



Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- North Sea Brent crude oil spot prices averaged \$58 per barrel (b) in October, an increase of \$1/b from the average in September. EIA forecasts Brent spot prices to average \$53/b in 2017 and \$56/b in 2018.
- West Texas Intermediate (WTI) crude oil prices are forecast to average almost \$5/b lower than Brent prices in 2018. After averaging \$2/b lower than Brent prices through the first eight months of 2017, WTI prices averaged \$6/b lower than Brent prices in September and October. The spread between Brent and WTI prices is expected to remain at this level through the first quarter of 2018 before narrowing to \$4/b during the second half of 2018.
- NYMEX contract values for February 2018 delivery that traded during the five-day period ending November 2 suggest that a range of \$45/b to \$67/b encompasses the market expectation for February WTI prices at the 95% confidence level.
- EIA estimates U.S. crude oil production averaged 9.3 million barrels per day (b/d) in October, down 90,000 b/d from the September level. Crude oil production in the Gulf of Mexico averaged 1.4 million b/d in October, which was 260,000 b/d lower than the September level. The lower production reflected the effects of Hurricane Nate. At the time of publication, most oil production platforms in the Gulf of Mexico had returned to operation following the hurricane, and EIA forecasts overall U.S. crude oil production will continue to grow in the coming months. EIA forecasts total U.S. crude oil production to average 9.2 million b/d for all of 2017 and 9.9 million b/d in 2018, which would mark the highest annual average production, surpassing the previous record of 9.6 million b/d set in 1970.
- U.S. regular gasoline retail prices averaged \$2.51 per gallon (gal) in October, a decrease of 14 cents/gal from the average in September, which was the highest monthly average since July 2015. The September prices reflected the effects of market disruptions following hurricanes Harvey and Irma. EIA forecasts the average U.S. regular gasoline retail price will average \$2.47/gal in November and \$2.39/gal in December. EIA forecasts that U.S. regular gasoline retail prices will average \$2.40/gal in 2017 and \$2.45/gal in 2018.

Natural gas

- U.S. dry natural gas production is forecast to average 73.4 billion cubic feet per day (Bcf/d) in 2017, a 0.6 Bcf/d increase from the 2016 level. Natural gas production in 2018 is forecast to be 5.5 Bcf/d higher than the 2017 level.
- In October, the average Henry Hub natural gas spot price was \$2.88 per million British thermal units (MMBtu), down 10 cents/MMBtu from the September level. Expected growth in natural gas exports and domestic natural gas consumption in 2018 contribute to the forecast Henry Hub natural gas spot price rising from an annual average of \$3.01/MMBtu in 2017 to \$3.10/MMBtu in 2018. NYMEX contract values for February 2018 delivery that traded during the five-day period ending November 2 suggest that a range of \$2.08/MMBtu to \$4.52/MMBtu encompasses the market expectation for February Henry Hub natural gas prices at the 95% confidence level.

Electricity, coal, renewables, and emissions

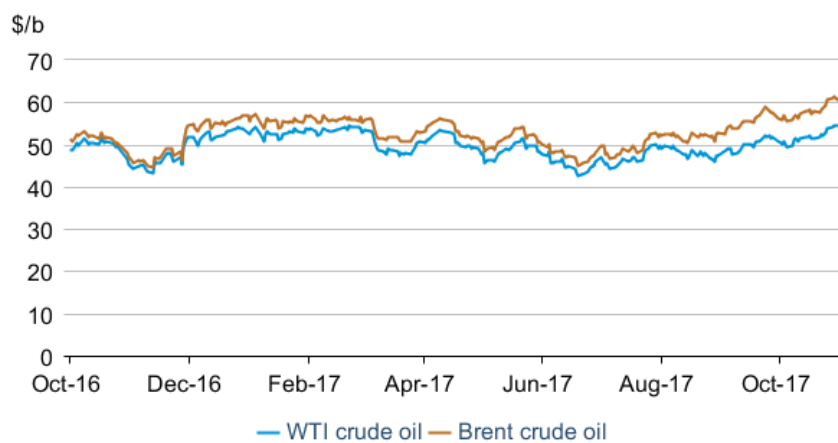
- EIA expects the share of U.S. total utility-scale electricity generation from natural gas will fall from an average of 34% in 2016 to about 31% in 2017 as a result of higher natural gas prices and increased generation from renewables and coal. Coal's forecast generation share rises from 30% last year to 31% in 2017. The projected annual generation shares for natural gas and coal in 2018 are 32% and 31%, respectively. Generation from renewable energy sources other than hydropower grows from 8% in 2016 to a forecast share of about 9% in 2017 and 10% in 2018. Generation from nuclear energy accounts for almost 20% of total generation in each year from 2016 through 2018.
- Coal production for the first 10 months of 2017 is estimated to have been 656 million short tons (MMst), 59 MMst (10%) higher than production for the same period in 2016. Annual production is expected to be about 790 MMst in both 2017 and 2018.
- [Wind electricity generating capacity](#) at the end of 2016 was 82 gigawatts (GW). EIA expects wind capacity additions in the forecast to bring total wind capacity to 88 GW by the end of 2017 and to 96 GW by the end of 2018.
- Total utility-scale solar electricity generating capacity at the end of 2016 was 22 GW. EIA expects solar capacity additions in the forecast will bring total utility-scale solar capacity to 27 GW by the end of 2017 and to 31 GW by the end of 2018.
- After declining by 1.6% in 2016, energy-related carbon dioxide (CO₂) emissions are projected to decrease by 0.8% in 2017 and then to increase by 2.1% in 2018. Energy-related CO₂ emissions are sensitive to changes in weather, economic growth, and energy prices.

Petroleum and natural gas markets review

Crude oil

Prices: The front-month futures price for North Sea Brent crude oil settled at \$60.62 per barrel (b) on November 2, an increase of \$4.50/b from October 2. Front-month futures prices for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, increased by \$3.96/b over the same period, settling at \$54.54/b on November 2 (**Figure 1**). October Brent and WTI monthly average spot prices were \$1.36/b and \$1.76/b higher, respectively, than the September average spot prices.

Figure 1. Crude oil front-month futures prices



eia Bloomberg L.P.

The Brent crude oil price closed at its highest level in more than two years in late October, settling at more than \$60/b for the first time since July 2015. Global economic data remain robust and support rising oil demand. Global refinery outages were below their five-year average in October as refiners likely deferred maintenance to take advantage of high crack spreads (the difference between petroleum product prices and crude oil prices), which increased near-term demand for crude oil. In addition, some near-term supply disruptions temporarily removed crude oil from the market. Market participants could also be expecting an extension to the crude oil [supply reduction](#) agreement at the next meeting of the Organization of the Petroleum Exporting Countries (OPEC) on November 30, as leaders in Saudi Arabia and Russia made public announcements supporting a nine-month extension to the end of 2018.

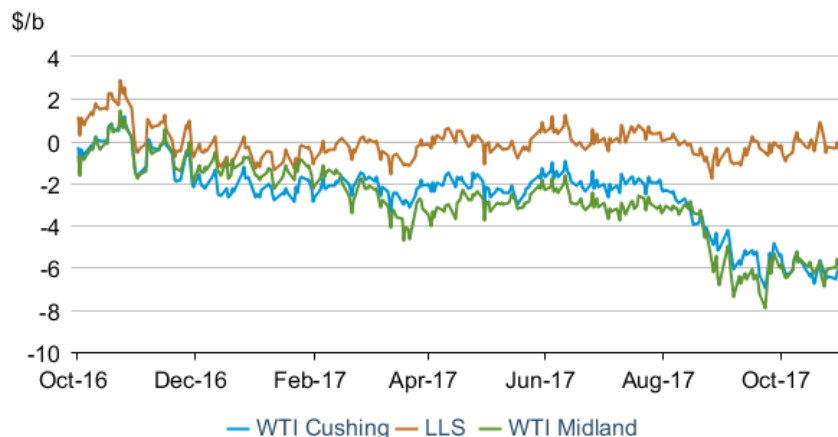
Oil deliveries from the Kurdistan Region of Iraq and Kirkuk area of Iraq to the Turkish port of Ceyhan declined to less than 0.3 million barrels per day (b/d) in October, as the Iraqi central government took control of the Kirkuk oil fields following the Kurdistan Regional Government's independence vote in September. Previously, exports from the Kurdistan Region to Ceyhan had been about 0.5 million b/d. Although a significant supply disruption could put upward pressure on crude oil prices, Iraq made up for the shortfall by increasing exports from its southern Basra port, because infrastructure expansions to increase export capacity were completed recently.

[Hurricane Nate](#) disrupted crude oil production in the Federal Offshore Gulf of Mexico briefly, but operations and production resumed by the week ending October 20. The disruptions in Iraq and the United States slightly reduced EIA's estimates for liquid fuels supply in October, but total [global unplanned supply disruptions](#) remain low by historical standards.

Despite the recent increase in Brent crude oil prices to more than \$60/b, EIA forecasts Brent prices to ease somewhat in the coming months and to average \$56/b in 2018. EIA expects global oil supply growth to outpace global oil demand growth in 2018, contributing to global oil inventories rising by a forecast 0.3 million b/d in 2018, compared with an estimated 0.2 million b/d draw in 2017. However, global economic developments, geopolitical events, and crude oil production dynamics in the United States and in other major producers in the coming months have the potential to push oil prices higher or lower than the current STEO price forecast.

WTI crude oil price differentials with Brent remain near their widest levels of the year. Based on spot prices, the WTI Cushing-Brent spread settled at -\$6.09/b on November 2, and the WTI Midland-Brent spread settled at -\$5.84/b. In comparison, the Light Louisiana Sweet (LLS)-Brent spread settled at -34 cents/b (**Figure 2**).

Figure 2. U.S. crude oil spot price differentials to Brent



 U.S. Energy Information Administration, Bloomberg L.P.

The WTI Cushing-Brent likely reflects the transportation costs associated with bringing light sweet crude oil from Cushing, Oklahoma, to the U.S. Gulf Coast and the costs to export the crude oil to the marginal market. Because LLS is produced in the Gulf of Mexico, it competes with global waterborne crude oils without the same transportation costs faced by inland crude oil and, as a result, trades closer to Brent prices.

The widening WTI Cushing-Brent spread in recent months could reflect increasing constraints on the capacity to transport additional crude oil from Cushing to the U.S. Gulf Coast. Increasingly constrained transportation and related high levels of crude oil stocks in [Petroleum Administration for Defense District \(PADD\) 2](#) are likely affecting WTI prices—both in Cushing, Oklahoma and in Midland, Texas—compared with waterborne crude oils like Brent and LLS.

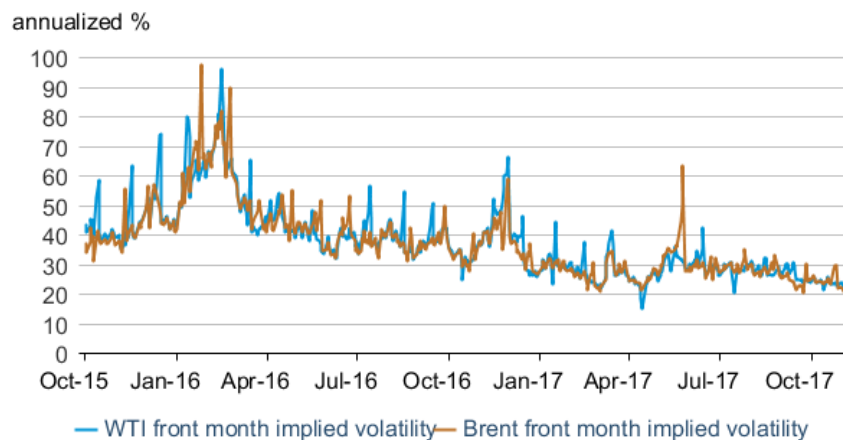
Total commercial U.S. crude oil inventories declined by 27 million barrels from the last week of July to the last week in October, according to EIA's *Weekly Petroleum Status Report* (WPSR), whereas inventories in Cushing, Oklahoma, increased by 8 million barrels.

Pipeline expansions in recent years have increased crude oil flows from rising Canadian and Bakken output into Cushing, Oklahoma, contributing to relatively high stock levels in the region. In addition, increased output from the Permian basin in West Texas and New Mexico is flowing into Cushing, Oklahoma. At the same time, new pipeline connectivity has also allowed more Permian barrels to [flow directly to the U.S. Gulf Coast](#).

Until new pipeline capacity is brought online in the first quarter of 2018, EIA expects Brent crude oil prices to remain \$6/b higher than WTI prices. EIA expects this spread to narrow to \$4/b during the second half of 2018. In the Texas region of the Permian Basin [the 0.4 million b/d Midland to Sealy pipeline](#) is scheduled to come online by the second quarter of 2018, which will increase Permian crude oil flows to the U.S. Gulf Coast. [The 0.2 million b/d Diamond pipeline from Cushing, Oklahoma, to Memphis, Tennessee](#), is scheduled to be complete by the end of 2017 and could begin to reduce some of the stocks in Cushing, Oklahoma.

Implied volatility: Crude oil implied volatility reached some of the lowest levels of the year in October. The WTI front-month average volatility was the lowest since September 2014 and settled at 21.2% on November 2. Although Brent front-month average volatility increased compared with September levels, settling at 20.7% on November 2 (**Figure 3**), it has remained lower than levels during much of the past two years. Despite considerable uncertainty ahead of the November 30 OPEC meeting, market participants expect less price volatility than they did ahead of the previous OPEC meeting in May 2017.

Figure 3. Crude oil implied volatility

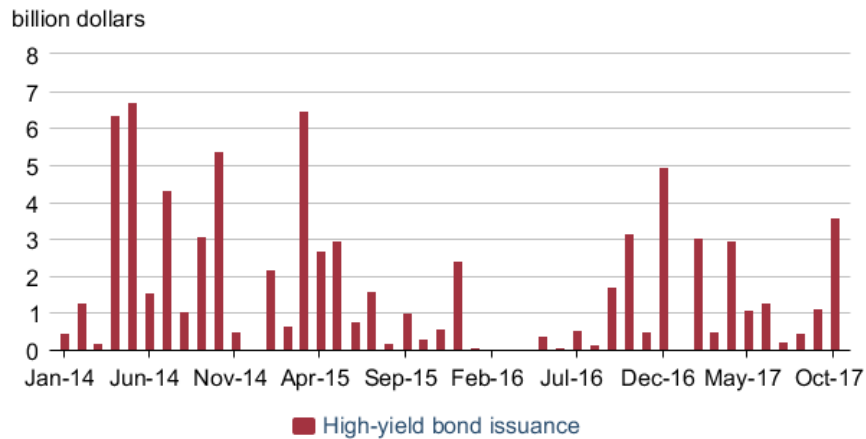


 Bloomberg L.P.

High-Yield bond issuance: U.S. exploration and production companies issued \$3.6 billion in high-yield bonds in October, the largest amount issued during any month in 2017 (**Figure 4**). Companies with a rating below investment grade by one of the corporate rating agencies (S&P,

Moody's, and Fitch) have already issued more bonds through October 2017 than during all of 2016, based on Bloomberg data. Many U.S. oil companies have been [expanding drilling programs and development expenditures](#) this year, and [borrowing costs remain at levels similar to those when crude oil prices were more than \\$100/b](#). Access to capital is necessary for many companies to increase investment spending, and it supports growth in U.S. crude oil production.

Figure 4. U.S. exploration and production company high-yield bond issuance



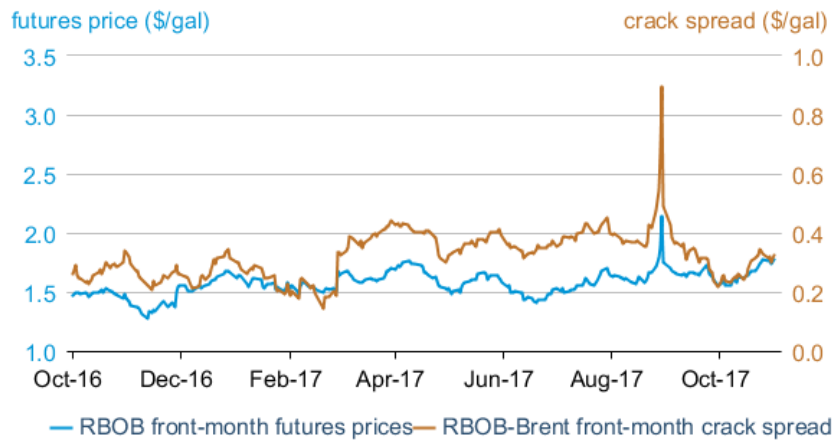
 U.S. Energy Information Administration, Bloomberg L.P.

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) rose by 21 cents per gallon (gal) from October 2 to settle at \$1.77/gal on November 2 (**Figure 5**). The RBOB-Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) rose by 11 cents/gal to settle at 33 cents/gal over the same period. EIA compares RBOB prices to Brent prices because [EIA research indicates that U.S. gasoline prices usually move with Brent prices](#), the international crude oil benchmark.

The average [gasoline crack spread](#) in October was 12 cents/gal higher than the five-year average for October, as gasoline inventories declined and as U.S. gasoline consumption increased. In this STEO, EIA estimates U.S. gasoline consumption in October averaged 9.3 million b/d, which would be a record high for the month of October. Also in this STEO, EIA estimates that gasoline stocks at the end of October were 7.2 million barrels (3%) lower than the end-of-September levels and 13.2 million barrels (6%) lower than the level at the end of October 2016.

Figure 5. Historical RBOB futures prices and crack spread

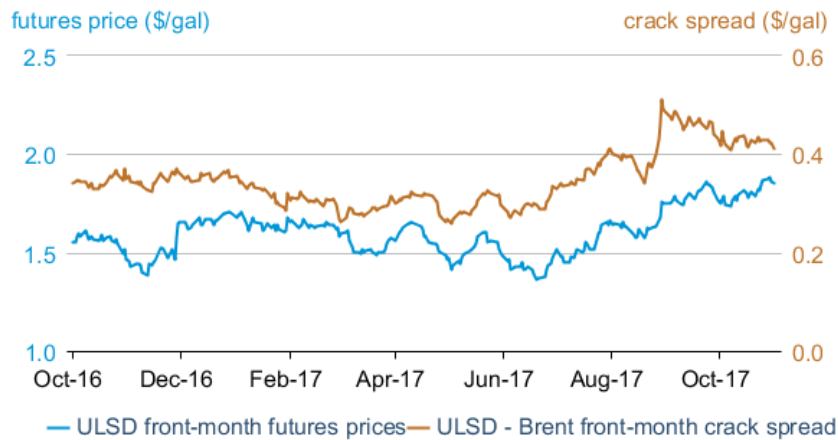


 Bloomberg L.P., RBOB=reformulated blendstock for oxygenate blending

Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) futures price increased by 9 cents/gal from October 2 to settle at \$1.85/gal on November 2. The ULSD-Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) declined 2 cents/gal over the same period, settling at 41 cents/gal (**Figure 6**).

The **ULSD crack spread** has remained higher than last year's level each month since July 2017, as distillate consumption and exports increased and U.S. distillate inventories declined. For much of 2017, year-over-year levels of U.S. distillate consumption and exports have been higher. During the first three quarters of 2017, EIA estimates U.S. distillate consumption was almost 70,000 b/d (2%) higher than during the same period in 2016. Distillate fuel exports set new five-year highs in all but one month so far in 2017, according to the *Petroleum Supply Monthly* (PSM). Higher consumption and exports have contributed to the decline in U.S. distillate stocks. EIA estimates that U.S. distillate inventories at the end of both September and October were below the five-year average for those respective months. These two months were the first since March 2015 that distillate inventories were below the five-year average at the end of any month.

Figure 6. Historical ULSD futures price and crack spread

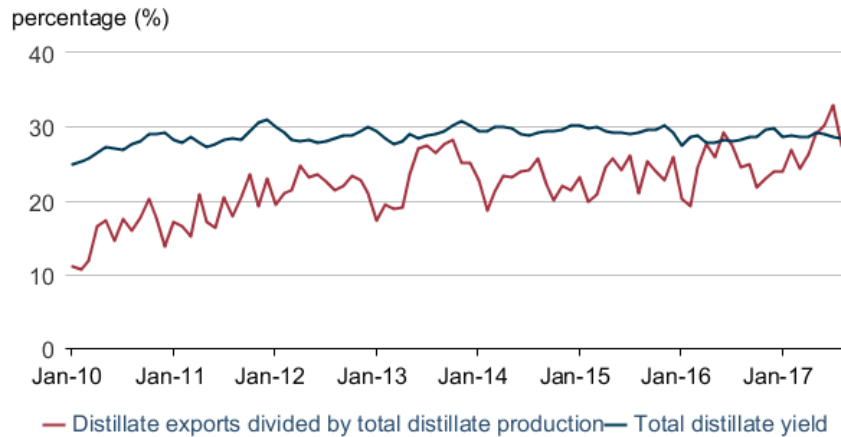


eia Bloomberg L.P., ULSD=ultra-low sulfur diesel

[U.S. distillate exports](#) have risen significantly in 2017. In July 2017, U.S. distillate exports rose to a record 1.7 million b/d before declining to 1.4 million b/d in August. Looking at U.S. distillate exports as a percentage of U.S. distillate production illustrates the growing importance of [U.S. exports in the global distillate market](#). U.S. distillate exports as a share of U.S. distillate production rose to a record high of 33% in July but then declined to 27% in August (**Figure 7**).

Compared with the first eight months of 2016, distillate exports this year were 16% higher, with increased exports to most major regions. The largest increases in U.S. distillate exports were to Central and South America, as oil distributors in Brazil began purchasing more competitively priced fuel from overseas sources rather than from its state-owned oil company, Petrobras. Beyond regional factors, broad-based economic growth among developed and emerging markets is a major contributor to increased distillate consumption globally.

Figure 7. U.S. distillate yield and export share



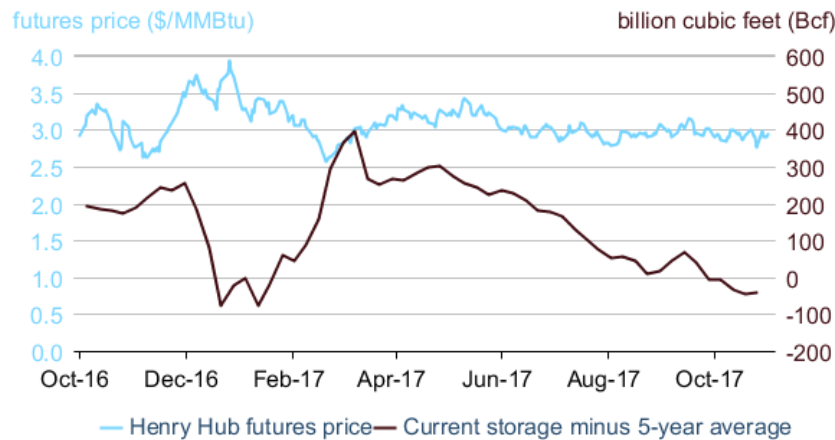
 U.S. Energy Information Administration

Natural Gas

Prices and storage: The front-month natural gas futures contract for delivery at Henry Hub settled at \$2.94/million British thermal units (MMBtu) on November 2, an increase of 2 cents/MMBtu from October 2 (**Figure 8**). Futures prices traded within a 31 cents/MMBtu range in October, the narrowest range for that month since 1995. Working natural gas injections in storage were below average in October, bringing inventories for the week ending October 27 to 3.8 trillion cubic feet, which is 1.1% lower than the five-year average and 4.6% lower than last year at this time.

Liquefied natural gas (LNG) exports in October increased from September, as the Gulf Coast region recovered from hurricane-related service disruptions. Despite growing export demand and below-average storage injections—factors that could contribute to upward pressure on prices—front-month futures prices remained in a narrow trading range. The National Oceanic and Atmospheric Administration’s (NOAA) [revised winter forecast](#) called for milder temperatures, putting downward pressure on futures prices and contributing to the January natural gas futures contract price falling to the lowest level since March 2016. The Henry Hub natural gas spot price averaged \$2.88/MMBtu in October, 10 cents/MMBtu lower than in September.

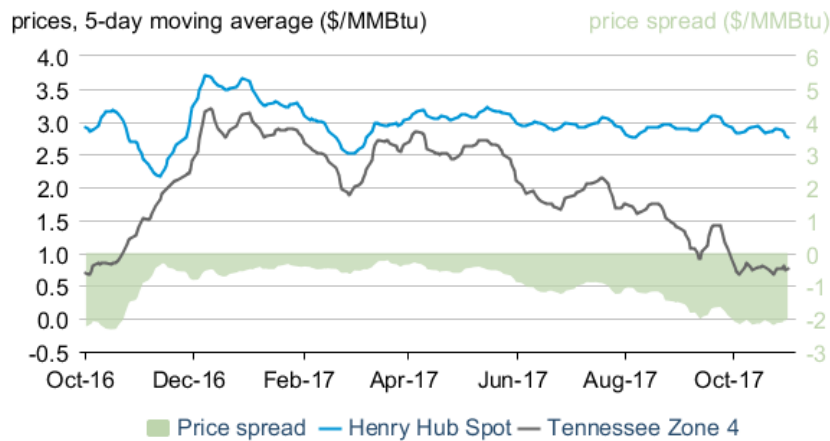
Figure 8. U.S. natural gas prices and storage



eia U.S. Energy Information Administration, Bloomberg L.P.

Marcellus area spot prices: The five-day moving average spot price in Tennessee Zone 4 (in the northern part of the Marcellus region) declined to 68 cents/MMBtu on October 6, the lowest level in a year (Figure 9). The price spread between Tennessee Zone 4 and Henry Hub reached -\$2.19/MMBtu on October 25, the widest point since last year. The differential to Henry Hub, which had widened in October 2016 because of constraints in takeaway capacity, narrowed after projects such as the Ohio Valley Connector, the Rockies Express, and the Algonquin Incremental Market pipelines entered service in the last quarter of 2016 and the beginning of 2017. However, with increased natural gas production in 2017, takeaway capacity is constrained again. The ramp-ups of the Rover pipeline, the Cove Point LNG facility, and the Nexus Gas Transmission Project in the last quarter of 2017 and the first quarter of 2018, which will have a combined 5.5 billion cubic feet per day (Bcf/d) of new takeaway capacity, will likely narrow the spread between Marcellus area and Henry Hub prices.

Figure 9. Henry Hub and Tennessee Zone 4 natural gas spot prices



eia U.S. Energy Information Administration, Bloomberg L.P.

Notable forecast changes

- EIA expects West Texas Intermediate crude oil prices to average almost \$5/b lower than Brent prices in 2018. Previously EIA had expected that spread to be almost \$4/b. The wider spread reflects the assumption of increasing near-term constraints in moving light sweet crude oil from Cushing, Oklahoma, to the U.S. Gulf Coast, where it can compete with globally traded crude oil.
- For more information, see the [detailed STEO table of forecast changes](#).

This report was prepared by the U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy. By law, EIA's data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views in this report therefore should not be construed as representing those of the U.S. Department of Energy or other federal agencies.