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## International Energy Module

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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 the U.S. liquid fuels market 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)

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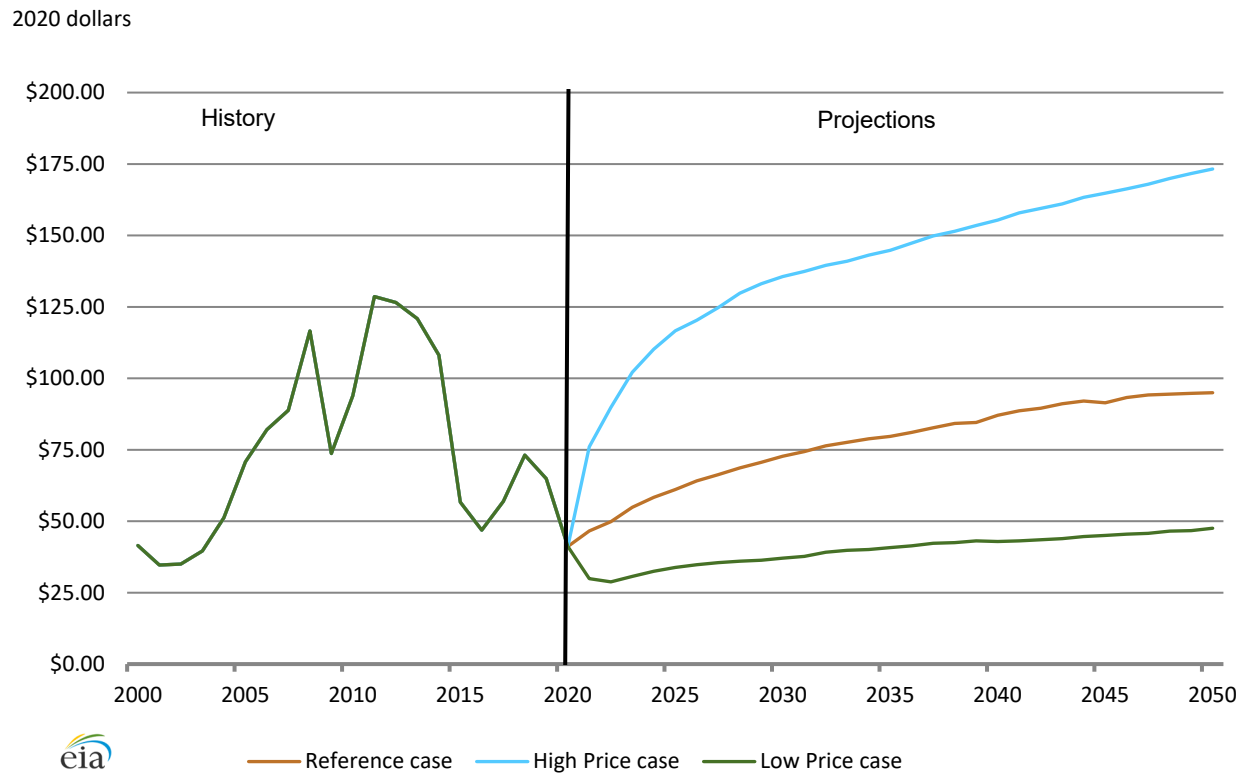
## Key Assumptions

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*Annual Energy Outlook 2021* (AEO2021) 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 since 2020

In the AEO2021 Reference case, U.S. crude oil production slowly decreases in 2021. Oil prices rise steadily starting in 2021 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 \$79 per barrel (b) through 2034. Growth in demand from non-OECD countries, combined with a slow decrease in U.S. crude oil production, pushes the oil price to \$95/b in 2050 (Figure 1).

**Figure 1. World oil prices in three cases, 2000–2050**

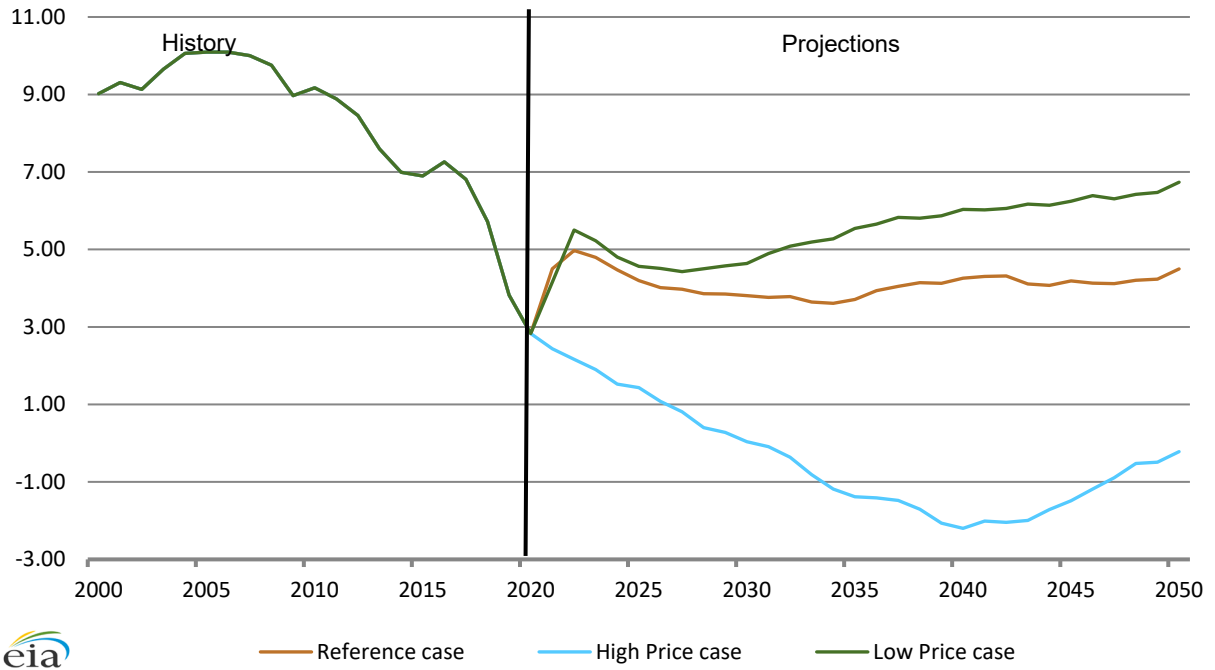
Source: U.S. Energy Information Administration. *Annual Energy Outlook 2021*, National Energy Modeling System runs REF2021.D113020A, HIGHPRICE. D113020A, LOWPRICE. D113020A

In the AEO2021 Low Oil Price case, the oil price drops to \$29/b through 2022, followed by a gradual increase to \$48/b in 2050. This trend is the result of higher upstream investment by OPEC and lower global demand. U.S. production decreases through 2022, then increases to 11.9 million barrels per day (b/d) in 2027, and then decreases to 8.8 million b/d in 2050. As a result, U.S. net imports of crude oil increase through 2022, then decrease to 4.4 million b/d in 2027, and then increase to 6.7 million b/d in 2050 (Figure 2).

In the AEO2021 High Oil Price case, the oil price increases to \$41/b in 2020 and \$173/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 2040 followed by a steady decrease through 2050. U.S. net imports of crude oil drop significantly through 2040 followed by a steady increase to -0.2 million b/d in 2050 (Figure 2).

**Figure 2. U.S. net crude oil imports in three cases, 2000–2050**

million barrels per day



Source: U.S. Energy Information Administration. Annual Energy Outlook 2021, National Energy Modeling System runs REF2021.D113020A, HIGHPRICE.D113020A, LOWPRICE.D113020A