Short-Term Energy Outlook (STEO)

Forecast highlights

Winter Fuels Outlook

- EIA forecasts that average U.S. household expenditures for most major home heating fuels will be higher this winter compared with last winter. Average increases vary by fuel; natural gas expenditures are forecast to rise by 5%, home heating oil by 20%, and electricity by 3%, while propane expenditures are forecast to remain similar to last year. Most of the increase reflects higher forecast energy prices. U.S. average heating degree days are expected to be 1% higher than last winter. However, realized expenditures are highly dependent on actual weather outcomes (Winter Fuels Outlook).

- EIA expects natural gas inventories to end October at the lowest levels for that time of year since 2005. Inventories of distillate fuel and propane are also below the five-year (2013–17) average in several regions. Although inventory levels are low, EIA expects fuel supplies to be adequate to meet winter demand.

Global liquid fuels

- Brent crude oil spot prices averaged $79 per barrel (b) in September, up $6/b from August. EIA expects Brent spot prices will average $74/b in 2018 and $75/b in 2019. EIA expects West Texas Intermediate (WTI) crude oil prices will average about $6/b lower than Brent prices in 2018 and in 2019. NYMEX WTI futures and options contract values for January 2019 delivery that traded during the five-day period ending October 4, 2018, suggest a range of $60/b to $93/b encompasses the market expectation for January WTI prices at the 95% confidence level.

- EIA estimates that U.S. crude oil production averaged 11.1 million barrels per day (b/d) in September, up slightly from August levels. EIA forecasts that U.S. crude oil production will average 10.7 million b/d in 2018, up from 9.4 million b/d in 2017, and will average 11.8 million b/d in 2019.

Natural gas

- EIA estimates dry natural gas production in the United States averaged 85.1 billion cubic feet per day (Bcf/d) in September, up 0.6 Bcf/d from August. EIA forecasts that dry natural gas production will average 82.7 Bcf/d in 2018, up by 7.9 Bcf/d from 2017 and
establishing a new record high. EIA expects natural gas production will continue to rise in 2019 to an average of 87.7 Bcf/d.

- EIA forecasts that U.S. natural gas storage inventories will total 3.3 trillion cubic feet (Tcf) at the end of October. This level would be 14% lower than both the 2017 end-of-October level and the five-year (2013–17) average for the end of October, and it would also mark the lowest level for that time of year since 2005.

- EIA expects Henry Hub natural gas spot prices to average $2.99/million British thermal units (MMBtu) in 2018 and $3.12/MMBtu in 2019. NYMEX futures and options contract values for January 2019 delivery that traded during the five-day period ending October 4, 2018, suggest a range of $2.22/MMBtu to $4.85/MMBtu encompasses the market expectation for January Henry Hub natural gas prices at the 95% confidence level.

Electricity, coal, renewables, and emissions

- EIA expects the share of U.S. total utility-scale electricity generation from natural gas-fired power plants to rise from 32% in 2017 to 35% in both 2018 and 2019. EIA’s forecast electricity generation share from coal averages 28% in 2018 and 27% in 2019, down from 30% in 2017. The nuclear share of generation was 20% in 2017 and EIA forecasts that it will be slightly below 20% in 2018 and in 2019. Wind, solar, and other nonhydropower renewables provided slightly less than 10% of electricity generation in 2017, and EIA expects them to provide more than 10% in 2018 and nearly 11% in 2019. The generation share of hydropower was 7% in 2017 and EIA forecasts that it will be about the same in 2018 and 2019.

- In 2017, EIA estimates that U.S. wind generation averaged 697,000 megawatthours per day (MWh/d). EIA forecasts that wind generation will rise by 8% to 750,000 MWh/d in 2018 and by a further 6% to 793,000 MWh/d in 2019.

- Solar power generates less electricity in the United States than wind power but continues to grow at a faster rate. EIA expects solar generation will rise from 211,000 MWh/d in 2017 to 267,000 MWh/d in 2018 (an increase of 26%) and to 305,000 MWh/d in 2019 (an increase of 14%).

- EIA forecasts U.S. coal production will decline by 2% to 756 MMst in 2018, despite a 12% (11 MMst) increase in coal exports. The production decrease is largely attributable to a forecast decline of 4% (26 MMst) in domestic coal consumption in 2018. EIA expects coal production to decline by 2% (13 MMst) in 2019 because it forecasts that coal exports and coal consumption will decrease by 7% and 5%, respectively.

- After declining by 0.8% in 2017, EIA forecasts that U.S. energy-related carbon dioxide (CO2) emissions will rise by 2.2% in 2018. This increase largely reflects higher natural gas consumption because of a colder winter and a warmer summer than in 2017. EIA expects emissions to decline by 1.1% in 2019, as forecast temperatures are forecast to
return to normal. Energy-related CO2 emissions are sensitive to changes in weather, economic growth, energy prices, and fuel mix.

**Petroleum and natural gas markets review**

**Crude oil**

*Prices:* The front-month futures price for Brent crude oil settled at $84.58 per barrel (b) on October 4, an increase of $6.41/b from September 4. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, increased by $4.46/b during the same period, settling at $74.33/b on October 4 (Figure 1).

![Figure 1. Crude oil front-month futures prices](image)

Both Brent and WTI crude oil prices reached four-year highs on October 3. Crude oil prices rose in anticipation of potentially steep declines in Iranian crude oil production and exports as a result of the reinstatement of U.S. sanctions on November 4. Trade press reports that major oil-importing countries including Japan, South Korea, China, and India, are planning or are considering sharp reductions in crude oil imports from Iran. As a result, the amount of Iranian crude oil supply available in the global market may be much lower than market participants initially expected in May, when the United States announced it would exit from the Joint Comprehensive Plan of Action. EIA estimates that Iranian crude oil production fell by more than 0.4 million barrels per day (b/d) since May to an average of 3.4 million b/d in September.

In June, members of the Organization of the Petroleum Exporting Countries (OPEC), along with Russia, agreed to increase oil production levels to the original crude oil production target set in November 2016. In the third quarter of 2018, OPEC members (other than Iran and Venezuela) increased crude oil production by more than the amount that crude oil production in Iran and Venezuela declined. However, recent price increases indicate that oil market participants have concerns about the ability of Saudi Arabia, other OPEC members, and Russia to continue to offset expected further production declines in Iran and in Venezuela. Increases in OPEC crude oil
production to offset declines in Iran and Venezuela have resulted in declining OPEC spare crude oil production capacity. STEO estimates that OPEC spare capacity fell below 1.4 million b/d in September, the lowest level since December 2016 when global oil inventory levels were much higher.

With increased uncertainty about the amount that Iranian crude oil production could decline, and how much of the decline can be offset by other suppliers, STEO now forecasts the Brent crude oil spot price will average $81/b in the fourth quarter of 2018, up from a forecast of $76/b in the September STEO. Despite continuing production declines in Iran and Venezuela, EIA forecasts global oil supply and demand to be nearly balanced in 2019 contributing to downward oil price pressures. By the second half of 2019, when transportation constraints in the Permian region of the United States are expected to be alleviated, U.S. crude oil production, and potentially crude oil exports, are expected to increase, which could help keep prices in the mid-$70/b range.

Although both the Brent and WTI front-month futures price rose during the past several weeks, Brent prices increased more than WTI prices. As a result, the Brent futures curve became more backwardated (when near-term contract prices exceed those of longer-dated ones) than the WTI futures curve for the first time since June (Figure 2). From September 4 to October 4, the Brent 1st–13th month futures contract price spread rose from $3.44/b to $4.29/b. During the same period, the WTI 1st–13th month futures contract price spread declined from $3.60/b to $2.40/b.

![Figure 2. Crude oil front-month - 13th month futures price spread](image)

During September and through the first week of October, the probability that the December 2018 WTI crude oil futures contract will expire at $70/b increased sharply. A probability calculated using futures and options data indicates that WTI futures prices have a 75% chance of reaching $70/b at expiration as of October 4 (Figure 3). The probability of reaching $70/b was at just 42% on September 4.
Economic growth: Some developed and emerging market economies may be starting to experience slower economic growth, which could result in lower-than-forecast oil demand, especially if crude oil prices continue to rise.

The CPB Netherlands Bureau for Economic Policy Analysis (CPB) publishes monthly data on global and regional industrial production, an important gauge for economic activity. Using a three-month moving average to smooth out short-term fluctuations, data from the CPB show that industrial production growth in advanced economies has begun to decelerate in January 2018 (Figure 4). Industrial production growth in emerging economies has also recently experienced a slight deceleration.

Among advanced economy regions the CPB tracks, the United States is the only region with accelerating industrial production growth, while Japan, the Euro Area, and Other advanced economies are all decelerating. Industrial production growth in the Euro Area, in particular, showed a year-over-year decline in July 2018, the first decline since the beginning of 2017, as industrial production in Germany and Italy showed slowdowns.

Further, growth in gross domestic product (GDP) in 2019 for countries both within and outside the Organization for Economic Cooperation and Development (OECD) has been revised down in recent months. The April 2018 STEO forecast OECD GDP growth of 2.2% for 2019; however, the current STEO forecast OECD GDP to be 2.0% next year. Similarly, non-OECD GDP growth was revised down from 4.3% to 3.8%. This decline in forecast growth is part of the reason that global oil demand growth for 2019 is forecast to be 1.5 million b/d in the current STEO, compared with 1.8 million b/d in the April STEO.
Equity markets: A divergence between the economic outlooks for the United States compared with that of other countries can be seen in equity market returns. From January 2, 2018, to October 4, 2018, the S&P 500 rose 8% (Figure 5). In contrast, the MSCI Emerging Markets Index fell 14% during the same period. The MSCI Emerging Markets Index consists of equities in 24 developing countries, and Chinese shares account for 30% of the index.

General trends affecting this divergence include interest rate increases by the U.S. Federal Reserve, the strengthening U.S. dollar (USD), and weakening emerging market currencies. Better returns in less risky assets along with concerns about high dollar-denominated debt in certain countries may have affected the outlook and investment in emerging markets more broadly.

Country-specific issues have also affected the MSCI Emerging Markets Index. Weaker-than-expected economic data from China and larger portions of the U.S.-China trade flow that are subject to tariffs have negatively affected Chinese equities. During past several weeks, the Indian rupee fell to record lows against the USD, increasing the cost of imports and resulting in domestic fuel prices reaching record highs. The Indian government may try to support its currency by further increasing interest rates and limiting imports. In Brazil, political uncertainty, currency depreciation, a strike related to high fuel prices, and weak economic fundamentals resulted in a selloff in Brazilian equities earlier in the summer. Rising oil prices could begin to affect oil demand in countries experiencing currency depreciation and/or a slowdown in their economic fundamentals.
Petroleum products

*Gasoline prices:* The front-month futures price of reformulated blendstock for oxygenate blending (RBOB, the petroleum component of gasoline used in many parts of the country) settled at $2.10 per gallon (gal) on October 4 (Figure 6), an increase of 11 cents/gal from September 4. The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) decreased by 5 cents/gal to settle at 9 cents/gal during the same period.

The RBOB–Brent crack spread declined as RBOB prices increased less than crude oil prices despite high gasoline demand in September. U.S. gasoline consumption combined with exports totaled 10.1 million barrels per day (b/d) for the four weeks ending September 28, which, if confirmed in monthly data, would be the highest on record for September. However, gasoline production and imports have more than kept pace with demand, resulting in gasoline inventory levels that were much higher than the five-year (2013–17) range on September 28.
Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price settled at $2.40/gal on October 4 (Figure 7), an increase of 15 cents/gal from September 4. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) declined by 1 cent/gal to settle at 39 cents/gal during the same period. The ULSD–Brent crack spread has been at or higher than the five-year average for most of 2018, but large U.S. distillate inventory growth in September resulted in a ULSD crack spread less than the five-year average. ULSD crack spreads are also declining in Northwest Europe. Rising gasoil inventories in the Amsterdam-Rotterdam-Antwerp (ARA) trading hub may have contributed to lower ARA ULSD-Brent crack spreads. Low water levels on the Rhine River hampered product movements inland and may have contributed to the increase in ARA inventories.

U.S. distillate inventories: U.S. distillate inventories increased by 3.0 million barrels for the four weeks ending September 28, an unusually large build for September. For the first time in 2018,
distillate inventories at the end of September nearly equaled those of the prior year (Figure 8). High throughput at U.S. refineries contributed to record-high distillate production for the month of September. Distillate production has set monthly records since June, which has supported inventory growth despite strong consumption and export demand. U.S. consumption and exports combined for the four weeks ending September 28, if confirmed in monthly data, would be the highest for September since 2015.

![Figure 8. U.S. distillate inventory](image)

**Natural Gas**

**Prices:** The front-month natural gas futures contract for delivery at the Henry Hub settled at $3.17/million British thermal units (MMBtu) on October 4, an increase of 34 cents/MMBtu from September 4 (Figure 9). The Henry Hub natural gas spot price averaged $2.99/MMBtu in September, 3 cents/MMBtu higher than in August. On September 24, natural gas futures prices rose to more than $3/MMBtu for the first time since June 2018. Temperatures were higher than normal across much of the Lower 48 states, which contributed to high natural gas demand for power generation and limited significant inventory level gains this month. Working natural gas in underground storage has remained below the five-year (2013–17) average for most of the year. Inventories on September 28 totaled 2,866 billion cubic feet (Bcf), which is 17% less than the five-year average and 18% less than last year at this time.
Prices for natural gas futures contracts for October delivery generally trade at a lower price than contracts for January delivery, when natural gas demand is expected to be much greater. This year, however, the discount of the October contract to the January contract was at its lowest in the past five years. High use of natural gas for electric power generation through the summer months did not allow for sufficiently high injections to compensate for the low inventory level on April 1, the traditional start of the injection season. From June through September, natural gas used for power generation and for LNG exports reached record high levels. Natural gas production also rose to record levels, but the high demand prevented inventory levels from rising sufficiently to account for the initial deficit relative to the five-year average, which reached 607 Bcf as of September 28. The tighter natural gas market this summer contributed to a narrower spread between the October and January natural gas futures prices, which averaged 16 cents/MMBtu during the month of September compared with a range of a 20 cent to 40 cent/MMBtu discount over the past five years (Figure 10). In addition, higher natural gas production reduces the need for inventory to meet winter demand, which further contributes to the smaller price spread.
U.S. natural gas production: Total U.S. dry natural gas production reached an estimated 85.1 billion cubic feet per day (Bcf/d) in September, 9.3 Bcf/d higher than year-ago levels and a record high if confirmed in monthly data. Compared with historical levels, front-month natural gas futures prices during this period of production growth have remained steady and not experienced a decline with increased production, likely because of lower-than-average inventory levels (Figure 11).
Notable forecast changes

- EIA forecasts that U.S. crude oil production will average 11.8 million barrels per day (b/d) in 2019, which is almost 0.3 million b/d higher than the forecast in the September STEO. The higher production reflects higher-than-expected increases to Texas and North Dakota production in July, revising up the baseline of the forecast, and a response to higher forecast prices.

- EIA forecasts that dry natural gas production will average 82.7 billion cubic feet per day (Bcf/d) in 2018, which is 1.8 Bcf/d higher than the forecast in the September STEO. The higher production reflects higher than expected increases to Texas production in July, increasing the baseline of the forecast. EIA expects natural gas production will continue to rise in 2019 to an average of 87.7 Bcf/d, 3.1 Bcf/d higher than the forecast in the September STEO. The 2019 upward revision is the result of increased expected production in the Haynesville region in response to higher forecast prices, upward revisions to the Permian region in response to higher prices, and expected new pipeline capacity to come online in the second quarter of 2019.

- EIA forecasts Brent crude oil prices to average $81 per barrel (b) in the fourth quarter of 2018, which is $5/b higher than forecast in the September STEO. This increase reflects recent price movements incorporated into EIA’s forecast, the higher starting point for the forecast, and the possibility that crude oil prices could remain elevated while market participants assess how much crude oil production in Iran will decline in the coming months and the ability of other oil producers to offset lost volumes.

- For more information, see the detailed table of STEO forecast changes.