International Energy Module

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The National Energy Modeling System 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 IEM computes Brent and WTI prices, provides a supply curve of world crude-like liquids, and generates a worldwide oil supply-demand balance with regional detail. The IEM also provides, for each year of the projection period, endogenous and exogenous assumptions for petroleum products for import and export in the United States.

Changes in the oil price (Brent) 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

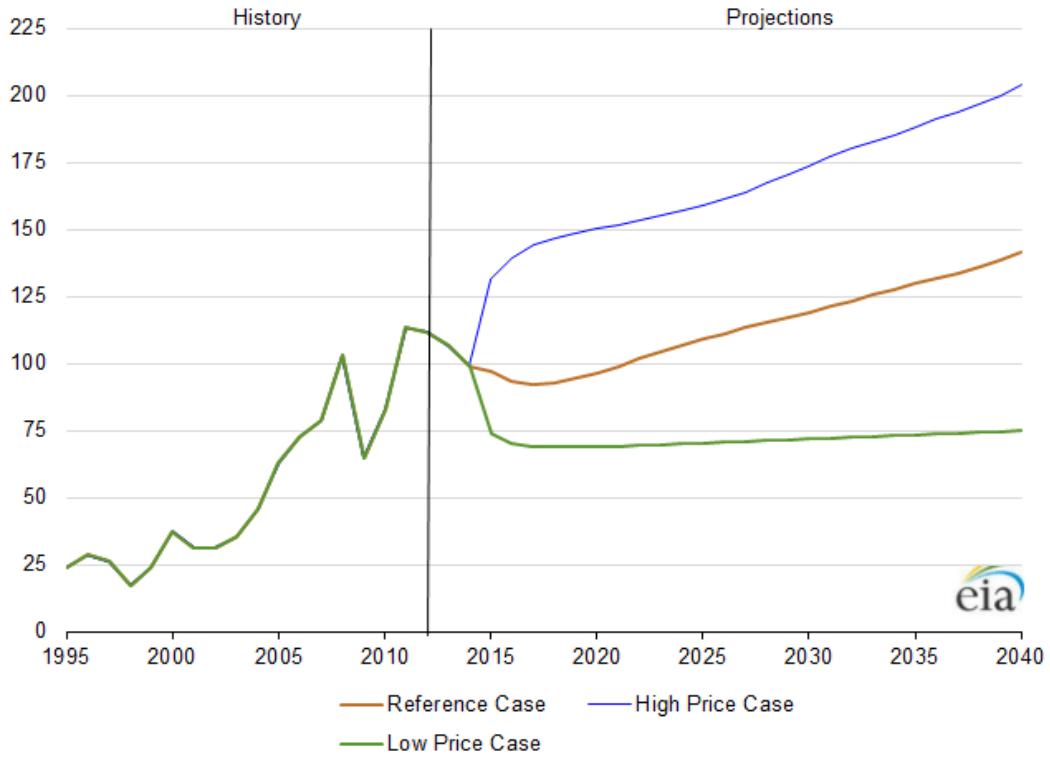
The level of oil production by OPEC is a key factor influencing the oil price projections incorporated into *AEO2014*. Non-OPEC production, worldwide regional economic growth rates and the associated regional demand for oil are additional factors affecting the world oil price.

In the Reference case, real oil prices rise from a $112 per barrel (2012 dollars) in 2013 to $141 per barrel in 2040. The Reference case represents EIA's current judgment regarding exploration and development costs and accessibility of oil resources. It also assumes that OPEC producers will choose to increase their share of the market and will schedule investments in incremental production capacity so that OPEC's oil production will represent about 44 percent of the world's total petroleum and other liquids production in 2040 compared with 40% in 2013. In the Low Oil Price case, crude oil prices are $75 per barrel (2012 dollars) in 2040. In the Low Oil Price case, the low price results from a combination of low demand for petroleum and other liquids in the non-OECD nations and higher global supply. Lower demand is measured by lower economic growth relative to the Reference case. The OECD projections are affected only by the price impact. On the supply side, OPEC countries increase their oil production to obtain a 51% share of total world petroleum and other liquids production, and oil resources outside the United States are more accessible and/or less costly to produce (as a result of technology advances, more attractive fiscal regimes, or both) than in the Reference case. In the High Oil Price case, oil prices reach about $204 per barrel (2012 dollars) in 2040. In the High Oil Price case, the high prices result from a combination of higher demand for petroleum and other liquid fuels in the non-OECD nations and lower global supply. Higher demand is measured by higher economic growth relative to the Reference case. The OECD projections are affected only by the price impact. On the supply side, OPEC market share averages 37 percent throughout the projection period 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 achieve a 44 percent market share of the world's total petroleum and other liquids in 2040. 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—around 1,200 billion barrels, about 73 percent of the world's estimated total, at the end of 2013. [1] Despite investment from foreign sources, Iraq's oil production is not assumed to maintain high levels until after 2015 as infrastructure limitations as well as security and legislative issues are assumed to slow development for the next five years.

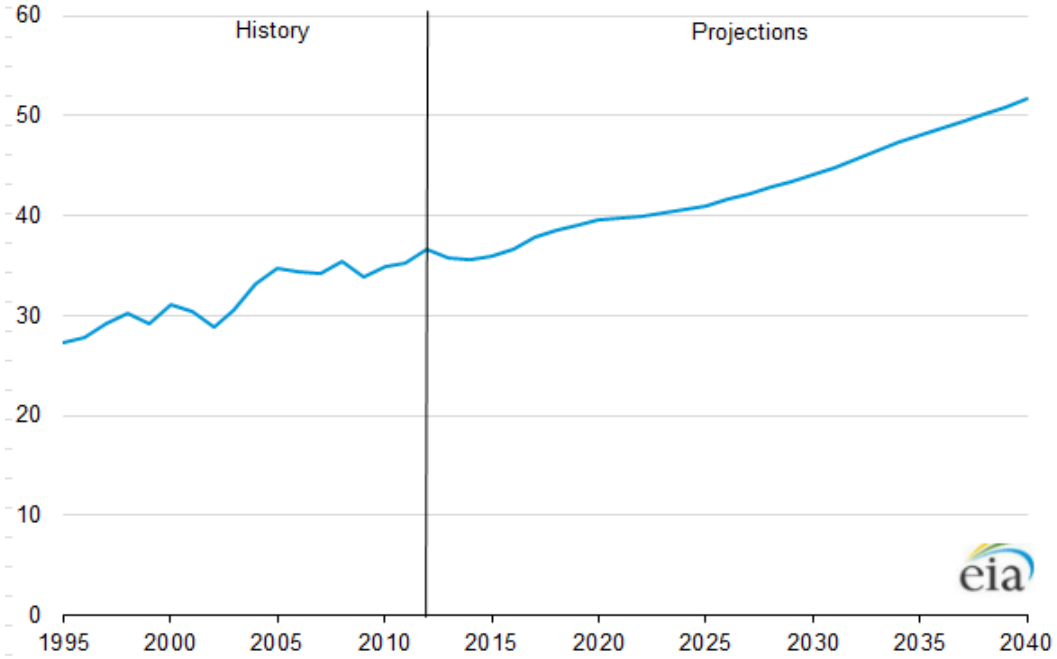
Non-U.S., non-OPEC oil production projections in the AEO2014 are developed in two stages. Projections of liquids production before 2015 are based largely on a project-by-project assessment of major fields, including volumes and expected schedules, with consideration given to the decline rates of active 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 three cases, 1995-2040
2012 dollars per barrel



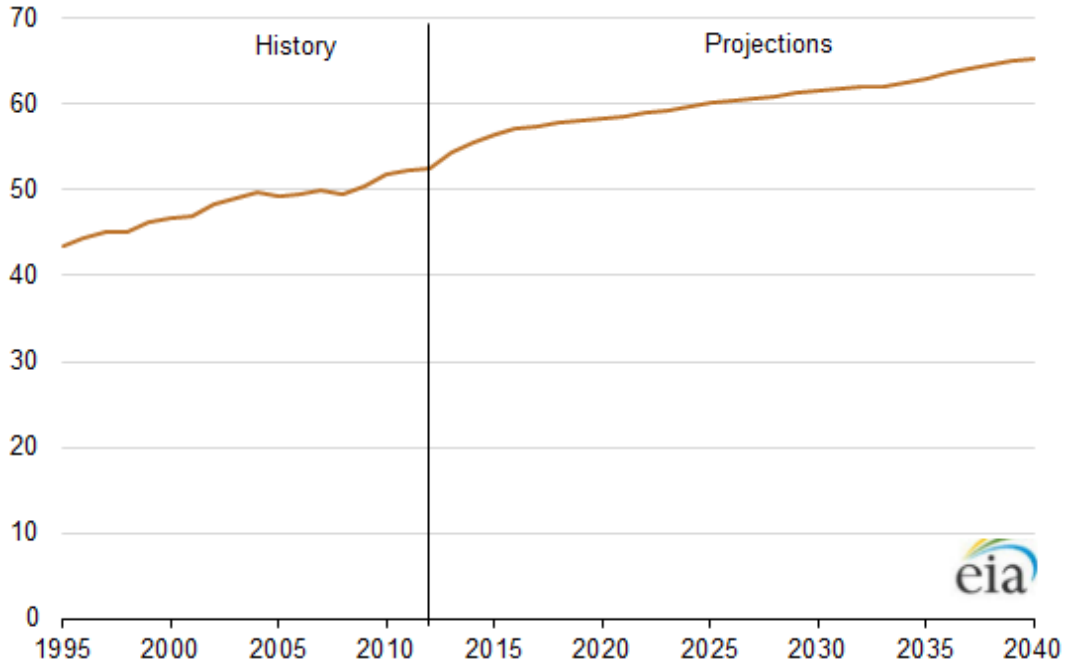
Source: U.S. Energy Information Administration. AEO2014, National Energy Modeling System runs REF2014.D102413A, HIGHPRICE.D120613A, LOWPRICE.D120613A

Figure 3. OPEC total liquids production in the Reference case, 1995-2040
million barrels per day



OPEC = Organization of Petroleum Exporting Countries.
Source: U.S. Energy Information Administration. AEO2014 National Energy Modeling System run REF2014.D102413A.

Figure 4 Non-OPEC total liquids production in the Reference case, 1995-2040
million barrels per day



OPEC = Organization of Petroleum Exporting Countries.
Source: U.S. Energy Information Administration. AEO2014 National Energiy Modeling System run REF2014. D102413A.

The non-U.S. oil production projections in the AEO2014 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 Oxford Economic Model (October, 2012).

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, 2013
billion barrels

Region	Proved Oil Reserves
Western Hemisphere	538.0
Western Europe	10.9
Asia-Pacific	45.4
Eastern Europe and Former Soviet Union (F.S.U.)	120.0
Middle East	797.2
Africa	127.7
Total World	1,639.4
Total OPEC	1,199.7

Source: Pennwell Corporation, Oil and Gas Journal, Vol 111. 12 (Dec. 2, 2013).

Table 3.2. Average annual real gross domestic product rates, 2010-40
2005 purchasing power parity weights and prices

Region	Average Annual Percentage Change
OECD	2.22%
OECD Americas	2.76%
OECD Europe	1.82%
OECD Asia	1.59%
Non-OECD	4.73%
Non-OECD Europe and Eurasia	3.77%
Non-OECD Asia	5.44%
Middle East	2.22%
Africa	4.62%
Central and South America	3.28%
Total World	3.64%

Source: U.S. Energy Information Administration, National Energy Modeling System run REF2014.d102413A.

Table 3.3. Average annual growth rates for total liquids demand in the Reference case, 2010-40
billion barrels

Region	Demand Growth
OECD	0.06%
OECD Americas	0.14%
OECD Europe	-0.11%
OECD Asia	0.16%
Non-OECD	1.84%
Non-OECD Europe and Eurasia	1.77%
Non-OECD Asia	2.38%
Middle East	1.45%
Africa	1.03%
Central and South America	1.09%
Total World	1.01%

Source: U.S. Energy Information Administration, National Energy Modeling System run REF2014.d102413A.

Notes and sources

[1] PennWell Corporation, Oil and Gas Journal, Vol. 111.12 (December 2, 2013).