



Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- Brent crude oil spot prices averaged \$65 per barrel (b) in November, down \$16/b from October, the largest monthly average price decline since December 2014.
- EIA expects Brent spot prices will average \$61 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 March 2019 delivery that traded during the five-day period ending December 6, 2018, suggest a range of \$36/b to \$77/b encompasses the market expectation for March WTI prices at the 95% confidence level.
- EIA estimates that U.S. crude oil production averaged 11.5 million barrels per day (b/d) in November, up 150,000 b/d from October levels because of platforms resuming normal operations after hurricane-related outages in October. 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.
- EIA forecasts total global liquid fuels inventories will increase by about 0.3 million b/d in 2018 and by 0.2 million b/d in 2019. Global liquid fuels production is forecast to increase by 1.4 million b/d in 2019. EIA expects production growth in the United States to be partially offset by declining production elsewhere, notably in the Organization of the Petroleum Exporting Countries (OPEC), where EIA forecasts that liquid fuels production will decline by 0.9 million b/d in 2019. EIA expects global liquid fuels consumption to increase by 1.5 million b/d in 2019, with growth largely coming from China, the United States, and India.

Natural gas

- The Henry Hub natural gas spot price averaged \$4.15/million British thermal units (MMBtu) in November, up \$0.87/MMBtu from the October average. Cold temperatures and low inventory levels contributed to the [increase in price](#). Despite low inventory 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 \$3.11/MMBtu in 2019, down 6 cents from the 2018 average and down from a forecast average price of \$3.88/MMBtu in the fourth quarter of 2018. NYMEX futures and options contract values for March 2019 delivery traded during the five-day period

ending December 6, 2018, suggest a range of \$1.85/MMBtu to \$8.37/MMBtu encompasses the market expectation for March Henry Hub natural gas prices at the 95% confidence level.

- EIA estimates that U.S. natural gas storage inventories were 3.0 trillion cubic feet (Tcf) at the end of November, which was 19% lower than the five-year (2013–17) average for the end of November.
- EIA forecasts that dry natural gas production will average 83.3 billion cubic feet per day (Bcf/d) in 2018, up 8.5 Bcf/d from 2017. Both the level and volume 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 90.0 Bcf/d.

Electricity, coal, renewables, and emissions

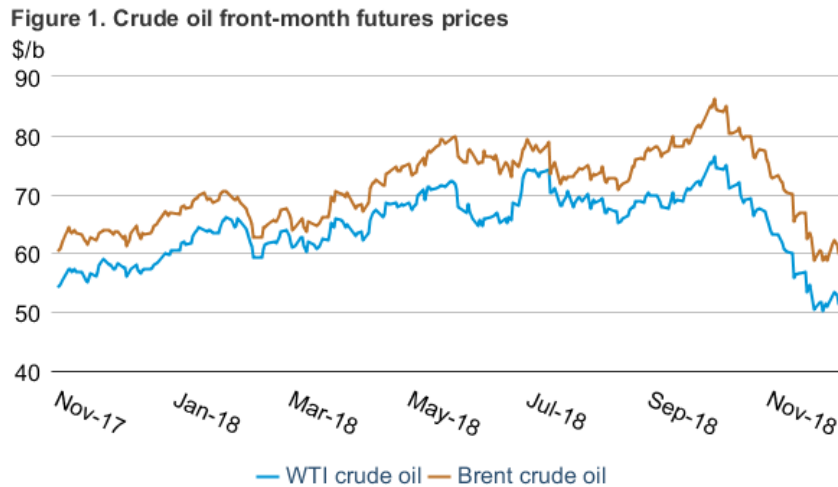
- EIA expects the share of U.S. total utility-scale electricity generation from natural gas-fired power plants to rise from 32% in 2017 to 35% in 2018 and in 2019. EIA forecasts that the electricity generation share from coal will average 28% in 2018 and 26% in 2019, down from 30% in 2017. The nuclear 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 about 10% of electricity generation in 2017. EIA expects them to provide 10% in 2018 and 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 average 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 nine months of 2018 totaled 87 million short tons (MMst), compared with 69 MMst exported during the same period in 2017. In July and September 2018, exports of steam coal (used for generating electricity) exceeded exports of metallurgical coal (used for producing steel). Before July 2018, the last month that this occurred was in February 2015. EIA expects coal exports to total 113 MMst in 2018 and 102 MMst in 2019. EIA expects U.S. coal production will total 762 MMst in 2018 (down 2% from 2017) and 742 MMst in 2019 (down 3% from 2018).
- After declining by 0.8% in 2017, EIA forecasts that U.S. energy-related carbon dioxide (CO₂) emissions will rise by 3.0% in 2018. This increase largely reflects more natural gas consumption in 2018 for heating during a colder winter and for electric generation to support more cooling during a warmer summer than in 2017. EIA expects emissions to decline by 1.2% in 2019 because it forecasts that temperatures will return to near

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 \$60.06 per barrel (b) on December 6, a decrease of \$12.83/b from November 1. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, decreased by \$12.20/b during the same period, settling at \$51.49/b on December 6 (**Figure 1**).



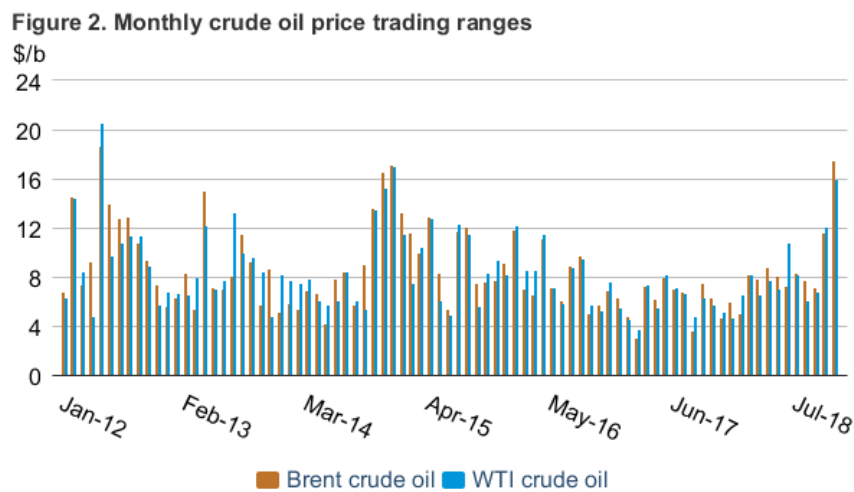
 CME Group and Intercontinental Exchange, as compiled by Bloomberg L.P.

Crude oil prices declined significantly in November but increased during the first week in December amid heightened price volatility. WTI prices experienced three [rare and large price declines](#) (each between -6% and -8%) within the span of 10 days in the middle of November, and WTI prices were down by more than 33% from the four-year highs set in early October by the end of November. Several factors contributed to falling prices. Crude oil production from the world's three largest producers—the United States, Russia, and Saudi Arabia—were at or near record levels in November. Implementation of sanctions on Iran began on November 5, but the United States granted waivers for some of Iran's largest customers to continue importing limited volumes of crude oil for six months. In addition, concerns about the pace of global economic growth in coming months have led to related concerns about the pace of oil demand growth.

On December 7, the Organization of the Petroleum Exporting Countries (OPEC) and several non-OPEC countries announced a production reduction of 1.2 million barrels per day (b/d) from their October production levels for six months beginning in January 2019. The cuts were in response to increasing evidence that oil markets could become oversupplied in 2019. This potential oversupply was reflected in recent price declines. EIA is revising its 2019 price forecasts for Brent and WTI to \$61/b and \$54/b, respectively, which are both \$11/b lower than forecast in

the November STEO. In last month's STEO, EIA expected downward price pressures could materialize by the middle of 2019 to reduce global inventory builds. EIA expects that the magnitude of the recent price declines combined with the OPEC production cuts will bring 2019 supply and demand numbers largely into balance, which EIA forecasts will keep prices near current levels in the coming months.

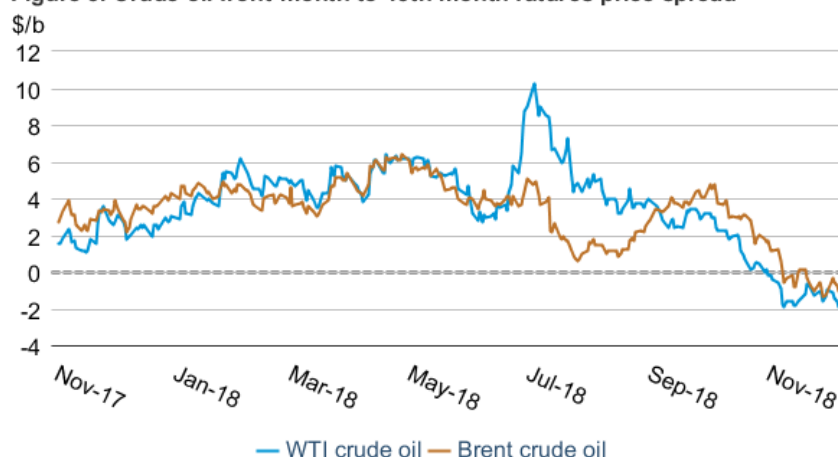
The realized volatility in crude oil prices last month, as measured by the difference between the monthly high and low prices (trading range), was the largest since 2012 for Brent and the largest for WTI since 2014 (**Figure 2**). The two crude oils traded in a \$17.49/b and \$15.98/b range, respectively, during the month. The implied volatility of Brent and WTI, calculated from options prices, more than doubled during the month, reflecting the market's heightened uncertainty regarding future oil supply and demand.



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

The crude oil 1st–13th futures contract price spreads for Brent and WTI declined to the lowest levels since the third quarter of 2017, settling at $-\$1.02/b$ and $-\$1.95/b$, respectively, on December 6 (**Figure 3**). Both crude oils are in contango (when near-term prices are lower than longer-dated ones), reflecting recent increases in global oil inventories. Some recent supply increases in Saudi Arabia and the United States have been larger than expected and likely contributed to an estimated global liquid fuels inventory build of 1.3 million b/d during November.

Figure 3. Crude oil front-month to 13th month futures price spread

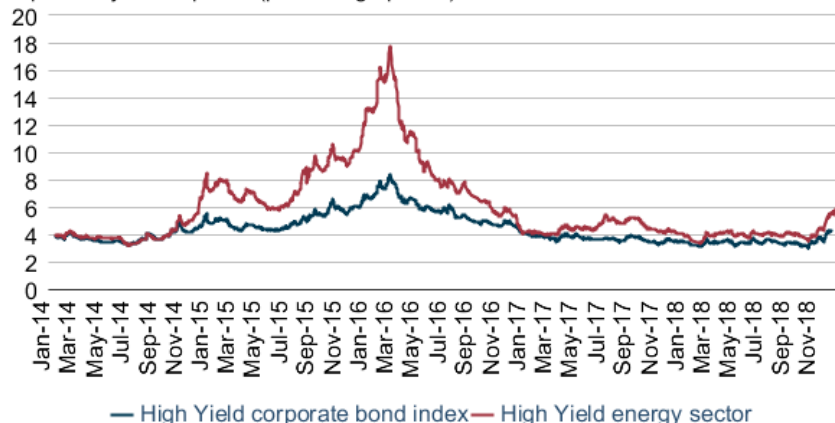


 CME Group and Intercontinental Exchange, as compiled by Bloomberg L.P.

Third-party ship tracking data suggest some of the inventories have recently built in [floating storage](#). Floating storage is typically the most expensive way to store oil, only occurring in markets where producers and traders have more difficulty finding customers or accessing available onshore storage. However, the increase in floating storage may not entirely be because of the recent market weakness. The increase also likely reflects, in part, the effects of U.S. sanctions on Iran, limiting the country's ability to sell crude oil openly. EIA estimates that Iranian crude oil exports have declined at a faster rate than their total crude oil production, indicating their oil is being stored. A similar phenomenon [occurred](#) during the 2012 sanctions.

Energy high yield bonds: Yields for high yield bonds—those from companies with a rating lower than investment grade from a credit rating agency—for energy and nonenergy companies increased at the same time as the higher market volatility in November. An increase in bond yields, measured by a higher [option adjusted spread](#) to U.S. government bonds, reflects higher default risk and could increase the cost of borrowing for some companies. The Bloomberg Barclays high yield corporate bond index increased by 0.7 percentage points from November 1, settling at 4.4% on December 6. For companies specific to the energy sector, the option adjusted spread increased 1.3 percentage points during the same period, settling at 5.8% on December 6 (**Figure 4**). Even though the energy bonds' option adjusted spread remains significantly lower than the highs reached in early 2016 when crude oil prices fell to \$26/b, the increase during the past two months has brought them to the highest level in two years. The decline in oil prices increases the default risk of some oil producers' ability to repay principal and interest.

Figure 4. Bloomberg Barclays high-yield corporate bond index option adjusted spread (percentage points)

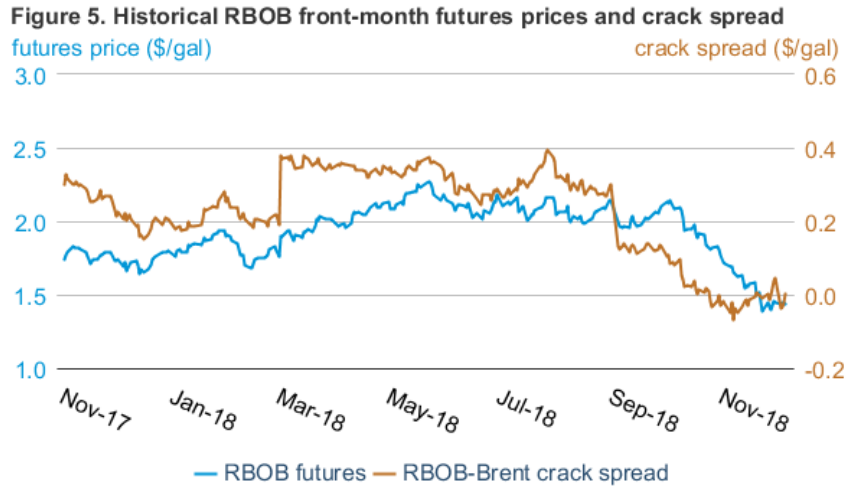


eia Bloomberg L.P., Barclays

Petroleum products

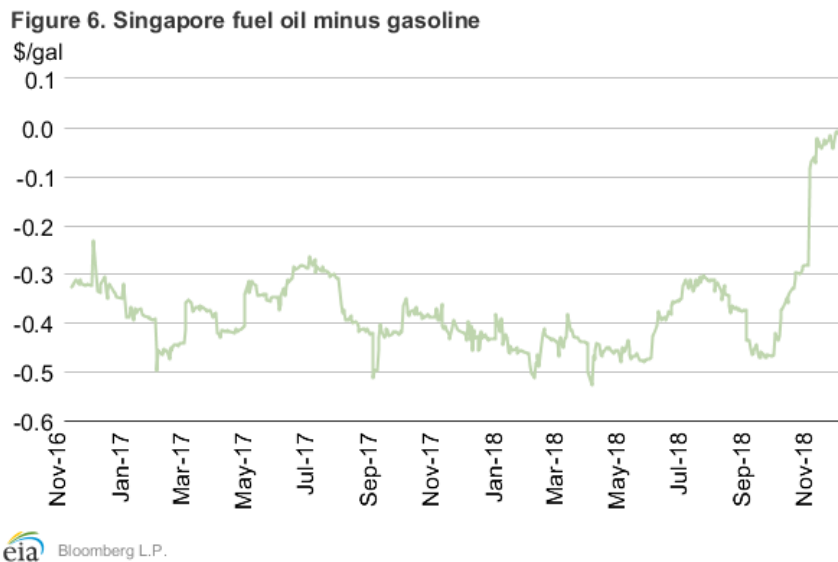
Gasoline prices: The front-month futures price of reformulated blendstock for oxygenate blending (RBOB, the petroleum component of gasoline used in many parts of the country) settled at \$1.43 per gallon (gal) on December 6 (**Figure 5**), a decrease of 28 cents/gal from November 1. The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) increased by 2 cents/gal to settle at 0 cents/gal during the same period.

The RBOB–Brent crack spread was negative for 18 consecutive days in late October through mid-November, the longest such stretch since 2011. According to EIA’s latest [Petroleum Supply Monthly](#), U.S. gasoline consumption declined by 260,000 barrels per day (b/d) year-over-year in September. STEO estimates that U.S. gasoline consumption continued to decline year-over-year for the fourth consecutive month in November. In addition, low [international demand and increased global gasoline supply](#) likely contributed to reduced U.S. gasoline exports. EIA estimates U.S. gasoline exports to have declined year-over-year by 289,000 b/d in November, based on the four-week average through November 30.



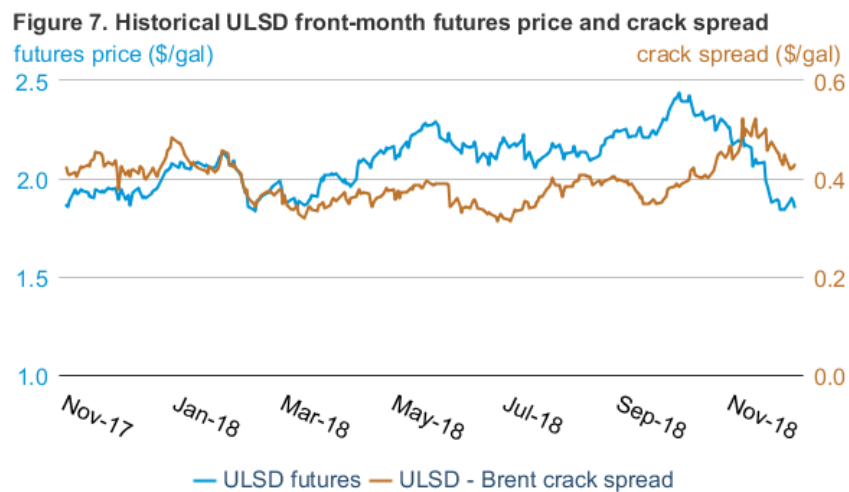
eia CME Group, as compiled by Bloomberg L.P., RBOB=reformulated blendstock for oxygenate blending

Singapore gasoline and fuel oil: Unique market dynamics in Singapore brought wholesale fuel oil prices near parity with gasoline prices for the first time based on available data. The Singapore fuel oil–gasoline spread increased to just under 0 cents/gal on December 4 before settling at -6 cents/gal on December 6 (**Figure 6**). The Asian gasoline market received several new sources of supply in 2018. The startup of a refinery in Vietnam has reduced gasoline imports into the country, and new Chinese refinery projects have contributed to increased gasoline exports. The Chinese government recently granted more export quotas—the fourth announcement this year—to state-owned refiners, which could contribute to additional regional supply. In contrast, the fuel oil market has been comparatively strong. Inventories in Singapore have remained lower than their five-year (2013–17) minimum level for most of the second-half of 2018. Russian fuel oil production, which has traditionally been a major supplier to Asian customers, also continues to decline because the country has [upgraded its refineries](#).



Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price for delivery in New York Harbor settled at \$1.86/gal on December 6 (**Figure 7**), a decrease of 34 cents/gal from November 1. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) decreased by 4 cents/gal to settle at 43 cents/gal during the same period.

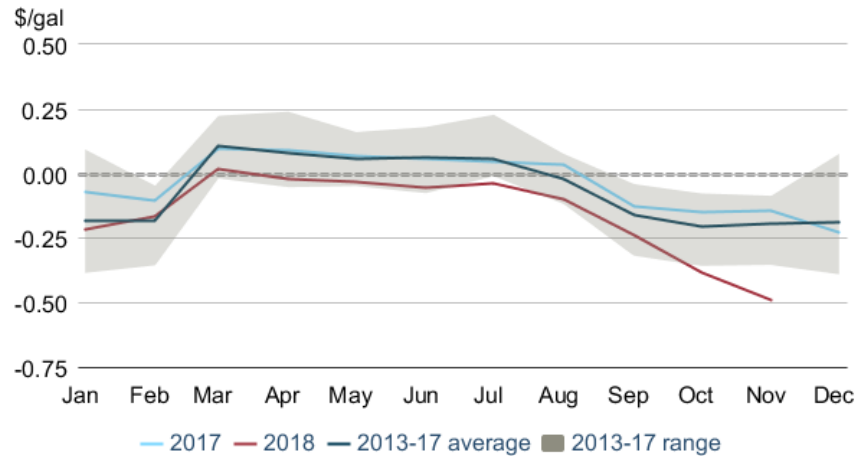
The ULSD–Brent crack spread approached a four-year high in mid-November of 52 cents/gal and averaged near the top of its five-year range in November. U.S. distillate inventories remain 10% lower than the five-year average, and the increasingly tight market was met by colder than normal weather. Temperatures in November were the coldest for the month in four years, and STEO estimates U.S. distillate consumption was the [highest for the month of November on record](#), averaging 4.2 million b/d.



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

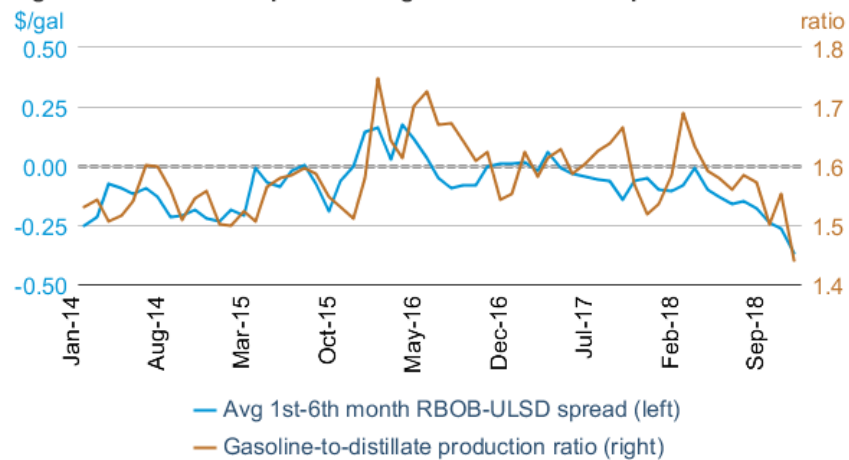
Gasoline-to-distillate production ratios and prices: The recent declines in gasoline prices relative to distillate prices are also reflected in the futures curves for both products, which could have an effect on the relative production of each fuel in the United States. The RBOB–ULSD front-month spread averaged -49 cents/gal in November, the lowest in 10 years (**Figure 8**). Averaging the spread between front-month contract prices and those six months in the future (to account for the seasonality in the RBOB futures curve), the RBOB–ULSD price spread declined to a monthly average of -37 cents/gal in November (**Figure 9**). The relative prices of these two products could have an effect on refinery operations and ultimately the amount of production of each fuel. Absent significant investments in new equipment, refiners can make small adjustments to their crude slate and operations to shift their yields of gasoline or distillate. When the RBOB–ULSD spread averaged 12 cents/gal in the first quarter of 2016, refiners adjusted operations to increase the relative production of gasoline to distillate. Now that the spread has reached significantly lower levels, STEO estimates the gasoline-to-distillate production ratio declined to less than 1.5 in November. The last time the ratio fell below 1.5 was in January 2015.

Figure 8. Monthly average RBOB-ULSD spread



eia CME Group, as compiled by Bloomberg L.P.

Figure 9. RBOB-ULSD spreads and gasoline-to-distillate production ratio

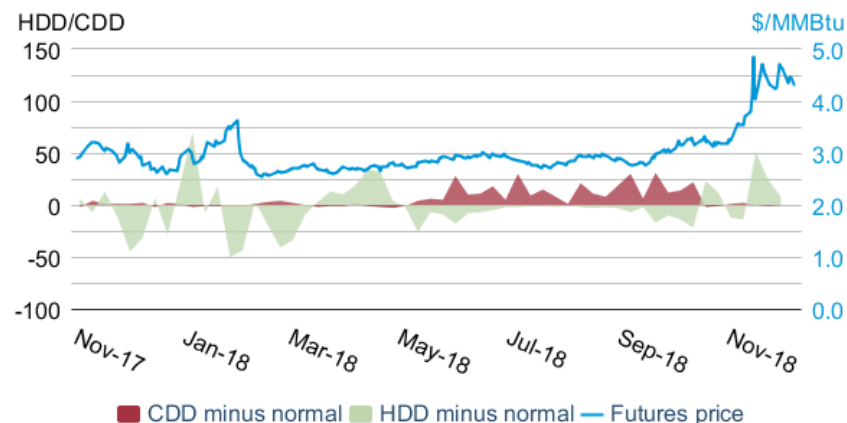


eia U.S. Energy Information Administration; CME Group, as compiled by Bloomberg, L.P.

Natural Gas

Prices: The front-month natural gas futures contract for delivery at the Henry Hub settled at \$4.33/million British thermal units (MMBtu) on December 6, an increase of \$1.09/MMBtu from November 1 (**Figure 10**). Prices rose substantially in the first half of November because of high natural gas demand for heating and power generation. Cold weather across the Lower 48 states in mid-November increased natural gas demand in the residential and commercial sectors. Heating degree days (HDD) reached 14% above normal, the coldest November in the United States in four years. The higher demand contributed to several early-season withdrawals, which kept storage levels low heading into winter and put upward pressure on prices. The deficit of working gas in underground storage widened month-over-month and stands at 0.7 trillion cubic feet (Tcf) lower than the five-year average for the end of November.

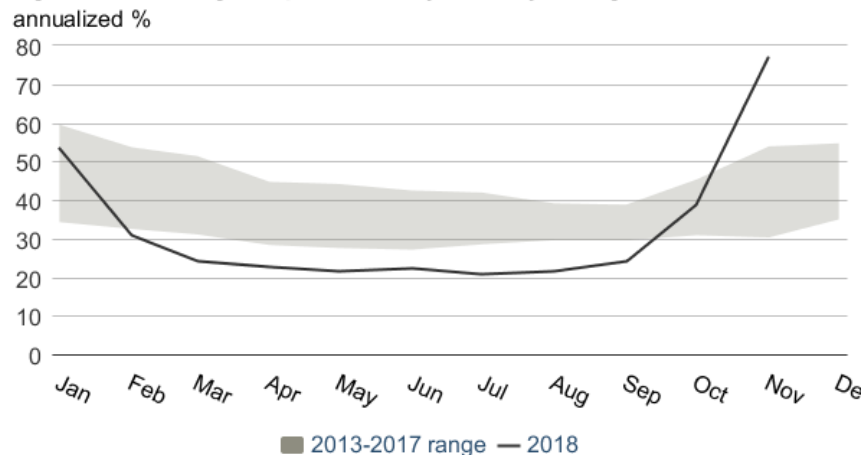
Figure 10. Natural gas front-month futures prices and actual minus historical average HDD and CDD



eia CME Group and National Oceanic and Atmospheric Administration, as compiled by Bloomberg L.P.

Implied volatility: Concerns about low storage levels with winter weather approaching contributed to an increase in volatility in natural gas futures prices. Natural gas implied volatility averaged 77% in November, much higher than the five-year range and the highest volatility in November in 17 years (Figure 11). In contrast, implied volatility reached the lowest levels ever recorded for the natural gas front-month contract during the summer, but it re-emerged at the end of this year’s injection season when inventories remained lower than historical levels. Throughout November, the increasing storage deficit to the five-year average, along with forecasts of colder temperatures, likely contributed to the increase in implied volatility.

Figure 11. Natural gas implied volatility, monthly averages



eia Bloomberg L.P.

Probability: At the beginning of November, the probability of the February 2019 Henry Hub contract expiring at more than \$4/MMBtu was 13% (Figure 12). The probability, calculated using futures and options data, of the contract expiring at more than \$4/MMBtu increased significantly throughout the month, reaching 52% on December 6. The higher probability was

driven by a much higher futures price, which increased by more than \$1/MMBtu, and by substantially higher implied volatility, which more than doubled from November 1.

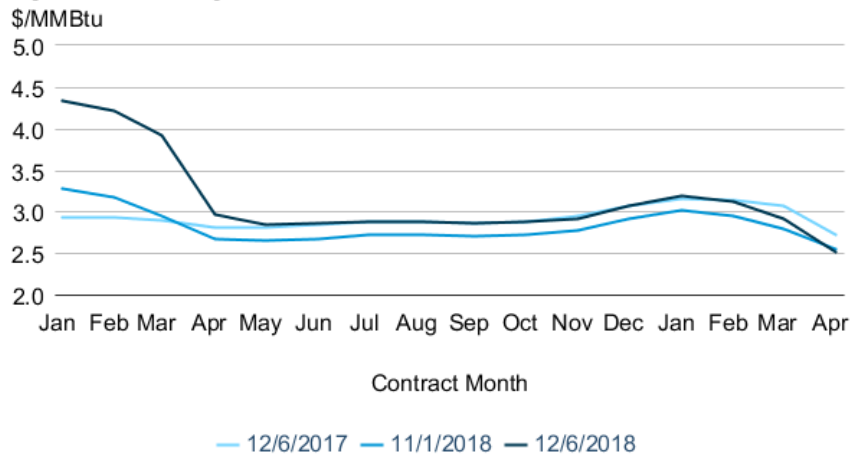
Figure 12. Probability of the February 2019 Henry Hub contract expiring above specified price levels



eia U.S. Energy Information Administration, CME Group

Futures curve: Natural gas futures prices have increased substantially since November 1 but primarily in the front part of the futures curve (**Figure 13**). Prices are elevated for the winter months, but as of December 6, the April 2019 contract showed prices falling back below \$3/MMBtu. EIA expects that dry natural gas production in April 2019 will be 90 Bcf/d—2 Bcf/d higher than current levels—putting downward pressure on prices as demand declines after the winter.

Figure 13. Natural gas futures curves



eia Bloomberg, Intercontinental Exchange

Notable forecast changes

- EIA forecasts Brent and West Texas Intermediate crude oil spot prices will average \$61 per barrel (b) and \$54/b, respectively, in 2019, which are both \$11/b lower than in the November STEO. The price of both crude oils fell significantly in November. In previous STEOs, EIA had been forecasting downward price pressures in the coming months. However, the drop in price occurred more quickly than expected and the magnitude was greater than expected. Prices have likely declined to a level that EIA believes will contribute to a roughly balanced oil market in 2019, which EIA expects will keep prices close to current levels on average. Uncertainty exists, though, in the both EIA's supply and demand outlooks for 2019, and deviations in actual outcomes or market expectations of supply and demand from those forecasted for the coming year could cause daily and monthly averages prices to fluctuate significantly.
- EIA revised downward its forecast of Canadian oil production for 2019 by 0.12 million b/d to reflect Alberta's announced production cuts on December 3. EIA's forecast for 2019 is an average of 5.1 million b/d compared with last month's forecast of 5.2 million b/d.
- On December 3, Qatar submitted to the Organization of the Petroleum Exporting Countries (OPEC) a notice of its withdrawal from the organization, effective January 1, 2019. In this STEO, Qatar is included in OPEC supply totals. Beginning with the January 2019 STEO, EIA will list Qatar as a non-OPEC producer.
- EIA forecasts coal production will be 742 million short tons (MMst) in 2019, which is 2% (13 MMst) higher than forecast in the November STEO, and would be a decrease of 3% (20 MMst) from 2018 levels. The increase in the production forecast reflects higher demand for coal in the U.S. electric power sector and in global export markets than expected in the previous STEO.
- For more information, see the [detailed table of STEO forecast changes](#).

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