



Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- Brent crude oil spot prices averaged \$81 per barrel (b) in October, up \$2/b from September. Despite the increase in monthly average prices, Brent spot prices declined from \$85/b on October 1 to \$75/b on October 31.
- EIA expects Brent spot prices will average \$72 in 2019 and that West Texas Intermediate (WTI) crude oil prices will average about \$7/b lower than Brent prices next year. NYMEX WTI futures and options contract values for February 2019 delivery that traded during the five-day period ending November 1, 2018, suggest a range of \$53/b to \$83/b encompasses the market expectation for February WTI prices at the 95% confidence level.
- EIA estimates that U.S. crude oil production averaged 11.4 million barrels per day (b/d) in October, down slightly from September levels because of hurricane-related outages in the Gulf of Mexico. EIA expects that U.S. crude oil production will average 10.9 million b/d in 2018, up from 9.4 million b/d in 2017, and will average 12.1 million b/d in 2019.
- U.S. regular gasoline retail prices averaged \$2.86 per gallon (gal) in October, an increase of 2 cents/gal from the average in September, marking the sixth consecutive month that U.S. prices averaged between \$2.85/gal and \$2.90/gal. EIA forecasts the average U.S. regular gasoline retail price will fall to \$2.57/gal in December 2018. EIA forecasts that regular gasoline retail prices will average \$2.75/gal in 2018 and in 2019.
- EIA forecasts total global liquid fuels inventories will remain flat in 2018, followed by an increase of 0.6 million b/d in 2019.

Natural gas

- EIA estimates dry natural gas production in the United States averaged 86.9 billion cubic feet per day (Bcf/d) in October, up 0.7 Bcf/d from September. EIA forecasts that dry natural gas production will average 83.2 Bcf/d in 2018, up 8.5 Bcf/d from 2017. Both the level and growth of natural gas production in 2018 would establish new records. EIA expects natural gas production will continue to rise in 2019 to an average of 89.6 Bcf/d.

- EIA estimates that U.S. natural gas storage inventories were 3.2 trillion cubic feet (Tcf) at the end of October. This level was 16% lower than both the 2017 end-of-October level and the five-year (2013–17) average for the end of October and was the lowest end-of-October level since 2005.
- Despite low storage levels, EIA expects strong growth in U.S. natural gas production to put downward pressure on prices in 2019. EIA expects Henry Hub natural gas spot prices to average \$2.98/million British thermal units (MMBtu) in 2019, down 4 cents from the 2018 average and down from a forecast average price of \$3.25/MMBtu in the fourth quarter of 2018. NYMEX futures and options contract values for February 2019 delivery traded during the five-day period ending November 1, 2018, suggest a range of \$2.06/MMBtu to \$4.94/MMBtu encompasses the market expectation for February Henry Hub natural gas prices at the 95% confidence level.

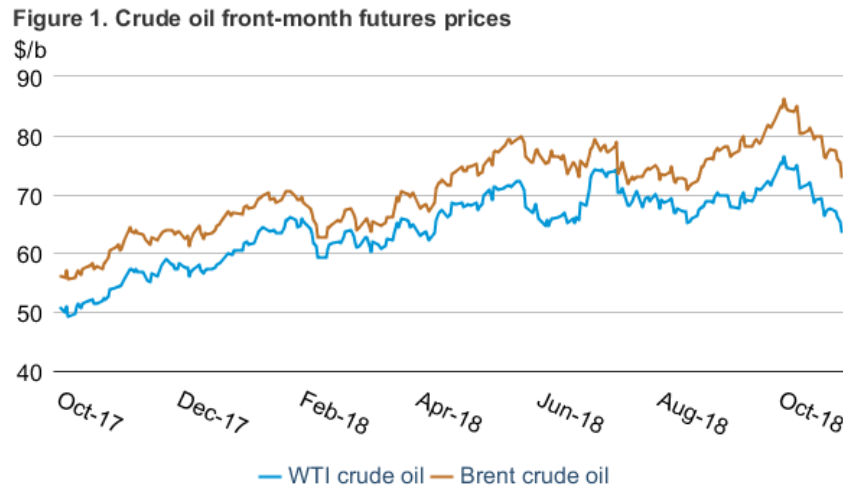
Electricity, coal, renewables, and emissions

- 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 2018 and to 36% in 2019. EIA forecasts that the electricity generation share from coal will average 28% in 2018 and 26% in 2019, down from 30% in 2017. The nuclear share of generation was 20% in 2017 and EIA forecasts that it will average about 19% in 2018 and in 2019. Wind, solar, and other nonhydropower renewables provided slightly less than 10% of electricity generation in 2017. 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 in 2019.
- EIA expects total U.S. solar generation will rise from 212,000 Megawatt hours per day (MWh/d) in 2017 to 268,000 MWh/d in 2018 (an increase of 27%) and to 303,000 MWh/d in 2019 (an increase of 13%). In recent years, the industry has seen a shift from [fixed-tilt solar PV systems to tracking systems](#). Although tracking systems are more expensive than fixed-tilt systems, revenue from the additional electricity generated by following the path of the sun across the sky often exceeds the increased cost.
- U.S. coal exports for the first eight months of 2018 totaled 78 million short tons (MMst), compared with 60 MMst exported during the same period in 2017. EIA expects coal exports to total 110 MMst in 2018 and 100 MMst in 2019, and EIA expects coal production will total 756 MMst in 2018 (down 2% from 2017) and 729 MMst in 2019 (down 4% from 2018).
- After declining by 0.8% in 2017, EIA forecasts that U.S. energy-related carbon dioxide (CO₂) emissions will rise by 2.5% in 2018. This increase largely reflects higher natural gas consumption in 2018 because of a colder winter and a warmer summer than in 2017. EIA expects emissions to decline by 1.3% in 2019 because 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 \$72.89 per barrel (b) on November 1, a decrease of \$12.09/b from October 1. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, decreased by \$11.61/b during the same period, settling at \$63.69/b on November 1 (**Figure 1**).



 CME Group and Intercontinental Exchange, as compiled by Bloomberg L.P.

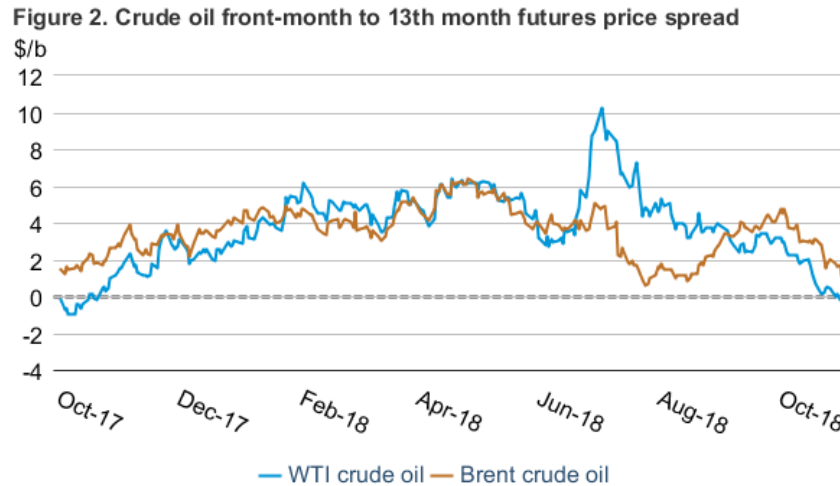
Crude oil prices declined from the end of September to the end of October at a faster percentage rate than in any month since July 2016. Prices approached four-year highs in early October given the uncertainty about the amount of Iranian crude oil supply coming off the market and whether or not other producers could make up for the shortfall. However, increased indications of a global economic slowdown, as well as higher than expected global petroleum supply, contributed to rapid price declines later in the month.

Similar to early 2018, financial markets exhibited significant price volatility in October, contributing to selloffs in risk assets such as equities and commodities. Chinese economic growth was lower than expectations, and leading economic indicators for several countries have slowed, leading to market concerns over the pace of oil demand growth in the coming months. Continued depreciation in emerging market countries' currencies—which makes the cost of crude oil imports more expensive—have also put downward pressure on the petroleum demand outlook. EIA is forecasting global petroleum and other liquid fuels consumption growth to average 1.4 million barrels per day (b/d) in 2019, which is 0.1 million b/d lower than forecast in the October STEO.

In addition to lower expectations for oil demand, higher oil supply estimates for October led to a large increase in global oil inventories. U.S. crude oil production increased at a faster rate than EIA previously anticipated. [Crude oil production reached a new monthly record](#) of 11.3 million

b/d in August 2018, according to EIA’s latest *Petroleum Supply Monthly*, which was 0.3 million b/d higher than EIA expected in the October STEO. EIA now estimates that October U.S. crude oil production averaged 11.4 million b/d, compared with a forecast of 11.0 million b/d in the previous STEO. Crude oil production in Saudi Arabia and Russia reached some of the highest levels in history last month, helping to offset the months of supply losses from Iran and Venezuela. Venezuela’s crude oil production declines have slowed, and estimates of its crude oil exports have increased as its domestic refining system is operating at low utilization rates. Libyan production has resumed at a faster than expected rate because of improved security, and Libya has produced more than 1 million b/d for two consecutive months.

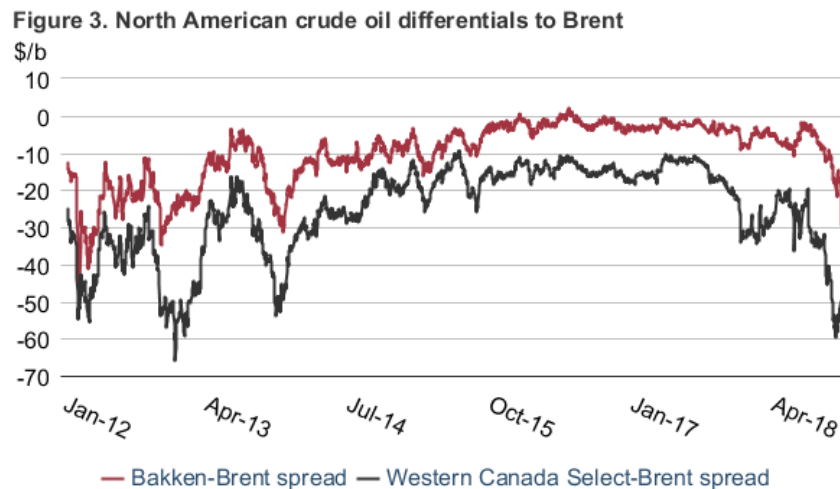
These supply developments have occurred when global refinery maintenance is typically at its highest for the year, contributing to an estimated global petroleum inventory build of 2.0 million b/d in October. The loosening global petroleum balance is also evident in both the Brent and WTI futures curves (**Figure 2**). The Brent and WTI 1st –13th futures price spread declined \$3.60/b and \$3.34/b, since October 1, respectively, settling at \$1.13/b and -18 cents/b on November 1, respectively. Refinery utilization in the United States in October averaged 89% and commercial crude oil inventories increased by 22 million barrels from the end of September, the largest monthly increase since January 2017. The WTI futures curve is now exhibiting slight contango (when near-term futures prices are lower than longer-dated ones), and the entire curve has flattened considerably in recent months. The rapid flattening of the futures curve reflects the recent petroleum oversupply and lower demand.



 CME Group and Intercontinental Exchange, as compiled by Bloomberg L.P.

Even though total U.S. refinery utilization was about average for this time of year, it was particularly low in the Midwest, *Petroleum Administration for Defense District* (PADD) 2. Four-week average refinery utilization for the week ending **October 26** was **73%**, which, if confirmed in EIA’s monthly data, would be the **lowest utilization** rate in the region for any month in EIA data back to 1985. Several large refineries planned month-long **maintenance**, which lowered the demand for and the prices of major crude oils that are typically processed in these refineries,

including Western Canada Select (WCS) and Bakken. In October, the WCS–Brent spread traded at the lowest level since 2012, settling at $-\$53.88/\text{b}$ on November 1, and the Bakken–Brent spread hit its lowest level since 2013, settling at $-\$29.38/\text{b}$ on November 1 (**Figure 3**). Transportation constraints in Western Canada have resulted in more crude oil that must be delivered by rail, a more expensive option than pipelines, which further affects the crude oil discounts at a time of low refinery demand. In the Bakken region, available pipeline capacity could begin to face constraints as production in the region is estimated to approach 1.4 million b/d in **November**, an all-time high.



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Correlations: Front-month Brent crude oil’s rolling 60-day correlation between both the daily percentage changes of the S&P 500 and Brent implied volatility increased in October. The correlation between Brent prices and Brent implied volatility tends to be negative and typically turns positive during periods of supply disruptions. Disruptions can occur quickly, and given the price sensitivity of oil to relatively small production outages, the resulting price movements tend to be volatile. The 60-day correlation represents about three months of trading activity, and the increased correlation between the two suggests that disruptions in supply from Venezuela and Iran have contributed to higher prices during the past quarter. Alternatively, Brent’s correlation with the S&P 500 index has been positively correlated for all of 2018 (**Figure 4**). Because underlying economic factors can drive both equity prices and crude oil demand, a positive correlation between these two assets suggests trends in economic growth are influencing both sets of prices. The recent volatility and price declines in equity markets could be contributing to some of the recent downward price pressure in crude oil markets.

Figure 4. Rolling 60-day correlations with Brent crude oil prices

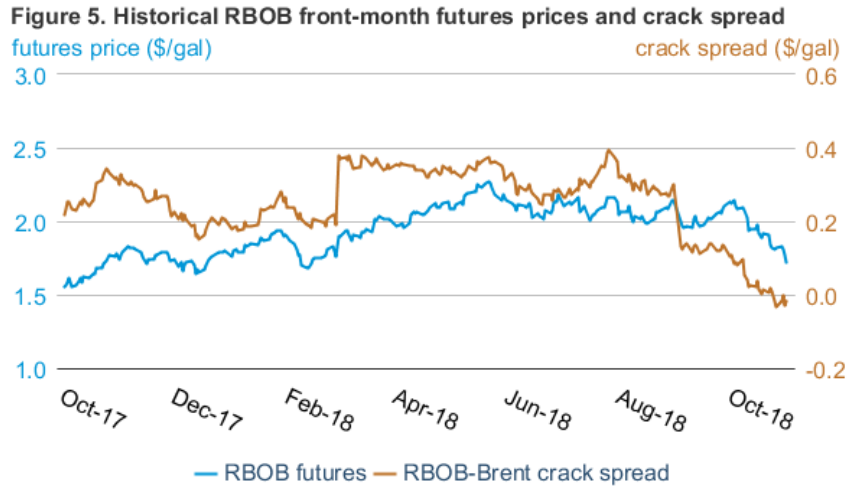


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Petroleum products

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) for delivery in New York Harbor settled at \$1.72 per gallon (gal) on November 1 (**Figure 5**), a decrease of 41 cents/gal from October 1. The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) decreased by 12 cents/gal to settle at -2 cents/gal during the same period.

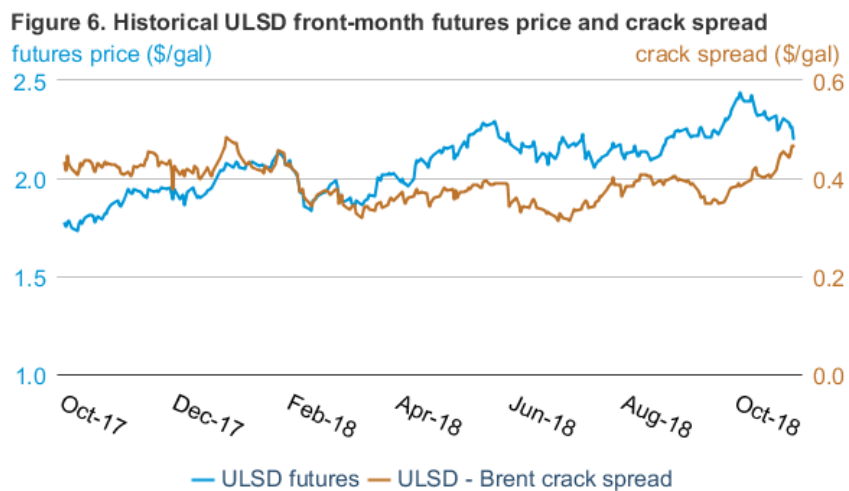
The RBOB–Brent crack spread turned negative in late October for the first time in five years. Flat or declining gasoline consumption for much of 2018 has contributed to lower crack spreads and increased inventories, settling at the top of the five-year (2013–17) range in October. After a slight decline in U.S. gasoline inventories from August through September, gasoline stocks declined by 11.2 million barrels in October but are estimated to remain 4% higher than the five-year average. STEO estimates that U.S. gasoline consumption declined by 1.3% compared with October 2017, the sixth month this year with year-over-year declines.



eia CME Group, as compiled by Bloomberg L.P., RBOB=reformulated blendstock for oxygenate blending

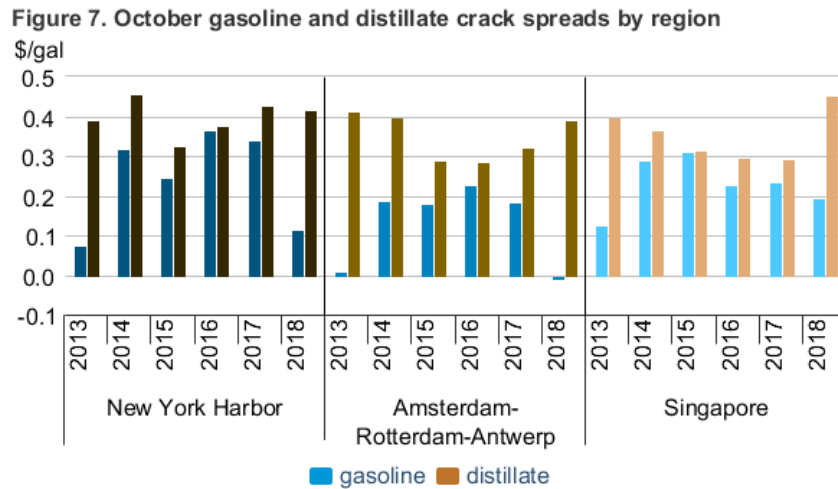
Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price for delivery in New York Harbor settled at \$2.20/gal on November 1 (**Figure 6**), a decrease of 21 cents/gal from October 1. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) increased by 8 cents/gal to settle at 47 cents/gal during the same period.

Distillate inventories declined from September to October, which was the first monthly decline since May. U.S. refiners produced a record level of distillate from June through September 2018, which helped to rebuild inventory levels after they fell in May to the lowest level in four years. However, distillate production declined in October, and consumption combined with exports increased, leading to the September to October decline in inventories. ULSD crack spreads were also supported by a tight international market for distillate fuel.



eia CME Group, as compiled by Bloomberg L.P., ULSD=ultra-low sulfur diesel

Global crack spreads: Gasoline and distillate crack spreads in October showed some of the widest disparities in several years across major refining regions. Gasoline crack spreads in New York Harbor, the Amsterdam-Rotterdam-Antwerp (ARA) hub in Europe, and Singapore traded at the lowest levels in years. In contrast, distillate crack spreads in all regions remained at relatively high levels (**Figure 7**).



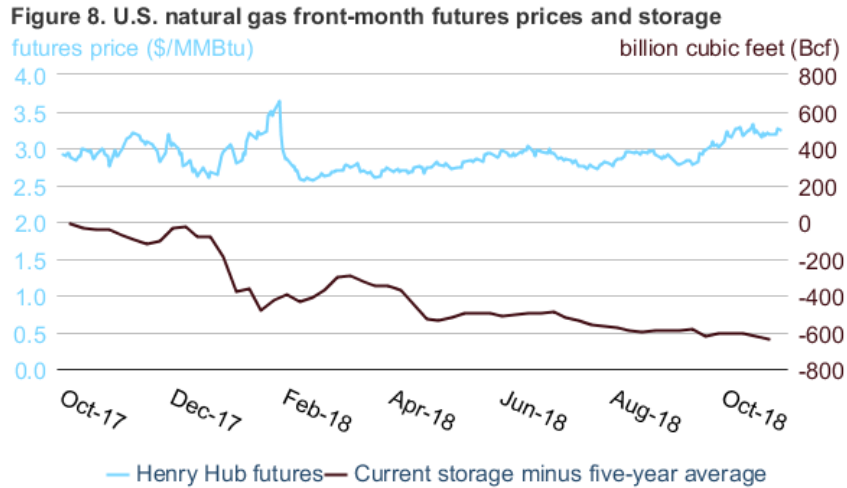
eia IntercontinentalExchange, CME Group, Bloomberg L.P.

Retail gasoline prices in some emerging market countries reached all-time highs in September and October, partially because of higher crude oil prices, but also because currency depreciation with the U.S. dollar in 2018 has made the cost of imported petroleum effectively higher in many countries. The combined effects could be contributing to a slowdown in demand growth globally and to lower gasoline crack spreads because gasoline consumption tends to be more price sensitive than distillate consumption. On the other hand, distillate margins in October remained between 39 and 46 cents/gal in the three regions, which is higher than their five-year averages. In Asia, refinery outages in Japan as well as low inventories in Singapore contributed to the highest distillate crack spreads in October since 2012. Inventories in the ARA region and in the United States also remain lower than their respective five-year averages. Given that certain regions typically build heating oil inventories ahead of winter, higher crack spreads likely reflect a call on refiners to increase production as a result of the current low stock levels.

Natural Gas

Prices: The front-month natural gas futures contract for delivery at the Henry Hub settled at \$3.24/million British thermal units (MMBtu) on November 1, 2018, an increase of 14 cents/MMBtu from October 1 (**Figure 8**). Several factors have contributed to higher Henry Hub prices. Warmer-than-normal temperatures persisted into early October, helping to maintain high power demand for natural gas in some parts of the country, while an early round of colder temperatures in other parts of the country resulted in increased residential and commercial heating demand. In addition, [nuclear outages](#) further contributed to demand for natural gas in

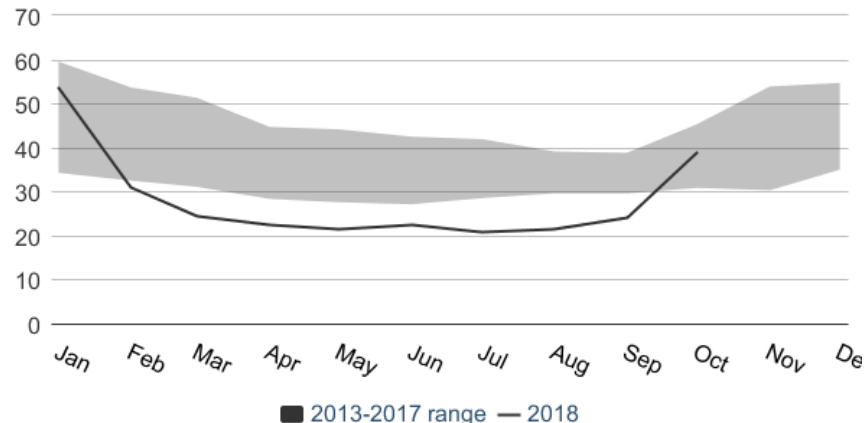
power generation. The higher demand helped to **keep storage levels low** heading into winter, which put upward pressure on prices. Working gas in underground storage remained 638 billion cubic feet (Bcf) (16.9%) lower than the five-year (2013–17) average for the week ending October 26 and 623 Bcf (16.5%) lower than last year at this time.



 U.S. Energy Information Administration, CME Group, as compiled by Bloomberg L.P.

Implied volatility: Concerns about low storage levels as winter approaches contributed to an increase in volatility in natural gas futures. Natural gas implied volatility averaged 38.7% in October, near the five-year average (**Figure 9**). In February 2018, implied volatility fell lower than the five-year range, and, during the summer, it reached the lowest levels ever recorded for the natural gas front-month contract. Record natural gas production growth and production levels helped to reduce concerns about supply availability and kept prices in a narrow trading range. Record natural gas demand for power generation and increased exports, however, countered some of the production growth and prevented inventories from reducing the storage deficit from last winter. Volatility re-emerged as the end of the injection period approached with inventories still lower than historical levels.

Figure 9. Natural gas implied volatility, monthly averages
annualized %



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Notable forecast changes

- U.S. crude oil production is rising at a faster rate than EIA previously anticipated. [Crude oil production reached a new monthly record](#) of 11.3 million barrels per day (b/d) in August 2018, according to EIA’s latest [Petroleum Supply Monthly](#), and surpassed 11 million b/d for the first time. August 2018 crude oil production was 290,000 b/d higher than expected in the October STEO. This higher level of production raised the baseline for EIA’s forecast for 2019 crude oil production, and EIA now expects U.S. crude oil production to average 12.1 million b/d in 2019, compared with a forecast of 11.8 million b/d in the October STEO.
- EIA forecasts Brent crude oil prices to average \$72 per barrel (b) in 2019, which is \$3/b lower than previously forecast. EIA expects West Texas Intermediate crude oil prices to average \$65/b in 2019, which is \$5/b lower than previously forecast. The lower crude oil price forecasts are partly the result of higher expected crude oil production in the United States in the second half of 2018 and in 2019, which is expected to contribute to growth in global oil inventory and put downward pressure on crude oil prices.
- Canadian oil production in July and August was higher than previously estimated, as updated analysis indicates that crude oil volumes EIA previously assumed were disrupted were online during those months. As a result, Canada’s total liquid fuels production for the third quarter of 2018 is more than 0.3 million b/d higher than estimated in the October STEO.
- For more information, see the [detailed table of STEO forecast changes](#).

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