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Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to address the issue of rising gasoline prices and the role of available domestic oil and natural gas resources.

The Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. EIA is the Nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views expressed in our reports, therefore, should not be construed as representing those of the Department of Energy or other Federal agencies.

My testimony today focuses on several aspects of the hearing topic, including EIA's near-term outlook for energy prices; EIA's evaluation of U.S. resources, reserves, and production of oil and natural gas; and ways in which domestic supply levels of oil and natural gas may influence energy markets and prices over different time horizons.

The outlook for energy prices in 2011 and 2012

Oil, including gasoline and other products produced from it, and natural gas together provided more than 60 percent of total U.S. primary energy use in 2010. While both oil and natural gas are internationally traded commodities, the market for oil is much more globally integrated than the market for natural gas, reflecting the fact that transport costs and logistical barriers for moving oil and oil products around the world are typically far lower relative to their value than is the case for natural gas. Differences in the degree of global integration for oil and natural gas markets mean that while the price of oil and gasoline produced from it generally reflect conditions on the world oil market – including the global balance between supply and demand and concerns related to actual and potential supply disruptions – the price of natural gas is largely determined by the balance of supply and demand and market conditions within North America. This key difference between oil and natural gas markets affects both the divergent trends in current and projected prices, discussed in this part of my testimony, and the effect of domestic resource development in the more distant future.

The discussion which follows is based on EIA's March *Short-Term Energy Outlook*, issued on March 8. It therefore does not reflect the impacts of recent and contemporaneous events in Japan, which can be expected to affect energy markets. The net effect of those events is too current to ascertain at this time.

Starting with the outlook for oil and gasoline markets, which we recognize is of great concern to both the Committee and the American people in light of recent developments, EIA expects continued tightening of world oil markets over the next two years – particularly in light of the recent events in North Africa and the Middle East, the world's largest oil producing region. The current situation in Libya increases oil market uncertainty because much of that country's 1.8 million barrels per day of liquids production, which represents about 2 percent of total world

supply, has been shut in and it is unclear how long this situation will continue. Many participants in oil markets remain concerned that the unrest in the region could continue to spread. This concern, along with other factors influencing prices, is reflected in the prices of spot market crude oil and related futures and options contracts, as discussed below.

Crude oil and wholesale gasoline prices. West Texas Intermediate (WTI) and other crude oil spot prices have risen about $15 per barrel since mid-February partly in response to the disruption of crude oil exports from Libya. Continuing unrest in Libya as well as other North African and Middle Eastern countries has led to the highest crude oil prices since 2008. As a result, EIA has raised its monthly *Short-Term Energy Outlook* forecast for the average cost of crude oil to refiners to $105 per barrel in 2011, $14 higher than in the February edition of the *Outlook*. The wholesale price of gasoline is closely linked to the price of crude oil, and the average wholesale price forecast for gasoline in 2011 is $2.91 per gallon, 39 cents per gallon higher than projected in the February *Outlook*. EIA projects a further small increase in crude oil prices in 2012, with the refiner acquisition cost for crude oil averaging $106 per barrel.

Retail gasoline prices. The recent rapid increase in crude oil and wholesale gasoline prices has led to a significant rise in the retail price of gasoline at the pump. Absent a near-term decline in crude oil prices, motorists currently experiencing a jump in pump prices will likely see further increases from now through the spring since the recent increase in crude oil prices has not yet been fully passed through to retail gasoline prices. EIA expects the retail price of regular-grade motor gasoline in the United States to average $3.56 per gallon in 2011, 77 cents per gallon higher than the 2010 average, and $3.57 per gallon in 2012. EIA projects gasoline prices will average about $3.70 per gallon during the peak driving season (April through September) in 2011 with considerable regional and local variation.

While EIA strives to provide accurate forecasts, it is important to recognize that there is significant uncertainty surrounding these projections. For example, as of March 3, the current market value of futures and options contracts for gasoline was suggesting about a one-in-four chance that the national monthly average retail price for regular gasoline could exceed $4.00 per gallon during summer 2011. EIA regularly tracks the uncertainty regarding future oil and gasoline prices implied by the market price of energy-related derivatives in a *Market Price and Uncertainty Report* that is issued alongside each month's *Outlook*.

Natural gas prices. Unlike oil prices, which reflect world market conditions, natural gas prices in the United States are largely determined by the balance of supply and demand within North America. Strong growth in the U.S. supply of natural gas in recent years, led by increased production of shale gas, which grew from 2.7 billion cubic feet (bcf) per day in 2006 to an estimated 13.3 bcf per day in 2010, has contributed to a significant moderation in natural gas prices. The price of natural gas at the Henry Hub in Louisiana, a major trading point for natural gas, averaged $4.39 per million British thermal units (Btu) in 2010 and is forecast to average $4.10 per million Btu in 2011. Since an average barrel of crude oil contains 5.8 million Btu of energy, the projected $4.10 per million Btu natural gas price projected for 2010 is less than $25 per barrel when expressed in "oil equivalent" terms. The fact that natural gas is so much cheaper than oil in energy-equivalent terms has strongly encouraged users with an option to switch from oil to natural gas to do so. Given the abundant natural gas resource in the United States, one

important issue for the future is the prospects for natural gas to make inroads into more uses of energy.

EIA expects modest declines in natural gas production through 2011 because of a falling gas-directed drilling rig count in response to lower prices. While EIA expects total 2011 natural gas consumption will remain close to 2010 levels, expected increasing consumption in 2012, led by strong growth in the electric power sector, contributes to higher prices and to an economic incentive for producers to resume drilling. EIA expects the natural gas market to begin to tighten in 2012, with the Henry Hub spot price increasing to an average of $4.58 per million Btu.

Current and near-term domestic liquids production and imports. Domestic crude oil production, which increased by 150,000 barrels per day in 2010 to 5.51 million barrels per day, is forecast to decline by 110,000 barrels per day in 2011 and by a further 130,000 barrels per day in 2012. The 2011 forecast includes production declines in Alaska of 60,000 barrels per day in 2011 and an additional decline of 10,000 barrels per day in 2012 because of maturing Alaskan oil fields. EIA expects production from the Federal Gulf of Mexico (GOM) to fall by 240,000 barrels per day in 2011 and by a further 200,000 barrels per day in 2012. These production declines in Alaska and the GOM are partially offset by projected increases in lower 48 non-GOM production of 190,000 barrels per day and 70,000 barrels per day in 2011 and 2012, respectively.

EIA expects slow growth in fuel ethanol production over the next 2 years. Ethanol production increases by a projected 40,000 barrels per day, to 900,000 barrels per day in 2011, followed by an additional 10,000 barrels per day increase in 2012.

Liquid fuel net imports, including both crude oil and refined products, fell from 57 percent of total U.S. consumption in 2008 to 49 percent in 2010, primarily because of the decline in consumption during the recession and rising domestic production. EIA forecasts that liquid fuel net imports will average 9.7 million barrels per day in 2011 and 10.0 million barrels per day in 2012, comprising 50 percent and 52 percent of total consumption, respectively.

Current and near-term natural gas production and imports. Total marketed natural gas production grew strongly throughout 2010, increasing from 59.7 Bcf per day in January to an estimated 63.8 Bcf per day in December. The large price difference between petroleum liquids and natural gas on an energy-equivalent basis contributes to an expected shift towards drilling for liquids rather than for dry gas. Projected natural gas production in 2011 is 0.8 percent higher than in 2010 as an increase of 1.0 Bcf per day in the lower-48 States is partially offset by a decline of 0.5 Bcf per day in the GOM. However, expected increasing consumption in 2012, led by strong growth in the electric power sector, contributes to higher prices and to an economic incentive for producers to resume drilling. Total domestic natural gas production is projected to increase by a further 0.9 percent in 2012. EIA expects U.S. reliance on natural gas imports will decline from 7.0 Bcf per day in 2010 to 6.5 Bcf per day in 2012, or from 11 percent to 10 percent of consumption.

Longer-term perspective on U.S. resources, reserves and production of oil and natural gas

Domestic oil and natural gas production. In the *Annual Energy Outlook 2011 (AEO2011)* Reference case, which assumes the continuance of current laws and regulations in place of fall 2010, EIA projects total U.S. crude oil production will remain above the 2009 level of 5.4 million barrels per day through 2035, increasing to 6.0 million barrels per day by 2017 and remaining near that level throughout the rest of the projection period. The primary contributors to this growth are onshore shale oil development and enhanced oil recovery in the short-term, and deepwater offshore production in the mid- to long-term. Note that here "shale oil" refers to oil in liquid form that is trapped in rock of low porosity, in contrast to "oil shale" which refers to kerogen, which is a solid form of hydrocarbon found in Wyoming, Utah and Colorado.

Oil production from shale plays, particularly the Bakken shale in North Dakota, has been rising rapidly. Using horizontal drilling and hydraulic fracturing, operators increased Bakken production from about 3,000 barrels per day in 2005 to 137,000 barrels per day in 2009 and 225,000 barrels per day in 2010. Oil production from other shale plays is also growing. In Eagle Ford, for example, production increased from under 100 barrels per day in 2006 to roughly 22,000 barrels per day in 2010. EIA projects shale oil production in the Bakken, Eagle Ford, Austin Chalk, and Avalon formations in 2035 to be 0.6 million barrels per day, more than double the current level.

Additionally, there is a significant opportunity for growing crude oil production using enhanced oil recovery (EOR) techniques that inject carbon dioxide (CO_2) into reservoirs that had previously been tapped by conventional drilling. In 2010, EIAs estimates that 281,000 barrels per day of crude oil, accounting for more than 5 percent of total U.S. crude production, was produced using CO_2-based EOR techniques. This reflects rapid growth from a 2004 production level of 206,000 barrels per day. In its *AEO2011* Reference case, which assumes no new policies to reduce CO_2 emissions, EIA projects that U.S. crude oil production using CO_2-based EOR techniques will grow to 0.4 million barrels per day by 2015 and 1.1 million barrels per day in 2025. In a scenario where a cost is associated with carbon emissions, additional carbon capture would likely occur that would, in turn, result in additional crude oil to be produced using CO_2-based EOR techniques. Several of the carbon capture and storage demonstration plants being built around the United States are being partly paid for by the production of crude oil using this technology.

The lower 48 offshore was a major source of U.S. crude oil production in 2010, with the vast majority (1.6 million barrels per day) coming from the GOM. In the *AEO2011* Reference case, drilling in the deepwater GOM Outer Continental Shelf (OCS) is expected to resume in 2011, resulting in increasing Gulf crude oil production after 2012, reaching 1.9 million barrels per day by 2018. EIA projects that total lower 48 offshore production will account for 1.8 million barrels per day of the total U.S. crude oil production of 5.8 million barrels per day in 2035.

Shale gas. The growth in shale gas production in recent years is one of the most dynamic stories in U.S. energy markets. A few years ago, many analysts foresaw a growing U.S. reliance on imported sources of natural gas, and significant investments were being made in regasification facilities for imports of liquefied natural gas (LNG). Today, the biggest questions are the size of

the shale gas resource base (which by most estimates is vast), the price level required to sustain its development, and the extent to which technical or environmental factors might dampen its development. Beyond those questions, the level of future domestic natural gas production will also depend on the level of natural gas demand in key consuming sectors, which will be shaped by prices, economic growth, and policies affecting fuel choice.

Natural gas. Annual natural gas production is projected to increase from 21 trillion cubic feet of dry gas to 26 trillion cubic feet between 2009 and 2035 as a result of continued exploration and development of shale gas resources. Shale gas is the largest contributor to the growth in production, while production in tight sands, coalbed methane deposits, and offshore waters remain relatively stable from 2009 to 2035. By 2035, shale gas production accounts for 46 percent of U.S. natural gas production, up from 16 percent in 2009. While production from tight sands and offshore resources do not contribute to the total growth in production, they remain an important source, contributing 23 and 11 percent respectively in 2035.

Domestic oil and natural gas proven reserves and technically recoverable resources. Reserves are those volumes of oil and natural gas that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Technically recoverable resources are an estimate of the total amount of oil and gas, both known and unknown, that is technically producible using currently available technologies and industry practices. EIA's crude oil and natural gas production projections are based on specific assumptions regarding technically recoverable resource assumptions. Estimates of technically recoverable crude oil and natural gas resources are highly uncertain and change over time as new information is gained through drilling, production, and technological and managerial development.

The domestic crude oil and natural gas industry has undergone a technological revolution that has revitalized the resource base in the onshore lower-48 states. The use of horizontal drilling in conjunction with hydraulic fracturing has greatly expanded the ability of producers to profitably produce crude oil and natural gas from low permeability geologic formations, particularly shale formations. As a result of this technological revolution, natural gas reserves grew 63 percent between 2000 and 2010, increasing from 167.4 trillion cubic feet at the start of 2000 to 272.5 trillion cubic feet at the start of 2010, the highest level since 1971. This increase in reserves occurred despite cumulative production of 246.7 trillion cubic feet during the 10-year period between those estimates. Even though total U.S. crude oil reserves have declined slightly over the same period, decreasing from 22.0 billion barrels at the start of 2000 to 20.7 billion barrels at the start of 2010, additions to oil reserves still replaced over 93 percent of cumulative production of 19.6 billion barrels over the decade. Notably, states with drilling focused on shale oil have experienced a growth in crude oil reserves. The primary example is North Dakota where proved crude oil reserves have increased from 270 million barrels in 2000 to over 1.0 billion barrels in 2010, most of it in the Bakken formation.

Total U.S. technically recoverable crude oil resources are estimated to be 219 billion barrels in the *AEO2011* Reference case, including 21 billion barrels of proved reserves. Resources in areas where drilling is officially prohibited (for example, national parks) are not included. It is

estimated that there are nearly 24 billion barrels of technically recoverable crude oil in the Bakken and three other shale formation plays.

Focusing on natural gas, the growing importance of shale gas resources is reflected in the *AEO2011* energy projections, with technically recoverable shale gas resources estimated at 862 trillion cubic feet. Given a total natural gas resource base of 2,543 trillion cubic feet in the *AEO2011* Reference case, shale gas resources constitute 34 percent of the domestic natural gas resource base represented in the *AEO2011* projections and 50 percent of lower 48 onshore resources. EIA estimates the remaining onshore non-associated natural gas technically recoverable resources in tight gas formations at 455 trillion cubic feet, coalbed methane at 138 trillion cubic feet, and other more conventional resources at 352 trillion cubic feet. The lower 48 offshore and Alaska are each estimated to contain nearly 300 trillion cubic feet of technically recoverable natural gas resources.

Impacts of greater access

When considering the effect of increased access to Federal lands, it is important to recognize that access does not typically translate into immediate or near-term production. The impact of greater access on market prices depends in part on actual production flows, on differences in the extent of global integration in oil and natural gas markets that have been discussed above, and on how a decision to increase access might affect market expectations – a factor that is very difficult to assess in today's supply environment. In the short-term, oil markets react to many competing factors in a global context, and it is extremely difficult to disentangle the near-term impact of mid-to-long-term developments in the context of oil markets that see typical daily price movements in the range of 1-2 percent, and much higher fluctuations at times. Long term, we do not project additional volumes of oil that could flow from greater access to oil resources on Federal lands to have a large impact on prices given the globally integrated nature of the world oil market and the more significant long-term compared to short-term responsiveness of oil demand and supply to price movements. Given the increasing importance of OPEC supply in the global oil supply-demand balance, another key issue is how OPEC production would respond to any increase in non-OPEC supply, potentially offsetting any direct price effect.

In the longer-term, greater domestic crude oil production no matter the cause – increased development on Federal lands, higher resource potential in current known fields, or wider application of advanced technology – would impact local economic activity, net oil imports, and the associated U.S. international trade balance resulting from oil imports.

Access to offshore federal resources. As of January 2009, the mean estimate of technically recoverable crude oil resources located in Federal offshore areas of the lower-48 states is 64.1 billion barrels. Of this amount, 3.7 billion barrels are estimated to exist in the Eastern/Central Gulf of Mexico region that is still under a Federal leasing moratorium.[1] In addition, the mean estimate of technically recoverable resources of crude oil located in the Alaska OCS area is 26.6

[1] These resource figures are based on the oil resource profile used for EIA's *AEO2011* energy projections, including resources in the North Atlantic, North Pacific, and Central Pacific OCS where EIA's projections assume that leasing does not occur before 2035.

billion barrels. Note that these and other technically recoverable resource estimates provided here tend to be higher than resource estimates from the USGS because the USGS estimates only include undiscovered resources, where as the EIA estimates used for modeling purposes also include proved reserves, inferred reserves, and undiscovered resources in areas not yet assessed by the USGS. In addition, the resource estimates provided here do not reflect recent downward revisions by USGS to resource estimates for the National Petroleum Reserve Alaska.[2]

From the above, it is evident that the Eastern/Central Gulf oil resources now subject to a formal leasing moratorium represent only a small part of the Federal OCS. Even if the moratorium that restricts leasing in this region were to be lifted, lags associated with the awarding of new Federal offshore leases and with the exploration and development of such leases suggest that production would be unlikely to occur until after 2020.

Given that OCS areas not under any leasing moratorium are estimated to account for over 95 percent of the total mean estimate of technically recoverable OCS resources, perhaps the most significant Federal OCS development issues relate to those areas that are already open to Federal oil and gas leasing. One such issue revolves around when newly available offshore areas, particularly in the Pacific and Atlantic, will be made available to oil and gas producers in future Federal lease sales. Areas where OCS leasing has been available for many years—including the Western Gulf, most of the Central Gulf, and Alaska—hold the vast majority of estimated technically recoverable OCS oil resources. The *AEO2011* generally assumes that both leasing and regulatory approvals in areas where OCS leasing has been available for many years will proceed in a manner that supports their continued major contribution to overall U.S. oil production. Were leasing and/or regulatory processes to slow or speed up significantly, projected OCS production could be reduced or increased from the level of 1.5 to 2 million barrels per day that is projected in the 2014 though 2035 period in the *AEO2011* Reference case.

Access to onshore federal resources: ANWR. The Arctic National Wildlife Refuge (ANWR) is not open to petroleum development, and is therefore not included in the *AEO2011*.[3] However, if legislation were enacted in the near term that approved oil and natural gas leasing in the 1002 Area, one could potentially see ANWR oil production starting soon after 2020. This timetable reflects the time required to obtain leases, drill an initial exploratory well, develop a production development plan if a commercial oil reservoir has in fact been discovered, construct the feeder pipelines, fabricate oil separation and treatment plants and transport them to the North Slope by ocean barge, construct drilling pads, drill to depth, and complete the wells.

Based on this timetable and the assumption that the largest ANWR fields would be the first to go into production, peak ANWR oil production could occur around 2030 at about 700,000 to 800,000 barrels per day. In this scenario, the greatest impact on crude oil prices could occur

[2] In October 2010, the USGS revised NPRA oil resources to 0.9 billion barrels from 10.6 billion barrels and gas resources to 52.8 trillion cubic feet from 61.4 trillion cubic feet. Note that this would not affect EIA modeling results because these resources do not get developed in the current Annual Energy Outlook.

[3] The technically recoverable resource estimate of 10.4 billion barrels for ANWR is not included in the 219 billion barrels total estimate for the U.S.

around peak ANWR production with oil prices projected to be perhaps about one percent lower as a result.

Access to onshore federal resources: lower-48 states. The *AEO2011* estimates that total onshore lower-48 technically recoverable oil resources available for development are 113.9 billion barrels (as of January 1, 2009), including about 6.6 billion barrels located on Federal lands with lease stipulations in addition to standard lease terms—which is about 6 percent of total onshore lower-48 oil resources.[4] Federal lease stipulations dictate what oil and natural gas producers can and cannot do on Federal lands. Oil and natural gas producers can employ a variety of technologies to comply with such stipulations, such as drilling extended reach wells to avoid drilling in sensitive habitat areas, drilling multiple wells from a single drilling pad to minimize the surface area disturbed, using water purification equipment to clean produced water before it is discharged, or replanting indigenous species to restore the land. While lease stipulations may tend to increase costs, they do not preclude oil and natural gas production on Federal lands. Given the relatively modest volume of the oil resources on these lands – compared to total U.S. oil resources – changing lease stipulations on Federal lands is unlikely to have a significant long-term impact on U.S. oil production or prices.

Interaction between production and prices

When exploring the possibility of substituting domestic resources for international resources or substituting one domestic fuel for another, it is important to consider the current distribution of fuels used in sectors of the U.S. economy. Three-quarters of liquid fuels (both petroleum and biofuels) are used for transportation and most of the remaining liquid fuels are used in industrial activities, primarily as feedstock for petrochemical production. Natural gas is used in roughly equal portions in industry, buildings and electricity generation. Over 90 percent of coal generates electricity, with most of the remainder used for metals and cement processing. Nuclear, hydroelectric, wind and solar energy is used exclusively for generating electricity. Starch and oil-rich biomass is used to generate liquid transportation fuels and the remainder of biomass is burned for heat and electricity generation.

Natural gas demand tends to be somewhat more price responsive in the short-run than petroleum demand in the United States, mainly because of a larger presence of natural gas in sectors where a moderate range of substitution possibilities exist (i.e. the industrial and power sectors). Nevertheless, demand shocks (in particular from weather) can have powerful feedback effects on natural gas demand through domestic natural gas prices, sometimes neutralizing output effects from the demand shock that might otherwise be supposed to ensue (e.g. electric power sector demand for natural gas during the heating season). Also, because near-term domestic natural gas market equilibrium tends to depend much less on the availability of foreign supplies at the margin compared to petroleum, demand shocks (particularly due to winter weather) will tend to induce sharp natural gas price increases that encourage reductions in consumption, most notably in the industrial sector.

[4] The 6.6 billion barrel figure does not include any oil resources estimated to exist under Federal lands that are deemed to be forever precluded from oil and natural gas leasing, such as those under national parks.

Competition among fuels in the United States. Interfuel competition driven by price differences is most likely in the three sectors that use natural gas because of the expanding recoverable natural gas resources which are expected to provide sustained lower prices relative to oil. Over the past decade the share of electric generation fueled by natural gas has been increasing, driven by lower new plant construction costs for natural gas relative to coal and recently by lower natural gas prices. Many existing coal plants are economical even at very low natural gas prices, but there is also a significant portion of older and/or less efficient coal plants whose production will decline when gas prices are low enough, reflecting the trade-off in the generation mix that has been experienced in the past few years. Construction costs for all new plants have risen dramatically in recent years, but the construction cost increases have been much more significant for new coal plants, which are more capital intensive and utilize more complex engineering technologies, relative to gas-fired turbines and combined cycle plants.

The potential for natural gas to compete with oil in the transport sector – whether directly or indirectly as electricity – depends on the price differences between the fuels, the vehicles, and the fueling infrastructure. Currently 97 percent of energy for transportation is provided by fossil liquids and biofuels and only 3 percent is supplied by natural gas. Most of this natural gas is consumed in the operation of pipelines (primarily in compressors) and a small amount is consumed as vehicle fuel for buses and taxis. There is great uncertainty surrounding how effective proposed legislation would be in stimulating the deployment of natural gas vehicles even though operating costs may be significantly lower compared to diesel and gasoline. Natural gas vehicles face significant range and infrastructure limitations, in addition to higher upfront capital costs, that drastically diminish the market for natural gas vehicles even in the presence of tax credits for capital, infrastructure, and fuel.

In the *AEO2011* Reference case, which reflects current laws and regulations, EIA projects the sale of 12,100 new light-duty natural gas vehicles and 26,000 new heavy-duty natural gas vehicles (representing 2.8 percent of total new heavy-duty vehicle sales) in 2035. Without a greatly expanded consumer market for natural gas vehicles based on infrastructure expansion, tax credits for natural gas vehicles will probably only impact sales for a niche market in both light- and heavy-duty vehicles. One *AEO2010* side case examined the impact of implementing tax incentives for vehicles, fueling stations and fuel – starting in 2011 and beginning to phase out in 2027 – on heavy-duty natural gas vehicle sales, and found that sales could reach 270,000 (representing 35 percent of total new heavy-duty vehicle sales) in 2035.

Oil and gasoline price shocks impact on the U.S. economy. There are three primary channels through which oil price shocks affect real economic activity. First, and arguably most important, is a rise in the import bill for imported oil, which reduces U.S. incomes, wealth, and aggregate demand. Second, a redistribution of domestic income from consumers to producers occurs, with mixed effects that are likely negative on balance. Third, a lower level of output can be produced with the existing stock of capital and supply of labor as firms economize on energy inputs. This effect, while difficult to quantify, has considerable longer-term importance.

However, the effects of oil price shocks on the economy depend importantly on the nature of the shock. Increases in oil prices caused by strong demand are less damaging to overall activity than

those caused by a supply shortage. Increases in oil prices that are expected to be temporary have smaller consequences on activity than those that are perceived to be persistent.

Conclusion

In addition to preparing the Reference case projections that are reviewed above, the full Annual Energy Outlook to be published this spring will include a large number of sensitivity cases that examine the impact of different market, technology, and policy assumptions. Several of these sensitivity cases will address the implications of alternative assumptions about the level of technically recoverable resources and access to those resources.

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