically recoverable gas from natural gas hydrates. Although these resources have not yet been proven economic, this USGS assessment estimates a mean of 85.4 trillion cubic feet of technically recoverable gas from gas hydrates from the Alaskan North Slope.

USGS assessments focus on undiscovered, technically recoverable oil and natural gas resources of the United States, exclusive of the Federal OCS, which is assessed by the MMS. Undiscovered, tech-

nically recoverable resources are resources that have yet to be found or drilled but, if found, could be recovered using currently available technology and industry practice. Economic factors are not always considered. For example, it may not be economically feasible to exploit those gas hydrate resources on the Alaskan North Slope, but they are technically recoverable.

The purpose of USGS and MMS assessments are to develop robust, geologically based and statistically sound and well-documented estimates of quantities of energy resources that have the potential to be added to reserves and, thus, contribute to the overall energy supply. The USGS and MMS resource assessment methodologies are thoroughly reviewed and externally vetted so as to maintain the transparency and robustness of the assessment results.

The assessment of undiscovered, technically recoverable resources do change over time. There are several reasons for this, including scientific and technological developments regarding petroleum resources as well as improvements to the geologic understanding in numerous settings.

One example of this is the change in the recently updated USGS assessment of the Bakken Formation of the U.S. portion of the Williston Basin. This assessment, released just last year in 2008, shows an estimated 3 billion to 4.3 billion barrels of undiscovered, technically recoverable oil, to compare to our 1995 mean estimate of 151 million barrels of oil.

Oil and natural gas produced offshore on the Outer Continental Shelf is a major supply source of energy for the domestic market. About 17 billion barrels of oil and 174 trillion cubic feet of natural gas have been produced from the OCS since 1954. Current production levels are about 1.4 million barrels of oil and about 8 billion cubic feet of natural gas per day. This represents approximately 27 percent of domestic oil production and 14 percent of natural gas production. These shares are expected to grow over the next 7 years, as new deep-water production in the Gulf of Mexico comes on.

OCS oil and gas resource assessments are completed as part of the Secretary's responsibilities for managing OCS energy and mineral resources and their requirement to assure fair-market value for OCS lands to be leased. The MMS conducts resource assessments for the OCS at various scales and for many purposes, such as evaluating future supply options, analyzing the relative merits of oil and gas development proposals, and providing critical input to decision-makers regarding various policy alternatives, and providing data essential for valuing Federal lands prior to leasing.

MMS assessments estimate the undiscovered, technically recoverable resources of oil and gas for individual plays. Estimates of the quantities of historical production reserves and future reserves appreciation are presented to provide a frame of reference for analyzing the estimates of undiscovered, technically recoverable resources.

Reserve growth is a well-documented phenomenon in the United States and is a major component of the Nation's remaining oil and natural gas resources. In fact, most additions to the world oil re-

serves in recent years are from growth of reserves in existing fields rather than new discoveries.

Given this context, it is important to note the important distinction between the terms "resource" and "reserves." "Resource" is a concentration of naturally occurring hydrocarbons in or on the Earth's crust, some of which is, or potentially is, economically extractable. "Reserves" specifically refer to the estimated quantities of identified, discovered petroleum resources that, as of the specified date, are expected to be commercially recovered from known cumulations under prevailing economic conditions, operating practices, and government regulations.

The assessment of both undiscovered resources and of additions to reserves from discovered fields and reservoirs requires estimation of reserve growth. The USGS has an active research effort to develop a methodology approach for better quantifying domestic and global contributions of reserve growth to the petroleum resource endowment.

U.S. undiscovered, technically recoverable mean oil resources total 48 billion barrels of oil onshore and in State waters and 86 billion barrels of oil for OCS. Undiscovered, technically recoverable mean natural gas resources total 743 trillion cubic feet onshore and in State waters and 420 trillion cubic feet for the OCS.

These resources have the potential to be added to reserves but are not yet proven and may or may not be economic at current or future prices. For example, the 86 billion barrels of undiscovered, technically recoverable oil resources in the OCS—of that, 54 billion barrels of that is estimated to be economically recoverable at about $46 per barrel.

Turning to other energy sources, coal accounts for 48 percent of domestic electricity generation. USGS has recently completed an assessment of coal resources and reserves in Wyoming's Gillette coalfield. The Gillette area accounts for nearly 40 percent of the Nation's current coal production, making it the single most important coalfield in the United States.

A total of 164 billion tons of original coal resources was found in the six beds included in the evaluation. Of that original resource, 10 billion tons, or about 6 percent, can be classified as reserves at the current average estimated sales price. So USGS studies will determine what portion of the resource base are technically and economically recoverable.

The USGS also evaluates renewable resources, such as geothermal energy. We recently completed a national geothermal resource assessment, the first one in more than 30 years. Results indicate that full development of the conventional, identified systems could expand geothermal power production by approximately 6,500 megawatts of electricity, or about 260 percent of the currently installed geothermal total of more than 2,500 megawatts electric.

The resource estimate for unconventional, enhanced geothermal systems is more than an order of magnitude larger than the combined estimates of both identified and undiscovered conventional geothermal resources, and, if successfully developed, could provide an installed geothermal electric power generation capacity equivalent to about half of the currently installed electric power generating capacity of this country.

America's oceans may also provide potential new renewable energy sources to support our Nation's growing energy needs, and MMS is developing a program for managing their uses. To date, there is no comprehensive evaluation for the available renewable energy potential in our offshore waters, but researchers have begun to examine the resource potential in specific areas of interest.

Although significant wave, wind, tidal, and current resources exist in close proximity to coastal population centers, areas that consume the majority of the Nation's electricity generation, the technologies used to generate this energy are relatively new and untested so far in the offshore environment of the U.S. OCS.

And, briefly, USGS international resource assessments. Our Nation depends heavily on imported energy resources. About 58 percent of the oil and 16 percent of the natural gas consumed in the U.S. come from imports. Given the significance of imported oil and gas in the U.S. energy mix, scientifically robust, unbiased assessments of the world's remaining endowment of petroleum accumulations are very important.

And a major focus of USGS research recently has been the Circum-Arctic petroleum assessment, which is the first estimate of the entire area north of the Arctic Circle. Results from that, released last July, indicate that there are 90 billion barrels of undiscovered, technically recoverable oil north of the arctic and 1,670 trillion cubic feet of technically recoverable natural gas. This accounts for about 22 percent of the undiscovered, technically recoverable resources in the world, 13 percent of that oil and 30 percent of that gas.

So, in conclusion, during the next decade, the Federal Government, industry, and other groups will need to better understand the domestic and global distribution of, genesis of, use of, and consequences of using geologically based energy resources to address national security issues, manage the Nation's domestic supplies, predict future needs, anticipate as well as guide changing patterns in use, and facilitate creation of new industries.

As the Nation's energy mix evolves, the USGS and MMS will work to ensure that our research and assessment portfolio ties into a comprehensive suite of assessments to inform policymakers about the energy choices. USGS and MMS stand ready to assist Congress as it examines these challenges and opportunities.

Thank you for the opportunity to provide an overview of our work, and we would welcome to answer questions.

[The prepared statement of Ms. Pierce follows:]

Statement of Brenda S. Pierce, Program Coordinator, Energy Resources Program, U.S. Geological Survey, U.S. Department of the Interior

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

Introduction

Adequate, reliable, and affordable energy supplies obtained using environmentally sustainable practices are essential to economic prosperity, environmental and human health, and political stability. National and global energy demand and resource consumption are projected to increase over the next several decades, though

at a slower rate than in recent years. The United States currently consumes 21 percent of the total world primary energy consumption and produces 15 percent of the total world primary energy production. Thus, the volumes, quality, and availability of domestic and foreign energy resources are of critical importance to the United States. The Nation continues to face important decisions regarding the competing uses of public lands and offshore waters, the supply of energy to sustain development and enable growth, and the environmental effects of energy resource development.

Role of the U.S. Geological Survey

The U.S. Geological Survey (USGS) provides the research and information needed to address these challenges by conducting scientific investigations of geologically based energy resources, such as research and assessment on the geology of oil, gas, and coal resources, emerging resources such as gas hydrates, underutilized resources such as geothermal, and unconventional resources such as oil shale, and research on the effects associated with energy resource occurrence, production, and (or) utilization. Our goal is: (1) to understand the processes critical to the formation, accumulation, occurrence, and alteration of geologically based energy resources; (2) to conduct scientifically robust assessments of those resources; and (3) to study the impact of energy resource occurrence and (or) production and use on both environmental and human health. The results from these geoscientific studies are used to evaluate the quality and distribution of energy resource accumulations, and to assess the energy resource potential of the Nation (exclusive of the Federal OCS)) and the World. As one example, the USGS recently produced the first-ever estimate of undiscovered, technically recoverable gas from natural gas hydrates. Although these resources have not yet been proven economic, this USGS assessment estimates a mean of 85.4 trillion cubic feet of technically recoverable gas from gas hydrates on the Alaska North Slope.

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

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

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

The current USGS effort to update national (onshore and State waters) assessments of oil and gas resources is done in support of the Energy Policy and Conservation Act (EPCA) Amendments of 2000 (P.L. 106-469 § 604). Through a collaborative, multi-agency effort involving the Bureau of Land Management, the USGS, the U.S. Forest Service, the Department of Energy, and the EIA, the USGS provides the oil and gas resource estimates as the basis for the EPCA inventory. The USGS role is to assess the potential volumes of conventional and continuous (unconventional) resources (e.g., coalbed gas, shale gas, tight gas sands) in each priority province using established, externally reviewed and vetted methodologies and provide this informa-

tion to the appropriate land and resource management agencies for subsequent analysis. The Energy Policy Act of 2005 (P.L. 109-58) re-authorized EPCA 2000 assessment activities by the USGS, emphasizing the unique and critical role of the USGS and specifically mandated that "the same assessment methodology across all geological provinces, areas, and regions [be used] in preparing and issuing national geological assessments to ensure accurate comparisons of geological resources."

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

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

OCS oil and gas resource assessments are completed as part of the Secretary's responsibilities for managing OCS energy and mineral resources and the requirement to assure fair market value for OCS lands to be leased. The MMS conducts resource assessments for the OCS at various scales and for many purposes. Regional assessments may be prepared simply to develop an inventory of potential oil and natural gas resources as part of an evaluation of future supply options. Assessments may be undertaken to analyze the relative merits of oil and gas development proposals and alternatives versus other competing uses. Resource estimates also provide critical input to decision makers regarding the virtues of various policy alternatives, and provide data essential for valuing Federal lands prior to leasing or analyzing industry exploration or development proposals. The MMS conducts periodic national assessments of the oil and natural gas resource potential of the Nation's Outer Continental Shelf; and in 2005, Congress directed (in Section 357 of the Energy Policy Act of 2005) that the Secretary conduct a comprehensive inventory and analysis of oil and natural gas resources of the U.S. OCS. This MMS assessment, which was completed in 2006, considers recent geophysical, geological, technological, and economic information and utilizes a probabilistic play based approach to estimate the undiscovered technically recoverable resources (UTRR) of oil and gas for individual plays. This methodology is suitable for both conceptual plays where there is little or no specific information available, and for developed plays where there are discovered oil and gas fields and considerable information is available. After estimation, individual play results are aggregated to larger areas such as basins and regions. Estimates of the quantities of historical production, reserves, and future reserves appreciation are presented to provide a frame of reference for analyzing the estimates of UTRR.

Reserve growth is well documented in the United States and is a major component of the Nation's remaining oil and natural gas resources. In fact, most additions to world oil reserves in recent years are from growth of reserves in existing fields rather than new discoveries. The EIA's 2009 forecast of significant increases in domestic oil production is partly owing to advances in enhanced oil recovery technologies. Given this context, it is important to note the important distinction between the terms "resource" and "reserves." Resource is a concentration of naturally

occurring solid, liquid, or gaseous hydrocarbons in or on the Earth's crust, some of which is, or potentially is, economically extractable. Reserves specifically refer to the estimated quantities of identified (discovered) petroleum resources that as of a specified date, are expected to be commercially recovered from known accumulations under prevailing economic conditions, operating practices, and government regulations.

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

Undiscovered, technically recoverable mean oil resources total 48 billion barrels of oil onshore and in State waters and 86 billion barrels of oil for the OCS. Undiscovered, technically recoverable mean natural gas resources total 743 trillion cubic feet onshore and in State waters (or 657 trillion cubic feet, exclusive of the recent natural gas hydrates assessment), and 420 trillion cubic feet for the OCS. These resources have the potential to be added to reserves, but are not yet proven and may or may not be economic at current or future prices. For example, according to the 2006 MMS national assessment (http://www.mms.gov/revaldiv/PDFs/NA2006 BrochurePlanningAreaInsert.pdf), of the 86 billion barrels of undiscovered, technically recoverable oil resources in the OCS, 54 billion barrels of that is estimated to be economically recoverable at $46/barrel. Of the 420 trillion cubic feet of undiscovered, technically recoverable natural gas resources in the OCS, 215 trillion cubic feet is estimated to be economically recoverable at $6.96/million cubic foot."

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

Unconventional Oil and Gas Resources

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

Coal

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

Renewable Energy

In addition to petroleum and coal resources, the USGS also evaluates renewable resources such as geothermal energy. The USGS recently completed a national geothermal resource assessment, the first one in more than 30 years. The USGS evaluated 241 moderate- and high-temperature geothermal resources capable of producing electricity. The USGS assessment estimates (1) 9,057 Megawatts-electric (MWe) of power potential from conventional, identified geothermal systems, (2)

30,033 MWe of power generation potential from conventional, undiscovered geothermal resources, and (3) 517,800 MWe of power generation potential from unconventional Enhanced Geothermal Systems (EGS) resources. The results indicate that full development of the conventional, identified systems could expand geothermal power production by approximately 6,500 MWe, or about 260 percent of the currently installed geothermal total of more than 2,500 MWe. The resource estimate for unconventional EGS is more than an order of magnitude larger than the combined estimates of both identified and undiscovered conventional geothermal resources and, if successfully developed, could provide an installed geothermal electric power generation capacity equivalent to about half of the currently installed electric power generating capacity of the United States.

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

U.S. Geological Survey International Energy Studies

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

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

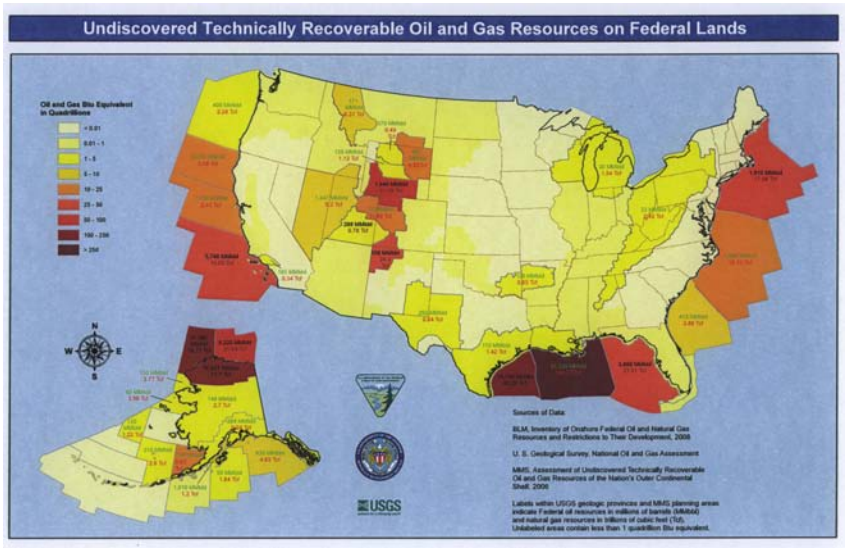
The results of the assessment, released last July, estimate that the area north of the Arctic Circle has 90 billion barrels of undiscovered, technically recoverable oil, 1,670 trillion cubic feet of technically recoverable natural gas, and 44 billion barrels of technically recoverable natural gas liquids in 25 geologically defined areas thought to have potential for petroleum. These resources account for about 22 percent of the undiscovered, technically recoverable resources in the world. The Arctic accounts for about 13 percent of the undiscovered oil, 30 percent of the undiscovered natural gas, and 20 percent of the undiscovered natural gas liquids in the world. About 84 percent of the estimated resources are expected to occur offshore.

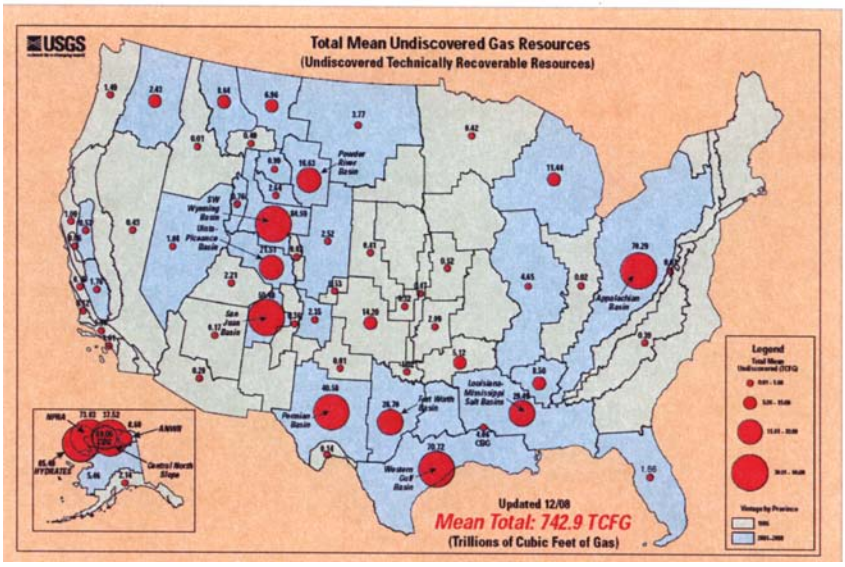
Conclusion

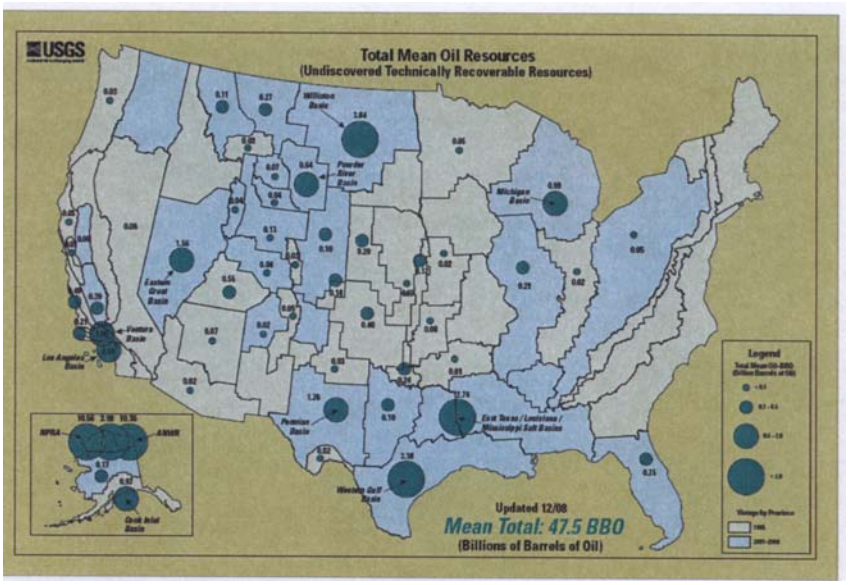
During the next decade, the Federal government, industry, and other groups will need to better understand the domestic and global distribution of, genesis of, use of and consequences of using geologically based energy resources to address pressing environmental problems such as climate change, national security issues, manage the Nation's domestic supplies wisely, predict future needs, anticipate as well as guide changing patterns in use, and facilitate creation of new industries. Energy resources research and assessments are a traditional strength of the USGS and the MMS, and these activities provide impartial, robust information necessary for the many needs just outlined. As the Nation's energy mix evolves, the USGS and MMS

will continue to work with other Federal agencies such as DOE to ensure that our research and assessment portfolio ties into a comprehensive suite of assessments to inform policymakers about energy choices. Future USGS and MMS assessments are anticipated to include hydrocarbon-based (for example, unconventional gas from coal and shale, gas hydrates, oil shale) and nonhydrocarbon-based sources (for example, geothermal resources and uranium) and address the effects of such resource use on land use, ecosystem health, and human welfare. USGS resource assessments and research play an important role in the public and government discourse about the energy resource future of the Nation so that science can inform, advise, and engage decision makers. The USGS and MMS stand ready to assist Congress as it examines these challenges and opportunities.

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







Mr. COSTA. Thank you very much, Brenda.

Now we will get to the part of the questions.

I would like to ask you at U.S. Geological Survey and the gentleman from EIA, given the changes that have occurred in recent decades—I mean, just think about in the last 10 years, the last 20 years—in our ability to determine carbon deposits, either oil or gas, with the seismology technology and others, how good the estimates are that both of you have just made your comments on.

Mr. GRUENSPECHT. Well, for the undiscovered, we really rely on USGS and MMS for the reserves part—the part that the operators have already identified and booked and report to the Securities and Exchange Commission if they are public companies—that we collect directly. The bigger part of the resource is the undiscovered resource, so maybe——

Mr. COSTA. So how good do you think your numbers are on the undiscovered, based upon current technology?

Ms. PIERCE. It is a very good question. It does depend on the amount of data and what that technology will help us understand. So areas that we have seismic or drill-hole data, I think our estimates are fairly good because we understand that. In areas that there are very little data, like parts of the Arctic, it is less certain.

And that is why we do probabilistic estimates; we give a range. And so the uncertainty is reflected in that range, so some of the estimates are quite uncertain and are reflected. So these numbers I shared are only mean numbers. So it is a mixed bag. Some areas we are pretty certain; some not so.

Mr. COSTA. I think you gave a good big picture for us to begin to try to draw a road map for our policy.

I question, as we ponder the issue of providing more availability of OCS leases, many of my colleagues question whether or not we

are realizing the full potential of those leases that are already available.

Do you understand what I am saying, Mr. Gruenspecht?

Is it your determination, as that discussion—I mean, I made the comment last week that I thought part of the debate or discussion last year was somewhat, in my view, mindlessness, but maybe that is my own view, about "use it or lose it" or "drill, baby, drill."

But having said that, is, to your knowledge, every carbon footprint on lease that is currently available for utilization retain that same carbon footprint, whether it be oil or gas, as you make these estimations? Do you understand my question?

Mr. GRUENSPECHT. I am not sure I do, sir.

Mr. COSTA. Well, if the idea is that all we really need to do is to exercise all of those lands that are currently available for lease, and if you were to assume that they all have the same carbon footprint, i.e. The same amount of oil and gas, or gas, than each lease lot that now is available for drill purposes, then logically you would assume that you would take, really, a usage of all that resource that is available in that area that is already available for lease.

Mr. GRUENSPECHT. You know, my understanding of the situation is that again we are projecting growing production from the OCS that at least we are pretty certain about, because close in, you know, between now and 2015, we know what projects are underway in the deepwater Gulf in particular. And we do see rising oil production coming out of that and rising natural gas production coming out of that.

But part of the development decision, as I understand it, there are multiple stages, there are issues about the connection to existing——

Mr. COSTA. Let me ask the question. To your understanding is there a lease available for utilization purposes containing the same amount of carbon in that lease, whether it be oil or gas? In terms of the value of the production?

Mr. GRUENSPECHT. No, that is not my understanding.

Mr. COSTA. You would concur, U.S. Geological Survey, why different leases are priced differently when they go to bid?

Ms. PIERCE. No, that's right. I do have a colleague from MMS here if you have specific questions for MMS. And geologically I would concur, yes. They are not all created equal.

Mr. COSTA. Dr. Birol, I talked in my opening statement about the near term, the interim and the long term. What should we be doing to utilize these resources for sustainable energy policy for a comprehensive energy policy today? What should we be doing in the next 5 to 10 years and beyond?

I am going to take the privilege of the Chair because my time has just run out, but please answer the question.

Mr. BIROL. OK, I think short term there are low hanging fruits in the United States which are the most important way to improving energy efficiency, using energy much more efficiently, the energy from transportation, cars, trucks, jets to electrical appliances. There is huge room to improve energy efficiency there, and we can save energy in the short term.

Second is the current Administration is very much determined to make more user renewable energy with solar and biomass. But at

the same time it will not be a bad idea to look at the option of nuclear power as it provides energy, particular energy, without emitting carbon emissions and without creating problems for security of supply.

In the longer term we all know that coal is the backbone of electric generation in the United States and will remain so for many years. So to look at the possibilities of using coal in a cleaner way may be a very good option.

To sum up, more energy efficiency, more renewables, more nuclear power and in the longer term clean coal technologies.

Mr. COSTA. My final question, if we were to take advantage in the short term of that low hanging fruit that you described, what are the best examples around either here in the United States or elsewhere of that low hanging fruit for us to pattern after?

Mr. BIROL. I think the most important ones today are energy efficiency improvements, renewables and nuclear power, sir.

Mr. COSTA. In what places are those most exhibited?

Mr. BIROL. Energy efficiency—almost throughout the world, but in the United States especially in the transportation sector—cars, trucks—there is huge room for improvement. But also in China, India, Middle East countries, there is strong room for improvement and nuclear power. We have the chance to increase the share of nuclear energy, which is good for the twin challenges I described here—to address the climate change issue and the security of supply issue.

Mr. COSTA. That good old-fashioned ethic of conservation?

Mr. BIROL. Yes, it is. That is right.

Mr. COSTA. Sir, my friend from Colorado. Mr. Lamborn.

Mr. LAMBORN. Thank you, Mr. Chairman. Mr. Gruenspecht, you did some analysis last year for the Senate Lieberman bill, Lieberman-Warner bill on cap and trade, your organization. I would like to ask you a couple questions about that. The report that EIA put out said, "The consumer price index for energy, a summary measure of energy prices facing households at the retail level, increases by approximately 18 percent above the reference case level by 2030. Industrial energy prices increase 10 percentage points more at 29 percent above reference case levels."

So by my reading of this report consumers will see a nearly 20 percent rise in cost in the industry, nearly 30 percent rise in cost under essentially the basic case presented by EIA of the Lieberman-Warner bill; is that correct?

Mr. GRUENSPECHT. I am trying to remember back exactly what we had. I remember that we did several different cases in part because of the issue of it is very difficult to know will nuclear power really be available, will coal carbon capture and sequestration really be available. I do recall we did a range of cases. But certainly not surprisingly coal is some of the cheapest—the electricity sector is where a lot of the reductions occur. It comes from backing out the current coal technology. So one needs to build a lot of new capacity of other types if one is subject to these caps and it does have significant impacts on energy prices, particularly electricity prices, and there are some impacts on gasoline prices and other fuel prices.

Mr. LAMBORN. Now did your analysis go on to analyze what would happen with these kinds of price increases, depending on the scenario and I know that that varies to the economy and to economic growth and jobs?

Mr. GRUENSPECHT. I am sure we did. I am trying to again think back to that, but I know there was a range of economic impacts on both the overall size of the economy and level of consumption, which is another measure of welfare, clearly depending on what technologies at what costs were soon to be available.

One thing to keep in mind, I think, is the EIA has sort of a funny mission—we try to present information. There is certainly uncertainty in all projections, but we don't do a lot of framing of that information. A good example would be the economic effects of a climate change policy. You could either measure it in how many billions or hundreds of billions or maybe even trillions, a number that we use more and more frequently in Washington these days, of dollars you get comparing one case to another.

On the other hand, you could say, you know, how big is the economy in 2030 if we did this and if we didn't do it. And the economy is very big, you know. So a difference of a few hundred billion or a trillion, which is certainly a lot of money to me, if you put those two bars next to each other in a 20 or 30 trillion dollar economy out into the future it doesn't look like that much. All I am saying is you can take the same results and depending on how they are framed you can say gee, this is a tremendous——

Mr. LAMBORN. Thank you.

If we are going to do cap and trade, knowing that it would raise energy prices, would you have a recommendation on the timing for instituting that? In other words, during a time of growth or during a time of recession if that was the two choices that we had?

Mr. GRUENSPECHT. That probably strays into the policy area where EIA does not play.

Mr. LAMBORN. OK.

Mr. GRUENSPECHT. But I think you could imagine what an answer might be.

Mr. LAMBORN. On carbon capture and sequestration am I correct in assuming that there is absolutely no proven technology for that today?

Mr. GRUENSPECHT. I think that is not—certainly in the power sector there is no carbon capture and sequestration operating on a full scale power plant. That would be correct. But there is carbon capture and sequestration going on in oil production and in some other areas.

Mr. LAMBORN. OK, thank you for that clarification.

So as far as the cost that that would add to energy and so on or even if it is feasible on a commercially scalable and viable level, we don't even know—really know—that for sure, do we?

Mr. GRUENSPECHT. It is pretty significant. The issue of baseload power generation, I think my colleague Dr. Birol raised, you can think of nuclear as one carbon free option and coal with carbon capture and sequestration as another. We probably have a lot more experience with nuclear. In EIA's analyses, the cost of those tends to be actually pretty close to each other. So coal with carbon capture and sequestration in addition to the extra kit that you need,

you also use a lot of the energy that you generate in the plant to run that extra kit to capture and handle the carbon. So it is pretty expensive.

Mr. LAMBORN. Thank you, I see my time is up. Thank you, Mr. Chairman.

Mr. COSTA. Thank the gentleman from Colorado. We now will give 5 minutes to the gentleman from the Northern Mariana Islands, Mr. Sablan.

Mr. SABLAN. Thank you, Mr. Chairman. I have one question, Ms. Pierce. I would like to thank you USGS for some of the recent activities you had in the Northern Mariana Islands. I come from the Mariana Arc in the Pacific Ring of Fire. I have no idea if we have oil in the Marianas, I don't know if you do, but I know we don't. But it seems that we have other kind of energy that is actually clean that no one has thought of—well, they have thought about using it but not in a commercial way. Do you have any efforts to update the national assessments of oil and gas resources on offshore and state waters? It does not appear that you have those assessments completed for the Northern Mariana Islands. Is USGS planning to perform an assessment some time?

Ms. PIERCE. Recently we have been very focused on domestic oil and gas resources in our state waters and onshore. And our international assessment has been focused solely on the Arctic because that was such a large piece missing. Now that the Arctic is done we need another year to integrate those efforts. But as that year goes on we are going to reprioritize the rest of the world, where there are holes and where there is missing information where we need to focus on next.

So certainly in that time frame we would be looking at potential and what we might do, and so we would be developing those plans.

Mr. SABLAN. Thank you.

Mr. COSTA. If the gentleman from the Northern Marianas would like to try to get some direction for the U.S. Geological Survey to focus in your area, I would be pleased as the Subcommittee Chairman to put together a letter to ask that when the resources become available that they do so if that is your intent.

Mr. SABLAN. Well, actually yes, Mr. Chairman. And actually I would also ask one of the other witnesses. In your last hearing in the Virgin Islands you actually asked, I think it was Energy Information Administration, to put some information for the territories, and I don't think it has been done yet. So I would also ask for that. You had a hearing in the Virgin Islands.

Mr. COSTA. No, we did. And part of it was done with our colleague.

You have just gotten some new information?

Mr. GRUENSPECHT. I am informed that there is work underway on that request. It has not been forgotten.

Mr. SABLAN. So they do listen.

Mr. COSTA. Does that include, besides the U.S. Virgin Islands, the Northern Mariana Islands as well?

Mr. GRUENSPECHT. I thought it was all of the territories.

Mr. COSTA. I thought it was, too. I want to get clarification since we have a Representative here who obviously needs to be clear as to what he understands is taking place.

Mr. GRUENSPECHT. How about if it doesn't, it will?

Mr. COSTA. I think it would be appropriate if your agency would provide a letter to the Subcommittee and to the Representative indicating what is taking place and on what time line. And then if we need to follow up with further response we can do so.

Mr. GRUENSPECHT. I think that is very reasonable, sir.

Mr. SABLAN. Thank you, Mr. Chairman. I yield the rest of my time.

Mr. COSTA. The gentleman always appreciates when Members are judicious with their time, which brings me to the gentleman from Utah, Mr. Chaffetz.

Mr. CHAFFETZ. Thank you, Mr. Chairman.

Mr. Gruenspecht, I appreciate all three of you being here, but my questions are primarily directed to you. It is not a trick question. What percentage of Americans consume energy?

Mr. GRUENSPECHT. All of them.

Mr. CHAFFETZ. And so if we had a tax, a cap and trade tax, what percentage of Americans would be affected by that tax?

Mr. GRUENSPECHT. Probably all of them.

Mr. CHAFFETZ. One hundred percent of Americans.

One of the things that is interesting here is that what I have read, and correct me if I am wrong, is that it assumes the current laws and regulations are in place. And one of my concerns is the disruption that we have, the lack of regulatory certainty that those companies that may be manufacturing and extracting these resources are dealing with.

Can you try to help me quantify or understand what the impact is when there is a lack of regulatory certainty? We are dealing with an issue, for instance, in Utah after a multi-year process where unilaterally we were no longer allowed to proceed with some leases on public lands. What sort of impact do you think that that lack of regulatory certainty has in the market?

Mr. GRUENSPECHT. It is actually a very tough question. It is not a trick question.

Mr. CHAFFETZ. In about 20 seconds.

Mr. GRUENSPECHT. Twenty seconds. There is an impact. If one knew what the ultimate decisions were going to be policy wise, I think everyone would agree that you would rather they know about them now than be uncertain about them. But on the other hand, there is a lot of disagreement about what the policy decisions are going to be. I think the parties also care about how the program comes out and how the decisions come out.

Mr. CHAFFETZ. Certainly you wouldn't disagree with the fact that, given the lack of regulatory certainty, there are real expenses that are ultimately passed on in the consumption of energy?

Mr. GRUENSPECHT. Uncertainty has a cost, but certainly people would rather be uncertain and not have the outcome they don't want than be certain that they have the outcome that they don't want. That is what I would say, and that is really the truth. That is an honest answer.

Mr. CHAFFETZ. And over the course of time, at least until 2030, you do see an increase in the consumption or extraction of resources in all areas, including those resources that are extracted from public lands?

Mr. GRUENSPECHT. We do and we see energy demand growing, but not growing that fast, in part because of some efficiency options that we think are really coming into play and in part because of some of the legislation that you all have enacted. You enacted fuel economy standards in 2007 and other things.

Mr. CHAFFETZ. Now, there has been a lot of discussion about increasing wind and solar development to reduce our dependence on foreign energy. Can you help quantify how many imported barrels of oil will be reduced by generating more electricity from renewable sources?

Mr. GRUENSPECHT. Well, I would say that very little oil is used to generate electricity right now. So while certainly using more renewable energy to generate electricity would affect the use of fossil fuels, probably since little oil is used to generate electricity, it would not affect——

Mr. CHAFFETZ. So if we don't generate much electricity from oil, how much electricity do we import from foreign nations?

Mr. GRUENSPECHT. I think we have net importers from Canada, but not much.

Mr. CHAFFETZ. So clearly when we talk about reducing our dependence on foreign energy it is not about creating more wind and solar power or about generating electricity, it is about the combination of producing more oil and gas here at home and consuming less. If that is clearly the case, since we have put in place many of the standards to begin to control the consumption of oil, shouldn't our focus be on increasing domestic production to reduce our import dependency?

Mr. GRUENSPECHT. Again, I think people would argue that there is—again EIA would not take a policy position. People would argue that there is still more room for increased efficiency. Certainly it is a combination of less demand and more domestic supply that reduce imports. So if your focus is on reducing imports both demand and supply matter.

Mr. CHAFFETZ. My last question, Mr. Chairman. My understanding is that by 2030 the United States will still need to rely on oil for more than 80 percent of its transportation fuels, is that correct?

Mr. GRUENSPECHT. I think our reference case projection would have something like that.

Mr. CHAFFETZ. We still are going to have more than 80 percent.

Mr. GRUENSPECHT. That would be down from a current 96 percent, yes.

Mr. CHAFFETZ. But still a huge 80 percent.

Mr. GRUENSPECHT. A lot, yeah.

Mr. CHAFFETZ. Thank you, Mr. Chairman. I yield back the balance of my time.

Mr. COSTA. Thank you. We appreciate that.

The next gentleman on the Subcommittee that the Chair will recognize, Mr. Sarbanes from Maryland. Good to have you here.

Mr. SARBANES. Thank you. I am glad to be here. Thank you for holding the hearing. I have an assortment of seemingly random questions, so bear with me.

First one is just definitional. Undiscovered but technically recoverable means what?

Ms. PIERCE. We produce resource estimates on those that are not currently reserved, so not booked by the SEC, not currently in production. They are undiscovered so they have not been drilled yet.

Mr. SARBANES. So would there be three categories or would there be in production and then there would be reserve, a class of reserve items, and then there would be this undiscovered, but technically recoverable.

Ms. PIERCE. And there is yet a bigger one of all undiscovered, like all molecules in the ground.

Mr. SARBANES. So, there are like four categories?

Ms. PIERCE. There are many, but in general, in general.

Mr. SARBANES. The OCS discussion is one that we have been having for the last couple of weeks and, of course, we are operating now in an environment where the moratorium has been lifted so the discussion is over. Re-imposing it or not having it at all, and so forth.

Describe, if you will, what you view as the practical impact of re-imposing the moratorium, recognizing that when it was in place there was a fair amount of the OCS what, 15 or 16 percent or something like that, that was available for exploration and production, because what I am trying to get a handle on is until that was lifted presumably people were projecting models on how they were going to make this transition and where our resources were going to come from that assume the moratorium would stay in place.

And maybe Ms. Pierce, you could speak to the question. You mentioned the Gulf of Mexico, there is going to be new deepwater production there in the next few years or something?

Ms. PIERCE. Yes.

Mr. SARBANES. Is that in the place exempt from the moratorium when it was in place?

Ms. PIERCE. Yes. And I would like to have MMS answer that question.

Mr. COSTA. State your name for the record.

Mr. SYMS. I have a cold. Harold Syms.

Could you ask that again, please? I am not quite sure.

Mr. SARBANES. The specific question was the Gulf of Mexico anticipated increased production that was referenced was something that was exempt from the prior moratorium that was in place?

Mr. SYMS. It was.

Mr. SARBANES. And so I guess my point is we are still in that time period where we are referencing things that we could have explored and produced, notwithstanding the existence of the moratorium because people haven't yet built all the new models that would assume the moratorium was gone. And the old models seemed to make it sound like there was a significant amount of resources that could come, energy resources that could come, even though the moratorium was going to be in place, and that you would be able to make this transition that we all talk about making from our current portfolio of energy resources to a new one that is less dependent on oil and all the rest of it.

And so what I am asking, and maybe, Dr. Gruenspecht, you could speak to this, when the moratorium was in place we still saw our way clear to a decent transition, notwithstanding the new needs that we project, right?

Mr. GRUENSPECHT. As I discussed in the testimony, we expect total OCS production to increase whether or not the moratoria are restored. In one case to about total lower 48 offshore would be something like 2.2 million barrels a day and in the other case it is something like 2.8 million barrels a day, but they are both higher than today's 1.3 million barrels a day in the OCS.

The other thing to keep in mind, the open—there is Alaska, Atlantic, and Gulf of Mexico that were open prior to 2008. There is the eastern Gulf of Mexico that was off limits and the Pacific that was off limits. The Gulf of Mexico that was open actually, and again MMS could speak for the undiscovered part, but I think those resources were something like 40 billion barrels. And the total OCS undiscovered is something on the order of 100. So actually the open part by the estimate of oil that it contains is actually more than the 17 or 18 percent that you referenced in your question. That might be the square miles or something.

Mr. SARBANES. OK.

Mr. GRUENSPECHT. That is a very rich part, but the Atlantic and Pacific together has been discussed as being 18 billion barrels of oil, and then you have the Alaska OCS which is open, was not subject to the moratoria, although there has not really been significant development there.

Mr. SARBANES. My time has expired, but I think you have helped make the point I am trying to make, which is that there is all this alarm about how we would be tying our hands if we went back to the moratoria that were in place when in fact we could argue we were in pretty decent shape with making the transition we need to make.

Now I myself argue that we should put more off limits than even the moratoria required, but at the very least it seems that going back to the moratoria isn't going to put us in a highly compromised position in terms of getting the energy that we need.

Thank you, Mr. Chairman.

Mr. COSTA. I thank the gentleman from Maryland. That just goes to prove that we all have different perspectives on this.

The gentleman from Texas, Mr. Gohmert. Would you yield?

I thought the questioning was very good between you and the gentleman from Maryland. My understanding is and I asked you how good your determination on these numbers. Haven't most of the fields once we have determined been lower than the projections? I mean higher once they have gone into production, the initial projections?

Mr. GRUENSPECHT. Sure. I know USGS has done studies on this, but there have been fantastic studies of some of the California fields and some of the Texas fields. I don't have the picture in front of me. I would need the picture. Maybe Brenda——

Mr. COSTA. You might provide that information.

Mr. GRUENSPECHT. I would be glad to provide that for the record.

Mr. COSTA. Thank you.

The gentleman from Texas. Thank you for yielding.

Mr. GOHMERT. Absolutely. Thanks for having the hearing. I mean you called the hearing, why wouldn't I yield?

So I would like to ask Dr. Birol, the UCSD economics professor James Hamilton had written "Nine out of 10 of the U.S. recessions since World War II were preceded by a spike up in oil prices."

Has EIA examined how much high energy prices Americans faced last summer may have contributed to reducing our GDP and pushing us into a recession at the end of the summer?

Mr. BIROL. We looked into that and it would be definitely an exaggeration to claim that the current recession is because of the high energy prices, but we do believe that high energy prices did make the economy much more vulnerable through higher budget deficits and provide a fertile ground for higher impact of the financial crisis on the economy.

Mr. GOHMERT. Thank you. There are people around Capitol Hill today who are concerned because they have been notified it looks like there will be additional taxes on the manner of producing oil and gas. And I am from east Texas where apparently we produce more natural gas in east Texas than anywhere else in the State of Texas. And people are concerned obviously that if this taxation goes into place, as was established earlier, it means every American will pay higher prices for everything at the worst possible time.

And so anybody can answer, but if we raise taxes on U.S. production, doesn't it mean that the marketplace will go outside the U.S., the Americans will end up buying more foreign oil if we tax more of our own production. Don't we normally see that? Anybody?

Mr. BIROL. I am not an American. I can better understand question.

Mr. GOHMERT. I enjoy your accent. You may enjoy talking to me since I don't have one.

Mr. COSTA. I was wondering when we were going to go there. Would you like me to translate for each other?

Mr. GOHMERT. You may need to translate for him. I can understand him.

Mr. BIROL. Let me just put the big picture. I tried to say in my testimony that the good times for the international oil companies will be soon over, mainly because of the fact that the reserves of the big oil companies are declining on the one hand. Second, there are enough reserves somewhere in the world, especially in the Middle East and elsewhere, but the big oil companies have difficulties to access those reserves because they are under the control of the national oil companies and they do not allow these international oil companies to go and invest and increase production.

So what happens is that the international oil companies now have to turn to perhaps less profitable fields to increase the production. And anywhere in the U.S. and elsewhere, if there is a tax, additional tax on production, this would definitely discourage those companies to increase the production and this would definitely have implications for the U.S. oil production prospects in a negative sense.

But, of course, this picture needs to be put in a broader context. What are the macroeconomic and political implications of it? But, just looking at it from oil production prospects, it will definitely have a negative implication for U.S. production prospects.

Mr. GOHMERT. Thank you. That means less jobs and it means less American energy that will be produced and apparently higher prices for what is.

But we keep talking about the carbon footprint, cap and trade, and I had some very good teachers growing up and they were basically all Democrats and they were brilliant. And they taught me that if you don't have carbon dioxide plants die, that you have to have carbon dioxide or plants die. Obviously there is concern on Capitol Hill that we produce too much carbon dioxide up here, especially on the Floor. But the problem is if we are going to put caps on carbon, it looks like we are going to have to cap what some people—some people are breathing too much apparently. But now there is a disagreement over global warming, and now I think that is why people are starting to call it climate changes because they are not sure that maybe we are cooling instead of warming and they don't want their contributions to slack off. So we need to go calling it climate change.

But this last question, do you know how many countries with coastlines besides the U.S. have historically placed their offshore oil and gas resources off limits, besides the United States? Does anybody know, because I don't know. I am curious if anybody knows. Are there other countries?

Mr. BIROL. I would say very few, sir.

Mr. GOHMERT. Do you know of any personally?

Mr. BIROL. No.

Mr. GOHMERT. You can't name any countries that do?

Mr. BIROL. I don't know how many.

Mr. GOHMERT. Either they are all really, really stupid or draw your own conclusion. Thank you very much.

Mr. COSTA. I thank the gentleman from Texas. I am glad that we are not determining that there is a lot of carbon problems with the Subcommittee here today. So that we are keeping that under control. And then I do want for the record it to be stated that the gentleman from Texas has acknowledged that there are smart Democratic teachers.

Mr. GOHMERT. Very smart.

Mr. COSTA. I always enjoy our exchange.

I think the next Committee member who is up is Mr. Heinrich from New Mexico. The gentleman from New Mexico for 5 minutes.

Mr. HEINRICH. Thank you, Mr. Chair.

Dr. Birol, in your testimony you stated that you believed that expanded drilling in the OCS could form "a crucial part of a comprehensive strategy to enhance the Nation's energy security." I don't think that anyone can disagree with the idea that oil production from the OCS is critical to our energy security and will be for some time to come.

The question that a number of us are wrestling with as a Nation and on this Committee is where should that expanded production take place from in the near term before the long term. And should it be those areas where drilling has already been allowed before the moratorium expired or should we be focusing on these new areas that seem to be the focus of renewed interest?

Now we heard the statistic today that the MMS provides that says that roughly 80 percent of the oil and gas on the OCS is in

those parts of the Gulf of Mexico and Alaska that are open for leasing. But another statistic that I find interesting from the MMS is that just in the central and western Gulf, where almost all of our offshore oil currently comes from, 60 percent of undiscovered oil is in the areas that have not been leased. That's about 24 billion barrels in the Gulf of Mexico available for leasing but not yet leased. That is more than the total, which I believe we mentioned about 18 billion, available in MMS estimates under the previous moratorium areas.

So when you say that drilling on the OCS should be expanded, should we be prioritizing basically the western-central Gulf region or should we be looking immediately to those new areas such as the Atlantic and the Pacific?

Mr. BIROL. I think, first of all, we should see that the U.S., as in many countries, is facing two major challenges. We cannot disconnect these two challenges, the energy security mainly on the oil side, and the second one is climate change. And in many cases the policies which are good for the climate change are at the same time good for the energy security. I wanted to make this point here that this is a win-win solution.

The question you raised, Mr. Chairman, which policies energy efficiency, renewables, nuclear power, they are good for the climate change but at the same time for energy security this is a win-win station here. I think there is no contradiction between pushing energy security or the climate change agenda. So I wanted to make this point that there are many synergies there.

In terms of energy security, I think a major problem for the United States which is going to come is the increasing risks with oil import dependency. 12 million barrels per day of oil import is very high in 2030, essentially if we see that one of the major suppliers such as Mexico, the production is going to decline, so U.S. has to import oil from longer distances and from countries which are far from the United States and very few number of countries. And two countries which are very important in this context are Saudi Arabia and Iraq, which will be the major exporting countries in the next years to come.

In this context I think there are two areas which are key to address this oil import dependency issue. One is using less oil, the question of oil import dependency, and because of increasing efficiency especially in the transportation sector. It is an old concept but it is a very important concept, and there is a lot of room still to apply this old but not yet fully implemented concept to two different channels. One standards and regulations and, second, perhaps it is not very politically correct here, but perhaps you can get the prices of gasoline and diesel in the United States and bring it to a level which would discourage the wasteful use of oil. So this on the efficiency side and which will bring the demand growth slower, which would make U.S. import less oil.

And the second issue you mentioned, distinguished member, it is increasing production from the offshore. These reserves offshore will be very important. If you look at the last 20 years, almost all the growth including what came from the offshore fields, no onshore growth, almost all the growth came from offshore fields. And when you get to the reserves two-thirds of the global reserves are

under the water. So there is no way of escaping this. This is under the water, otherwise we will lose that domain. In the context of the prioritization I would think that the Gulf of Mexico and Alaska these are the areas that we have to look at carefully, but this shouldn't exclude to get to other parts the offshore especially in terms of having much more realistic assessments in terms of having more drilling.

Thank you.

Mr. HEINRICH. Mr. Chair, do I have more time for another question or am I out?

Mr. COSTA. If it is a quick one.

Mr. HEINRICH. Real quick question. We heard about the risk of addressing pollution from carbon. Do you see an economic risk in not addressing pollution from carbon as the temperature rises?

Mr. BIROL. That may be long-term implications in terms of the climate change would have an effect on many areas of the world, including United States, ranging from the productivity in the agriculture sector, to the availability of water, changing the landscape of the plants and others. That may have such implications.

But second, I think more importantly, the later we address the climate change issue, the more costly it will be in the future. Because there are a lot of investments being done, not everywhere in the world, especially in China and India and also in those countries which do not take into account the climate change issue, and those investments once they are done, for example, building a coal-fired power plant, it will be with us 50, 60 years. So the earlier, if you want to give a signal to the investors we give, the better and less costly it is in the next years to come.

Mr. COSTA. We thank the gentleman for his response. It may have been a quick question, but it wasn't a quick answer.

Mr. HEINRICH. I thought it was a yes or no. I apologize.

Mr. COSTA. I think he tried to respond in a complete fashion.

The Chairman is pleased to recognize the gentlewoman from Wyoming, Ms. Lummis.

Mrs. LUMMIS. Thank you, Mr. Chairman. My first question is for Dr.—is it Gruenspecht. Would you pronounce it for me?

Mr. GRUENSPECHT. Gruenspecht.

Mrs. LUMMIS. Gruenspecht. Thank you.

Mr. GRUENSPECHT. Gruen means "green," so you are pretty close.

Mrs. LUMMIS. There is a great town in Texas called Gruen and they pronounce "green," but it is pronounced like your name. It is really neat. You ought to go down there some time.

What percentage of our domestic energy use is renewables right now?

Mr. GRUENSPECHT. I would say probably close to 10. And the biomass industry and the wind and the solar all together will probably be close to maybe 9 or 10.

Mrs. LUMMIS. And what do you predict that percentage will increase to by 2030?

Mr. GRUENSPECHT. I don't have the renewable all together, but I have the fossil part, is like 85 percent now, and we see that dropping to about 79 percent. So the other 15 percent would be renewables and nuclear now and then that renewables and nuclear

would grow to about 21 percent by 2030. I can get you the breakdown if you want. I just don't have it in my head.

Mrs. LUMMIS. Thank you, Mr. Chairman, I would love to have that. So thanks.

Mrs. LUMMIS. The President's budget, I am on the Budget Committee and I was over there this morning, his budget proposes to repeal the intangible drilling cost deduction for oil and gas producers. And that would prevent people who are drilling for oil and gas to deduct some of their business costs up front like other industrial sectors do. I have been informed that eliminating the IDC deduction will increase the cost associated with domestic natural gas production to such a degree that it will single-handedly reduce the number of natural gas wells in the U.S. by one-fourth.

How would such a decrease affect your analysis that net imports of natural gas will decline to less than 3 percent by 2030?

Mr. GRUENSPECHT. Clearly in our projection we do have an increase in natural gas drilling in the unconventional areas. A lot of that it would be sensitive to—tax provisions definitely matter, although I can't agree or disagree with the specific estimate you cited. The other thing that matters a whole lot is the price of natural gas. And as a person from an energy producing state, you and I know that drilling right now is—natural gas prices have come down quite a bit, as have oil prices come down and drilling activity is down dramatically. So I would say that certainly tax provisions matter and certainly the wellhead prices available matter.

Mrs. LUMMIS. Thank you. My next question, Mr. Chairman, is for Dr.—and once again is it Birol?

Mr. BIROL. Birol.

Mrs. LUMMIS. Thank you for joining us. The whole panel has done a great job. You state in your testimony that even if global oil demand remained flat until 2030 the equivalent of over four times of the current capacity of Saudi Arabia would be needed to offset declining production at existing fields. How much of that global oil demand do you associate with the United States?

Mr. BIROL. I think for the United States likely we expected that the oil demand in the U.S. in 2030 will be less than today. But still a significant portion of the oil demand would come from the United States but less than today. And the bulk of the growth would come from China, India, and the Middle East countries.

Mrs. LUMMIS. OK. And is there an analysis that you know of regarding how much of that demand could be met if the OCS areas that were formerly under a moratorium were actively developed?

Mr. BIROL. It would depend on how much of the OCS will be utilized. But I wouldn't say that OCS will be a big part.

Mrs. LUMMIS. Thank you. One more question, Mr. Chairman, this one for Mrs. Pierce. You made a key point in your testimony that the estimate of technically recoverable resources changes dramatically over time. It is based on geologic understanding and developing technology.

One of the technologies that has really improved production in recent years and has the potential for doing so into the future years is that of a fracking technology. And that has allowed us to recover from tight sands, and so forth.

There is concern here in Congress, on my part certainly, that if fracking technology is not allowed to be used and it is brought under the Safe Drinking Water Act and basically regulated out of existence, that even more resources that we could recover with nonconventional fracking technologies would be lost. Do you think that is a fair statement?

Ms. PIERCE. It probably is a fair statement. I mean part of the reason the Bakken Formation grew exponentially in terms of resources, and the Barnett Shale and the Marcellus Shale, is the technology you are talking about and the horizontal drilling.

Our assessments are technically recoverable and they are based upon what technology is used today. If any technology isn't used today, we don't use that in our technically recoverable resource estimate. So regardless of the type, whichever one is there or not, it will effect the resource estimates and what is usable and what is not, what is economically recoverable.

Mrs. LUMMIS. Thank you, Mr. Chairman. This has been a very informative panel, and I am deeply grateful to all of you for attending today. Thank you.

Mr. COSTA. Thank you. And the Chair stands corrected. I believe I mispronounced the gentlewoman's name, it is Lummis?

Mrs. LUMMIS. Lummis, yes, thanks.

Mr. COSTA. I know a Lummis in my district and so I mispronounced it, obviously not intentionally. Lummis.

Mrs. LUMMIS. Thank you very much.

Mr. COSTA. You are welcome. It is the Chair's intention to recognize both the two remaining members of the Subcommittee who have not had a chance to ask questions yet, the gentleman from New Jersey and the gentleman from Louisiana, and at that time I think we are going to be having votes. So we will close the testimony. So Members who have additional questions, I don't think we are going to get to a second round is my point.

Anyway, the gentleman from New Jersey, who has a deep interest and his own research on this subject, Mr. Holt.

Mr. HOLT. Thank you. I take that to mean I have only 5 minutes.

Mr. COSTA. Well, the Chair has been somewhat generous with the time.

Mr. HOLT. I would gladly spend all afternoon talking with the witnesses. It is an excellent panel.

Mr. COSTA. It has been a good panel.

Mr. HOLT. I apologize for my absence earlier in the hearing.

Mr. COSTA. We missed you.

Mr. HOLT. Let me ask a general question that is, I guess, a request for your help in answering what we all hear from our constituents, and I suppose this would be directed to Dr. Birol and Dr. Gruenspecht. We have heard drill here, drill now, pay less. Last summer we got a lot of mail from constituents on both sides of that, but they said, gasoline is at $4 a gallon, you have to start drilling off the Jersey shore or off the Virginia shore or wherever else. What would you say to the people who write us Members of Congress and ask that? I think it is worth noting that the price has dropped from $4 a gallon to considerably less than that and this drilling didn't take place. And that during the early part of the

21st century for the first half dozen years there was quite a bit of drilling and prices went up.

So let me ask you to help us answer those constituents.

Mr. BIROL. I guess our answers would be a bit different, because I don't have the concern to be elected or reelected. So I will tell you what I believe.

Mr. COSTA. That is why he is asking you the question.

Mr. BIROL. So I would say even if it is $4 per gallon, it is cheap. It is still half of the money that the people pay in Europe or even less than they pay in Japan.

Mr. HOLT. But putting that aside, and I take your point.

Mr. BIROL. Yes.

HOLT. But really what I wanted to get at is the effect of drilling here, drilling now on gasoline prices for the commuter, for the local businesses.

Mr. BIROL. I wouldn't say that even drilling here or there will have major impact to bring the price down. It may have some impact by increasing the production, but I would be surprised if it would change a lot. Because why the prices so increased was the result of what happened in the entire nation's oil markets. And the drilling and getting more oil from here and there wouldn't have a major impact on the international oil markets and wouldn't unfortunately bring the prices significantly down, is my answer.

Mr. HOLT. Mr. Gruenspecht.

Mr. GRUENSPECHT. I think that all else being equal, which is an important thing, because all else is not always equal, I think more production has some impact on prices but a pretty small impact on prices. When we have done analyses of increased—either it is opening ANWR, which we have been asked to look at that by various folks over the years, or the OCS. Again in our OCS case without the moratoria restored, we get about 600,000 barrels a day more production in the U.S. That is in the long-run setting. It isn't like you added 600,000 barrels a day to the market today. In the short run that could make a very big difference, but over time there is both supply response from other suppliers and there is also a demand response to prices and the effect of adding 600,000 a barrels a day is probably $1 or $2 a barrel, which translates into the $0.02, $0.03, $0.04 or $0.03 to $0.05 a gallon.

Mr. COSTA. Will the gentleman yield for a second? I will give you the extra time. Could you define for the Subcommittee what you mean by in the short time and the long term, years, 5 years, 10 years?

Mr. GRUENSPECHT. Let's say if you are looking—when the oil markets were extremely tight, let's say before last summer when you were getting all your fan mail, adding a million barrels of demand to that market where there was no spare capacity or removing a million barrels of supply or adding a million barrels of supply could immediately make a difference. Over time people can make different decisions in terms of the vehicles they buy, in terms of the fueling decisions they make. So over a 10-year or 20-year period, we often talk about 2030, both the IEA and EIA, there are both responses from other suppliers and responses in demand that tend to attenuate the price effects.

So I don't know if I have answered your question. But I would say less than a year for a short run—10 years or longer for a long run—would be a fair way to look at it. But again the drilling takes time. So all these issues is that if one would start leasing or if one would—I know ANWR isn't on the agenda today, or open ANWR, it takes a long time for that production to occur, so one thinks that the long run responses where other suppliers adjust and other people take account of that in the equipment they buy is probably valid.

Mr. HOLT. If the Chair will allow me to reclaim my time?

Mr. COSTA. No, no, go ahead.

Mr. HOLT. Your report and it is well-known that energy—and this is getting at the demand question. You report and it is well-known that energy intensity has decreased continually and actually quite in an almost a straight line, whether you are talking about energy per capita or energy per dollar of economy, economic activity, for now 30 years.

Do you see any reason for that to be leveling off any time soon?

Mr. GRUENSPECHT. We actually have had energy per dollar GDP has been falling off. Historically, energy per capita in the U.S. over the last 20 years has actually been pretty flat, but we do see it falling off going forward somewhat because—in part because of the things—again, what you folks do up here have consequences. So things like the Energy Independence and Security Act, which had the fuel economy standards, which has the appliance standards and lighting standards, we do see—and also our projection of prices with real energy prices in our reference case rising. We see per capita, which has been relatively flat since 1990, falling a little bit. We do see a continued decline, and you are exactly right, per dollar of GDP, it has been falling steadily and we see that continually. So we do see some growth in energy demand.

One of the differences between the U.S. and maybe Europe is that there is still population growth in the U.S. So, even with per capita declining a little bit, our overall energy use is growing a little bit, where in Western Europe, population is relatively flat or declining in many countries. And there are a lot of details, but I think that is the answer to your question.

Mr. HOLT. I think my time has expired.

Mr. COSTA. Thank you. I think we have all enjoyed the testimony here this afternoon. We may want to look for an opportunity to revisit this, because I think this is the thoughtful way we try to formulate policy, and I appreciate everybody's efforts.

Our last questioner is the gentleman from Louisiana. Am I to determine that your answer to the question—is long term by your definition as 10 years?

Mr. GRUENSPECHT. Oh. I am an economist, I have two hands. But I think 1 year is short term in the oil market, I think 20 years is long term, and somewhere between 1 year and 20 years, which I have arbitrarily defined as 10 years, is a good way to think about it.

Mr. COSTA. OK. Gentleman from Louisiana, Mr. Fleming.

Mr. FLEMING. Thank you, Mr. Chairman. Am I to understand that I hear today that there is perhaps a consensus emerging that

we need to move more toward nuclear energy which will help us out in the long run. Am I correct on that?

Mr. BIROL. I think this will be a very good choice for both of the challenges we are facing, both security of supply and climate change. I look at the countries outside the United States. There is a change of wind, direction of wind. In last 3 or 4 years, mainly for two reasons, many countries in Europe are changing their nuclear policy. Italy, for example, which banned nuclear power in 1992, is going back to nuclear power. Finland is building a new nuclear power plant. U.K. is changing its nuclear policy. And many developing countries want nuclear power because it produces electricity cheap without having security of supply problems and they deduct emitting in the carbon dioxide emissions.

Mr. FLEMING. Do other panelists agree with that?

Mr. GRUENSPECHT. Well, I am not really in a position to agree with it. All I would say is that certainly if you are interested in reducing greenhouse gas emissions and baseload power generation, your two kinds of options are nuclear and coal with carbon capture and sequestration, if that comes into being. Whether nuclear is cheap or not, I think people would have—it is compared to what else you could do if you weren't worried about greenhouse gas emissions. It is probably less economic. But that is a policy call, not my call.

Ms. PIERCE. And policy aside, all those factors are very true. I would just ask people to keep in mind it is still a resource. You still have to have the basic resources to run these nuclear power plants. And so again we need to understand where they are, at what cost they are provided, do we need to import those, do we have those resources. It is another thing to keep in mind.

Mr. FLEMING. Well, it kind of gets back to the cost of energy. So I am very concerned we have got—as my friend from Wyoming just mentioned, we have this idea in the Fiscal Year 2010 budget to remove incentives for drilling, which is going to add cost to oil and gas companies, which is going to hurt jobs. Then we are talking about $646 billion impact which regard to cap and trade, which is going to impact cost to the consumers and it could well hurt the poorest or working poor more because a higher percentage of their budget is going to be fuel oil and electricity warming their homes.

Mr. FLEMING. So I am very concerned about some moves that we're making here. I believe that the more we replace coal with things like nuclear energy and also the more we produce oil and gas, and also, Ms. Pierce, you mentioned that there is actually more and more stores of natural gas being found. We have the Haynesville Shale in our area, and apparently they have underestimated what that can produce.

With all of that, it seems to me that if we provide increase in supply and reduction in demand by moving into more efficiency and more alternatives like nuclear energy, that the costs will come down. It seems like to me—I worry some that there seems to be a goal to increase the cost. And I think our constituents, particularly the working poor and the poor are going to be the ones to hurt the most.

So, and also, it is kind of a second unrelated question but I will let you all address both of these, is what are other countries doing?

I see us potentially doing a whole lot but, of course, we are not producing all of the CO_2 going into the atmosphere. So we can do a lot. But is that really going to have a big impact when other countries aren't?

I would love to have a response from any of the panel on these.

Mr. BIROL. In terms of cost, it is too general to say that it depends on what we understand about the cost. But if we just look at the electricity generation cost, and natural gas and nuclear, if you compare this, too, if the oil prices were about $60 and above, nuclear power seems to be an economic choice. And in the absence of any carbon tax or anything. But if you have a carbon tax this would definitely favor, or any cap-and-trade whatever the system, this would definitely favor nuclear power or other carbon free sources.

But another thing for nuclear—we shouldn't think of nuclear only as a source of electricity generation. Today almost all the oil in the world, in the U.S. and other countries are used in the transportation system, cars, trucks. If you want to in the future move toward plug-in hybrids at electrical vehicles, we need electricity in order to feed those cars. And nuclear can also play a crucial role in that respect if we are forward looking in energy policy.

In terms of the carbon dioxide emissions initiatives, you are perfectly right, sir. As I tried to say, if the U.S. emissions tomorrow would be zero, European emissions would be zero, Japanese emissions would be zero and if it was to remain zero 20 years, no economic activity in the U.S., Europe or Japan, therefore no carbon dioxide emissions, if China, India, and Russia would continue with their policies we cannot make any significant improvement in the climate change. This is the point, unfortunately.

Mr. FLEMING. Any other comments?

Mr. GRUENSPECHT. A short comment. You know, the relevant position of natural gas versus nuclear, I think there is a difference from looking at things from a world perspective or a U.S. perspective. In the U.S.-North American market we would expect the price of natural gas to be separated significantly from the price of oil in energy terms in part because of the unconventional resource that we have, which I don't think is fully reflected in the IEA's analysis. And certainly with oil at $60 a barrel we do not think nuclear would be competitive with natural gas.

And I guess this other point I would make is I agree with Fatih in many respects. There are synergies between these goals of energy security and climate change in some respects. But let's be serious. There are also conflicts as well. Something like coal to liquids in a country like the United States, very attractive for energy security given our coal resource, a disaster perhaps—I don't want to get carried away because you could have sequestration, but it could help you on one issue and hurt you on another issue. Something like biomass, do we use it as a source of a substitute for oil, which helps us maybe on energy security, or you could take the same biomass and use it to back out coal, which actually gives you a bigger carbon dioxide bang for the buck.

So I think you do have to—you know, sometimes there are synergies, sometimes there are conflicts. And we have to be kind of honest about what issues we care about. And again, the EIA

doesn't have a position in how we prioritize those various concerns because it isn't like we are all going to hold hands and go down the street and everything will be a win-win because life is not really that way, as we all know.

Mr. COSTA. We are trying.

Mr. GRUENSPECHT. Whatever.

Mr. FLEMING. Mr. Chairman, I know I am out of time. I would like if it's OK——

Mr. COSTA. You are out of time. What would you like to do?

Mr. FLEMING. I want to enter into the record a letter from the Louisiana Oil and Gas Association President regarding this issue of the lack of incentives.

Mr. COSTA. Without objection.

Mr. FLEMING. Thank you.

Mr. COSTA. Gentleman from Colorado, wind up here.

Mr. LAMBORN. With leave of you as the Chairman, I would like to just ask just one very quick question of Ms. Pierce.

Mr. COSTA. If she can give us a quick answer.

Mr. LAMBORN. We have talked about other sources of energy, nuclear has come up briefly. What kind of supply does the U.S. have domestically for uranium?

Ms. PIERCE. That is a good question, I don't think there has been a recent assessment. We are gearing up to look at doing a resource assessment. But there is not a current assessment on uranium.

Mr. COSTA. Good question, gentleman from Colorado. If you could respond to the Subcommittee as to how that assessment is going to take place and what timeline we can determine the proven reserves, I don't know if that is a term of art or not, proven reserves of uranium that would be available for what type of nuclear expansion might be contemplated, that would be helpful. We would like you to do that.

Mr. COSTA. We are going to close here. I just want to mention to members of the Subcommittee that you have not seen. Dr. Birol, who has done such a good job, produces this World Energy Outlook every year, the international consortium that he is a part of, and so I would urge members of the Subcommittee to get this in your office. It is, I think, a helpful resource material. I am not plugging it for any reason. Dr. Birol and I don't have anything going. But I do find this helpful, and we do appreciate the good work you do, the good work that all the witnesses who testified here this afternoon do.

I want to thank the members of the Subcommittee for your focus, your attention, and your interest. We will continue to try to work on this effort so that, as Dr. Gruenspecht referenced, that maybe we can somehow find a way, all going down merrily that same road. Because certainly our Nation depends upon it.

Thank you very much. This hearing is adjourned.

[Whereupon, at 4:05 p.m., the Subcommittee was adjourned.]

[Additional material submitted for the record follows:]

[The letter submitted for the record by Mr. Don G. Briggs, President, Louisiana Oil and Gas Association, follows:]

Louisiana Oil & Gas Association
Don G. Briggs, President

March 2, 2009

The Honorable John Fleming
United States House of Representatives
1023 Longworth House Office Building
Washington, D.C. 20515-1804

Dear Congressman Fleming,

As you are well aware, President Obama released his FY 2010 Budget, entitled ***A New Era of Responsibility Renewing America's Promise***. The budget provides for a $30 plus billion-dollar tax increase on the nation's oil and natural gas producers, designed to help pay for alternative energy projects. In the proposed budget, President Obama strips from the oil and gas industry incentives that have been the "holy grail" of the industry for years, incentives that are critical in a high-risk investment industry.

Louisiana is the "Energy State" of these United States. Twenty-five percent of the oil and twenty-five percent of the natural gas that fuels our nation flows through the vast oil and gas infrastructure of our state. Fifty percent of the fuels that drive the engines of our country flow through and from the state of Louisiana. Our nation's energy security is greatly dependent on the well being of Louisiana's oil and gas industry.

Congressman Fleming, should Congress pass President Obama's budget proposals on oil and gas, our nation's energy security will be at great risk. Our nation's oil and gas industry is not made up of the five or so major integrated oil companies, but of several thousand independent oil and natural gas producers. It is these American oil and gas companies that drill and produce the vast majority of oil and natural gas produced in the United States.

President Obama's budget proposals will strip from the American independent oil and gas producer the economic incentives that provide the investment capital that is needed to explore and produce oil and gas for our country. Without the economic investment incentives, exploration and production of oil and natural gas, as we know it, will drastically decline. Trillions of dollars will be lost, tens of thousands of jobs will be lost and our nation's energy security will be severally threatened.

Louisiana is the heartbeat of our nation's energy infrastructure; President Obama's budget proposals will put that infrastructure at great risk. Please Congressman Fleming, work to defeat or amend President Obama's budget. Please feel free to call me should you have any questions.

Sincerely,

Don G. Briggs
President
Louisiana Oil & Gas Association

PO Box 4069 • Baton Rouge, LA 70821-4069 • 225-388-9525 • 800-443-1433 • Fax: 225-388-9561
email: don@loga.la • cece@loga.la • gifford@loga.la • ben@loga.la • jodee@loga.la • tiffany@loga.la •Web page: www.loga.la