Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- For the 2019 summer driving season that runs from April through September, EIA forecasts that U.S. regular gasoline retail prices will average $2.76 per gallon (gal), down from an average of $2.85/gal last summer. EIA’s forecast is discussed in its Summer Fuels Outlook. The lower forecast gasoline prices primarily reflect EIA’s expectation of lower crude oil prices in 2019. For all of 2019, EIA expects U.S. regular gasoline retail prices to average $2.60/gal and gasoline retail prices for all grades to average $2.71/gal, which would result in the average U.S. household spending about $100 (4%) less on motor fuel in 2019 compared with 2018.

- Brent crude oil spot prices averaged $66 per barrel (b) in March, up $2/b from February 2019. Brent prices for the first quarter of 2019 averaged $63/b, which is $4/b lower than the same period in 2018. Despite lower crude oil prices than last year, Brent prices in March were $9/b higher than in December 2018, marking the largest December-to-March price increase since December 2011 to March 2012. EIA forecasts Brent spot prices will average $65/b in 2019 and $62/b in 2020, compared with an average of $71/b in 2018. EIA expects that West Texas Intermediate (WTI) crude oil prices will average $8/b lower than Brent prices in the first half of 2019 before the discount gradually falls to $4/b in late-2019 and through 2020.

- EIA estimates that U.S. crude oil production averaged 12.1 million barrels per day (b/d) in March, up 0.3 million b/d from the February average. EIA forecasts that U.S. crude oil production will average 12.4 million b/d in 2019 and 13.1 million b/d in 2020, with most of the growth coming from the Permian region of Texas and New Mexico.

Natural gas

- The Henry Hub natural gas spot price averaged $2.95/million British thermal units (MMBtu) in March, up 26 cents/MMBtu from February. Prices increased as a result of colder-than-normal temperatures across much of the United States, which increased the use of natural gas for space heating. EIA expects strong growth in U.S. natural gas production to put downward pressure on prices in 2019 and in 2020. EIA expects Henry Hub natural gas spot prices will average $2.82/MMBtu in 2019, down 33 cents/MMBtu from 2018. The forecasted 2020 Henry Hub spot price is $2.77/MMBtu.
• EIA forecasts that dry natural gas production will average 91.0 billion cubic feet per day (Bcf/d) in 2019, up 7.6 Bcf/d from 2018. EIA expects natural gas production will continue to grow in 2020 to an average of 92.5 Bcf/d.

• EIA estimates that natural gas inventories ended March at 1.2 trillion cubic feet (Tcf), which would be 17% lower than levels from a year earlier and 30% lower than the five-year (2014–18) average. EIA forecasts that natural gas storage injections will outpace the previous five-year average during the April-through-October injection season and that inventories will reach 3.7 Tcf at the end of October, which would be 13% higher than October 2018 levels but 1% lower than the five-year average.

Electricity, coal, renewables, and emissions

• EIA expects the average U.S. residential customer will use an average of 1,026 kilowatthours (kWh) of electricity per month during the summer cooling season that runs from June through August, 2019, about 5% less than the same period last year. EIA uses the National Oceanic and Atmospheric Administration’s weather forecast, which indicates that temperatures will be cooler than last summer in all regions of the United States. The cooler forecast temperatures contribute to lower expected electricity use.

• EIA forecasts that U.S. residential electricity prices will average 13.4 cents/kWh during the summer cooling season, about 2% higher than last summer. The higher forecast prices primarily reflect higher actual generation fuel costs from 2018 that affect retail rates with a time lag, as well as rising electric transmission and distribution costs.

• EIA forecasts that all renewable fuels, including wind, solar, and hydroelectric generation, will produce 18% of U.S. electricity in 2019, and almost 20% in 2020. EIA expects that wind generation will surpass hydroelectric generation to become the leading source of renewable electricity in both years.

• EIA estimates that U.S. coal production decreased by 19 million short tons (MMst) (2%) in 2018, totaling 756 MMst. EIA expects that coal production will continue to fall in the forecast as both domestic consumption and exports, which reached a five-year high in 2018, are forecast to decline. In the electric power sector, which accounts for more than 90% of U.S. coal consumption, more than 7 gigawatts of coal-fired generation is scheduled to retire by the end of 2020. EIA forecasts that coal production will total 684 MMst in 2019 (down by 9% from 2018) and 640 MMst in 2020 (down by 6% from 2019).

• After rising by 2.7% in 2018, EIA forecasts that U.S. energy-related carbon dioxide (CO2) emissions will decline by 1.6% in 2019 and by 1.0% in 2020. EIA expects emissions to fall in 2019 and in 2020 as forecasted temperatures return to near normal after a warm summer and cold winter in 2018, and because the share of electricity generated from natural gas and renewables is forecast to increase while the share generated from coal, which produces more CO2 emissions, is forecast to decrease. Energy-related CO2 emissions are sensitive to 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 $69.40 per barrel (b) on April 4, an increase of $4.33/b from March 1. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, increased by $6.30/b during the same period, settling at $62.10/b on April 4 (Figure 1).

Figure 1. Crude oil front-month futures prices

Crude oil prices increased for the third consecutive month in March and are trading near the middle of the range established over the previous year. Increasing crude oil supply disruptions and voluntary reductions in oil production from the Organization of the Petroleum Exporting Countries (OPEC) are among the recent price drivers in the crude oil market. Venezuela, in particular, has experienced several prolonged electric power failures throughout the country, which has directly resulted in reduced crude oil production and exports.

Economic indicators have recently sent mixed signals, increasing uncertainty regarding the future direction of oil prices. Recent manufacturing Purchasing Managers’ Indexes (PMIs) in several European countries are showing continued contraction in their manufacturing sectors. In the United States, the Treasury yield curve inverted in March for the first time since 2007, a phenomenon that indicates a combination of tight monetary policy, investment risk aversion, and lower long-term economic growth expectations. However, manufacturing PMI surveys in the United States and China increased in March, and the U.S. Federal Reserve indicated it is unlikely to increase interest rates for the remainder of 2019, all factors that could signify a reversal of some of the negative economic indicators and support economic growth, and consequently crude oil prices.

EIA estimates that global liquid fuels inventories declined by 0.7 million barrels per day (b/d) in March 2019 and by 0.5 million b/d for the first quarter of 2019, which would be the first
quarterly stock draw since fourth-quarter 2017. High compliance among a number of OPEC and non-OPEC countries subject to voluntary oil production reductions has contributed to falling petroleum inventories in the Organization for Economic Cooperation and Development (OECD). Saudi Arabia, the largest oil producer in OPEC, produced 9.85 million b/d in March, down by almost 0.9 million b/d from October. OECD petroleum inventories are now lower than the five-year (2014–18) average, which is considered a key metric among market participants for assessing global oil balances.

Withdrawals in global inventories are reflected in the increased backwardation in both Brent and WTI crude oil futures curves. Backwardation is the term used when near-term crude oil prices are higher than longer-dated ones. Both the Brent and WTI 1st–13th month spreads reached 6-month highs as of the first week of April, settling at $3.24/b and $1.92/b, respectively, on April 4 (Figure 2). EIA estimates that some of the largest global inventory withdrawals occurred in the United States and are likely contributing to the steepening of the WTI futures curve in particular. U.S. petroleum inventories declined by more than 10 million barrels per week three times in the first quarter of 2019—including two consecutive weeks in March—the most weekly declines of more than 10 million barrels for the first quarter of any year since 2007. A spill in the Houston Ship Channel at the end of March disrupted movement in the region and may have affected petroleum imports, exports, and inventory management in the final week of the month, but the large stock draws throughout the quarter largely reflect the fundamentals of an increasingly tight petroleum market.

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

**Options activity:** Recent trading activity in Brent crude oil options suggests that market participants increased their purchases of derivatives they use to manage the financial risk of continuing crude oil price increases. Trading volume for call options (derivatives that increase in value when crude oil prices increase) with strike prices between $70/b and $90/b on the June 2019 Brent crude oil contract increased by 68% in March compared with the daily average for January and February. Trading volume in these call options averaged 8,300 contracts per day in
March, with more than 25,000 contracts traded on March 20 and nearly 35,000 contracts traded on April 1 (Figure 3). In contrast, trading volume for Brent put options (derivatives that increase in value when crude oil prices decrease) with strike prices between $40/b and $60/b averaged less than 4,000 contracts per day in March, similar to the January and February average.

The recent divergence in call option trading volume versus put option trading volume indicates market participants sought to mitigate the risk of rising prices more than the risk of falling prices. The increase in market participants seeking upside price protection came amid significant inventory withdrawals in February and March and high levels of unplanned supply disruptions. As a result, market participants may be trading call options if inventory levels are insufficiently available at or near current prices. An important factor to consider, however, is that put options have generally been more expensive than call options recently, which could be a contributing factor for the lower trading volume on put options.

With respect to the June 2019 WTI futures contract, the probability that WTI prices will expire higher than $60/b increased from the beginning of March to the first week in April. On April 4, the market-derived probability of the June 2019 WTI futures contract expiring higher than $60/b was 62%, an increase of 29 percentage points from March 1 when the probability was almost 34% (Figure 4). Because Brent prices are higher than WTI prices, the probability of Brent futures contracts expiring higher than the same dollar thresholds is higher.
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) at New York Harbor settled at $1.94 per gallon (gal) on April 4, 2019, an increase of 21 cents/gal since March 1, 2019 (Figure 5). The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) increased by 11 cents/gal to settle at 29 cents/gal during the same period.

RBOB prices and crack spreads increased from unusually low levels in February, but gasoline inventories remain near the five-year (2014–18) average. EIA estimates that U.S. gasoline consumption (measured as product supplied) was 9 million barrels per day (b/d) for the first quarter of 2019, about equal to the first-quarter 2018 level. In addition, EIA estimates finished gasoline exports for the four weeks ending March 29 averaged 725,000 b/d, about 226,000 b/d less than in March 2018, according to that month’s Petroleum Supply Monthly. Lower gasoline prices in European and Asian markets, low international demand, and sufficient global gasoline supply may have contributed to reduced U.S. gasoline exports.
The RBOB–Brent crack spread **typically increases from February to March**, as the more expensive April RBOB contract for delivery of summer grade gasoline becomes the front month contract in March. In 2019, the RBOB–Brent crack spread increased by 27 cents/gal from February to March, higher than the five-year average increase of 21 cents/gal (**Figure 6**). Despite the large increase from February to March, the level of the March RBOB–Brent crack spread did not reach the five-year average of 41 cents/gal and, in fact, was the lowest March crack spread since 2008. EIA estimates that total gasoline inventories ended March at 236.1 million barrels, about 640,000 barrels more than the five-year average, a factor that could be contributing to crack spreads remaining lower than the five-year average.
Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price remained relatively steady, increasing by 1 cent from March 1 to settle at $2.01/gal on April 4. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) decreased by 9 cents/gal during the same period, settling at 36 cents/gal (Figure 7).

The average March ULSD–Brent crack spread of 39 cents/gal was 6 cents/gal higher than the five-year average, continuing a trend of strong distillate refining margins. Crack spreads declined 11 cents/gal during the month, however. This decrease was the largest within-month decline since February 2012, indicating how high the crack spread was in early 2019.

Gasoline-to-distillate prices: Although the RBOB–ULSD front-month price spread trended upward in March, which was in line with seasonal trends, it remained lower than the five-year range throughout the first quarter. The first quarter of 2019 had the lowest average first-quarter spread on record since RBOB began trading in late 2005. In March, RBOB sold at a 14-cent/gal average discount to ULSD, 21 cents less than the five-year average for the month. The average RBOB–ULSD front-month spread has been negative for 12 consecutive months (Figure 8). High gasoline inventories combined with factors specific to the distillate market may have contributed to gasoline futures prices being lower than distillate futures prices in March. Tonnage hauled by trucks, the largest users of diesel fuel in the United States, increased significantly in 2018 compared with 2017, and although truck tonnage growth has moderated in 2019, it has continued at relatively strong levels. Also, colder-than-normal weather lasted through March in parts of the United States, which likely led to higher heating oil consumption.
Natural Gas

Prices: The front-month natural gas futures contract for delivery at the Henry Hub settled at $2.64/million British thermal units (MMBtu) on April 4, a decrease of 22 cents/MMBtu from March 1 (Figure 9). Temperatures were significantly colder than normal at the beginning of March but remained close to normal for the remainder of the month. For the month, U.S. population-weighted heating degree days (HDD) averaged 9% higher than normal.

U.S. natural gas inventory: EIA estimates that working natural gas in underground storage declined to 1,161 billion cubic feet (Bcf) at the end of March (Figure 10). the lowest level since 2014. Inventory levels are generally lowest at the end of the winter season and before the natural gas storage injection season, which occurs from April to October. However, EIA forecasts that steadily rising natural gas production will contribute to inventory builds outpacing the five-
year average during the 2019 injection season, which will bring natural gas inventories to 3,673 Bcf at the end of October, 46 Bcf (1%) lower than the five-year (2014–18) average compared with inventory levels that were 492 Bcf (30%) lower than the five-year average at the end of March.

**Permian Basin spot prices:** Prices at the Waha Hub in West Texas, which is located near the Permian Basin, averaged $0.73/MMBtu in March, $2.22/MMBtu lower than the average Henry Hub spot price during the same period. *Multiple force majeures* have constrained pipeline capacity and reduced westbound flows out of the Permian, which has put downward pressure on prices. Prices at the Waha Hub turned negative during the last week of March, and they fell to a record low of -$4.63/MMBtu on April 3 (Figure 11). Negative prices indicate that some producers are willing to pay someone to take their natural gas to avoid the costs or penalties of storing, shutting in, or flaring their natural gas production or to lose revenue by reducing their liquids production. EIA expects additional natural gas pipeline capacity out of the Permian Basin to come online later in 2019, which should help to stabilize prices at the Waha Hub.
Natural gas implied volatility: The implied volatility of front-month natural gas futures prices, which is calculated using futures and options data, has remained lower than the seasonal five-year range since February, setting the lowest seasonal levels ever recorded for the natural gas front-month contract. Implied volatility of natural gas futures prices had previously been at record highs during the winter months of November and December 2018 because of concerns about low storage levels. Natural gas implied volatility averaged 21.3% in March, lower than the five-year average of 37.7% (Figure 12).

Low implied volatility indicates lower expectations by market participants that prices will change significantly in the near future. Record natural gas production levels and growth may be reducing concerns about supply availability, reducing the need for increased storage. However, low inventory levels combined with increasing natural gas use for electric power generation—particularly during periods of higher-than-normal temperatures in the summer—and growth in both liquefied natural gas and pipeline exports could result in higher price volatility during the summer months.
Notable forecast changes

- EIA forecasts Brent crude oil prices to average $65 per barrel (b) in 2019, up $2/b from last month’s STEO forecast. Global oil market balances for all of 2019 are slightly tighter than in the March STEO, with forecast inventory builds averaging 0.1 million barrels per day (b/d), slightly less than previously forecast. Given the slightly tighter balances and recent crude oil spot prices increases, EIA now forecasts Brent prices to average $69/b in the second quarter of 2019, which is $5/b higher than in the March STEO. However, EIA expects global inventories to build by 0.4 million b/d next year, contributing to a Brent price forecast of $62/b for 2020, which is unchanged from last month’s STEO.

- EIA forecast U.S. lower 48 onshore crude oil production will average 10.5 million b/d in 2020, which is more than 0.2 million b/d above the 2020 forecast in the March STEO. The higher crude oil production is the result of both higher forecast prices in 2019 that have a lagged effect on production and of data updates that increased drilling levels in the Permian Basin. Additionally, EIA forecasts Gulf of Mexico offshore crude oil production will average 2.1 million b/d in 2020, which is almost 0.2 million b/d below the 2020 forecast in the March STEO. The lower forecast is the result of model adjustments that updated decline rate forecasts. The net effect of these changes is that forecast total U.S. crude oil production is 0.1 million b/d more than in the March STEO.

- EIA expects natural gas consumption to increase by 2.5 billion cubic feet per day (Bcf/d) (3.0%) in 2019, up from expected growth of 1.5 Bcf/d (1.8%) in the March STEO. The forecast largely reflects higher consumption in the first quarter of 2019, as a result of estimated heating degree days for March that were higher than previously forecast. The colder-than-expected temperatures in March raised consumption of natural gas for space heating use in the residential and commercial sectors. In addition, EIA slightly
raised its forecast growth of natural gas consumption in the industrial and electric power sectors for 2019.

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