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Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to discuss the long-term outlook for oil, both in the United States and globally. Enactment of the Energy Independence and Security Act of 2007 (EISA) and rising oil prices have changed the long-term outlook, and this morning I would like describe our analyses of those changes.

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, and our views should not be construed as representing those of the Department of Energy or the Administration. 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.

Defining "Oil"

Discussions of the long term outlook for oil and liquid fuels should start with a clear set of definitions. **Table 1** in my testimony shows estimated global quantities for six categories of liquid fuels in 2006. We use the term "oil" to refer to the first four of those categories: conventional crude oil and lease condensate, natural gas plant liquids, refinery gain, and unconventional crude oil. We use the term "liquids" to refer to "oil" plus biofuels and liquid fuels manufactured using coal (CTL) or natural gas (GTL) as a feedstock.

We also make a distinction between conventional and unconventional crude oil. Conventional crude oil comes from underground reservoirs for which the geophysical properties of the reservoir rock and characteristics of the crude oil permit the oil to flow readily to a vertical wellbore. Unconventional oil is oil which, due to the characteristics of the reservoir rock or the fluid, is not easily extracted using vertical wells, including Canadian oil sands, shale oil, and very heavy crude oil (e.g., Orinoco crude oil from Venezuela).

These distinctions are important because the conventional crude oil share of total liquid fuel supply, which was 84 percent in 2006, is expected to decline to between 62 percent and 74 percent of total global liquids supply in 2030 in the two analysis cases discussed later in this testimony.

Effects of the Energy Independence and Security Act of 2007 (EISA) on Oil Markets

Last December, the Congress passed and the President signed the Energy Independence and Security Act of 2007. The specific EISA provisions that have the most significant implications for future oil markets are updates to the corporate average fuel economy (CAFE) standard for new light-duty vehicles and to the renewable fuel standard (RFS).

The EISA 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 EISA 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 is 38 percent above its 2006 level.

By amending Section 211(o) of the Clean Air Act, EISA also accelerates the use of renewable liquid fuels. The updated RFS sets a requirement for 36 billion gallons of total renewable fuels by 2022, including 21 billion gallons of advanced biofuels. 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 in the RFS as amended by EISA. The modification of volumes expected by EIA would reduce the overall RFS 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.

Taken together the CAFE and RFS updates contained in EISA produce a substantial reduction in oil use and oil imports. EIA estimates that the combined effects of the CAFE and RFS update are to reduce U.S. oil use by 0.2 million barrels per day by 2015 and 1.8 million barrels per day by 2030. The reduction in oil imports is 0.4 million barrels per day in 2015 and 1.5 million barrels per day in 2030. The estimated reductions in both oil use and imports would be significantly higher if they were measured against a baseline that assumes that vehicle fuel economy would be frozen at the levels mandated prior to enactment of EISA absent its passage.

Implementation of these EISA provisions will also reduce oil's share of overall U.S. carbon dioxide emissions. In 2006, oil accounted for about 44 percent of total U.S. energy-related carbon dioxide emissions, but this falls to 40 percent in 2030 in the *AEO2008* reference case projection, which includes EISA.

Effects of Higher Oil Prices on U.S. Liquids and Oil Markets

EIA recognizes that oil prices are highly uncertain and that their future path has a significant impact on energy supply and use. The *AEO2008* illustrates these impacts by developing and reporting projections for several alternative oil price paths. In developing the oil price paths used in *AEO2008*, 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.

For 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 oil prices begin to rise (**Figure 1**), 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 (**Figure 2**).

For the high price case in the *AEO2008*, prices fall back to $79 per barrel in 2010 and then gradually rise to $90 per barrel in 2015 and $119 per barrel in 2030 (2006 dollars). In nominal dollars these prices for 2010, 2015, and 2030 are $86, $107, and $186 per barrel, respectively. The high price case assumes more limitations on access to resources and high development costs in non-OPEC regions. The case also assumes OPEC holds total production nearly constant at 36 to 37 million barrels per day through 2030. Current oil prices, driven by recent strong global economic growth; weaker-than-expected global supply additions; shortages of experienced personnel, equipment, and construction materials in the oil industry; and instability in some major producing regions, exceed both the reference and high price case paths in the *AEO2008*.

Although today's oil prices are higher than both the reference and high price case paths in *AEO2008*, a comparison of these two *AEO2008* cases, both of which include EISA provisions that EIA could model, provides a useful illustration of the impact of sustained higher prices on energy supply and use. Generally, the responsiveness of both supply and demand to higher prices grows over time. Higher prices can be expected to reduce U.S. liquids consumption, increase domestic production, and reduce the Nation's reliance on imported liquid fuels.

The annual average growth in liquids consumption in the high price case is 0.15 percent per year, less than half of that in the reference case. Similar to the reference case, liquids demand in the high price case is mainly driven by transportation uses, which account for 74 percent of total liquids consumption by 2030. For this reason, changes in consumer habits and decisions regarding transportation have a very large impact on overall consumption of liquids. Higher oil prices result in both an increase in efficiency and a decrease in miles traveled. The result of consumers' reaction to higher prices is that liquids use in the transportation sector in the high price case is 4.7 percent lower than in the reference case (**Figure 3)**.

Higher oil prices also result in fuel switching between liquids and other energy sources, primarily in the industrial sector. In the reference case, industrial uses of liquids decrease at an average annual rate of 0.3 percent from 2006 to 2030, reaching 9.3 quadrillion Btu in 2030, or 26.4 percent of total industrial energy use. However, in the high price case, liquids consumed by the sector decrease at an average annual rate of 0.7 percent, amounting to only 8.4 quadrillion Btu in 2030 or 23.0 percent of the sector's energy consumption.

Turning to supply, 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 4).** Crude oil production is more profitable in the high price case, resulting in higher projected domestic production. By dampening the demand for liquid fuels and increasing the domestic

production of crude oil and biofuels, higher oil prices, together with the EISA CAFE and RFS provisions, substantially reduce projected U.S. oil imports. In 2006, U.S. net oil imports were 12.4 million barrels per day, accounting for 60 percent of our total liquid fuel use. In the AEO2008 high price case, crude oil and petroleum product imports in 2015, 2022, and 2030 are projected at 10.8, 9.7 and 9.4 million barrels per day respectively, with total petroleum imports providing 52, 46, and 44 percent of our total liquid fuels use in those respective years. (**Figure 5**) In the reference case, with lower oil prices, demand is higher and domestic production is lower, raising the share of petroleum imports in total liquids fuel use in 2015, 2022, and 2030, to 52, 50, and 54 respectively.

Effects of Higher Oil Prices on Global Liquid Fuel and Oil Markets

Higher oil prices will also affect projected growth in global liquid fuels demand. In the *AEO2008* high price case, liquids consumption grows from 85 million barrels per day in 2006 to 98 million barrels per day in 2030, significantly below the reference case consumption level of 113 million barrels per day in 2030.

Economic and population growth – which are major drivers for liquids consumption – are much lower in the OECD than the non-OECD, thus most of the liquids consumption growth occurs in the non-OECD (**Figure 6**). Strong economic growth in China, India, and the Middle East oil-producing countries drives growing demand for liquid fuels. Overall, non-OECD liquids consumption increases from 35.5 million barrels per day in 2006 to 50.8 million barrels per day in 2030; roughly 9 million barrels per day lower in the 2030 than the reference case. Liquids consumption in China grows from 7.3 million barrels per day in 2006 to 13.2 million barrels per day in 2030, roughly 2.5 million barrels per day lower than in the reference case.

On the OECD side of the market, liquids consumption in the *AEO2008* high price case is projected to decline from 49.2 million barrels per day in 2006 to 46.9 million barrels per day in 2030, significantly below the reference case consumption level of 53.3 million barrels per day in 2030. OECD-Europe consumption will decline by 2.1 million barrels per day, and Japan consumption will decline by 0.7 million barrels per day, relative to 2006. Small increases will occur in other parts of the OECD.

In addition to affecting consumption growth, higher oil prices also affect the mix of liquids that are produced globally, encouraging more unconventional liquids while less conventional oil makes it to the market due to OPEC production policies, limitations on access of oil resources, and slower technology development, relative to the reference case. Global conventional crude oil and lease condensate production in the high price case is projected to decline by 11 million barrels per day from their 2006 level to 60 million barrels per day in 2030, a sharp contrast to the 12-million-barrel-per-day increase in production over the same time period in the reference case. In the high price case of the *AEO2008*, natural gas plant liquids are projected to increase by 6 million barrels per day, which is similar to the reference case.

Unconventional liquids production in the *AEO2008* high price case is 19 million barrels per day higher in 2030 than in 2006, compared to an increase of only 11 million barrels per day projected in the reference case. Coal and natural gas conversion to liquids provides the largest portion of

this increase at 9 million barrels per day. Canadian oil sands and Venezuelan extra heavy crude add a combined 5 million barrels per day increase between 2006 and 2030. Similarly, biofuels on an oil equivalent basis provide a combined 5 million barrels per day increase between 2006 and 2030.

Conclusion

Both the reference and high price cases in *AEO2008* suggest that liquids will continue as a primary global fuel through 2030. However, liquids will represent a declining share in the total energy mix as the effect of high prices and EISA reduce world consumption from levels that would otherwise be expected. Furthermore, the share of oil, and especially conventional oil, in the overall liquids mix, is also expected to decline. Our high price case illustrates a scenario where overall liquids use grows by about 15 percent from 2006 to 2030, while conventional crude oil production declines by more than 15 percent over the same period. Policy decisions by conventional oil resource owners to limit access to oil resources are expected to be a key driver behind higher oil prices and the proportion of conventional oil relative to production of unconventional oil and other liquid fuels through 2030. Policy decisions by consuming nations and possible technological breakthroughs, both of which are not included in the analysis cases I have discussed today, could also play an important role in determining oil's future role in the U.S. and global energy picture.

As I noted at the outset, while EIA does not take positions on policy issues, provision of energy information to policymakers is an important part of our mission. In addition to the work on baseline projections that I have reviewed this morning, EIA has also recently responded to requests from congressional committees 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 data and 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.

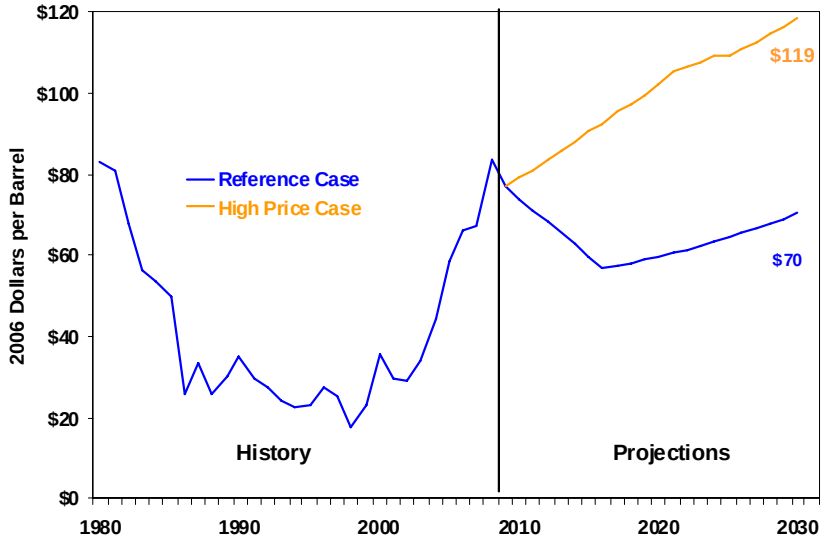
Table 1. The Distinction between "Liquids" and "Oil" is increasingly important.

(MMB/D)	2006	Reference Case 2030	High Price Case 2030
Conventional Crude*	71.5	83.4	60.3
Natural Gas Plant Liquids	8.0	13.0	13.7
Refinery Gain	2.4	2.9	2.1
Conventional Subtotal	**81.9**	**99.3**	**76.1**
Unconventional Crude**	1.8	5.2	6.6
CTL and GTL	0.2	4.8	9.0
Biofuels (oil equivalent)	0.8	4.0	6.1
Unconventional Subtotal	**2.8**	**14.0**	**21.6**
Total Liquids	**84.7**	**113.3**	**97.7**

* Crude oil and lease condensate ** Oil sand production, extra-heavy crude oil, and shale oil

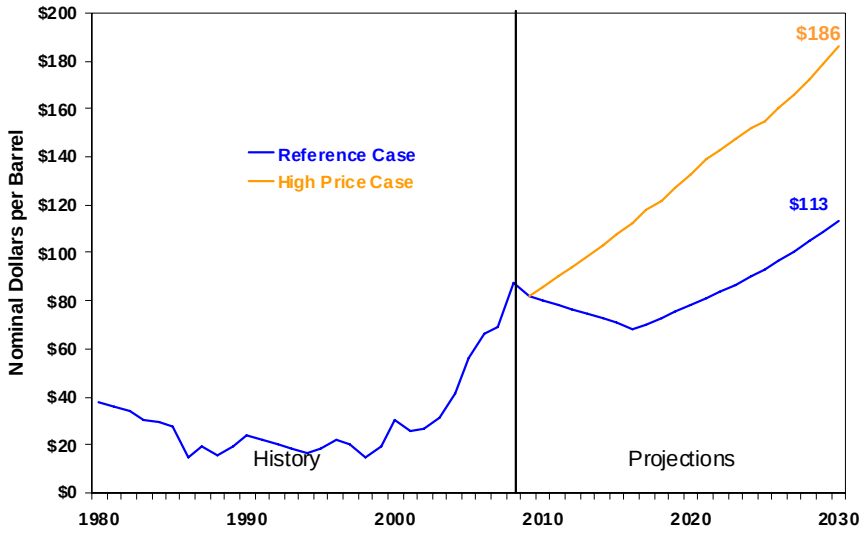
Source: Annual Energy Outlook 2008. Published Reference Case; preliminary High Price Case.

Figure 1. AEO2008 reference and high oil price cases (2006 dollars per barrel).



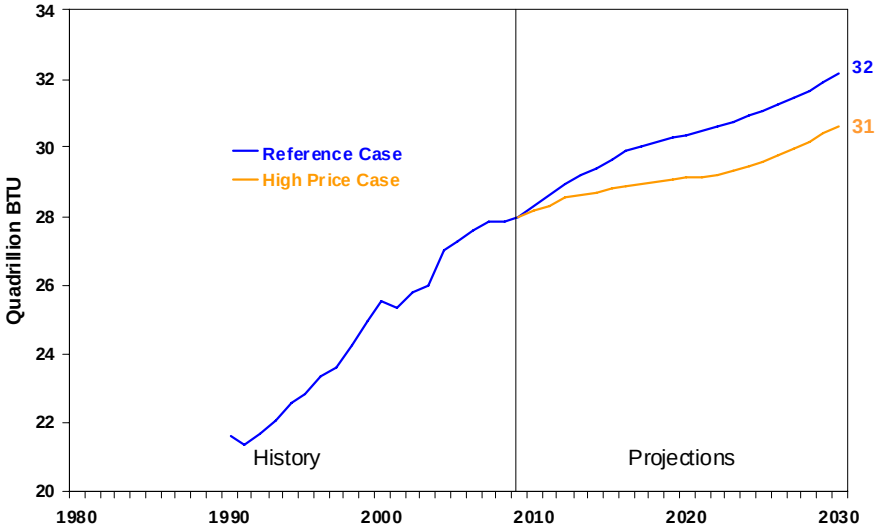
Source: Annual Energy Outlook 2008. Published Reference Case; preliminary High Price Case.

Figure 2. AEO2008 reference and high oil price cases (nominal prices).



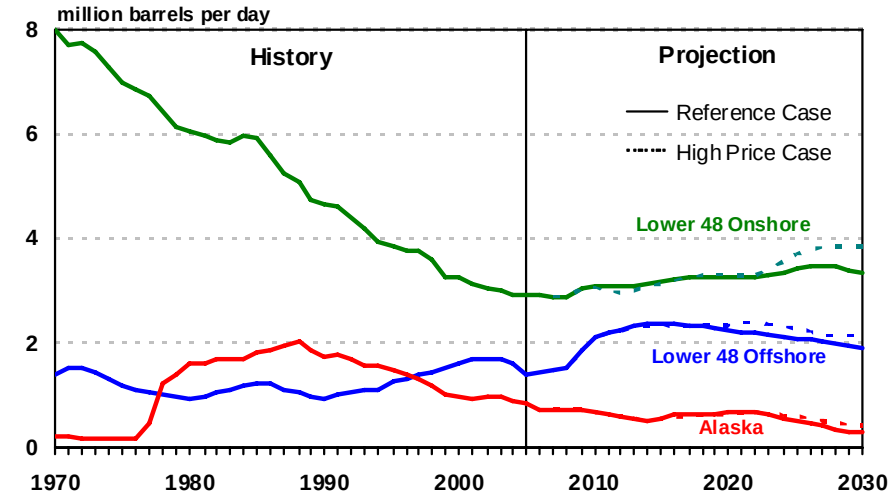
Source: Annual Energy Outlook 2008. Published Reference Case; preliminary High Price Case.

Figure 3. Use of liquids in the transportation sector changes with price.



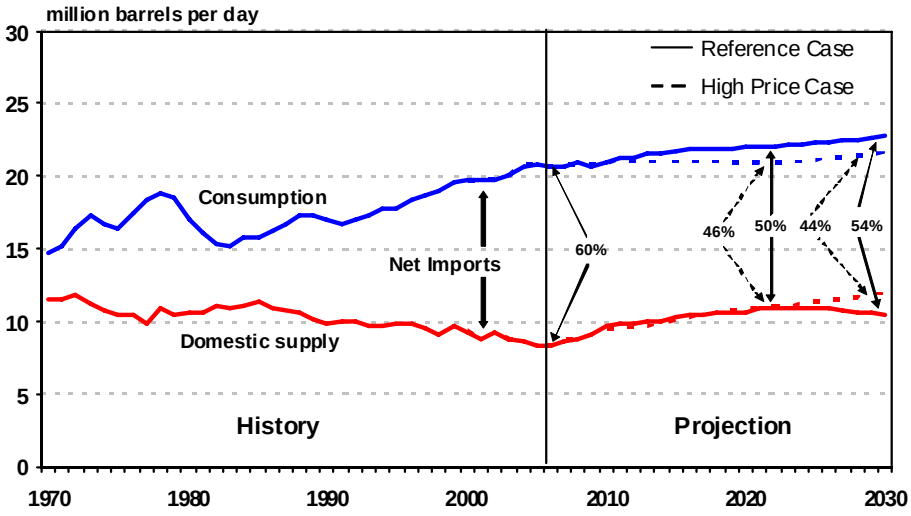
Source: EIA, IEO2008

Figure 4. Domestic crude oil production grows in in the near-term.



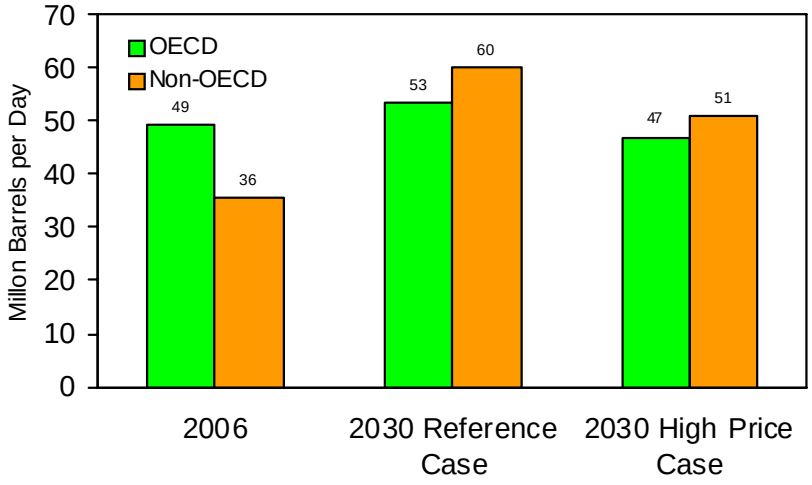
Source: Annual Energy Outlook 2008. Published Reference Case; preliminary High Price Case.

Figure 5. The import share of total liquids use falls from its current level.



Source: Annual Energy Outlook 2008. Published Reference Case; preliminary High Price Case.

Figure 6. Most growth in world consumption of liquids occurs in the non-OECD region.



Source: EIA, IEO2007