AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

S. HRG. 110–387

# REVISED ENERGY OUTLOOK

## HEARING

BEFORE THE

## COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

TO

RECEIVE TESTIMONY ON THE ENERGY INFORMATION ADMINISTRATION'S REVISED ANNUAL ENERGY OUTLOOK

MARCH 4, 2008

Printed for the use of the
Committee on Energy and Natural Resources

U.S. GOVERNMENT PRINTING OFFICE

42–513 PDF WASHINGTON : 2008

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 ENERGY AND NATURAL RESOURCES

JEFF BINGAMAN, New Mexico, *Chairman*

DANIEL K. AKAKA, Hawaii
BYRON L. DORGAN, North Dakota
RON WYDEN, Oregon
TIM JOHNSON, South Dakota
MARY L. LANDRIEU, Louisiana
MARIA CANTWELL, Washington
KEN SALAZAR, Colorado
ROBERT MENENDEZ, New Jersey
BLANCHE L. LINCOLN, Arkansas
BERNARD SANDERS, Vermont
JON TESTER, Montana

PETE V. DOMENICI, New Mexico
LARRY E. CRAIG, Idaho
LISA MURKOWSKI, Alaska
RICHARD BURR, North Carolina
JIM DEMINT, South Carolina
BOB CORKER, Tennessee
JOHN BARRASSO, Wyoming
JEFF SESSIONS, Alabama
GORDON H. SMITH, Oregon
JIM BUNNING, Kentucky
MEL MARTINEZ, Florida

ROBERT M. SIMON, *Staff Director*
SAM E. FOWLER, *Chief Counsel*
FRANK MACCHIAROLA, *Republican Staff Director*
JUDITH K. PENSABENE, *Republican Chief Counsel*

# CONTENTS

## STATEMENTS


| | Page |
|---|---|
| Bingaman, Hon. Jeff, U.S. Senator From New Mexico | 1 |
| Caruso, Guy, Administrator, Energy Information Administration, Department of Energy | 5 |
| Domenici, Hon. Pete V., U.S. Senator From New Mexico | 2 |


## APPENDIX


| | |
|---|---|
| Responses to additional questions | 37 |

# REVISED ENERGY OUTLOOK

**TUESDAY, MARCH 4, 2008**

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
*Washington, DC.*

The committee met, pursuant to notice, at 10:03 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

## OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. Ok. Why don't we go ahead with the hearing. Thank you very much for joining us today.

Mr. Caruso, thank you for being here. We're always glad to hear from you, and look forward to discussing your Administration's recently revised Annual Energy Outlook.

We know that EIA has just completed this year's energy outlook last December. They had just completed it when the Energy Independence and Security Act was signed into law. We're very appreciative that on your own initiative you took the effort to re-run those models so that we might all begin to better understand the effects of the new energy legislation.

Because it is clear that the effects of the legislation will be substantial, I believe we've made some great strides toward reducing our energy dependence and curbing global warming pollution. In 2006, 60 percent of our oil, gas and other transportation fuels came from foreign sources. As I understand your projections now in 2022, only 51 percent of those fuels will come from foreign sources.

This is a substantial achievement. It reverses the long standing trend of becoming more and more reliant on imported oil. It appears that OPEC will meet tomorrow and decide not to increase oil production despite new record high prices for oil.

We hit a new high of $103.95 per barrel yesterday. OPEC's decision to sit by and watch as oil prices skyrocket highlights how important it is to wean ourselves off of imported oil to the maximum extent possible. This bill that was signed into law takes a strong step away from oil dependency and toward greater efficiency and home grown biofuels.

I'm also glad to see that your revised outlook suggests that EISA will lead to substantially reduce—that's the initials of that bill that was signed into law, will lead to substantially reduce growth in greenhouse gas emissions. Through the greenhouse gas emissions reduction requirements included in that bill's renewable fuel stand-

ard. Congress passed and the President signed into law the country's first global warming legislation.

Your testimony states that you now expect energy-related carbon emissions in 2030 to be 500 million metric tons below what was published or expected prior to the passage of this legislation. This again is a substantial change, a substantial decrease and a step in the right direction. It demonstrates that government policy can and will move toward reducing greenhouse gas emissions. I hope we will use this first step to build momentum toward more comprehensive global warming legislation.

I also want to thank Mr. Caruso for his responsiveness to Congress' request that EIA facilitate more transparency on refinery capacity and utilization. Both Senator Domenici and I co-sponsored an amendment that was adopted as part of the recent legislation requiring EIA to analyze refinery outage data and report its findings to the Secretary of Energy. EIA has now decided to go one step further and publish aggregate data on refinery outages every month in its Petroleum Supply Monthly.

This kind of data transparency is critical to the free and properly functioning markets that we depend upon. I applaud EIA for making the efforts. Again, thank you for being here. Let me call on Senator Domenici for his comments.

**STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO**

Senator DOMENICI. Mr. Chairman, fellow Senators, this ought to be a red letter hearing. The crowd should fill this place and reporters that are interested in reporting something good that was done by Congress, not only good, but exceptionally good, should be here. Because Mr. Caruso's agency is the best in the world and they're probably as close to right on predictions as anyone around.

The Administrator has come before us to discuss the law we passed to change CAFE standards. In that same bill we added biofuel production, as you may recall, and we also added some additional appliance efficiencies. Those were your specialty, Mr. Chairman.

Now the Administrator tells us that he is able to predict the impact of changing the CAFE standards, adding to the biofuels standard and improving appliance efficiency. He's giving us a report on the impact of that law, and those provisions, on America's energy consumption. It turns out that for the first time, our use of crude oil that is imported is going to come down, rather than continue its upward spiral.

Now, people will say, by how much? It's substantial. Two million barrels a day less by the year 2030, a time when people are expected to be using more oil elsewhere in the world.

Second, we didn't talk very much when we passed that bill. Commerce did its part. We had a say in the rest of the bill, but the Commerce committee worked on that provision.

By raising the CAFE standard, we said that we're going to have a different kind of automobile mix in the next 10 years and then thereafter. By doing that, we will save huge amounts of carbon dioxide, Senator Craig. You know we're out talking about what new thing we should impose on ourselves to reduce carbon dioxide emis-

sions. Of course there's going to be a battle royal as to whether we're going to impose a substantial cost on our economy or not.

But the energy bill we passed last year is going to cause us to save. I've got it down here where you could understand it: It's going to save in carbon dioxide emissions what 71, 500-megawatt coal plants would have emitted over that 23-year period. Senator Bingaman, just think of that.

By changing those car standards we are going to reduce the carbon dioxide by the equivalent of 71, 500-megawatt coal burning plants. What they would have emitted over 23 years? Now whatever else one wants to say about the excellent report that Mr. Caruso and his agency have given us here today, it is extremely important that we send our message out to the Senate and all those who worked hard with this committee to pass the major energy bill and the two that followed, that we can have an impact on the deleterious effect of being so dependent on crude oil.

But you can't change it quickly. Our dependence is pervasive, and you've got to change it gradually. But we have changed it forever just on the CAFÉ standard change.

Now if we can just look around and see if there's other things where we can produce—more American owned resources—we will truly be making some headway in terms of what we must do for our country. We're not there, but I'm very positive that we are making progress because we did do something that for years said we couldn't.

We were told it would have a measurable effect. You recall, Senator Bingaman, we were told by the expert from Oak Ridge National Laboratory, were we not, that if we passed the CAFÉ standard bill on an amendment of Senator Dianne Feinstein, that would be the biggest step you can take in reducing carbon dioxide and in reducing our dependence upon crude oil.

He was just theoretically telling us that. Now we did it, and we have the experts saying what the result will be. We've never passed anything to have this big an effect to your knowledge, have we, Mr. Caruso?

Mr. CARUSO. No, sir.

Senator DOMENICI. I have my additional remarks—a prepared statement—that I will not give. I ask you to include them, Mr. Chairman, as if read. Thank you very much.

[The prepared statement of Senator Domenici follows:]

PREPARED STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM NEW MEXICO

Administrator Caruso, I want to start by thanking you for your hard work on this year's energy outlook. It is important that we take the information that you provide into account as we seek ways to increase America's energy security.

Our efforts in Congress have led to three pieces of landmark energy legislation in the past three years. First we passed the Energy Policy Act of 2005, then the Gulf of Mexico Energy Security Act of 2006, and last year we passed the Energy Independence and Security Act of 2007. That legislation will:

- Raise CAFÉ standards;
- Increase biofuels production; and
- Improve appliance efficiency.

Each of these measures was intended in part to reduce America's reliance on imported oil, which has grown steadily over the years.

When I first came to the Senate in 1973, imports accounted for 28 percent of our oil supply. Thirty-five years later, oil imports account for more than sixty percent. EIA projects that level to diminish only slightly by 2030, even as alternative fuels account for a much greater percentage of our energy supply.

I am deeply concerned about the long-term impacts this dependence will have—I believe it threatens our economic strength, our national security, and our standing in the world.

In the 25 years preceding our most recent energy bills, Americans spent $1.76 trillion on foreign oil. Looking forward, EIA has projected that we will spend closer to $8.5 trillion over the next 25 years.

As we seek to reduce our dependence on imported oil, we must also address global climate change. I believe the bipartisan legislation we have passed in the last three years has, and will continue to, make a difference on both fronts. EIA is projecting over 16 gigawatts of new power plant capacity by 2030—that is a big deal. I also believe that there is additional room for bipartisan solutions to address both global climate change and our nation's dependence on foreign oil. This week I will be introducing a bill that establishes a Clean Energy Investment Bank. I expect bipartisan support for this measure which seeks to facilitate substantial additional investments into clean energy projects throughout the United States.

The energy bill we passed last December shows that Congress can reduce greenhouse gas emissions without harming the economy or increasing the price of energy—your data makes this clear. The five-billion metric ton reduction that will result from our most recent bill is equivalent to the carbon dioxide emissions that 71 500-MW coal plants would have emitted over the same 23-year period. It shows that our legislative options are not limited to a potentially devastating cap-and-trade system.

The data in this year's Annual Energy Outlook is encouraging—it shows that some progress has been made. These estimates would have been worse in the absence of Congressional action. More importantly, however, this Outlook should be seen as a warning for the future, and an indication of the significant work that remains.

The price of oil reached an all-time high yesterday—$103.95 per barrel. It broke a record that was set during a supply shock nearly 30 years ago. It will be a serious undertaking to address this growing challenge. Equally daunting is our seeming inability to accurately estimate the massive growth of the world's new energy consumers and the difficulty of the world's producers to keep pace with rising demand. Just four years ago, EIA estimated that the price of oil would rise from approximately $24 to $29 per barrel by 2010. We must ask how our estimates could be so far off the mark in such a short time. And, we must re-examine our policies in light of these new factors.

It has never been more important to develop an effective energy policy—one that will reduce our dependence on foreign oil and reduce our carbon emissions.

In my view, such a policy will focus on three types of initiatives:

- Those that increase production of our domestic resources;
- Those that accelerate research, development, and deployment of renewable and alternative sources of energy; and
- Those that enhance our nation's ability to conserve energy.

In terms of production, EIA projects that a great deal of our domestic oil will come from development of reserves in the Gulf of Mexico. It is no coincidence that just two years ago the Congress passed legislation to open more of this area. We are now seeing the import-reducing benefits of that work in EIA projections.

With energy prices near all-time highs, it is time to revisit the debate over responsible energy production on the Arctic Coastal Plain of Alaska as well. It is time to inventory our resources and produce more oil and gas on the Outer Continental Shelf—we must know what we have to work with and then we must produce it.

At the same time, we should advance the next generation of fuels and technologies, such as oil shale, coal-to-liquids, and advanced batteries. As I mentioned, I plan to introduce legislation this week that would establish a mechanism to help ensure that clean energy projects receive the financing they need to find success.

I look forward to working with you, Mr. Chairman, on legislation that will help many of these initiatives become reality.

The CHAIRMAN. Sure, we will include those in the record. Mr. Caruso, why don't you go right ahead with your testimony?

**STATEMENT OF GUY CARUSO, ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY**

Mr. CARUSO. Mr. Chairman, members of the committee, thank you very much for this opportunity to present the Energy Information Administration's updated Annual Energy Outlook. As you know EIA does not promote, formulate or take positions on policies. Our views should not be construed as representing those of the Department of Energy or the Administration.

My written statement provides an overview of the Annual Energy Outlook 2008 reference case, which incorporates EIA's assessment of portions of the Energy Independence and Security Act of 2007. I'll refer to it as EISA 2007 that was enacted last year. This 2008 reference case replaces the earlier released version that we issued shortly before that enactment. EISA 2007 provisions with the greatest effect, as Senator Domenici just mentioned, are the new fuel economy standards for light-duty vehicles, the new renewable fuel standard and new efficiency standards for various types of equipment.

My oral presentation today focuses on highlights in the areas of energy prices, consumption, production, imports, renewable energy use and greenhouse gas emissions. As implied earlier, our projections are based on current laws and regulations that are in place as of February 2008. The updated 2008 reference case also includes additional revisions that reflect historical data issued after the December early release; our latest Short Term Energy Outlook, when these runs were made, which was January 2008; a more current economic outlook; and updates to correct modeling problems in the earlier released version.

Starting with energy prices, real world oil prices in real terms in the AEO2008 reference case decline gradually from current levels to $57 per barrel in 2016, or about $68 when looked at in nominal dollars. As expanded investment in exploration and development brings new supplies to the world oil market, we do expect prices will trend downward over this period between now and 2016. As shown in figure 1 of my written testimony, real prices then begin to rise after 2016 as demand continues to grow and higher cost supplies are brought to the market.

In 2030, the average real price of oil is $70 per barrel in constant 2006 dollars or about $113 dollars per barrel in nominal dollars. We recognize that there is uncertainty in our long term price projections and due to unpredictable changes in energy markets and geopolitical concerns. For this reason, we project a range of oil prices using different assumptions from what are in the reference case. Under our high-price case, for example, oil prices in 2030 reach about $185 per barrel in nominal dollars.

Projections for natural gas prices are also higher than those in our 2007 outlook, but coal price projections have not risen substantially. Electricity prices, which follow fuel prices, are expected to rise in real terms through 2009 then decline until 2015, before rising again through 2030.

Total energy consumption, as shown in figure 3, is projected to grow by 19 percent between 2006 and 2030 at a rate of about 0.7 percent per year or less than one-third the rate of growth in gross domestic product, which we project to be 2.4 percent per year. Total

consumption of liquid fuels, both oil and renewable liquids, shown in figure 4, grows at an average annual rate of 0.4 percent in the AEO2008 reference case, increasing from 20.7 million barrels a day in 2006 to 22.8 million barrels per day in 2030, led by growth in transportation fuels which account for 68 percent of total liquid demand in 2006, increasing to 73 percent in 2030.

Total consumption of natural gas, shown in figure 5, is projected to increase about 10 percent over its 2006 level by 2016, and then decline by about 5 percent from that 2016 level by 2030. Industrial natural gas use is lower than in previous editions of the outlook because of the higher delivered natural gas prices, lower economic growth and a reassessment of natural gas in the energy-intensive industries, which clearly are increasing their efficiency in the use of natural gas.

Under current laws and regulations, natural gas is expected to lose market share to coal in the electric power sector as a result of a continued increase in natural gas prices in the later half of the projection period and slower growth in electricity demand, largely attributable to slower economic growth.

Coal consumption is projected to grow at a faster rate toward the end of the projection period, particularly after 2020, as coal use for new coal-fired generating capacity grows rapidly under current policies.

Nuclear generating capacity increases from about 100 gigawatts in 2006 to 115 gigawatts in 2030, including more than 16 gigawatts of capacity at newly-built nuclear power plants and 2.7 gigawatts expected from upgrades of existing plants. These are partially offset by 4.5 gigawatts of retirements.

Total marketed renewable energy consumption is the fastest growing segment of this outlook. It is projected to grow by 3 percent per year in the reference case. Rapid growth in the projected use of renewable fuels in transportation in AEO2008 reflects the EISA 2007 renewable fuels standard.

Ethanol use grows from 5.6 billion gallons in 2006 to 24.3 billion gallons in 2030. This is about 16 percent of the total gasoline consumption by volume in that year, and that's divided between corn and cellulosic feedstocks in this outlook.

Biomass-to-liquids technology plays a significant role in compliance with EISA 2007—its requirement for cellulosic renewable fuels. While the situation is very uncertain at this early stage, our current view is that available quantities of cellulosic biofuels prior to 2022 will be insufficient to meet the new RFS targets. As a result, the modification-of-applicable-volumes provision included in EISA 2007 is expected to be triggered, reducing the overall RFS target in 2022 from 36 billion gallons to about 32.5 billion gallons.

The use of renewable technologies for electricity generation is stimulated by improved technology, existing State RPS programs, the availability of the renewable production tax credit for eligible generation placed in service before the end of 2008, and higher fossil fuel prices. Total renewable generation in the AEO2008 reference case, including combined heat and power and end use generation, grows by 2.2 percent per year.

Turning to liquid energy production and imports, U.S. crude oil production grows from 5.1 million barrels per day in 2006 to a peak

of 6.3 million barrels per day in 2018, primarily due to increased production from the deep waters of the Gulf of Mexico and from the expansion of enhanced oil recovery operations in onshore areas supported by higher crude oil prices. Domestic production subsequently declines to 5.6 million barrels a day in 2030 as increased production from newer and smaller discoveries is inadequate to offset the declines in large fields in Alaska and the Gulf of Mexico. Total domestic liquids supply, which includes crude oil, natural gas plant liquids, refinery processing gains and other refinery inputs such as biofuels, grows from 8.3 million barrels per day in 2006 to 10.5 million barrels per day in 2030.

Differences between the updated AEO reference case and the prior early release version are driven largely by EISA 2007, although they also reflect some of the other updates mentioned earlier.

Net imports of crude oil and refined products in 2030 are 2.4 million barrels a day lower in the updated reference case then in the early release version. The net imports share of total liquid supplied, including crude oil and refined products, is significantly affected by EISA 2007, dropping from 60 percent in 2006 to 51 percent in 2022 and then increasing to 54 percent in 2030, as shown in figure 9 of my statement.

Compared to previous AEOs, lower projected growth in energy consumption and greater reliance on renewable fuels yields a lower projection in energy-related carbon dioxide emissions. In the AEO2008 reference case, greenhouse gas emissions are projected to increase at an average annual rate of 0.6 percent, as shown in figure 14. Over the period 2008 to 2030 projected cumulative energy-related carbon emissions are 5.3 billion metric tons lower in the updated AEO reference case than they were in the early release version. Projected increases in energy-related carbon emissions primarily result from continued reliance on coal for electricity generation and on petroleum fuels in the transportation sector.

In conclusion, Mr. Chairman, in addition to its work on baseline projections that I have reviewed this morning, EIA has also responded to a request from this committee and others for analysis of the energy and economic impacts of alternative proposals to limit greenhouse gas emissions and other policy proposals. We look forward to providing whatever further analytical support that you may require on energy-related topics. We believe that such analysis can identify both potential synergies and potential conflicts among different energy-related objectives that are currently under discussion in this committee and elsewhere.

This concludes my testimony, Mr. Chairman and members of the committee. I would be happy to answer any questions you may have. Thank you.

[The prepared statement of Mr. Caruso follows:]

PREPARED STATEMENT OF GUY CARUSO, ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee: I appreciate the opportunity to appear before you today to discuss the long-term outlook for energy markets in the United States.

The Energy Information Administration (EIA) is the independent statistical and analytical agency within the Department of Energy. We do not promote, formulate,

or take positions on policy issues. Our mission is to produce objective, timely, and relevant data, projections, and analyses that are meant to assist policymakers, help markets function efficiently, and inform the public. The energy projections that I will discuss today are widely used by government agencies, the private sector, and academia as a starting point for their own energy analyses. However, our views are strictly those of EIA and should not be construed as representing those of the Department of Energy or the Administration.

The *Annual Energy Outlook 2008 (AEO2008)* reference case discussed today includes the impact of the Energy Independence and Security Act of 2007 (EISA2007) that was enacted in December and replaces the early release version issued shortly before that enactment. The specific EISA2007 provisions that are modeled in *AEO2008* include updates to the renewable fuel standard (RFS) and to the corporate average fuel economy (CAFE) standard for new light-duty vehicles; updated and new appliance energy efficiency standards for boilers, dehumidifiers, dishwashers, clothes washers, and walk-in refrigerators and freezers; lighting energy efficiency standards; provisions to reduce energy consumption in Federal buildings; and industrial electric motor efficiency standards. Consistent with the general approach used in the AEO, the reference case does not consider those sections of EISA2007 that require appropriations for implementation or sections with highly uncertain impacts on energy markets. The updated reference case also includes additional revisions that reflect: historical data issued after the early release version of the *AEO2008* was completed, the EIA *Short-Term Energy Outlook* released in January 2008, a more current economic outlook, and updates to correct modeling problems in the early release version.

The *AEO2008* is intended to represent an energy future based on given technological and demographic trends, current laws and regulations, and consumer behavior as derived from known data. EIA recognizes that projections of energy markets are highly uncertain and subject to political disruptions, technological breakthroughs, and other unforeseeable events. In addition, long-term trends in technology development, demographics, economic growth, and energy resources may evolve along a different path than expected in the projections. The complete *AEO2008*, which EIA will release in April, includes a large number of alternative cases intended to examine these uncertainties. The following discussion summarizes the highlights from the *AEO2008* reference case.

ENERGY PRICES

EIA has raised the reference case path for world oil prices in *AEO2008*, although the upward adjustment is smaller than the last major adjustment, introduced in *AEO2006*. In the *AEO2008* reference case, real world crude oil prices (defined as the price of light, low-sulfur crude oil delivered in Cushing, Oklahoma, in 2006 dollars) decline gradually from current levels to $57 per barrel in 2016 ($68 per barrel in nominal dollars), as expanded investment in exploration and development brings new supplies to the world market. After 2016, real prices begin to rise (figures 1 and 2),* as demand continues to grow and higher cost supplies are brought to market. In 2030, the average real price of crude oil is $70 per barrel in 2006 dollars, or about $113 per barrel in nominal dollars.

In developing its oil price outlook, EIA explicitly considered four factors: (1) growth in world liquids consumption, (2) the outlook for conventional oil production in countries outside the Organization of the Petroleum Exporting Countries (OPEC), (3) growth in unconventional liquids production, and (4) OPEC behavior. With the forces driving demand outside the United States as strong or stronger than previously expected and with global supply projections somewhat weaker, trends in total world liquids production are similar to those in the *Annual Energy Outlook 2007 (AEO2007)* reference case but the oil prices are higher.

Current oil prices are above EIA's reference case estimate of the long-run equilibrium price, driven by recent strong global economic growth, shortages of experienced personnel, equipment, and construction materials in the oil industry, and political instability in some major producing regions. EIA's expectations regarding the ultimate size of both conventional and unconventional liquid resources have not changed since the *AEO2007*. Of course, geopolitical trends, the adequacy of investment and the availability of crude oil resources and the degree of access to them, and the market behavior of key OPEC producers are all inherently uncertain. To evaluate the implications of uncertainty about world crude oil prices, the *AEO2008* includes alternative high and low price cases (figure 2).

* All figures have been retained in committee files.

The price of natural gas also is higher in the *AEO2008* reference case. The real wellhead price of natural gas (in 2006 dollars) declines from current levels through 2016, as new supplies enter the market. After 2016, real natural gas prices rise to $6.56 per thousand cubic feet ($10.52 per thousand cubic feet in nominal dollars) in 2030 (figure 1). The higher prices reflect an increase in production costs associated with trends that were discussed in *AEO2007* but not fully reflected in its reference case. The higher natural gas prices also are supported by higher oil prices.

Minemouth coal prices in the *AEO2008* reference case, both nationally and regionally, are generally similar to those in the AEO2007 reference case. Average real minemouth coal prices (in 2006 dollars) fall from $1.21 per million British thermal unit (Btu) ($24.63 per short ton) in 2006 to $1.14 per million Btu ($22.51 per short ton) in 2020, as prices moderate following a substantial run-up over the past few years. After 2020, prices rise due to demand growth, reaching $1.19 per million Btu ($23.24 per short ton) in 2030 (figure 1). In nominal terms, the average minemouth price of coal in the *AEO2008* reference case is $1.91 per million Btu ($37.29 per ton) in 2030.

Electricity prices follow trends in the delivered prices of fuels to power plants. From a peak of 9.3 cents per kilowatthour (2006 dollars) in 2009, average delivered electricity prices in the *AEO2008* reference case decline to 8.5 cents per kilowatthour in 2016 and then increase to 8.8 cents per kilowatthour in 2030. In nominal dollars, the average delivered electricity price reaches 14.1 cents per kilowatthour in 2030.

## ENERGY CONSUMPTION

*Total primary energy consumption* grows by 19 percent between 2006 and 2030 (figure 3), at a rate of 0.7 percent per year or less than one-third the rate of growth in gross domestic product (GDP) (2.4 percent per year). Energy intensity, as measured by primary energy use per dollar of GDP (2000 dollars), declines at an average annual rate of 1.7 percent from 2006 to 2030. Since 1992, the energy intensity of the U.S. economy has declined on average by 2.0 percent per year, in part because the share of industrial shipments accounted for by the energy-intensive industries has fallen from 30 percent in 1992 to 21 percent in 2006. In the *AEO2008* reference case, the energy-intensive industries' share of total industrial shipments continues to decline, although at a slower rate, to 18 percent in 2030.

Population is another key determinant of energy consumption, influencing demand for travel, housing, consumer goods, and services. Since 1990, population has increased by about 20 percent and energy consumption by 18 percent. Population in the reference case increases by 22 percent from 2006 to 2030, compared to the aforementioned 19 percent growth in energy consumption. The rest of this section reviews consumption trends for each major energy source.

*Total consumption of liquid fuels* grows at an average annual rate of 0.4 percent in the AEO2008 reference case, from 20.7 million barrels per day in 2006 to 22.8 million barrels per day in 2030 led by growth in transportation uses, which account for 68 percent of total liquid fuels demand in 2006, increasing to 73 percent in 2030 (figure 4). Improvements in the efficiency of vehicles, planes, and ships are more than offset by growth in travel.

EISA2007 requires new light-duty vehicles, including both cars and trucks, to reach an average fuel economy of 35 miles per gallon (MPG) by 2020, based on the Environmental Protection Agency (EPA) test value used to measure compliance with the CAFE standard. The EPA CAFE test value generally differs from the estimated MPG value on the fuel economy label and typically exceeds the actual on-the-road fuel economy of a new vehicle by a significant margin. Despite these differences, the higher fuel economy standards in EISA2007 significantly improve the in-use fuel economy of the stock of light-duty vehicles. In the reference case, the average in-use fuel economy for the stock of light-duty vehicles in 2030 increases to 28.0 miles per gallon, 38 percent above its 2006 level. EISA2007 also results in a shift in the mix of transportation vehicle fuels. Total biofuel consumption reaches 2.8 quadrillion Btu (29.7 billion gallons) in 2030 in the revised *AEO2008* reference case, 2.3 quadrillion Btu (24.4 billion gallons) more than in 2006. This represents about 11.3 percent of total motor vehicle fuel, on a Btu basis, in 2030.

*Total consumption of natural gas* increases from 21.7 trillion cubic feet in 2006 to 23.9 trillion cubic feet in 2016, then declines to 22.7 trillion cubic feet in 2030 (figure 5). Industrial natural gas use is lower than in previous *AEO*s because of the higher delivered natural gas prices, lower economic growth, and a reassessment of natural gas use in the energy-intensive industries in *AEO2008*. Under current laws and regulations, natural gas is expected to lose market share to coal in the electric

power sector as result of a continued increase in natural gas prices in the latter half of the projection and slower growth in electricity demand.

*Total coal consumption* increases from 22.5 quadrillion Btu (1,114 million short tons) in 2006 to 30.1 quadrillion Btu (1,557 million short tons) in 2030, growing by 1.2 percent per year. Coal consumption grows at a faster rate toward the end of the projection period, particularly after 2020, as coal use for new coal-fired generating capacity grows rapidly. About 91 percent of the coal is currently used for electricity generation. Coal remains the primary fuel for electricity generation and its share of generation (including end-use sector generation) is expected to increase from about 49 percent in 2006 to 54 percent in 2030. Growth in coal use by coal-to-liquids (CTL) plants is lower than in previous *AEO*s as a result of EISA2007. Investment dollars that would have previously gone into CTL capacity now flow to biomass-to-liquids (BTL) capacity. However, there is a great deal of uncertainty about this projection.

*Total electricity consumption*, including both purchases from electric power producers and on-site generation, grows from 3,814 billion kilowatthours in 2006 to 4,974 billion kilowatthours in 2030, increasing at an average annual rate of 1. 1 percent (figure 6). In comparison, electricity consumption grew by annual rates of 7.3 percent, 4.2 percent, 2.6 percent, and 2.3 percent in the 1960s, 1970s, 1980s, and 1990s, respectively. The most rapid growth (1.7 percent per year) occurs in the commercial sector, as building floorspace is expanded to accommodate growing service industries. Growing use of electricity for computers, office equipment, and small electrical appliances is partially offset in the *AEO2008* reference case by improved energy efficiency.

*Total marketed renewable fuel consumption* grows by an average of 3.0 percent per year in the reference case, from 6.8 quadrillion Btu in 2006 to 13.7 quadrillion Btu in 2030. About 45 percent of the demand for renewables in 2030 is for grid-related electricity generation (including combined heat and power), and the rest is for dispersed heating and cooling, industrial uses, or transportation uses.

The rapid growth in the use of renewable fuels for transportation in *AEO2008* reflects the updated RFS in Section 211(o) of the Clean Air Act as amended by EISA2007. The updated RFS sets a requirement for 36 billion gallons of total renewable fuels by 2022, including 21 billion gallons of advanced biofuels. Included are requirements for 1 billion gallons of biodiesel by 2012 and 16 billion gallons of cellulosic biofuels, both of which count toward the advanced biofuels requirement. The remaining 4 billion gallons of advanced biofuels may come from any source. The difference between advanced biofuels and total renewable fuels may be met by corn ethanol. Diesel fuels that are derived from biomass feedstocks count 1.5 times their physical volume as credits towards meeting the RFS requirements owing to diesel's higher energy content relative to ethanol.

While the situation is very uncertain, the current state of the industry and our present view of projected rates of technology development and market penetration of cellulosic biofuel technologies suggest that available quantities of cellulosic biofuels prior to 2022 will be insufficient to meet the new RFS targets for cellulosic biofuels, triggering both waivers and a modification of applicable volumes as provided for by paragraphs 7(D) and 7(F), respectively, of Section 211(o) of the Clean Air Act as amended by EISA2007. The modification of volumes reduces the overall target in 2022 from 36 billion gallons to 32.5 billion gallons. The modified cellulosic biofuel requirement is projected to be met by a combination of domestic cellulosic ethanol, imported cellulosic ethanol, and biomass-to-liquids diesel, but the specific mix is again highly uncertain.

Ethanol use grows from 5.6 billion gallons in 2006 to 24.3 billion gallons in 2030 (over 16 percent of total gasoline consumption by volume) (figure 7). Ethanol use for gasoline blending grows to 13.3 billion gallons and E85 consumption to 11.0 billion gallons in 2030. The ethanol supply is expected to be produced from both corn and cellulosic feedstocks, with corn accounting for 15.0 billion gallons of ethanol production in 2030. The *AEO2008* reference case also expects strong growth in ethanol imports after 2010, reflecting the pending expiration of the tariff on imported ethanol in January 2009. Biodiesel use reaches 1.3 billion gallons in 2030 (about 1.6 percent of total diesel consumption by volume). Consumption of diesel liquids produced from biomass (BTL) grows to 4.2 billion gallons in 2030, 4.9 percent of total diesel consumption by volume.

Excluding hydroelectric power, renewable energy consumption for electric power generation grows from 0.9 quadrillion Btu in 2006 to 3.1 quadrillion Btu in 2030. The higher level of nonhydroelectric renewable energy consumption in the *AEO2008* reference case primarily reflects a revised representation of State renewable portfolio standard (RPS) programs, which require that specific and generally increasing shares of electricity sales be supplied by renewable resources such as wind, solar,

geothermal, and sometimes biomass or hydropower. Previous *AEO*s placed more weight on the "escape clauses" incorporated in many State RPS programs, given that the consumer costs of these programs would increase significantly if the Federal production tax credit (PTC) for qualifying renewable energy expired as provided for under current law. The new representation, which assumes that the State RPS goals will be met absent a clear contrary indication, results in significant additional growth of renewable generation from wind, biomass, and geothermal resources.

ENERGY PRODUCTION AND IMPORTS

Net imports of energy are expected to continue to meet a major share of total U.S. energy demand. The increased use of biofuels resulting from EISA2007, much of which is domestically produced, and the reduction in transportation fuel demand due to the new fuel economy standards both serve to moderate growth in energy imports. Higher fuel prices over the projection period also spur increased domestic energy production and moderate energy demand growth, also tempering growth in imports. Furthermore, the net import share of total U.S. energy consumption in 2030 is 27 percent, a decline from the 30-percent share in 2006.

*Liquids and Other Petroleum Products*

U.S. crude oil production grows from 5.1 million barrels per day in 2006 to a peak of 6.3 million barrels per day in 2018, primarily due to increased production from the deep waters of the Gulf of Mexico and from the expansion of enhanced oil recovery operations in onshore areas supported by higher crude oil prices. Domestic production subsequently declines to 5.6 million barrels per day in 2030, as increased production from new smaller discoveries is inadequate to offset the declines in large fields in Alaska and the Gulf of Mexico (figure 8) Total domestic liquids supply, including crude oil, natural gas plant liquids, refinery processing gains, and other refinery inputs (e.g., ethanol, biodiesel, BTL, and liquids from coal) grows from 8.3 million barrels per day in 2006 to 10.5 million barrels per day in 2030.

The net import share of total liquids supplied, including crude oil and refined products, drops from 60 percent in 2006 to less than 51 percent in 2022, and then increases to 54 percent in 2030 as crude oil imports grow rapidly at the end of the projection to meet liquids demand (figure 9). Net crude oil imports in 2030 are 11. 1 million barrels per day in 2030 and net product imports (including net ethanol imports) are 1.3 million barrels per day in 2030.

*Natural Gas*

Total domestic natural gas production, including supplemental natural gas supplies, increases from 18.6 trillion cubic feet in 2006 to 20.1 trillion cubic feet in 2022 before declining to 19.6 trillion cubic feet in 2030 in the *AEO2008* reference case. While onshore conventional production declines steadily from 6.6 trillion cubic feet in 2006 to 4.4 trillion cubic feet in 2030, lower-48 offshore production grows from 3.1 trillion cubic feet in 2006 to a peak of 4.5 trillion cubic feet in 2017 as new resources come online in the Gulf of Mexico. After 2017, lower-48 offshore production declines to 3.5 trillion cubic feet in 2030. Lower-48 production of unconventional natural gas, particularly gas from shale, is expected to be a key contributor to growth in U.S. natural gas supplies, increasing from 8.5 trillion cubic feet in 2006 to 9.5 trillion cubic feet in 2030. The Alaska natural gas pipeline is expected to be completed in 2020, later than previously anticipated, because of delays in the resolution of issues between Alaska's State government and industry participants.

Net pipeline imports of natural gas fall from 2.9 trillion cubic feet in 2006 to 0.3 trillion cubic feet in 2030 in the *AEO2008* reference case (figure 10), reflecting both resource depletion in Alberta and Canada's growing domestic demand. Total net imports of liquefied natural gas (LNG) to the United States increase from 0.5 trillion cubic feet in 2006 to 2.8 trillion cubic feet in 2030. U.S. LNG regasification capacity increases from 1.5 trillion cubic feet in 2006 to 5.7 trillion cubic feet in 2009 with the addition of six new regasification facilities that are currently under construction (four along the Gulf Coast and two off the coast of New England). Given global LNG supply constraints, overall capacity utilization at the U.S. LNG import facilities is expected to remain below 50 percent through 2030. The future direction of the global LNG market, with many new international players entering LNG markets and strong competition for available supply, is one of the key uncertainties in the *AEO2008* reference case.

*Coal*

As coal demand grows in the *AEO2008* reference case, U.S. coal production increases at an average rate of 1.0 percent per year (figure 11). On a Btu basis, 60

percent of domestic coal production originates from States west of the Mississippi River in 2030, up from an estimated 49 percent in 2006.

ELECTRICITY GENERATION

Absent new environmental policy initiatives that would serve to accelerate the retirement of existing coal-fired power plants, the slowing rate of electricity growth reduces the need for new generating capacity. In the *AEO2008* reference case, the natural gas share of electricity generation (including generation in the end-use sectors) remains between 20 percent and 21 percent through 2017, before falling to 14 percent in 2030 (figure 12). The coal share remains between 48 percent and 49 percent through 2018, before increasing to 54 percent in 2030. Net additions to coal-fired generating capacity in the *AEO2008* reference case total 103 gigawatts from 2006 to 2030, including 4 gigawatts at CTL plants and 30 gigawatts at integrated gasification combined-cycle plants. Given the assumed continuation of current energy and environmental policies in the reference case, carbon capture and sequestration (CCS) technology does not come into use during the projection period.

Nuclear generating capacity in the *AEO2008* reference case increases from 100.2 gigawatts in 2006 to 114.8 gigawatts in 2030. The increase includes 16.4 gigawatts of capacity at newly-built nuclear power plants and 2.7 gigawatts expected from uprates of existing plants, partially offset by 4.5 gigawatts of retirements. Total electricity generation from nuclear power plants grows from 787 billion kilowatthours in 2006 to 917 billion kilowatthours in 2030 in the *AEO2008* reference case, accounting for about 18 percent of total generation in 2030. Additional nuclear capacity is built in some of the alternative *AEO2008* cases, particularly those that project higher demand for electricity or even higher fossil fuel prices.

The use of renewable technologies for electricity generation is stimulated by improved technology, existing State RPS programs, the availability of the renewable production tax credit for eligible generation placed in service before the end of 2008, and higher fossil fuel prices. Total renewable generation in the *AEO2008* reference case, including combined heat and power (CHP) and end-use generation, grows by 2.2 percent per year, from 385 billion kilowatthours in 2006 to 654 billion kilowatthours in 2030 (figure 13).

ENERGY-RELATED CARBON DIOXIDE EMISSIONS

Carbon dioxide emissions from energy use in the *AEO2008* reference case increase from 5,890 million metric tons in 2006 to 6,859 million metric tons in 2030, an average annual increase of 0.6 percent (figure 14). The energy-related carbon dioxide emissions intensity of the U.S. economy falls from 520 metric tons per million dollars of GDP in 2006 to 339 metric tons per million dollars of GDP in 2030, an average decline of 1.8 percent per year. Increases in carbon dioxide emissions primarily result from a continued reliance on coal for electricity generation and on petroleum fuels in the transportation sector.

CONCLUSION

As I noted at the outset, while EIA does not take positions on policy issues, its data, analyses, and projections are meant to assist policymakers in their energy policy deliberations. In addition to the work on baseline projections that I have reviewed this morning, EIA has also recently responded to requests from this Committee and others for analyses of the energy and economic impacts of alternative proposals to limit greenhouse gas emissions and other policy proposals. We look forward to providing whatever further analytical support that you may require on energy-related topics. We believe that such analyses can help to identify both potential synergies and potential conflicts among different energy-related objectives that are currently under discussion in this Committee and elsewhere.

This concludes my testimony, Mr. Chairman and members of the Committee. I would be happy to answer any questions you may have.

The CHAIRMAN. Thank you very much. Let me start with a few questions.

You cite three areas that we legislated in as having influenced the changes in your forecast. I think the CAFÉ standard, the increased renewable fuel standard, and increased efficiency standards for various appliances, lighting included. Is there any way to give us a break down as to how much of the reduction in green-

house gas emissions that you are able to now project, results from each of these three?

Mr. CARUSO. One of the reasons it's very difficult to disaggregate that is that there are a number of other factors going on that I mentioned, including the reduced economic growth outlook and a number of other modeling changes we've made. So to isolate just those provisions would be very difficult. I can tell you in broad terms that the CAFÉ standards, by far, have the largest impact. We have almost two and a half million barrels a day less oil demand in 2030 then we had without them. The other major impact on greenhouse gas emissions is the efficiency standards that were enacted for a number of types of equipment, largely in the residential sector. We have a significant reduction in demand in the electricity sector. Much of the new electricity generated beyond 2020 would have been coal so that has a significant impact on emission levels.

I would be pleased to ask my team to provide a more detailed break out, but I have to raise a little flag here in that there's a number of other moving parts——

The CHAIRMAN. Right.

Mr. CARUSO [continuing]. Making it often difficult to disaggregate some of the effects of the law, for example, the biofuels impact. We have more biofuels-to-liquids in this outlook as direct result of the renewable fuel standard. One of the things that did was reduce the amount of investments we see going into coal-to-liquids, for example. That had an impact on reducing greenhouse gas emissions.

We could make an attempt to actually quantify that. I'd be happy to provide that for the record, Senator Bingaman.

[The information referred to follows:]

The energy impacts of the Energy Independence and Security Act of 2007 (EISA) and its individual provisions can be measured in several different ways. For example, individual or grouped provisions can either be added to a variety of Annual Energy Outlook baselines that do not include EISA, or subtracted from a baseline that includes EISA. Other impact measures can be obtained by assuming that both EISA standards and those in existence prior to EISA are binding without alteration throughout the projection period, so that energy impacts can be calculated based on the difference in standards and measures of equipment stock turnover and utilization. This latter approach, which essentially adopts a "frozen efficiency" baseline reflecting the existing standard, tends to produce larger estimates for the impact of changes in efficiency standards.

EIA has made several different calculations to provide ranges of impact estimates that would be suitable for a variety of purposes. Using National Energy Modeling System model runs that add or subtract EISA provisions to current baselines, EIA found that EISA reduces total U.S. energy consumption between 3.2 and 4.1 quadrillion Btu (2.7 to 3.3 percent) in 2030. Those same calculations suggest that cumulative energy-related carbon dioxide emissions between 2008 and 2030 are reduced by 4.0 to 4.9 billion metric tons (2.7 to 3.2 percent). With respect to the three groups of provisions in EISA that were represented in the AEO2008 reference case projections for 2030, the renewable fuels standard (RFS) reduces net petroleum imports by 0.3 to 0.6 million barrels per day (1.9 to 4.9 percent), the energy efficiency standard (EES) provisions reduce electricity use by 130 to 148 billion kilowatthours (2.6 to 2.9 percent), and the Corporate Average Fuel Economy (CAFÉ) standard reduces light duty vehicle consumption by about 1.2 to 1.4 million gasoline-equivalent barrels per day (12.1 to 12.9 percent).If measured against a frozen-efficiency standard, which the National Highway Transportation and Safety Administration (NHTSA) and the Office of Management and Budget (OMB) use—where vehicle efficiency does not improve above the floor set by the previous CAFÉ standards, the CAFÉ standard in EISA 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).

| Provision | Energy Savings, 2030 (Quadrillion BTU) | Cumulative Reduction in Carbon Dioxide Emissions (2008-2030) (billion metric tons) |
|---|---|---|
| Renewable Fuels Standard (RFS) | -0.7 (-0.6%) | 0.9 to 1.4 (0.6% to 0.9%) |
| Energy Efficiency Standards (EES) | 1.2 to 1.3 (1.0%) | 1.0 to 1.2 (0.7% to 0.8%) |
| Corporate Average Fuel Efficiency Standards (CAFE) | 2.7 to 3.0 (2.3% to 2.4%) | 1.8 (1.2%) |
| Total from Energy Independence and Security Act Modeled Provisions[1] | 3.2 to 4.1 (2.7% to 3.3%) | 4.0 to 4.9 (2.7% to 3.2%) |

[1] The total is not the sum of the parts due to synergistic and offsetting effects that each provision has upon one another.

The CHAIRMAN. Let me ask about this change in your projection as to the rate of growth of gross domestic product. You're now projecting that it will grow at a rate of 2.4 percent per year between 2000 up to 2030. I think. Yes.

Mr. CARUSO. Yes.

The CHAIRMAN. Between now and 2030. How much of a reduction is that from what you had earlier thought? Is that consistent with what OMB and CBO are projecting?

Mr. CARUSO. The answer to the first part of the question is in the earlier version of this outlook we were using 2.6 percent GDP growth. So we've reduced that by two-tenths of 1 percent. CBO and OMB typically only go out about 10 years. So it's consistent with their projections. But not many projections by public forecasters go out to 2030.

We've used our own, in-house, macroeconomic analysis as well as the consulting firm, Global Insights, to come up with these numbers. The main reason for the revision is the macroeconomic analysts now are having a re-look at the impact of productivity, which is such a big part of that sharp growth we saw in the 1990s and even in the early part of this decade. We now see less productivity over the next couple decades.

There also is some effect of the higher energy prices in that lower GDP projection.

The CHAIRMAN. Let me just ask one final question. Do you, in this projection, do you assume that the production tax credit for renewable energy will be renewed or that it will expire?

Mr. CARUSO. We assume it will expire as the law currently indicates. We have run cases in the past where if you assumed extension in perpetuity it makes a huge difference in the renewable fuel numbers that are in the outlook. They would be significantly higher.

We have done that case in previous annual energy outlooks, and extension beyond 2008 would make a huge difference.

The CHAIRMAN. All right.

Senator Domenici.

Senator DOMENICI. Thank you, Mr. Chairman. Let me start by saying the EIA projects that increased oil production will result in a gradually lower oil prices between now and 2016. However we have recently seen financial sector analyses which conclude that unprecedented investments will be required to merely maintain existing production levels from aging oil fields and projecting that 100 million barrel per day may be the maximum production level possible in the near future. These production constraints are combined with concerns that demand appears to be increasingly inelastic.

At Deutsche Bank, for one example, is forecasting the possibility of $150 per barrel of oil by 2015. I'm told that this is higher than your high case for that year. Can you explain the difference?

Mr. CARUSO. Yes. I think the fundamental difference is that we do believe that the higher prices will stimulate more investment in the new development of liquid resources. I think it's very important to make a distinction between crude oil alone which I think the Deutsche Bank report really focused on.

For example, our latest outlook to 2015 indicates a total liquid demand and supply for 2015 of about 97 million barrels a day. Of that 97 million barrels a day only 77 million barrels a day is crude oil. There's going to be a lot of unconventional liquids, including biofuels and other contributors to the supply—natural gas liquids for example.

All that having been said, the main point that Deutsche Bank is making is that because of the decline rates in older fields, which I mentioned in our reference case in Alaska and the Gulf of Mexico, it still requires a huge investment effort. I'm not in any way belittling the effort it's going to take. But we think that companies, with the stimulus of higher prices, will make those investments if access is available and the above ground risk is permitted.

Senator DOMENICI. You identified LNG markets as a key uncertainty associated with the 2008 outlook. Is the EIA attempting to account for OPEC-like behavior among natural gas exporting nations in your existing model or updates to it?

Mr. CARUSO. We don't explicitly try to model a gas OPEC. But one thing we do to try to capture that uncertainty is the high and low natural gas price cases. For natural gas that makes a huge difference.

With a high price case for natural gas you have a much lower demand for LNG. We see LNG as the marginal supplier to the gas market, so to the extent high, natural gas price reduces demand, we think most of that will come out of LNG.

Another example of uncertainty is whether there will be an Alaskan natural gas pipeline, which we have in this outlook coming on stream in 2020 at two trillion cubic feet per year. To the extent that that either comes on later or sooner, almost all of that two trillion cubic feet per year would have to be supplemented by LNG to the extent that it would fall short of our timing or the volume.

Senator DOMENICI. Now that pipeline is the one we've already approved.

Mr. CARUSO. It's still being——

Senator DOMENICI. I mean we did——

Mr. CARUSO. Yes, at the Federal level, but now it's——

Senator DOMENICI. The State hasn't completed——

Mr. CARUSO [continuing]. The State government is negotiating with the off-takers.

Senator DOMENICI. Are they ever going to get that done, Senator? No, excuse me, I didn't——

Senator MURKOWSKI. We are eternally optimistic. We are encouraging it every step.

Senator DOMENICI. Great. Mr. Chairman, I have some additional questions. I'll wait another round or submit them for the record. Thank you. Thank you, Mr. Caruso.

Mr. CARUSO. Thank you, Senator.

The CHAIRMAN. Thank you.

Senator Craig.

Senator CRAIG. Thank you very much, Mr. Chairman and Mr. Caruso. I think the points that both Senator Domenici and our Chairman made, are valuable for us to see that when policy is put in place that you can take it into the out years and make those kinds of projections. It is significant that a two million barrel a day impact out there in 2030 is powerful stuff.

You've cast some doubt as it relates to the ability to get to where we want to get in relation to ethanol production or the nonpetroleum liquids. Let me use this as an example because our frustration has ended up in Senator Domenici introducing the Clean Energy Investment Bank. I'm a co-sponsor of that because we saw the Department of Energy, in our opinion, falling short in its ability to move expeditiously once we acted to bring on board loan guarantees, grants, those kinds of things to go out to the outer edge of science and technology to bring cellulosic production on line.

I have been watching very closely a facility in Canada that is substantially financed. It now has a demonstration plant up and running. It seems to be working at a capacity of about a million gallons a day of cellulosic.

For the last 4 years this particular company has been waiting for DOE loan guarantees and grant programs in order to get the financial backing they need to move up into the next level of commercial scale production. I guess my question comes to that. Have you considered these types of delays in your projections, those that might be tied to the ability of this government to move expeditiously?

Have you considered that once proven on a commercial scale there will be a significant influx of capital? For example, into cellulosic, to get us to where we get in those out years with the numbers we looked at, 32 billion and beyond in gallons annualized. I think the only way we're going to get there to meet those liquid energy non-hydrocarbon types of liquids is moving in an expeditious way there. Have those factors gone into consideration when you make these projections?

Mr. CARUSO. Yes. We've tried to look as hard as we can at the economics and the technology. We've worked closely with the program offices in the Department of Energy—got their latest assess-

ment of how things are going and the time scale they're on, particularly on cellulosic.

Senator CRAIG. Yes.

Mr. CARUSO. Which as you point out is really critical to being able to get to 36 billion gallons.

Senator CRAIG. Right.

Mr. CARUSO. We've got the corn ethanol going up rapidly.

Senator CRAIG. Yes.

Mr. CARUSO. Reaching 15 billion gallons as scheduled in the EISA. It's the cellulosic component that we think may be lagging behind a bit, and fail to meet the targets that were set in EISA 2007 by 2014 and 2015.

There is a provision within the EISA as it amends the Clean Air Act that if the targets are missed by 20 percent or more for 2 consecutive years, the EPA Administrator can then adjust the volumes—and we have that being triggered. That's the reason why we think that the cellulosic volumes will fall behind a bit, and that's the reason that we come up with the conclusion that instead of 36 billion gallons of alternative fuels in 2030, we project 32.5.

Senator CRAIG. So that's the shortfall?

Mr. CARUSO. The shortfall is about 3.5 billion gallons from meeting the targeted amount in the bill. It's largely the result of our assessment of where the technology and economics are at this point as we look out for 5 years. First of all to get to the 2012 target that was set actually in the EPACT 2005.

Senator CRAIG. Yes. Yes.

Mr. CARUSO. Then updated in EISA 2007. I think if someone were here from the program office they would say that they are really working extremely hard and spending a lot of money to try to facilitate the breakthroughs in that technology. But as of the time that we've consulted with them, we think this is a pretty realistic assessment.

As time goes on we certainly would continue to work with——

Senator CRAIG. Yes.

Mr. CARUSO [continuing]. NREL and other program offices to update that.

Senator CRAIG. I don't disagree they're hustling now. But as a result of some heavy pushing on the part of many of us here and when I look at these numbers of dollars going offshore everyday verses putting some risk capital out there. Not quite sure where it takes us, but knowing that we've got to do it.

I look at that as a reasonable risk investment in relation to bringing technology on line. I think many of us do here. That's why we've urged it. Thank you.

The CHAIRMAN. Senator Barrasso.

Senator BARRASSO. Thank you very much, Mr. Chairman. Thank you very much, Mr. Caruso, for being here. You know the *Washington Post* business section front page story forecast for crude oil rise to $105 on new trading high was in today's paper. They talk not just about supply and demand of oil, but also supply and demand of dollars in the world currency market. Do you try to take that into effect or into account as you try to work on some of these things?

Mr. CARUSO. As you can imagine, trying to relate the influx of speculative money into the commodities market has been a topic, really, of heightened interest. Most recently, the direct correlation, it seems, between the decline of the dollar and moneys flowing out of foreign exchange index funds into commodity index funds—including oil—seems to have put some upward pressure on the price of oil and other energy. We have a short term modeling effort that we use to publish our short term outlook.

In a hearing before Senator Dorgan 2 months ago, we tried to look at what is the impact of some of these other, what we would consider non-fundamental, factors. Our model does continue to show the track pretty well of fundamental factors with the trend of the price. But clearly during short-term periods other factors, including commodity index funds and geopolitical events do move that price above and below that trend analysis.

To try to predict it is extremely difficult.

Senator BARRASSO. Reading the report it almost seems like you think this is almost at a high point now. Then we're going to look at a decline over the next number of years, almost cut in half of this price. So would this be something you would consider a bubble now—that we're going to be able to work through?

Mr. CARUSO. Yes. I think it's difficult to say whether this is the peak because there's so much uncertainty on the geopolitical front and on some of the issues such as the value of the dollar. In the longer run we do think, as I mentioned to Senator Domenici, that high prices do stimulate investment on the supply side. We've seen it in deep water in the United States, Brazil and Angola.

We've seen it in unconventional gas with the shale gas, Barnett Shale, and in the Piceance Basin unconventional gas there. So we do think that over time the economics should prevail, but——

Senator BARRASSO. I mean you read the reports: does a company make an investment? At $100 barrel oil it pays to put in windmills, you know, solar panels all of these things that lower prices that we may be predicting for the future then it isn't as cost effective to do it in terms of the return on the investment. So I'm trying to make that balance.

Mr. CARUSO. Yes. That's why we do the high price case—to say, what if we're wrong. You know, we've been wrong for the last several years. So the track record is very clear.

Senator BARRASSO. Last week we had some people here talking about the Strategic Petroleum Reserve. I think they're putting 70 million barrel—70,000 barrels a day which is about a million barrels every 2 weeks, 25 million barrels a year. The paper today talks about as long the supply and demand are still relatively tightly balanced there's not a lot of spare production refinery capacity that, you know, any little incremental demand can spook a market or can drive prices disproportionate to that amount.

I know you don't make policy recommendations. But I don't know if you share the information. Because we were discussing whether this is the wise time to be paying $100 a barrel to put 70,000 barrels a day into the Strategic Petroleum Reserve when we may be able to get it a lot cheaper next year or 5 years from now.

Mr. CARUSO. You're right. The direction is clearly upward. Again referring back to Senator Dorgan's hearing in December, I was

asked had we, had EIA been asked to do an analysis and at that time we had not.

So I went back and as I promised I asked our people to look at that. I used 100,000 barrels a day as the hypothetical build for the first 10 months of 2008. Our analysis shows that it has about a $2-per-barrel impact on the global market based on our, the same modeling effort that I mentioned. That's about four or five cents per gallon converted into gasoline.

Senator BARRASSO. Because it seems that just doing the math. I'm out of time, Mr. Chairman. To get from the 750 million barrels we have there now to the 1.5 billion that they're trying to get to.

You're going to be putting, I mean, 70 to 100 thousand barrels a day for the next 25 to 30 years. So, ok. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Senator Dorgan.

Senator DORGAN. Mr. Chairman, thank you very much. First of all, Mr. Caruso, thank you for your report. I think I share the thoughts expressed by Senator Domenici and some others. I think there's some good news in this report.

I am struck however, you talked about trying to predict the short term issues is very, very difficult. Then we predict 2030. You know, we don't know what's going to happen in 24 months let alone 24 years. What you have done is useful.

Keynes used to say in the long run we're all dead. We're interested in the long run nonetheless, but I'm very interested in the short run. I want to ask you a couple of questions that relate to some things Senator Barrasso asked you because I have been very interested in this.

When you did your modeling with respect to SPRO, taking oil out of the supply, putting it underground, you talk about $2 per barrel of oil. Did you consider that this is sweet, light crude as a subset and therefore will have a different impact on the price of oil?

Mr. CARUSO. Yes.

Senator DORGAN. You did.

Mr. CARUSO. We did take into account the quality of the crude. We looked at what had been the impact of the different types of crudes, looking back over the past several years.

Senator DORGAN. There are some who estimate that because it's sweet, light crude it has as much as a 10-percent influence on the price. I want to talk about two things. I want to talk about SPRO and I'll come back to that in a moment.

I want to talk about this issue of the markets setting the price that have a disconnect to supply/demand. In today's newspaper it talks about Lawrence Goldstein, an economist at the Energy Policy Research Foundations says that yet, ironically you're looking at triple digit oil prices because the price is being set by non-physical investors. *Wall Street Journal* has an article talking about hedge funds and the excess speculation of hedge funds in the futures market.

It talks about investment banks and the new speculation in the new futures market for oil by investment bankers who are actually off buying storage, a new phenomenon. Investment banks can take oil off the market, put it in storage and wait until the price goes

up. So you have a substantial amount of additional speculation in the futures market.

We have Fadel Gheit who's an analyst with the Oppenheimer Company said at this table. He says, "There is absolutely no shortage of oil. I'm convinced oil prices shouldn't be a dime above $55 a barrel." That was 3 months ago.

Oil speculators include the largest financial institutions in the world. I call it the world's largest gambling hall open 24/7. Unfortunately it's totally unregulated. This is like a highway with no cops and no speed limit. Everybody is going 120 miles an hour.

I am fairly convinced and I'm not an expert in this area. But I'm fairly well convinced that in the short term what we have is an unbelievable amount of speculation in these futures markets, which means, in the short term, that you move away from the supply/demand relationships we are led to expect would set the price. That we now have, as I related to this morning's quote about the price being set by non-physical investors. Tell me your analysis of that, Mr. Caruso.

Mr. CARUSO. The way we've approached that, as I did at the hearing in December, is looking at the short term factors, the fundamental factors—typical macroeconomics, supply/demand, inventory levels and spare productive capacity. We looked and tracked that as to the history, and the tracking was reasonably good in terms of the kind of modeling characteristics.

We were sometimes a little below, sometimes a little above. Our trend-line analysis indicated that those fundamental factors can explain most of the change in the price over the last 5 or 6 years. That's what we've been using in our short term outlook, which currently, by the way, is about a $90 price. So $100, $104, I think it may have reached today——

Senator DORGAN. Have you had a?

Mr. CARUSO [continuing]. Means that there's something else going on.

Senator DORGAN. Right.

Mr. CARUSO. There's clearly been a surge in moneys coming into commodity markets, including energy, which has had some upward effect on the price above the trend line. Then we've seen other periods where you see that money, the open interest, actually go down. So there have been periods over this 5 to 6 year timeframe where it's actually gone above the trend and also gone below the trend.

So I think something is clearly going on. As I mentioned earlier it is very difficult to say whether that number is $5 or $10. But I would, I think, strongly disagree that it's $50.

Senator DORGAN. Yes. The implication of your answer is that there's about a 10-percent increase as a result of speculation. At least when you said your number is 90, it's 103.

Let me ask you. Have you reached out and talked to the analysts who have been describing this publicly? Their analysis, that as they review these things there's no justification for the price above $50, $60, $70. Whatever it is they conclude.

Have you reached out and talked to those folks to understand their analysis?

Mr. CARUSO. Yes. We talked to them all the time. In fact we have them in and have what we call forecasting seminars to try to understand what we find.

When we meet with many of them they really don't have a quantitative assessment. It's mostly a qualitative assessment.

Senator DORGAN. You shook your head affirmatively when I talked about the hedge fund positions in the futures market and the investment banks. Investment banks buying storage. You know all those things?

Mr. CARUSO. We have the same information that is publicly available. We don't have any, you know, we don't get any reporting directly from those entities.

Senator DORGAN. You think that entry in those futures markets on the demand side has an impact on price? The question is just what impact.

Mr. CARUSO. I think it has had some impact. As I pointed out earlier, in some cases we've actually seen where that impact has, compared to our trend line analysis, actually been below it. When in some cases they've perceived for whatever reason that they should go short and actually had to——

Senator DORGAN. I understand. But I'm talking as you——

Mr. CARUSO. Right now it's been mostly upward.

Senator DORGAN. I don't mean to be talking about the manure and you keep talking about the pony. But the fact is what we're seeing at the moment is a trend line of substantial new speculation in futures market that's putting upward pressure on prices beyond that which would normally exist with the supply/demand relationship.

Mr. Chairman, are you going to have a second round because I do want to ask about SPRO at some length, but——

The CHAIRMAN. Yes, we certainly will.

Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman. Thank you, Mr. Caruso. I want to go back to the gas line that Senator Domenici raised.

I think the last time we had the forecast that you presented we were again pushed back an additional 2 years. As I think I commented at that time that every time you come in and calculate where the Alaska gas line in the natural gas equation. We're 2 years further. I don't know if I want to see you next year if that's going to be the prognosis.

Mr. CARUSO. I think that's a safe assumption.

Senator MURKOWSKI. I would like to think that we're going to have this gas line. I do remain eternally optimistic that the State and the industry will figure out how we advance this. My question to you is what degree of confidence do you have that Alaska gas does become part of that picture?

2020 is a ways off now. In the interim the economy of the lower 48, the rest of the country is going to be seeking that gas from somewhere. You've noticed some of the factors in your report, extra LNG, re-gasification capacity.

If some of those issues can be worked out does the Alaska gas get locked out of the market at some point in your calculation if in fact those commitments have not been made?

Mr. CARUSO. I don't really think so. The reason is that we see the LNG as being more of a supplier on the margin because there's such a long lead time, as you know, in the building of that line.

There will be a large advance notice once the construction starts. We're thinking it's, at least, probably a 9-year process. So I don't think that just the existence of new re-gasification terminals will deter the pipeline. As is noted in our report, the ones that are under construction, under permit and construction, are double what we think LNG imports will be in 2030.

Senator MURKOWSKI. What about domestic shale opportunities that you've noted that you expect some increase in production there?

Mr. CARUSO. Shale gas?

Senator MURKOWSKI. Yes.

Mr. CARUSO. Yes, I think that's directly related to the price, to the extent that the natural gas price stays high. We could even see more shale gas under the reference case price scenario. We have that as the fastest growing source of domestic gas in this outlook.

So it is important, but I don't think it's enough to lock out Alaskan gas. We think the economics of Alaskan gas under our current estimate, which is, as you know, subject to change as costs go up, still make it very attractive.

Senator MURKOWSKI. Let me ask then about oil production. Yes?

Senator DOMENICI. Can I ask for clarification? You and Mr. Caruso were speaking about shale gas. That's not the shale oil in Colorado. That shale gas, where does it come from?

Senator MURKOWSKI. It's from Colorado, but there's some newer opportunities over on the East Coast that is being explored right now.

Mr. CARUSO. The biggest places for shale gas right now are in Texas and Oklahoma, the Barnett Shale. There's also some in the Rockies as well. But it's not directly related to the shale oil prospect.

Senator DOMENICI. Shale gas is just a gas that you can get out of the ground——

Mr. CARUSO. Exactly.

Senator DOMENICI. It's called——

Senator MURKOWSKI. Oil deposits, yes.

Mr. CARUSO. Yes, sir.

Senator DOMENICI. We're not using a version of shale.

Mr. CARUSO. No.

Senator DOMENICI [continuing]. Up in Colorado, that's not even in the equation yet.

Mr. CARUSO. It's gas produced from a shale formation, much like the Bakken shale in North Dakota is now producing a fair amount of new oil.

Senator DOMENICI. Thank you, Senator.

Senator MURKOWSKI. With the oil production you've indicated that you expect to see domestic oil production rising because of what we're seeing with the high prices. That's going to encourage enhanced oil recovery but then we're going to see a decline there. But we're not necessarily seeing any new areas of production of domestic supplies of oil coming online.

So, what does it look like 10, 20 years from now, if in fact, we have no new oil production domestically? Of course, this will then lead to my next question about the Alaska production. As you know there is a point where our Trans Alaska pipeline reaches a level where the flow of oil within that gas line requires or mandates that that line be shut down because you cannot efficiently, you can't move it down the line.

So if we don't have increased production up North whether through ANWR or NPRA or any of the other opportunities that we have. We not only lose what remains up in the North Slope in terms of the production that we've been seeing. Give me the scenario for oil domestically if we don't see those new areas of production.

You have the Alaska line going down. The way I describe it, it sounds pretty grim. But can you speak to that?

Mr. CARUSO. I think the only area where we see new production coming on line in this outlook is the deep water of the Gulf of Mexico. The other increase is in enhanced oil recovery, which has been stimulated by the higher prices. We're seeing some of that on shore.

But due to lack of access we really don't see any new significant increases. As you pointed out that we have a continued decline in Alaska, although we do have the line continuing—the TAPS, Trans Alaska Pipeline System—continuing to operate throughout this timeframe.

So, we have a short term gain which goes from about five million barrels a day in domestic crude oil production this year to a bit over six million in 2016. Then the decline continues again so that by the end of the 2030 timeframe we're about back to where we are now, a little over five million barrels a day. So we have a short term increase in domestic supply of crude and then a decline.

Senator MURKOWSKI. Did you do a run to assess the impact on prices if we were to be successful in opening ANWR in an analysis in terms of the cost?

Mr. CARUSO. We have not done that analysis, Senator.

Senator MURKOWSKI. I know that you had done it in previous years anticipating what——

Mr. CARUSO. Oh, opening——

Senator MURKOWSKI [continuing]. A million barrels of extra production would be.

Mr. CARUSO. I'm sorry. Yes, we did do that in previous years. We have not done it for this Annual Energy Outlook. But we had done that at the request of Congress. I think the last one we did was 2007.

Senator MURKOWSKI. There are many of us who still believe that having an additional million barrels into production domestically would help with the price in this country and make a difference, so. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much. Let me ask a few additional questions. Then we'll just proceed here through our second round.

I passed out a couple of things to you there. One is a chart* that called U.S. mid range abatement curve. This was developed by McKenzie and Company.

It's included in a publication by McKenzie and Company that the conference board came out with on reducing greenhouse gas emissions. How much would it cost? The other chart is similar but I'm trying to determine who prepared it. It looks like it's prepared in Europe because it's Euros per ton of $CO_2$ reduced.

I guess what my initial idea from reading these is that this would be a very useful thing for us to have agreement on, if we could, for purposes of making policy. If in fact these are accurate and you can reduce greenhouse gas emissions much more substantially through building insulation which is what this one chart indicates, then you can through a voided deforestation over here on the right or one other of the items on the right. Then clearly that's where we ought to concentrate our efforts; on the areas that the greatest bang can be achieved for the dollar spent or the Euros spent or whoever spending it.

Senator DOMENICI. Where did you find that?

The CHAIRMAN. I'm looking at this chart now. You see building insulation is the on the far left hand which indicates that you save substantial amount of money by investing in building insulation, as I read this.

Senator DOMENICI. All those things.

The CHAIRMAN. Yes. All of those on the left you save a lot of money by going ahead and doing. On the right it's going to cost you money. Then you get into the question of whether it's worth the cost involved to go ahead and do those things. I mean in terms of the impact on the environment and other questions.

But I guess I have two questions. First whether you have reviewed these particular charts and have any opinion on whether they are valid or whether your agency is capable of giving us an assessment of your own version of this so that we could have that for policymaking purposes. I think it would be very useful if we had a consensus within the Federal Government and within the country on what abatement measures yield the greatest results in terms of greenhouse gas emissions.

Do you have any reaction to this?

Mr. CARUSO. Yes. I think the answer to your question is we would certainly take a crack at it and do our best. The couple comments are that some of these have already been implemented in the EISA bill.

The CHAIRMAN. Right.

Mr. CARUSO. Some of our people have been in contact with the McKinsey analysts and have some disagreements as you might expect. I don't know what the actual costs are. So clearly we wouldn't—our numbers would be different and we'd be happy to take a crack at it.

The CHAIRMAN. I'd appreciate it if you would. I would request that you do that. You know one obvious example of where I think we're not in agreement on how to make policy is the President's budget suggests we eliminate the Weatherization program.

---

* Charts have been retained in committee files.

If in fact the greatest bang for the buck is putting more money into building insulation you would think we would want to go ahead and do that. So that's——

Senator DOMENICI. If it was being done effectively.

The CHAIRMAN. Yes. I think you'd want to know that. But presumably there's some assumption built in here that it can be done effectively.

Senator DOMENICI. Oh, of course.

The CHAIRMAN. If it's done effectively you have tremendous savings. I've never heard anybody argue that the reason we're not funding weatherization at the Federal level this year is because we don't think it can be effective. I mean it's just a question of priority of that compared to other things we want to put money into, as I understand it. So, at any rate I would appreciate it.

Let me ask one other question.

Senator DOMENICI. Senator, what is it that you want him to do?

The CHAIRMAN. I would like him to see if he could look at these various graphs that we've distributed here and come up with their own.

Senator DOMENICI. Ok.

The CHAIRMAN. So that they would be telling us that in their opinion there are certain abatement measures we could take that would be the highest yielding in terms of greenhouse gas emission reductions. There are others that are going to cost us a lot more.

Senator DOMENICI. I think that's an excellent idea in general. Excuse me for interfering.

The CHAIRMAN. No, go ahead.

Senator DOMENICI. But I think some experts have concluded that these are the effective items. Shouldn't he be permitted to consider others?

The CHAIRMAN. Oh, sure. If there are some other measures that you think make more sense than the ones on these charts. But the McKenzie one, the way it was represented to me, is they looked at 250 different options for abatement of greenhouse gas emissions, and tried to rank those in order of highest yielding—lowest or highest cost then lowest yielding.

If you can come up with more than 250, I'd be glad to have you include more.

Mr. CARUSO. Our comparative advantage, of course, is in those options directly related to energy and some of these are non-energy. But we will certainly do our best——

The CHAIRMAN. Ok.

Mr. CARUSO [continuing]. Using what is in our database and our technology database.

[The information referred to follows:]

The greenhouse gas abatement curve from page 20 of Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost by McKinsey and Company is based upon a complex methodology and numerous assumptions. EIA is working with McKinsey and Company to better understand the methodology and assumptions used. The greenhouse gas emissions abatement options contained in the report are based on energy projections contained in EIA's Annual Energy Outlook 2007. EIA hopes to assess the impact of updating the baseline to the Annual Energy Outlook 2008 reference case, which reflects the Energy Independence and Security Act of 2007; provide some insights on the general approach used in the McKinsey report; and provide greenhouse gas marginal abatement supply curves derived from National Energy Modeling System simulations. For now, EIA recommends that reviewers care-

fully note the caveats contained in the McKinsey report. For instance, McKinsey's analytical approach does not consider the cost of regulation, implementation, and any related Federal funds. For example, taking Chairman Bingaman's weatherization example, the McKinsey study does not specify any of the policy options that might be necessary to induce homeowners to improve building shell efficiency, such as price incentives or mandated building standards. On page xiv of the Executive Summary, under the abatement section that would include weatherization, they state, "While this category of abatement options would cost the least from a societal point of view, persistent barriers tomarket efficiency will need to be overcome." Similar caveats about costs and policy options appear on pages 3 and 32 of the report. Additionally, the savings shown in the McKinsey study are based on optimal sequencing among demand-side and supply-side options. EIA believes that the sequence in which carbon-mitigating measures are implemented will have a bearing on their effectiveness and costs. For example, if weather stripping and energy-efficient windows are installed after wind-power generation is added to the grid supplying electricity to that home, the carbon-saving value of the weatherization program would be diminished.

The CHAIRMAN. That would be great. Let me just ask one more question. Could you give us a sense of how much of EIA's forecasted biodiesel consumption is expected to come from imports?

I know that our domestic biodiesel industry is going through a difficult period here. What do you project in the future as far as imports of biodiesel verses domestic production of biodiesel?

Mr. CARUSO. In this particular outlook we don't have any finished biodiesel imports as part of biodiesel supply. The reason is because the $1 per gallon tax credit is set to expire after 2008. The second reason is that the EISA requirement for one billion gallons of biodiesels per year after 2011 is well within the domestic biodiesel capacity.

So we think that the domestic biodiesel industry will be able to provide supply competitively. Therefore we don't expect finished biodiesel imports. We do expect perhaps some palm oil imports which would then be used as an input or a feedstock to create biodiesel. But in this outlook we don't have any finished biodiesel imports.

The CHAIRMAN. All right.

Senator Domenici.

Senator DOMENICI. Mr. Chairman, I want to say to you that I thought this was a very important hearing. For the first time for this Senator, I was exceptionally pleased to find that we have a credible agency finding that legislation that we spent a lot of time on—that we were told would have a big impact on American people in terms of oil imports and $CO_2$ emission—that we did it, part of it after many years of contrarianism. It is rather refreshing to find that what we did is really effective.

I think Senators that worked on it with us ought to know that there are certain things that we can do. They're hard, but these were very effective. I think there are a few left. Lots of them left when you get to $CO_2$.

I still think our energy challenges could be devastating. I want to close my remarks without a question by saying I believe, as I've said publicly, that the cost of oil is so high when compared to previous eras when we were so dependent and oil was $10, $20 a barrel, that I think it is making us poor.

I think we are just literally getting poorer because so much of our wealth must go for this. We get nothing. You know there's no

quid pro quo from the standpoint of our own growth, and I think our dependence on foreign oil is causing very serious consequences.

I think the people don't know what they're feeling, but they're feeling this along with many other things. This is part of the real hardship feeling among our people. I think it's going to get worse.

That's why I think a little good news is important. This is good news. Maybe if we find a few more, we should try to take a chance on them. I want to say, one example would be the offshore drilling that was such a success in bidding. You know, some of the Floridian waters we released in a bill that we fought hard for had had a moratorium on them.

I think it's incumbent upon us as energy leaders to see what else we have in the offshore that we could take a look at. I think to just leave it out there because people have been crying moratorium is irresponsible. A moratorium made sense perhaps with $10 a barrel oil. It may not make sense with 110 from the standpoint of an impact on the American people. Thank you.

The CHAIRMAN. Thank you very much.

Senator Dorgan.

Senator DORGAN. Mr. Chairman, I would say to Senator Domenici, the same principle I think holds true with respect to a moratorium or an issue of filling SPRO. What might hold true at $27 a barrel oil may not hold true at $103 a barrel oil. I want to come back to the SPRO issue.

That is that when oil is bouncing around $100, $200 and $3 a barrel and you're pulling up to the gas pump and paying a lot of money for a gallon of gasoline. I understand what you have said today is that the activities of the Federal Government at this point to put oil underground is increasing the price of gas. You say about four or five cents a gallon right?

Mr. CARUSO. Yes, sir.

Senator DORGAN. Five cents a gallon?

Mr. CARUSO. Yes, sir.

Senator DORGAN. So, I mean, you look at the numbers of this. Others say it has a higher impact because it's a subset of oil, sweet, light crude which is pretty valuable subset of oil. But at any rate, the decision by our government to at record prices of oil be taking oil out of the supply side and sticking it underground has the impact of increasing the price of gasoline.

Mr. CARUSO. That's correct, sir.

Senator DORGAN. I have a piece of legislation I've introduced here in the Congress. I've changed it since I've introduced it. I'm probably going to offer it to the bill that's on the floor today that would shut down, have a pause for at least 1 year if the price of oil is above $75 a barrel.

It seems to me that just as Senator Domenici talked about a moratorium might be useful in one circumstance, but not another. I happen to on the Lease 181, just to go back to that point. I happen to think we ought to go back again and try to get more of that.

We pared that back. You know the four of us that introduced the original legislation to be able to get some additional resources out of the Gulf of Mexico. It was a broader piece of legislation which I support.

We had to pare it back in order to get it passed, but I think with the price of oil where it is, we ought to go back and revisit a portion of that and try to get more. If you look at where the potential is, the Gulf, off the West Coast or Alaska, by far the most significant capabilities come from the Gulf if you just look at the three. So I'd like to see us go back and get more of what was Lease 181.

But at least at the moment what I'm hoping we'll be thoughtful as a Congress in how we address these things. The issue of buildings as being the biggest bang for the buck in conservation makes a lot of sense to me. So there's a lot of things we can do.

But there's a lot of things we shouldn't do. We shouldn't sit around and take a look at the increased speculation in the futures market and say well, that doesn't matter. We don't maybe understand it, but it doesn't matter. I think it does matter with respect to the price of oil.

On this issue of SPRO, my belief is that at $100 a barrel for oil, we ought not to be taking oil out of supply and increasing gas prices. That ought not be an affirmative action by the Federal Government. That's just dumb headed in my judgment.

So I'm hoping that we can stop that. I'm hoping a group of us would say this has nothing to do with the oil companies. It has to do with the public policy by the Federal Government.

Now you've said earlier, Mr. Caruso, that you don't make policy and you don't recommend policy. You come and give us the numbers and I appreciate that. I did want to say that I think your report does describe a couple of things that are important.

I and some others on this panel felt that we should move on CAFÉ. So we moved on CAFÉ standards. Your analysis is that's going to have a significant impact going forward. We opened up some additional production. That has an impact.

There's a series of things we've done with respect to renewable fuels. Tell us again the significant portions of policy from the legislation that we have completed here in the Senate that you think give us the best opportunity in the longer term to be less dependent on foreign oil.

Mr. CARUSO. The three are the CAFÉ standards, and any others that would improve vehicle efficiency, efficiency standards for appliances and other equipment, and the renewable fules standard that has already been passed in EISA. But as Senator Bingaman indicated in this cost abatement curve there are probably areas where more could be done.

Senator DORGAN. Lighting standards are important?

Mr. CARUSO. Yes, sir.

Senator DORGAN. You know, we did, I believe SEER 13 standards for air conditioning. I mean those things sound like a foreign language to people. But the fact is these required efficiencies that we've been pushing on and been successful in have made a big difference. Haven't they?

Mr. CARUSO. They definitely have. I think the results are clear with both the RFS and CAFÉ with 2.4 million barrels a day less oil demand in this outlook than there was a year ago. The cumulative reduction in carbon dioxide emissions which I mentioned—you can attribute over five billion tons to the energy bill that you've passed.

Senator DORGAN. Mr. Caruso, if you were running things, you wouldn't be putting oil underground at this moment, would you?

Mr. CARUSO. I have to defer that to my bosses at this point.

Senator DORGAN. All right. Mr. Caruso, thank you.

The CHAIRMAN. Senator Sessions.

Senator SESSIONS. Thank you, Mr. Chairman. Mr. Caruso, I likewise have been intrigued but I likewise have a concern about storing this amount of oil at the current high prices. Let me ask you about domestic production.

It seems to me we that have more interest in this country than just $CO_2$ reduction. Would you agree that national security is an important issue for us?

Mr. CARUSO. Definitely, sir.

Senator SESSIONS. That cost for the consumer is an important issue?

Mr. CARUSO. Yes, sir.

Senator SESSIONS. It seems to me that the producing of oil and gas in this vast land of Alaska, ANWR or off our shores meets those standards. It helps us be more energy independent. It wouldn't be produced if the producers didn't think that they could make a profit by producing it cheaper than we could buy on a world market.

What about the national interest in maintaining more of our wealth? If we don't produce oil and gas in our Nation, that does not mean we won't utilize oil and natural gas. We're going to see more natural gas imported. We're going to continue to see a rise in imports of our oil.

For those who are trying to stop the utilization of oil, I don't see how they're making any progress overall other than denying us the right to produce what we have here.

Would you agree that there are a lot of economic and other reasons for producing oil and gas at home rather than sending our money to Venezuela and other places that seem to be hostile to our interest?

Mr. CARUSO. Yes. That's what our analysis indicates to the extent that new regulations and law would support that—it would reduce oil imports and reduce our trade deficit as well.

Senator SESSIONS. It would create jobs in the United States instead of jobs in Saudi Arabia or Iran or Venezuela, the countries that are producing so much of the world's oil and gas.

Mr. CARUSO. Yes, sir.

Senator SESSIONS. It creates revenue whenever there's a production of oil and gas either to the Federal Government and now to some degree in the Gulf of Mexico. The States are able to receive some of those royalties from the sale of the oil and gas instead of having those royalties go to a foreign country when we consume it. We're helping those States with their financial condition as well as the jobs created in those States. Wouldn't you agree?

Mr. CARUSO. Yes, I agree with you. We need a significant amount of investment to meet the projected demands I mentioned to Senator Murkowski—earlier that the decline rate in the older fields alone requires significant new investments just to maintain our production levels even at the level that they're at now.

Senator SESSIONS. I just couldn't agree more. I just don't agree with that we have an emotional feeling that if we produce oil and gas off our shores and in Alaska and in throughout the United States that we're not producing today that's somehow this makes us more dependent on oil and gas than we would be otherwise. Really I don't think that's true.

I think it helps our economy. It helps our Nation. It helps create jobs.

To me one of the things that seems to be a possibility, a real possibility, of a practical breakthrough solution of large proportions would be the continual improvement of the hybrid and a plug-in hybrid or fully electric automobile improved batteries. Would you agree that we're making some progress toward that? In your projections what kind of projections do you make?

Mr. CARUSO. We do have a significant increase in the alternatively fueled vehicles in this outlook, including hybrids. We do not have much if at all of the plug-in version of the hybrids as of now mainly because battery technology still is not sufficient to, we think to——

Senator SESSIONS. This day it's not. But there was an article in, a big article, in Barron's recently about oil and the problems with oil and the individual who promotes clean fuels at Toyota, that's his job within the corporation.

If you read the article carefully, it concludes that the future lies with plug-in hybrids. He indicated nuclear energy. So the combination of clean nuclear energy that could charge the batteries of our automobiles and could drive throughout the day would be a huge breakthrough if that could be made a reality, would it not?

Mr. CARUSO. It definitely would be a huge potential if that battery technology can be developed at a reasonable cost. So many of our miles are driven fairly close to home, so plug-in hybrids have great potential, but based on our current assessment the battery technology isn't there yet.

Senator SESSIONS. If we continue to work it you would have the potential of reducing $CO_2$. You would have the potential of reducing our dependence on foreign oil. Maybe, break the tide of tight supplies a little bit and take us in the right direction.

So it would help us meet our $CO_2$ goals as well as our economic goals. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Salazar.

Senator SALAZAR. Thank you very much, Senator Bingaman for this hearing. Director Caruso, I guess first I have some questions concerning your charts. If I look at figure 2 where you have world oil prices are higher in 2008. You have your projections out into the future.

If I'm reading that chart correctly, now in 2008, what you have us there is about $85 or so a barrel. Then moving on down to 2015, it seems that we're around $58 or so a barrel. How confident are you? What's the basis for you making that kind of prediction that we're going to go down from $100, I guess it's $103 today or something like that, down to $58 a barrel in 2015.

Mr. CARUSO. This is our reference case. We use that as our, you know, base case. So it's our view that the longer-term impact of the

current high oil prices and high prices we've experienced for several years will lead to two things.

One, more exploration and development and investment in the upstream that will bring on both conventional and unconventional——

Senator SALAZAR. Let me ask you this question. I mean, from my point of view, you know, and from many people I talk to, we're looking at, I think at $100 a barrel oil today. We see China coming into the market and competing for finite resource. We see India and others, rest of the world coming on board.

I'm not confident in these projections in any way, shape or form. I mean, it seems to me if we're at 100 dollar a barrel oil today that we may very well be there in 2010 and 2012 and 2015. Now your conclusion, as the expert that's informing us is that that's not the case. That by the year 2015 you think we'll be down to $58 a barrel. Are you confident in that conclusion?

Mr. CARUSO. No, I think the way I'd rather characterize it is that that's one scenario. But we also recognize that we've been wrong and been too low in our price projections in the last several years. That's why we also do a high price scenario which is in the same chart, where prices essentially don't retreat. They just keep going up—in fact, reach in nominal terms $185 by 2030.

So our view is we need to do this on a risk basis. We think there's a significant risk that the reference case could be wrong, and therefore we should look at the high price case.

Senator SALAZAR. Just a factual question for you on that same chart why is it that you would have the high water mark there for 2008 at approximately $80 to $83 a barrel when in fact we've gone up to $100.

Mr. CARUSO. That's the annual average, so it averages the whole——

Senator SALAZAR. So if we look at the 2008 average that's what you will predict it will be is around $80.

Mr. CARUSO. That's our current assessment, $85.

Senator SALAZAR. Let me ask you, moving onto figure 4 on the liquid fuel consumption, following up on my colleague Jeff Session's comments there. I see us at, you know, approximately 15 million barrels per day in 2010 for the transportation sector and that trajectory continues to move upward into 2020 and 2030. If we were able to move forward with some of the policies that have been advocated by Senator Sessions, Senator Bingaman, myself, with respect to advance vehicle technologies and plug-in hybrids, could that projection come down?

Mr. CARUSO. Yes, sir. Definitely. It's come down as I mentioned earlier by about 2.4 million barrels a day just from what you did in EISA 2007.

Senator SALAZAR. That was based on the increase in CAFÉ standards.

Mr. CARUSO. CAFÉ standards, yes, sir.

Senator SALAZAR. Ok.

Mr. CARUSO. We do have a significant increase in alternatively fueled vehicles as part of the fleet mix, but as I mentioned to Senator Sessions, it doesn't include hardly any plug-in hybrids. So a breakthrough in that area would change that number and to the

extent it changes it would really depend on how significant the cost reductions would be in battery technology.

Senator SALAZAR. So just a comment to my friend, Jeff Sessions from Alabama, you know I always talked about the set America free agenda as a way in which we could unify the country especially because of the foreign policy and implications here. I think that when we talked about these advanced vehicle technologies and moving forward with hybrid plug-ins and the like, I think it's an absolute agenda that's an imperative for us. I hope we're able to do a lot more with that.

Let me move to on figure number 7, you have set forth the projections with respect to renewable fuels. We were very active in pulling the RFS together out of this committee. Are those projections that you have there for 2020 and 2030 around the different items that are part of this RFS portfolio from your point of view achievable?

Mr. CARUSO. Yes, sir. The projections we have are achievable. We do show a relatively small shortfall compared with the EISA values.

As I mentioned, instead of 36 billion gallons in 2030 we are in this outlook assuming or projecting 32.5 billion and the main reason for that shortfall is the assumption on the ability of the cellulosic portion of that EISA requirement to be met. There are provisions that if along the way any component does not meet the EISA requirements, the EPA Administrator has an option to adjust that. Therefore, we have a small adjustment around 2016 and then again in 2022.

Senator SALAZAR. Mr. Chairman, may I ask one more quick question?

The CHAIRMAN. Sure.

Senator SALAZAR. The amount they have for cellulose based ethanol. I look at 2020 and that looks, your projecting about 2.5 billion gallons. My understanding from those who are involved at the National Renewable Energy Lab in Golden, Colorado as well as the company that is putting forward a demonstration project in Georgia, they believe they're about a year away or so from being able to move forward with the commercial deployment of cellulosic ethanol.

If they are correct that we are within a year or two from being able to commercially deploy cellulosic ethanol would these numbers change looking out at 2020 and 2030 with respect to the green portion of the graph where you have those allocations for cellulosic ethanol?

Mr. CARUSO. I don't have the details of what the Georgia company and the NREL have said, but we do think that if there are significant breakthroughs in technology, these numbers would change, definitely. They're based on our best current judgment having talked to the NREL people as to where they are right now and where they might be by 2014 and 2015 when they have to meet these certain targets.

As of now this is our best judgment. But I definitely agree that there's a great deal of uncertainty in this, and that if some of these technological breakthroughs occur these numbers would change upward.

Senator SALAZAR. Thank you very much, Administrator Caruso.

The CHAIRMAN. Thank you.

Senator Murkowski.

Senator MURKOWSKI. Thank you. Mr. Caruso, on the alternative energies and the renewables, you are predicting some good increases and you just spoke to that to Senator Salazar. But in terms of the market share that we see coming from the renewable energy sector.

If I understand your presentation here, you only anticipate it to grow by a few percentage points over the next couple decades. Why is it that we don't see a more pronounced growth then? You mentioned to somebody and it might have been to Senator Dorgan that your analysis does not include a continuation of the production tax credits that we have. Is that part of the reason?

Mr. CARUSO. It's definitely part of the reason, yes. The assumption that the renewable, I mean the production tax credit for renewables is allowed to expire at the end of 2008 makes a huge difference in the——

Senator MURKOWSKI. What would it look like? Did you do the analysis?

Mr. CARUSO. We have done it; I think Senator Bingaman has asked us to do that. I would hesitate to want to give you a number off the top of my head, but I remember it being a significant change. I would be happy to provide that for the record.

[The information referred to follows:]

In its Annual Energy Outlook 2008 (AEO2008) reference case, EIA assumes, consistent with laws in effect as of January 1, 2008, that the production tax credit (PTC) for new wind and other renewable generation will expire at the end of 2008. The Congressional Joint Committee on Taxation (JCT) requested that EIA model a scenario assuming a 10-year extension of the PTC based on the current structure of the law. By 2018, the assumed PTC expiration date in the JCT analysis, wind capacity with the extension is projected to grow to almost 72 gigawatts, compared to a 2018 capacity of approximately 31 gigawatts in the AEO2008 reference case. Through 2030, wind capacity with a 10-year PTC extension is projected at almost 74 gigawatts, suggesting little additional growth after the 2018 assumed expiration, but still significantly higher than the 40 gigawatts projected in the AEO2008 reference case by 2030. A 10-year extension of the PTC is also projected to spur additional development in geothermal, landfill gas, and open-loop biomass generation, although the impact on the additional capacity of these resources is substantially less on an absolute basis than for wind, with less than 3 gigawatts of additional combined capacity for those resources by 2018 when compared to the AEO2008 reference case.

Senator MURKOWSKI. I think that would be helpful to know what that actually looks like——

Mr. CARUSO. By——

Senator MURKOWSKI [continuing]. Because a lot think that continuation of those protection tax credits is going to be very, very important. It sounds like you would agree in terms of what's going on.

Mr. CARUSO. It would be very important nationally as well as for a lot of States that have their own RPS programs. I can also say that even with these relatively conservative assumptions on the production tax credit, the renewables component is the fastest-growing segment of the energy mix in this outlook. That's the first time I think I've been able to say that in 6 years of presenting these outlooks.

Senator MURKOWSKI. As I go back home, I don't care what part of the State I am in, I am inundated with questions about what are you guys going to do back here about the high price of fuel? In some of my smaller and more remote communities, I was out in a community just last week. They're paying seven bucks a gallon for their gasoline. Home heating fuel is absolutely through the roof.

If we were to do one thing short term that would reduce the price of fuel, what would that be?

Mr. CARUSO. The problem is that, as you know too well——

Senator MURKOWSKI. Here's the silver bullet.

Mr. CARUSO [continuing]. It's a long-term issue and that involves requiring investment whether you're on the supply side or on the demand side in terms of efficiency. So in the short run it's really up to the consumer. They have to respond to the prices, as you indicated. Sometimes it's not possible because there is very little you can do in the short run.

Senator MURKOWSKI. You don't have any choice. Yes.

Mr. CARUSO. Yes.

Senator MURKOWSKI. So what you're saying is that in reality I can't tell my constituents that there is any one thing that we can do short term, short of——

Mr. CARUSO. Behavioral.

Senator MURKOWSKI. Consuming less. But when it's 50 below, it's kind of tough to tell people well, don't fill up your home heating fuel tank, so.

Mr. CARUSO. But the one thing you can say is that whatever we do, we should start now with even long-term solutions. I think what this outlook revision shows is that the EISA bill of 2007 was the beginning of many of these policy changes.

Senator MURKOWSKI. We're making some headway. But to the individual it looks pretty glum right now. So, thank you.

Mr. CARUSO. Thank you, Senator.

Senator SALAZAR [presiding]. Senator Sessions.

Senator SESSIONS. Administrator Caruso, let me ask you a little bit about a sore spot that I'm hearing. I'm not able to give an answer to and that is why diesel fuel consistently is substantially more expensive than gasoline. Historically, I was under the impression that diesel fuel was a less expensive product. How is this occurred?

Mr. CARUSO. I think that's directly related to the refinery tightness we have in this country, the lack of investments that have been made in the refinery—sector that is, the secondary conversion of the crude oil after it leaves the primary distillation has been——

Senator SESSIONS. Explain that a little more.

Mr. CARUSO. When crude oil goes into a refinery it goes through the first process which is primary distillation. It gets separated into broad categories of different products. But then it has to be further refined to make more specific products such as gasoline or diesel.

Senator SESSIONS. It takes more refining and costs more to produce the gasoline.

Mr. CARUSO. Yes, and not enough investment has been made to increase the amount of the middle distillate part of the barrel

which is where the diesel comes from. That's led to the tightest of supply.

Senator SESSIONS. If you were in the business of marketing diesel fuel why wouldn't you want there to be a shortage of refineries so that the price would spike up and you could do well.

Mr. CARUSO. The main reason I would want to make the investments is that I could gain market share from my competitor and would have a greater——

Senator SESSIONS. But it's not happening very effectively. Would you agree? I mean something, it seems to be an aberration in the marketplace to me.

This complaint about we can't find a place to build a refinery, I don't think is accurate. I believe there are areas in my State that would welcome a refinery if they were confident that it was well managed. We have refineries already in our State.

So I'm just a little bit unhappy about this. I hear it from truckers. I hear it from consumers. You buy a car that's diesel that gets better gas mileage and all of a sudden you're paying 40 cents more a gallon.

Why don't we have more diesel refineries?

Mr. CARUSO. I think we will, but right now there's also a global tightness. Europeans have moved very heavily into diesel-powered vehicles. Therefore there really isn't enough diesel availability.

Normally, when you have a market aberration as you indicated, one solution is you could import that product from abroad and that's what happens a lot with gasoline, but right now there's very little excess diesel-making capability available in refineries abroad such as in Europe or Singapore.

Senator SESSIONS. Are they buying our diesel fuel? Are we shipping diesel to Europe?

Mr. CARUSO. Not that I'm aware of. If it is, it's quite small.

Senator SESSIONS. It seems to me then in our process what happens in Europe is not so important.

Mr. CARUSO. The reason it's important is that if our prices got high enough to attract imports that would put downward pressure on the price. That hasn't been happening, especially in the winter time when that same middle distillate part of the refinery output also supplies our home heating oil.

Senator SESSIONS. Let me cut to the core of the question. Most of us try to understand that the free market works and prices tend to work in. But with regard to diesel I'm baffled why we're not seeing an adjustment. I am not such a pure free market person as to believe they aren't aberrations and dysfunctions that can occur within the system that would artificially allow these prices to remain higher.

Do you see anything that we could do to encourage more refining capacity or otherwise to bring diesel fuel to a more natural price level?

Mr. CARUSO. I think anything to facilitate investment. As you pointed out, you think there are siting issues——

Senator SESSIONS. But you know you got to subsidize diesel fuel when it's at this rate?

Mr. CARUSO [continuing]. That would be subsidized——

Senator SESSIONS. There's something else in regulating or so political things that are frustrating the production of diesel fuel that leaves me concerned.

Mr. CARUSO. I wouldn't recommend subsidies. I'm just saying that right now there does appear to be an insufficient investment in diesel-making capability and, to the extent that there are any regulations or laws that are impeding that, I would look there, but right now you've got peak heating oil demand for that same part of the barrel.

Senator SESSIONS. From a global warming perspective the Europeans have concluded and I'll ask you if you disagree that diesel gets better mileage and has less $CO_2$ emissions.

Mr. CARUSO. Absolutely. The more than 50 percent of new car sales in Europe are diesel as of——

Senator SESSIONS. We're less than 10?

Mr. CARUSO. Way less than 10, we're probably less than 2.

Senator SESSIONS. So, one reason I think price is a factor. Thank you. My time is up, Mr. Chairman.

Senator SALAZAR. Thank you very much, Senator Sessions. Unless you have any additional questions we will conclude the hearing. The hearing is adjourned. Thank you very much, Administrator Caruso.

Mr. CARUSO. Thank you, Senator Salazar.

[Whereupon, at 11:46 a.m. the hearing was adjourned.]

# APPENDIX

## RESPONSES TO ADDITIONAL QUESTIONS

---

DEPARTMENT OF ENERGY,
CONGRESSIONAL AND INTERGOVERNMENTAL AFFAIRS,
*Washington, DC, May 2, 2008.*

Hon. JEFF BINGAMAN,
*Chairman, Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.*

DEAR MR. CHAIRMAN: On March 4, 2008, Guy Caruso, Administrator, Energy Information Administration, testified regarding EIA's revised Annual Energy Outlook.

Enclosed are the answers to 11 questions that were submitted by Senators Domenici and Dorgan for the hearing record.

If we can be of further assistance, please have your staff contact our Congressional Hearing Coordinator, Lillian Owen, at (202) 586-2031.

Sincerely,

LISA E. EPIFANI,
*Assistant Secretary.*

[Enclosures.]

### RESPONSES TO QUESTIONS FROM SENATOR DOMENICI

*Question 1.* You noted in your testimony that previous ElA forecasts assumed that the Federal Production Tax Credit for renewable electricity would expire, thereby rendering renewable electricity expensive enough to trigger the so-called "escape clauses" included in many State RPS programs. However, in its 2008 assessment of increased renewable electricity demand, EIA "assumes that the State RPS goals will be met" even though the PTC is set to expire at the end of this year.

Given that the federal PTC is set to expire at the end of 2008 and numerous attempts to extend the energy tax credits have failed, why has EIA assumed that State RPS targets will be realized? Why, wouldn't the expiration of the PTC trigger the State RPS "escape clauses" as EIA has predicted in previous forecasts?

Answer. This year's Annual Energy Outlook reference case continues to assume, for modeling purposes, that the production tax credit for renewable electricity expires as currently called for in the law. However, we are now assuming that the States with renewable portfolio standards will continue to try and stimulate renewables, even if the tax credit is not extended. Extending the federal tax credit would certainly make it less expensive for these States to do so, and make renewables more attractive in all States, but we have not assumed that this occurs in the reference case. It is certainly possible that the expiration of the production tax credit might lead some utilities in States with renewable portfolio standards to use alternative compliance mechanisms, rather than building new renewable facilities, but we believe that most would try to find ways to stimulate the required renewables.

*Question 2.* If the PTC is extended by the end of this year, how does that change EIA's renewable electricity forecast?

Answer. The impact would depend on the length of the PTC extension. If the extension were only for a year to two, there might be a near-term increase in renewable generation but the longer-term trend would continue to be driven by the renewable portfolio standards that exist in many States. A longer-term extension of the PTC could lead to significantly larger growth in renewable generation than we currently project in the EIA reference case.

*Question 3.* You testified that total renewable generation in the reference case grows by 2.2% per year through 2030. How much growth can be attributed to combined heat and power use? How much can be attributed to end-use generation?

Answer. In absolute terms, most of the increase in renewable ueneration between 2006 and 2030 occurs in the power sector as a result of investment in new wind

facilities. However, end-use renewable generation does grow at a faster rate, 4.6 percent per year. Most of the increase in end-use renewable generation is projected to come from increased biomass use in biomass-to-liquids plants that also produce electricity for sale, followed by a much smaller increase in photovoltaic generation stimulated by programs to encourage the use of roof-top solar systems.

*Question 4.* You testified that the slowing rate of electricity growth reduces the need for new generating capacity. Has EIA examined the role of Demand Response in contributing to this reduction?

Answer. It is very difficult to separate out all of the forces contributing to slowing electricity demand growth. Across the country, regional wholesale electricity organizations, State public utility commissions, and the utilities that they regulate are trying to increase their investments in demand side management programs. Reports on these programs are generally available on each region's web site. For example, information on New England's demand response programs is available at http://www.iso-ne.com/genrtion__resrcs/dr/index.html, and information on New York's is available at http://www.nyiso.com/public/products/demand__response/index.jsp. Although the demand for electricity continues to grow, the rate of growth has been slowing for more than 50 years. In the 1950s, the use of electricity increased 9.0 percent per year. However, in every decade since then growth has slowed, falling to 7.3 percent per year in the 1960s, 4.2 percent per year in the 1970s, 3.1 percent per year in the 1980s, 2.4 percent per year in the 1990s, and only 1.2 percent per year between 2000 and 2005. It is likely that a portion of the slowing growth is due to utilities' investments in demand-side management. EIA's projections continue to reflect this trend, with the projected growth in electricity demand slowing further to 1.1 percent per year between 2006 and 2030.

*Question 5.* According to the EIA forecast, the most rapid growth in total electricity consumption occurs in the commercial sector. In its assessment, has EIA included the anticipated energy savings from the 2007 Energy Independence and Security Act—including establishing a Director of Commercial High-Performance Green Buildings and a Zero Net Energy Commercial Building Initiative—on the electrical consumption of commercial buildings?

Answer. The specific EISA2007 provisions that are modeled in *AEO2008* include the renewable fuel standard (RFS), new corporate average fuel economy (CAFE) standard for new light-duty vehicles, new appliance and lighting energy efficiency standards, provisions to reduce energy consumption in Federal buildings, and new industrial electric motor efficiency standards. Any anticipated energy savings from the Federal buildings provisions and efficiency standards affecting the commercial sector are included in the EIA projections. Activities under the Zero Net Energy Commercial Building Initiative are not included because they depend on future appropriations, which are uncertain. The coordination, negotiation, and promotion efforts of the Director of Commercial High-Performance Green Buildings are not included because these activities are beyond the level of detail modeled in *AEO2008*.

*Question 6.* Has EIA assessed the anticipated energy savings from the efficiency portions of the 2007 Energy Independence and Security Act (i.e., the appliance standards; lighting standards, including the phase-out of incandescent light bulbs; federal building targets; and commercial buildings)?

Answer. As noted in the answer to the previous question, the specific EISA2007 provisions that are modeled in *AEO2008* include the renewable fuel standard (RFS), new corporate averne fuel economy (CAFE) standard for new light-duly vehicles, new appliance and lighting energy efficiency standards, provisions to reduce energy consumption in Federal buildings, and new industrial electric motor efficiency standards. EIA is currently developing separate impact assessments for major EISA2007 components, however, results for these analyses are not yet available.

*Question 7.* Your analysis asserts that in the absence of policy changes, carbon capture and sequestration will not be deployed by 2030. Increased oil production in the 2008 Outlook is, in part, attributed to enhanced oil recovery using carbon dioxide, however. How significant is the contribution of this enhanced oil recovery to domestic production, and the $CO_2$ comes from a man-made source, would EIA credit those operations with reducing the amount of $CO_2$ emitted in the coming years?

Answer. In the reference case of the *AEO2008*, domestic oil production from $CO_2$-enhanced oil recovery is projected to more than triple, increasing from 350,000 barrels per day (or 6.8 percent of total domestic production) in 2006 to 1.3 million barrels per day (or 23.4 percent of total U.S. production) in 2030. However, the projected use of $CO_2$ from industrial sources is not driven by emission requirements but, rather, is strictly an economic decision to increase oil production. If a greenhouse gas reduction policy were enacted, rules and procedures for measuring, monitoring and crediting $CO_2$ sequestered in oil fields would have to be established. Once

such rules were established, EIA would be able to estimate how much of the $CO_2$ sequestered in oil fields would be credited against industrial emissions.

*Question 8.* Your testimony contends that the recently-passed biofuels mandate will not be fully met and will require waivers and other reductions. Has EIA looked at how much more significant our biofuels shortfall will be if the tariff is, in fact, renewed and imports are not available to make up the difference?

Answer. EIA has not examined the impact of extending the tariff past 2009. If the tariff was extended, imported fuels would be more expensive relative to domestically produced fuels and the level of imports after 2009 would he lower than in the *AEO2008* reference case. Imports would not be likely to disappear completely, as the *AEO2008* reference case projects imports of 800,000 gallons in 2008 compared to 460,000 gallons in 2007, with the tariff in place. Imported biofuels are projected to contribute 3.4 billion gallons towards the Advanced Fuels requirement in 2022, so to what degree this amount would decrease is unclear. It is also possible that cellulosic ethanol or other bioluel technologies would become more profitable relative to imports and thus lead to more domestically produced bioluels.

RESPONSES TO QUESTIONS FROM SENATOR DORGAN

*Question 1.* The Energy Information Administration's budget request for FY 09 is $110.6 million. The Senate had provided your full request for FY 08 at $105 million but had to cut it back to $95.5 million to get to the President's demand that we cut $22 billion across the board for domestic programs. Can you explain your priority areas for your increase in your Fiscal Year 2009 budget request?

Answer. The FY 2009 budget request increase supports five critical activities that were deferred due to EIA's FY 2008 $95.5 million program. Specifically, the $12.2 million increase in support services for FY 2009 would allow EIA to: address critical and growing petroleum survey data quality deficiencies, in order to reflect changes in the industry and assure statistical validity, accuracy, and reliability (+$3.7M); implement monthly ethanol and biodiesel surveys, as yell as a weekly ethanol survey, mandated by the Energy Policy Act of 2005 (+$3.4M); resume replacing the aging National Energy Model, which is critical to improving our ability to assess and project supply, demand and technology trends impacting U.S and world energy markets (+$3.3M); enhance the availability and timeliness of international oil, gas, and coal markets data and analyses (+$1.1M); and provide for mandatory Information Technology infrastructure upgrades and strengthen cyber-security to protect market-sensitive data (+$0.8M).

*Question 2.* Your projections indicate that the U.S. will not achieve the Renewable Fuels Standard targets that were recently increased to 36 billion gallons by 2022 in the enemy bill signed by the President in December. You assume we will produce about 8.6 billion gallons of cellulosic ethanol by 2022. Let me remind you that since we enacted the first renewable fuels standard of 7.5 billion gallons by 2012 in EPACT 2005, we are now on pace to exceed that goal in next year in 2009. So if we can produce nearly 8 billion gallons of corn ethanol in 4 years, what basis do you have to assume that we will only produce 8.6 billion gallons of cellulosic ethanol by 2022?

Answer. The recent expansion of corn ethanol capacity and production was driven by favorable corn prices, high crude oil prices, and the phase-out of methyl tertiary butyl ether (MTBE) as a gasoline additive. The renewable fuels standard in the Energy Policy Act of 2005 may have reduced the risk of investment in corn ethanol capacity, but it has not been the primary driver of the corn ethanol expansion over the last two years as evidenced by the fact that ethanol use has exceeded the EPACT 2005 requirement.

The production of ethanol from corn is a known technology. When ethanol demand increased, reflecting both the elimination of MTBE and the rapid increase in oil prices that increased the attractiveness of ethanol as a volume enhance in conventional gasoline, investors responded by adding capacity very quickly, which is still occurring.

Cellulosic ethanol is not currently cost-competitive with corn ethanol. Significant technological advancements will be necessary before cellulosic biofuel production will begin to penetrate motor fuel markets. Another challenge arises from the saturation of the market for EIO blends by existing and planned corn ethanol capacity. As more ethanol is added to the market it must compete based on energy content rather than volume. The Energy Department's first round of funding for development of cellulosic biofuels technology is expected to result in 6 plants being built with a combined capacity of 140 million gallons of cellulosic ethanol per year by 2011. A second round of funding is expected to result in 3 more cellulosic ethanol plants with combined capacity of about 6 million gallons per year by 2012.

*Question 3.* In your assumptions, you also indicate that the existing 54 cent tariff on imported ethanol will not be renewed in 2009, leading to a significant increase of imported ethanol. What basis do you have to make that assumption?

Answer. For modeling purposes, the *Annual Energy Outlook 2008* reference case is based on the laws and regulations that were in effect at the time the projections were formulated. Currently, the ethanol import tariff is scheduled to expire in December 2008. In past editions of the Annual Energy Outlook, the ethanol blending tax credit was extended indefinitely past its scheduled expiration. Since the stated purpose of the import tariff is to offset the blending tax credit for foreign ethanol, the import tariff received the same treatment as the blending tax credit. For the *AEO2008* reference case, the assumption regarding the ethanol blending tax credit was changed to make it consistent with all of the other policies represented, i.e., based on laws and regulations in place as of early this year. Without the blending tax credit, the stated purpose of the import tariff is voided and, therefore, the ethanol import tariff was also assumed to expire as scheduled.

○