

# International Energy Module

The International Energy Module determines 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 and demand for regions outside the United States, along with a new world oil price that balances supply and demand in the international oil market. A detailed description of the International Energy Module is provided in the EIA publication, *Model Documentation Report: The International Energy Module of the National Energy Modeling System*, DOE/EIA-M071(06), (Washington, DC, February 2006).

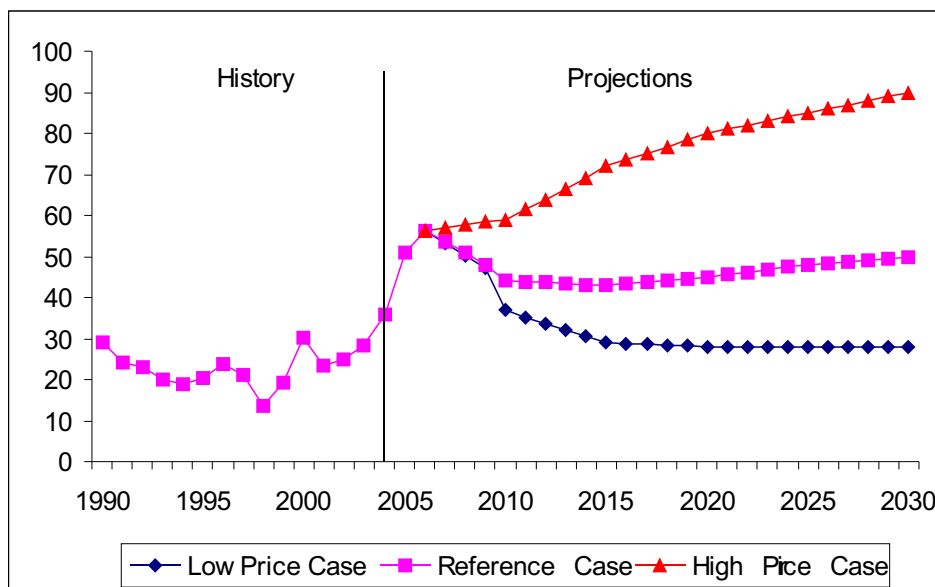
## Key Assumptions

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 AEO2006. 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 crude oil. Three distinct world oil price scenarios are represented in AEO2006, the low, reference, and high price cases. For the low, reference, and high oil price cases, prices reach \$28, \$50 and \$90 per barrel in 2030, respectively, in 2004 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.

**Figure 2. World Oil Prices in Three Cases, 1990-2030**

2004 Dollars per Barrel

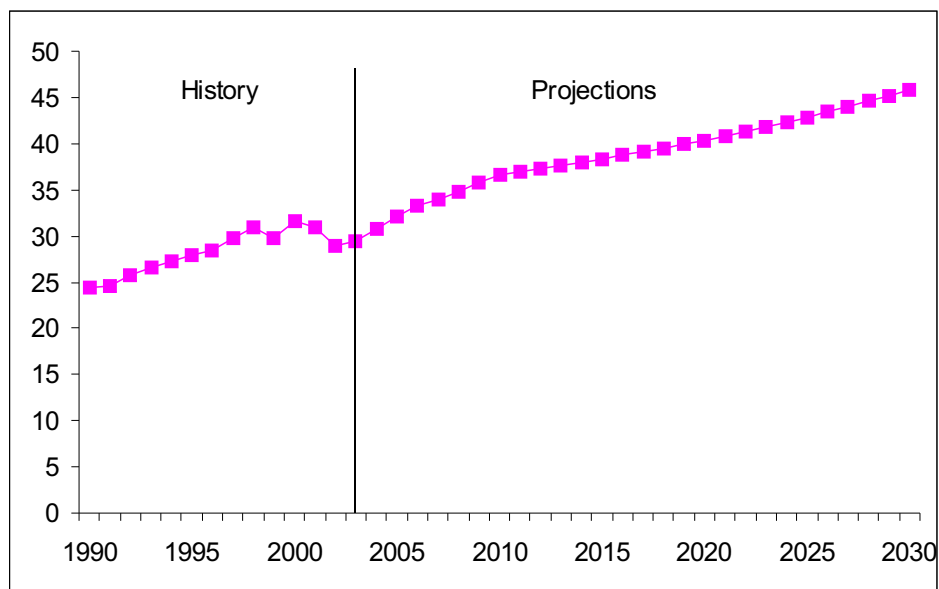


Source: AEO2006 National Energy Modeling System runs AEO2006.D111905a, LP2006.D120105a, and HP2006.D113005a.

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 2005.<sup>4</sup> The reference case values for OPEC production are shown in Figure 3. Iraq is assumed to sell oil at approximately pre-conflict volumes until 2005. They are expected to increase production levels to over 3.5 million barrels per day by the end of the decade. By 2030, Iraq is expected to increase production capacity to more than 6 million barrels per day with likely investment help from foreign sources. Non-OPEC oil production is expected to increase by almost 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.

**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. AEO2006 National Energy Modeling System run AEO2006.D111905a.

The non-U.S. oil production forecasts in the *AEO2006* 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 DRI-WEFA August 2004 World Economic Outlook.

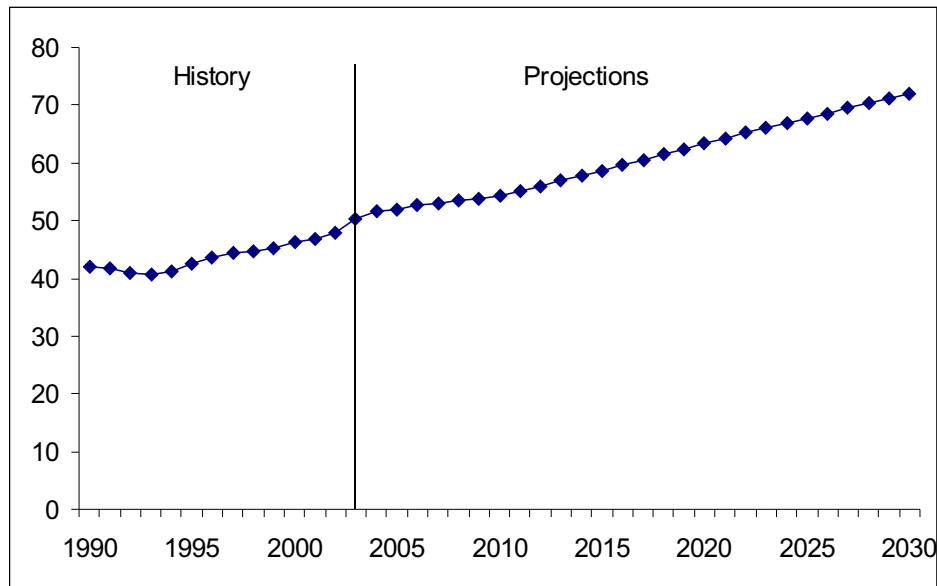
The values for growth in oil demand calculated in the International Energy Module, which depend upon the oil price levels as well as the GDP growth rates, are shown in Table 6 for the reference case by regions.

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 are calculated using the World Oil Refining Logistics

Demand (WORLD) Model.<sup>5</sup> The WORLD model uses as inputs worldwide demand for crude oil and petroleum products based on world oil prices that are close to the oil prices assumed for *AEO2006*, as well as values for worldwide petroleum production that are consistent with such prices. The refinery technology incorporated in the model is updated using the most recently available Oil & Gas Journal Database.<sup>6</sup>

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

Millions barrels per Day



OPEC = Organization of Petroleum Exporting Countries.

Source: Energy Information Administration. AEO2006 National Energy Modeling System run AEO2006.D111905a.

**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 Publishing Co., International Petroleum Encyclopedia, (Tulsa, OK, 2005).

**Table 5. Average Annual Regional Gross Domestic Product Growth Rates, 2002-2025**  
(Percent per Year)

Region	Gross Domestic Product Growth
Industrialized Countries	2.5
Other Developing Countries	3.5
Eurasia	5.6
China	6.2
Former Soviet Union	4.6
Eastern Europe	4.1
Total World	3.9

Source: Global Insight's DRI-WEFA, World Economic Outlook, (Lexington, MA, August 2004).

**Table 6. Average Annual Regional Growth Rates for Oil Demand in the Reference Case, 2002-2025**  
(Percent per Year)

Region	Oil Demand Growth
Industrialized Countries	1.0
Other Developing Countries	2.6
Eurasia	3.1
China	4.5
Former Soviet Union	1.3
Eastern Europe	1.8
Total World	1.8

Source: Energy Information Administration, AEO2005 National Energy Modeling System run: aeo2005.d102004a.

## Notes and Sources

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[4] PennWell Publishing Co., International Petroleum Encyclopedia, (Tulsa, OK, 2005).

[5] EIA, EIA Model Documentation: World Oil Refining Logistics Demand Model, "WORLD" Reference Manual, DOE/EIA-M058, (Washington, DC, March 1994).

[6] Oil & Gas Journal, World Wide Refinery Survey, (data as of January 1, 2006).

