

# International Energy Module

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The International Energy Module (IEM) performs two tasks in all NEMS runs. First, the module reads exogenously global and U.S.A. petroleum liquids supply and demand curves (1 curve per year; 2008-2030; approximated, isoelastic fit to previous NEMS results). These quantities are not modeled directly in NEMS. Previous versions of the IEM adjusted these quantities after reading in initial values. In an attempt to more closely integrate the *AEO2008* with *IEO2007* and the STEO some functionality was removed from IEM while a new algorithm was implemented. Based on the difference between U.S. total petroleum liquids production (consumption) and the expected U.S. total liquids production (consumption) at the current WTI price, curves for global petroleum liquids consumption (production) were adjusted for each year. According to previous operations, a new WTI price path was generated. An exogenous oil supply module, Generate World Oil Balances (GWOB), was also used in IEM to provide annual regional (country) level production detail for conventional and unconventional liquids.

The second task of the IEM is to interact with the PMM module during runs to determine changes in the WTI price and the supply prices of crude oils and petroleum products for import to the United States in response to changes in U.S. import requirements. As a result of the interaction with PMM, this module also determines new values for oil production in the Middle East OPEC region, along with a report for crude oil, light and heavy refined products imports by source.

## Key Assumptions

The level of oil production by countries in the Organization of Petroleum Exporting Countries (OPEC) is a key factor influencing the world oil price projections incorporated into *AEO2008*. Non-OPEC production, worldwide regional economic growth rates and the associated regional demand for oil are additional factors affecting the world oil price.

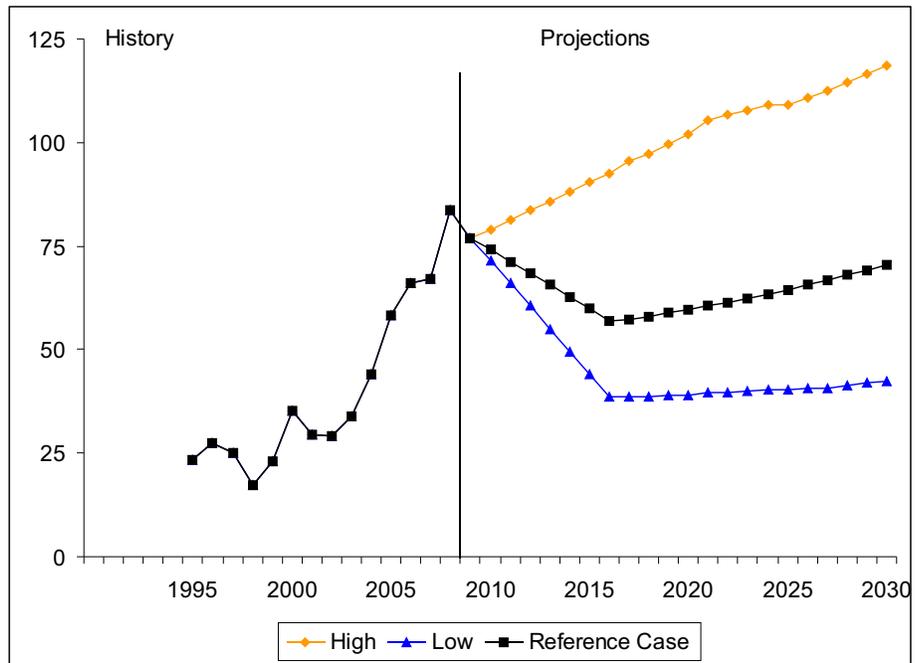
The world oil price is the annual average U.S. cost of imported low-sulfur light crude oil in PADD2. For the low, reference, and high oil price cases, prices reach \$42, \$70 and \$118 per barrel in 2030, respectively, in 2006 dollars. The reference case assumes that OPEC producers will continue to demonstrate a disciplined production approach. The low oil price case reflects a market where all oil production becomes more competitive and plentiful. The high oil price case could result from a more cohesive and market-assertive OPEC whose long-term goal might be to maintain a constant market share. The three price scenarios are shown in Figure 2.

OPEC oil production is assumed to increase throughout the reference case projection, making OPEC the primary source for satisfying the worldwide increase in oil consumption expected over the projection period (Figure 3). OPEC is assumed to be the source of additional production because its member nations hold a major portion of the world's total reserves—exceeding 927 billion barrels, about 70 percent of the world's estimated total, at the end of 2006.<sup>1</sup>

The reference case values for OPEC production are shown in Figure 3. Ecuador is not included in OPEC in *AEO2008* because of the late announcement. Iraq oil production is assumed to not return to pre-conflict volumes until 2010. By 2030, Iraq is expected to increase production capacity to more than 4.6 million barrels per day with likely investment help from foreign sources. Non-OPEC liquids production is expected to increase by 1.1 percent per year over the projection period, as advances in both exploration and extraction technologies result in an upward trend. The non-OPEC production path for the reference case is shown in Figure 4.

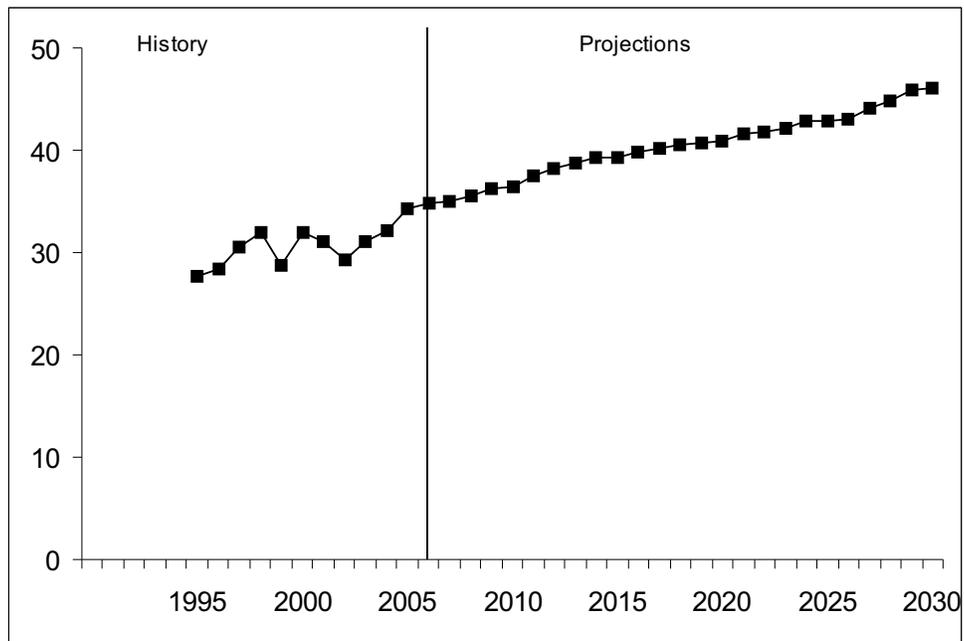
The non-U.S. oil production projections in the *AEO2008* begin with country-level assumptions regarding oil resources. These resource estimates are taken in part from the USGS World Petroleum Assessment of 2000 as well as from PennWell Publishing Company Oil and Gas Journal, summary of which is shown in Table 4.

**Figure 2. World Oil Prices in Three Cases, 1995-2030**  
2006 Dollars per Barrel



Source: AEO2008 National Energy Modeling System runs AEO2008.D030208F, LP2008.D031608A, and HP2008.D031808A.

**Figure 3. OPEC Total Liquids Production in the Reference Case, 1995-2030**  
Millions barrels per Day

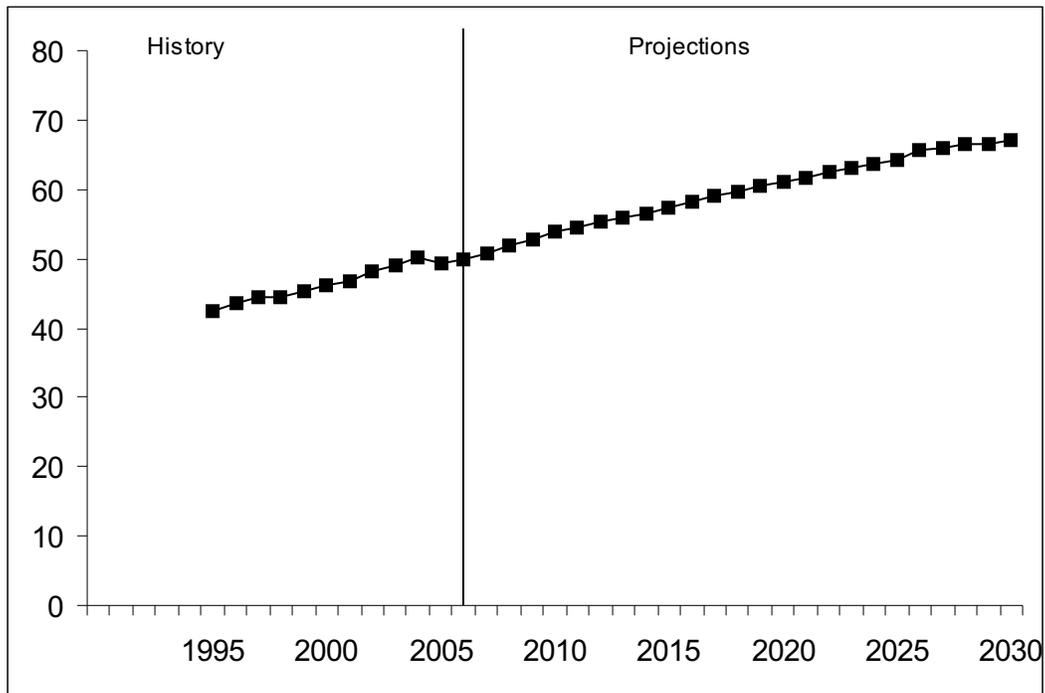


OPEC = Organization of Petroleum Exporting Countries.

Source: Energy Information Administration. AEO2008 National Energy Modeling System run AEO2008.D030208F.

**Figure 4. Non-OPEC Total Liquids Production in the Reference Case, 1995-2030**

Millions barrels per Day



OPEC = Organization of Petroleum Exporting Countries.

Source: Energy Information Administration. AEO2008 National Energy Modeling System run AEO2008.D030208F.

The reference case growth rates for GDP for various regions in the world are shown in Table 5. Except for the United States, the GDP growth rate assumptions for non U.S. country/regions are taken from IEO2007.

The values for growth in oil demand in the International Energy Module, which depend upon the oil price levels as well as GDP growth rates, are shown in Table 6 for the reference case by regions.

Petroleum products imports are represented in the projections through a series of curves for each of the five Petroleum Administration for Defense Districts (PADDs). Curves are provided for seventeen products: traditional gasoline (including aviation), reformulated gasoline, conventional and reformulated gasoline blending stocks for oxygenated blending (CBOB, RBOB), traditional distillate fuel, low-sulfur heating oil, ultra low-sulfur diesel fuel, high and low-sulfur residual fuel, jet fuel (including naphtha jet), liquefied petroleum gases, petrochemical feedstocks, unfinished oils (resid, naphtha, heavy gas oil), methanol, MTBE, and other petroleum products. The curves are derived from AEO2007 curves and analysis of price differential between marker crude oils and refined petroleum productions imported into the U.S.

**Table 4. Worldwide Oil Reserves as of January 1, 2008**  
(Billion Barrels)

Region	Proved Oil Reserves
Western Hemisphere	321.1
Western Europe	13.2
Asia-Pacific	34.3
Eastern Europe and F.S.U.	100
Middle East	748.3
Africa	114.8
Total World	1331.7
Total OPEC	927.5

Source: PennWell Corporation, Oil and Gas Journal, Vol 103, No 47 (Dec 19, 2005).

**Table 5. Average Annual Real Gross Domestic Product Rates, 2004-2030 (2000 Purchasing Power Parity Weights and Prices)**

Region	Average Annual Percentage Change
OECD	2.3
OECD North America	2.6
OECD Europe	2.3
OECD Asia	1.9
Non-OECD	5.3
Non-OECD Europe and Eurasia	4.3
Non-OECD Asia	5.8
Middle East	4.2
Africa	4.9
Central and South America	3.9
Total World	4.0

Source: For the U.S., Energy Information Administration, National Energy Modeling System run AEO2008.D030208F; for other countries, Global Insight, Inc., World Overview (Lexington, MA, January 2007)

**Table 6. Average Annual Growth Rates for Total Liquids Demand in the Reference Case, 2004-2030**  
(Percent per Year)

Region	Oil Demand Growth
OECD	0.3%
OECD North America	0.4%
OECD Europe	0.1%
OECD Asia	0.4%
Non-OECD	2.3%
Non-OECD Europe and Eurasia	1.1%
Non-OECD Asia	2.8%
Middle East	2.2%
Africa	2.2%
Central and South America	2.3%
Total World	1.2%

Source: Energy Information Administration, AEO2008 National Energy Modeling System run: AEO2008.D030208F; and IEO2007 System for the Analysis of Global Energy Markets (2007).

## Notes and Sources

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[1] PennWell Corporation, Oil and Gas Journal, Vol. 103, No. 47 (December 19, 2005).

