International Energy Module

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The NEMS International Energy Module (IEM) simulates the interaction between U.S. and global petroleum markets. It uses assumptions of economic growth and expectations of future U.S. and world crude-like liquids production and consumption to estimate the effects of changes in U.S. liquid fuels markets on the international petroleum market. For each year of the forecast, the NEMS IEM computes oil prices, provides a supply curve of world crude-like liquids, generates a worldwide oil supply-demand balance with regional detail, and computes quantities of crude oil and light and heavy petroleum products imported into the United States by export region.

Changes in the oil price (WTI), which is defined as the price of light, low-sulfur crude oil delivered to Cushing, Oklahoma in PADD2, are computed in response to:

1. The difference between projected U.S. total crude-like liquids production and the expected U.S. total crude-like liquids production at the current oil price (estimated using the current oil price and the exogenous U.S. total crude-like liquids supply curve for each year).

and

2. The difference between projected U.S. total crude-like liquids consumption and the expected U.S. total crude-like liquids consumption at the current oil price (estimated using the current oil price and the exogenous U.S. total crude-like liquids demand curve).

Key assumptions

The level of oil production by OPEC is a key factor influencing the oil price projections incorporated into *AEO2012*. Non-OPEC production, worldwide regional economic growth rates and the associated regional demand for oil are additional factors affecting the world oil price.

For the low, reference, and high oil price cases, the oil price reaches $62, $145 and $200 per barrel, respectively, in 2010 dollars. The Reference case assumes that OPEC producers will continue to demonstrate a disciplined production approach. The Reference case represents EIA's current judgment regarding exploration and development costs and accessibility of oil resources outside United States. It also assumes that OPEC producers will choose to maintain their share of the market of about 42 percent of the world's total liquids production. In the Low Oil Price case, the low price results from lower demand for liquid fuels in the non-OECD nations. In this case, GDP growth in the non-OECD is reduced by 1.5 percentage points in each projection year beginning in 2015 relative to Reference case. On the supply side, OPEC countries increase their conventional oil production to obtain a 46 percent share of total world liquids production, and oil resources outside the United States are more accessible and/or less costly to produce than in the Reference case. In the High Oil Price case, the high prices result from higher demand for liquid fuels in the non-OECD nations. Higher demand is measured by higher economic growth relative to the Reference case. In this case, GDP growth in the non-OECD region is raised by 0.1 to 1.0 percentage points relative to Reference case in each projection year, starting in 2012. China and India GDP growth rates are raised by 1.0 percentage points relative to the Reference case in 2012 and decline to 0.3 percentage points above the Reference case in 2035. GDP growth rates for most other non-OECD regions average about 0.5 percentage points above the Reference case in each projection year. On the supply side, OPEC countries are assumed to reduce their market share somewhat, and oil resources outside the United States are assumed to be less accessible and/or more costly to produce than in the Reference case.

OPEC oil production in the Reference case is assumed to increase throughout the projection (Figure 3), at a rate that enables the organization to maintain an approximately constant market share over the projection period. OPEC is assumed to be an important source of additional production because its member nations hold a major portion of the world's total reserves—exceeding 1060 billion barrels, about 72 percent of the world's estimated total, at the beginning of 2011. [1] Despite investment from foreign sources, Iraq's oil production is not assumed to maintain steady growth until after 2015 as infrastructure limitations as well as security and legislative issues are assumed to slow development for the next five years.

Non-U.S., non-OPEC oil production projections in the *AEO2012* are developed in two stages. Projections of liquids production before 2015 are based largely on a project-by-project assessment of major fields, including volumes and expected schedules, with consideration given to the decline rates of active projects, planned exploration and development activity, and country-specific geopolitical situations and fiscal regimes. Incremental production estimates from existing and new fields after 2015 are estimated based on country-specific consideration of economics and ultimate technically recoverable resource estimates. The non-OPEC production path for the Reference case is shown in Figure 4.

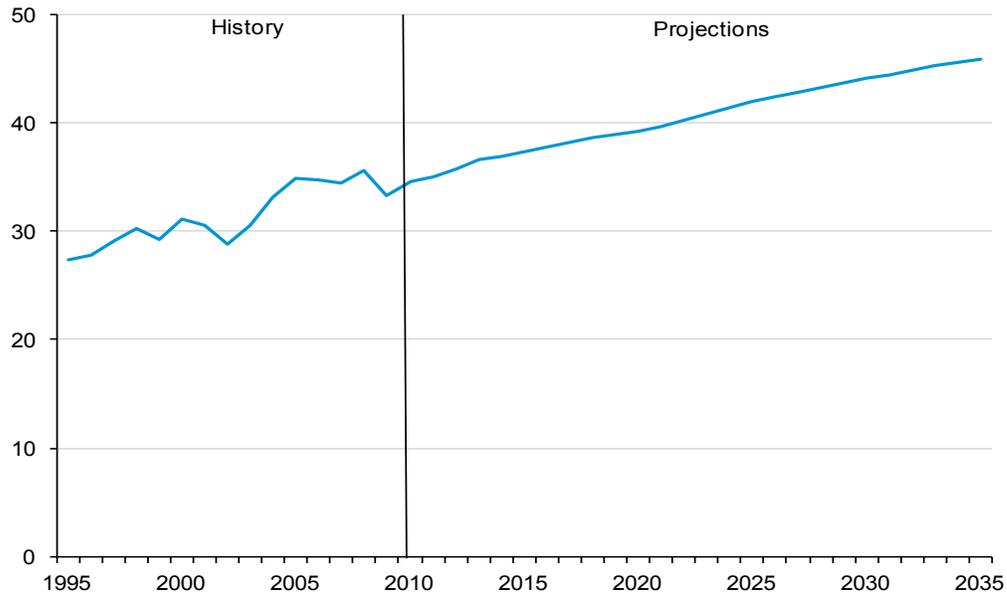**Figure 2. World oil prices in five cases, 1995-2035**
2009 dollars per barrel
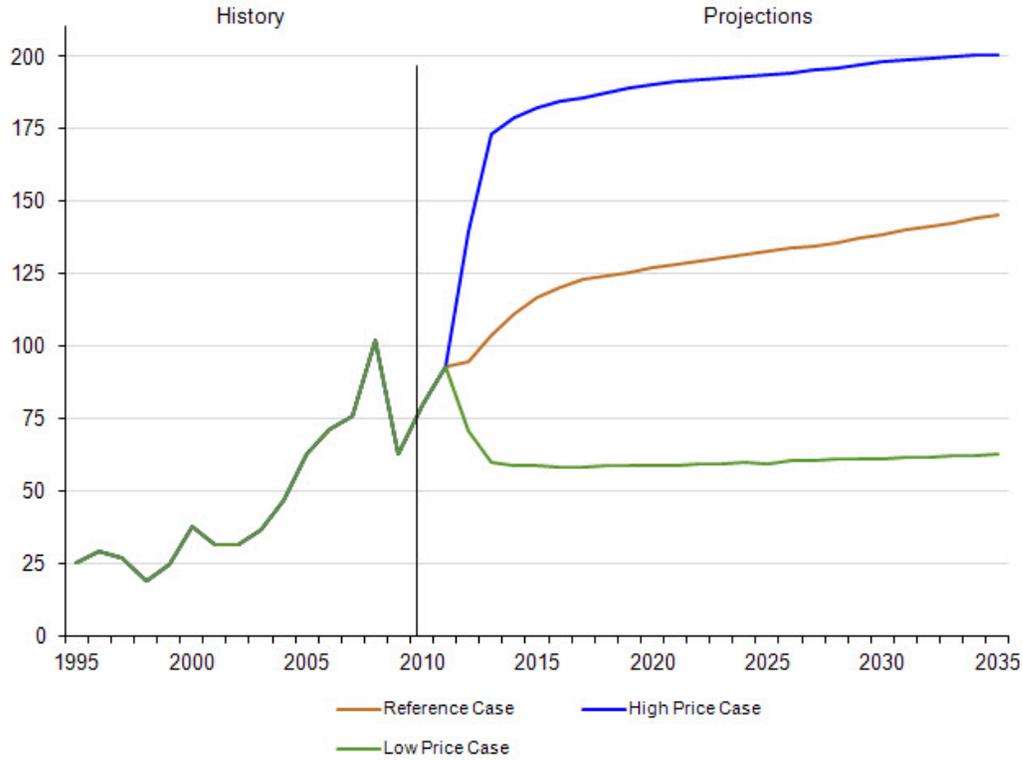
Source: U.S. Energy Information Administration. *AEO2012*, National Energy Modeling System runs REF2012. d020112C, HP2012.d022112A LP2012.d022112A.

Figure 3. OPEC total liquids production in the Reference case, 1995-2035
million barrels per day

OPEC = Organization of Petroleum Exporting Countries.
Source: U.S. Energy Information Administration. *AEO2012* National Energy Modeling Sysytem run REF2012. d020112C.

Figure 4 Non-OPEC total liquids production in the Reference case, 1995-2035
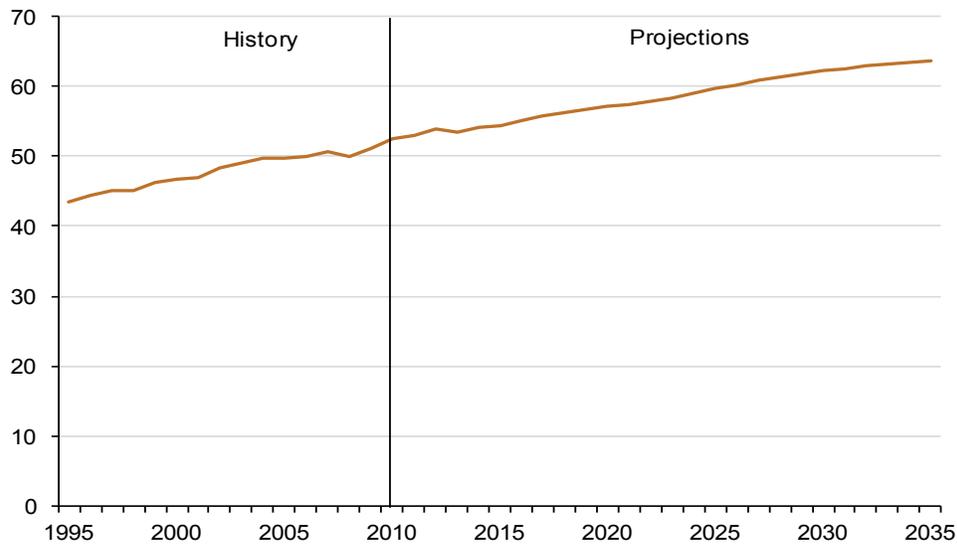million barrels per day

OPEC = Organization of Petroleum Exporting Countries.
Source: U.S. Energy Information Administion. *AEO2012* National Energiy Modeling System run REF2012.
d020112C.

The non-U.S. oil production projections in the *AEO2012* are limited by country-level assumptions regarding technically recoverable oil resources. Inputs to these resource estimates include the USGS World Petroleum Assessment of 2000 and oil reserves published in the Oil & Gas Journal by PennWell Publishing Company, a summary of which is shown in Table 3.1.

The Reference case growth rates for GDP for various regions in the world are shown in Table 3.2. The GDP growth rate assumptions for non-U.S. countries/regions are taken from IHS Global Insight, Inc., Global detailed forecast (August 25, 2011).

The values for growth in total liquids demand in the International Energy Module, which depend upon the oil price levels as well as GDP growth rates, are shown in Table 3.3 for the Reference case by regions.

Table 3.1. Worldwide oil reserves as of January 1, 2011
billion barrels

Region	Proved Oil Reserves
Western Hemisphere	441.9
Western Europe	11.0
Asia-Pacific	40.3
Eastern Europe and Former Soviet Union (F.S.U.)	100.0
Middle East	752.9
Africa	123.6
Total World	1,469.6
Total OPEC	1,064.8

Source: Pennwell Corporation, Oil and Gas Journal, Vol 109. 19 (Dec. 5, 2011).

Table 3.2. Average annual real gross domestic product rates, 2008-2035
2005 purchasing power parity weights and prices

Region	Average Annual Percentage Change
OECD	2.10%
OECD Americas	2.58%
OECD Europe	1.81%
OECD Asia	1.40%
Non-OECD	4.70%
Non-OECD Europe and Eurasia	2.79%
Non-OECD Asia	5.46%
Middle East	3.80%
Africa	3.85%
Central and South America	3.83%
Total World	3.46%

Source: U.S. Energy Information Administration, National Energy Modeling System run REF2012.d0201C.

Table 3.3. Average annual growth rates for total liquids demand in the Reference case, 2008-2035
billion barrels

Region	Oil Demand Growth
OECD	0.03%
OECD Americas	0.18%
OECD Europe	-0.20%
OECD Asia	-0.02%
Non-OECD	1.86%
Non-OECD Europe and Eurasia	0.46%
Non-OECD Asia	2.64%
Middle East	1.34%
Africa	0.92%
Central and South America	1.30%
Total World	0.94%

Source: U.S. Energy Information Administration, National Energy Modeling System run REF2012.D0201C; and World Energy Projection system Plus (2012), run AEO2012-REFA_annual_1236.

Notes and sources

[1] PennWell Corporation, Oil and Gas Journal, Vol. 109.19 (December 5, 2011).