

International Energy Module

The International Energy Module (IEM) performs two tasks in all NEMS runs. First, the module reads exogenously derived supply curves, initial price paths and international regional supply and demand levels into NEMS. These quantities are not modeled directly in NEMS because NEMS is not an international model. Previous versions of the IEM adjusted these quantities after reading in initial values. In an attempt to more closely integrate the AEO2007 with the IEO2006 and the STEO some functionality was removed from the IEM. More analyst time was devoted to analyzing price relationships between marker crude oils and refined products. A new exogenous oil supply model, Generate World Oil Balances (GWOB), was also developed to incorporate actual investment occurring in the international oil market through 2015 and resource assumptions through 2030. The GWOB model provides annual country level oil production detail for eight conventional and unconventional oils.

The second task of the IEM is to interact with the PMM module during NEMS runs to determine changes in the world oil 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. A market clearing method is used to determine the price at which worldwide demand for oil is equal to the worldwide supply. The module determines new values for oil production in the Middle East OPEC region, along with a new world oil price that balances supply and demand in the international oil market.

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 *AEO2007*. Non-OPEC production, worldwide regional economic growth rates and the associated regional demand for oil are additional factors affecting the world oil price.

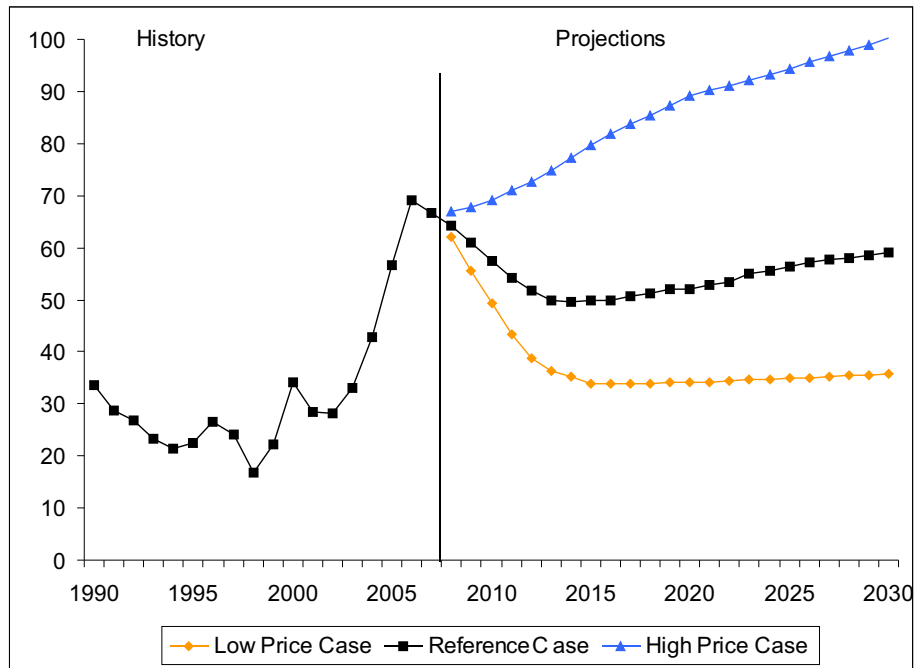
The world oil price is the annual average U.S. refiner's acquisition cost of imported low-sulfur light crude oil. Three distinct world oil price scenarios are represented in *AEO2007*, the low, reference, and high price cases. For the low, reference, and high oil price cases, prices reach \$36, \$59 and \$100 per barrel in 2030, respectively, in 2005 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 forecast, making OPEC the primary source for satisfying the worldwide increase in oil consumption expected over the forecast 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 902 billion barrels, over 70 percent of the world's estimated total, at the end of 2006.⁴ The reference case values for OPEC production are shown in Figure 3. Angola is not included in OPEC in *AEO2007* because the announcement was made after September 1, 2006. Iraq oil production is assumed to not return to pre-conflict volumes until 2009. By 2030, Iraq is expected to increase production capacity to more than 5.5 million barrels per day with likely investment help from foreign sources. Non-OPEC oil production is expected to increase by 1.3 percent per year over the forecast 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 forecasts in the *AEO2007* begin with country-level assumptions regarding proved oil reserves. These reserve estimates are taken from PennWell Publishing Company's *Oil and Gas Journal* and are shown in Table 4.

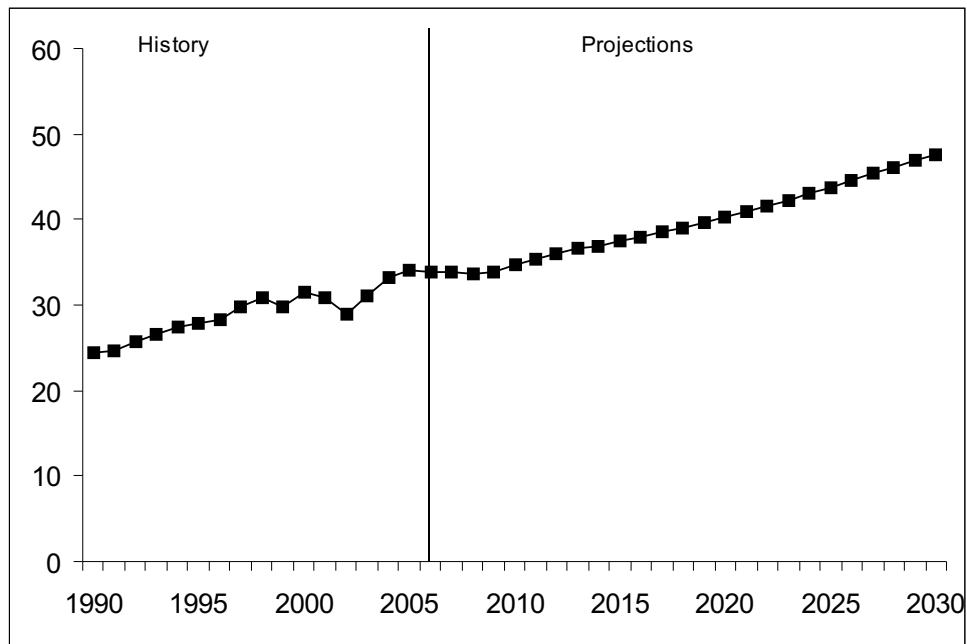
The assumed growth rates for GDP for various regions in the world are shown in Table 5. The same GDP growth rates are applied in all three world oil price cases. The GDP growth rate assumptions are from Global Insight's August 2006 World Economic Outlook.

Figure 2. World Oil Prices in Three Cases, 1990-2030
2005 Dollars per Barrel



Source: AEO2007 National Energy Modeling System runs AEO2007.D112106a, LP2006.D112106a, and HP2007.D112106a.

Figure 3. OPEC Oil Production in the Reference Case, 1990-2030
Millions barrels per Day

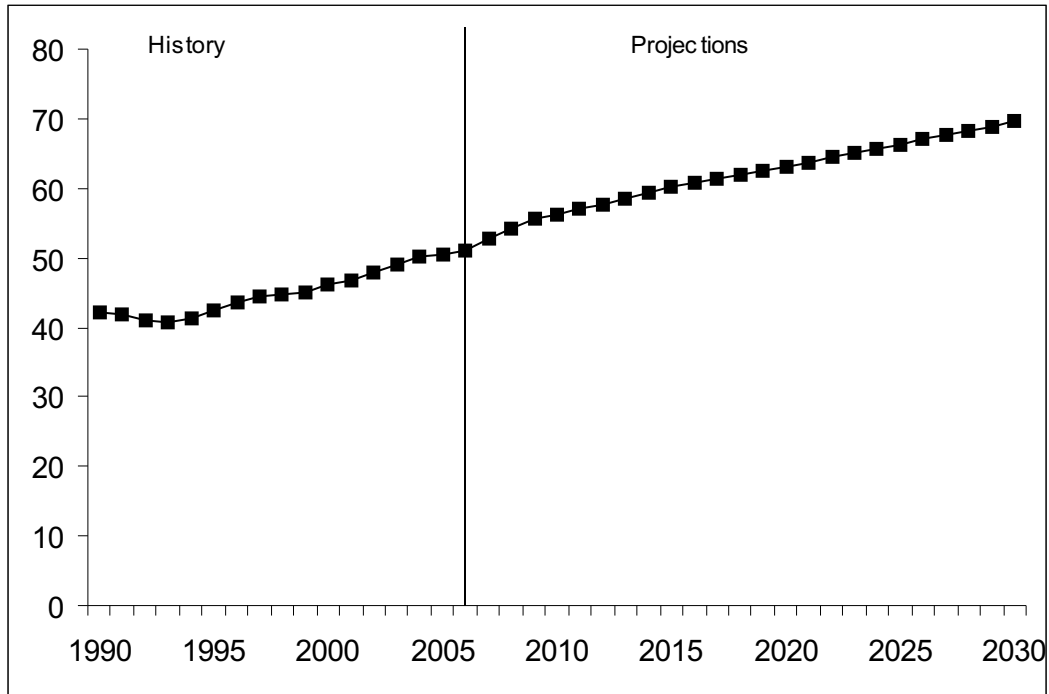


OPEC = Organization of Petroleum Exporting Countries.

Source: Energy Information Administration. AEO2007 National Energy Modeling System run AEO2007.D112106a.

Figure 4. Non-OPEC Oil Production in the Reference Case, 1990-2030

Millions barrels per Day



OPEC = Organization of Petroleum Exporting Countries.

Source: Energy Information Administration. AEO2007 National Energy Modeling System run AEO2007.D112106a.

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

Petroleum product imports are represented in the projections through a series of curves that present the quantity of each product that the world market is willing to supply to U.S. markets for each of the five Petroleum Administration for Defense Districts (PADDs). Curves are provided for twelve products: traditional gasoline (including aviation), reformulated gasoline, reformulated gasoline blending stocks for oxygenated blending (RBOB), traditional distillate fuel, low-sulfur No. 2 heating oil, low-sulfur diesel fuel, high- and low-sulfur residual fuel, jet fuel (including naphtha jet), liquefied petroleum gases, petrochemical feedstocks, and other petroleum products. The curves were derived from *AEO2006* 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, 2006
(Billion Barrels)

Region	Proved Oil Reserves
Western Hemisphere	316.4
Western Europe	14.8
Asia-Pacific	35.9
Eastern Europe and F.S.U.	79.4
Middle East	743.4
Africa	102.6
Total World	1292.5
Total OPEC	901.7

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

Table 5. Average Annual Regional Gross Domestic Product Growth Rates, 2003-2030
(Percent per Year)

Region	Gross Domestic Product Growth
OECD	2.6
OECD North America	3.1
OECD Europe	2.2
OECD Asia	1.9
Non-OECD	5.0
Non-OECD Europe and Eurasia	4.4
Non-OECD Asia	5.5
Middle East	4.2
Africa	4.4
Central and South America	3.8
Total World	3.8

Source: Global Insight, Inc., World Overview (Lexington, MA, August 2005) and World Economic Outlook (Lexington, MA, January 2006)

Table 6. Average Annual Regional Growth Rates for Oil Demand in the Reference Case, 2003-2030
(Percent per Year)

Region	Oil Demand Growth
OECD	0.8
OECD North America	1.1
OECD Europe	0.2
OECD Asia	0.6
Non-OECD	2.3
Non-OECD Europe and Eurasia	1.7
Non-OECD Asia	2.9
Middle East	1.4
Africa	2.2
Central and South America	1.8
Total World	1.4

Source: Energy Information Administration, AEO2007 National Energy Modeling System run: aeo2007.d112106a and IEO2006 System for the Analysis of Global Energy Markets (2006).

Notes and Sources

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