International Energy Module

The International Energy Module (IEM) of the National Energy Modeling System (NEMS) simulates the interaction between U.S. and global petroleum markets. The IEM uses assumptions of economic growth and expectations of future U.S. and world petroleum 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 projection period, the IEM computes Brent crude oil prices, and it provides a supply curve of world crude-like liquids and supply curves for each foreign crude oil type considered. The IEM also provides, for each year of the projection period, endogenous assumptions for petroleum products for U.S. import and export.

Changes in the Brent oil price are computed in response to

- 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)

- The difference between projected U.S. total petroleum liquids consumption and the expected U.S. total petroleum 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

Annual Energy Outlook 2020 (AEO2020) considers a number of factors related to the uncertainty of future oil prices, including

- Changes in worldwide demand for petroleum products
- Investment and production decisions by the Organization of the Petroleum Exporting Countries (OPEC)
- Non-OPEC petroleum liquid fuels supply
- Supplies of other liquid fuels
- The International Maritime Organization (IMO) convention that limits sulfur in fuel oil to be used on ships starting 2020

In the AEO2020 Reference case, the steady increase in U.S. crude oil production, combined with the moderate increase in world crude oil production, contributes to a drop in oil price to $59 per barrel (2019 dollars) in 2020. Oil prices rise steadily after 2020 in response to growth in demand from countries outside of the Organization for Economic Cooperation and Development (OECD), even as downward pressure from increased U.S. oil production keeps the oil price lower than $83 per barrel (b) through 2034. Growth in demand from non-OECD countries combined with a decrease in U.S. crude oil production pushes the oil price to $105/b in 2050 (Figure 1).
Figure 1. World oil prices in three cases, 2000–2050
2019 dollars

In the AEO2020 Low Oil Price case, the oil price drops to $35/b in 2021, followed by a gradual increase to $46/b in 2050. This trend is the result of higher upstream investment by OPEC and lower global demand. U.S. production varies within narrow limits during the 2020–2030 period followed by a decrease to 8.6 million barrels per day (b/day) in 2050. As a result, U.S. net imports of crude oil are almost constant during the 2020–2030 period followed by an increase to 7.2 million b/d in 2050 (Figure 2).

In the AEO2020 High Oil Price case, the oil price increases to $88/b in 2020 and $183/b in 2050. This trend is the result of significantly lower OPEC production, higher non-OECD demand for petroleum products, and more limited international supply of other liquid fuels than in the Reference case. As a result, U.S. production increases significantly through 2025 followed by a steady decrease through 2050. U.S. crude oil exports follows a similar pattern during the projection period. U.S. net imports of crude oil drop significantly through 2024 followed by a steady increase to 6.5 million b/d in 2050 (Figure 2).
Figure 2. U.S. net crude oil imports in three cases, 2000–2050

million barrels per day