



## Short-Term Energy Outlook (STEO)

---

### Forecast highlights

#### *Global liquid fuels*

- U.S. crude oil production averaged 9.4 million barrels per day (b/d) in 2015, and it is forecast to average 8.9 million b/d in 2016 and 8.8 million b/d in 2017.
- EIA forecasts Brent crude oil prices to average \$43 per barrel (b) in 2016 and \$52/b in 2017. West Texas Intermediate (WTI) crude oil prices are forecast to average about \$1/b less than Brent prices in 2017. The values of futures and options contracts indicate significant uncertainty in the price outlook. The NYMEX contract values for March 2017 delivery traded during the five-day period ending December 1 suggest that a range from \$34/b to \$71/b encompasses the market expectation of WTI prices in March 2017 at the 95% confidence level.
- Lower crude oil prices contributed to U.S. average retail regular gasoline prices in November averaging \$2.18 per gallon (gal), a decline of 7 cents/gal from the October level. EIA expects gasoline prices to fall to an average of \$2.10/gal in January. Retail gasoline prices are forecast to average \$2.14/gal in 2016 and \$2.30/gal in 2017.
- Global oil inventory builds are forecast to average 0.7 million b/d in 2016 and 0.4 million b/d in 2017.

#### *Natural gas*

- Natural gas marketed production is forecast to average 77.5 billion cubic feet per day (Bcf/d) in 2016, a 1.3 Bcf/d decline from the 2015 level, which would be the first annual production decline since 2005. In 2017, forecast natural gas production increases by an average of 2.5 Bcf/d from the 2016 level.
- Growing domestic natural gas consumption, along with higher pipeline exports to Mexico and liquefied natural gas exports, contribute to the Henry Hub natural gas spot price rising from an average of \$2.49 per million British thermal units (MMBtu) in 2016 to \$3.27/MMBtu in 2017. NYMEX contract values for March 2017 delivery traded during the five-day period ending December 1 suggest that a price range from \$2.20/MMBtu to \$5.04/MMBtu encompasses the market expectation of Henry Hub natural gas prices in March 2017 at the 95% confidence level.

### *Electricity, coal, renewables, and emissions*

- Total U.S. electricity generation from utility-scale plants averaged 11,172 gigawatthours per day in 2015. Forecast U.S. generation grows by 0.2% in 2016 and by 0.7% in 2017.
- EIA expects the share of U.S. total utility-scale electricity generation from natural gas will average 34% this year, and the share from coal will average 30%. In 2015, both fuels supplied about 33% of total U.S. electricity generation. In 2017, natural gas and coal are forecast to generate 33% and 31% of electricity, respectively. Nonhydropower renewables are forecast to generate 8% of electricity generation in 2016 and 9% in 2017. Generation shares of nuclear and hydropower are forecast to be relatively unchanged from 2016 to 2017.
- Coal production in November 2016 was 70.7 million short tons (MMst), the third time this year monthly production exceeded 70 MMst. Monthly coal production exceeded 70 MMst nine times in 2015 and in every month in 2014. Forecast annual coal production declines by 15% to 758 MMst in 2016, which would be the lowest level of coal production since 1978. Coal production is forecast to increase by 2% in 2017.
- Despite recent increases in global coal prices, [spot U.S. coal prices](#) have remained unchanged for the past six weeks. The delivered coal price averaged \$2.23/MMBtu in 2015. Forecast coal prices average \$2.14/MMBtu in 2016 (a 4% decline) and \$2.21/MMBtu in 2017 (a 3% increase).
- Wind energy capacity at the end of 2015 was 72 gigawatts (GW). EIA expects capacity additions of 7 GW in 2016 and 9 GW in 2017. These additions would bring total wind capacity to 89 GW by the end of 2017.
- On November 23, 2016, the U.S. Environmental Protection Agency (EPA) finalized a [rule setting Renewable Fuel Standard \(RFS\) volumes for 2017](#). EIA used the final volumes to develop the current STEO forecast. EIA expects that the largest effect of the finalized 2017 RFS targets will be on biomass-based diesel consumption, which includes both biodiesel and renewable diesel and helps to meet the RFS targets for use of biomass-based diesel, advanced biofuel, and total renewable fuel. Biodiesel production averaged 82,000 b/d in 2015, and it is forecast to average 99,000 b/d in 2016 and 104,000 b/d in 2017. Net imports of biomass-based diesel are expected to rise from 31,000 b/d in 2015 to 45,000 b/d in 2016 and to 51,000 b/d in 2017. Projected ethanol consumption averages about 940,000 b/d in both 2016 and 2017, resulting in the [ethanol share of the total gasoline pool averaging 10%](#) in both years.
- After declining by 2.6% in 2015, energy-related carbon dioxide (CO<sub>2</sub>) emissions are projected to decline by 1.3% in 2016 and then increase by 0.9% in 2017. Energy-related CO<sub>2</sub> emissions are sensitive to changes in weather, economic growth, and energy prices.

## Petroleum and natural gas markets review

---

### Crude oil

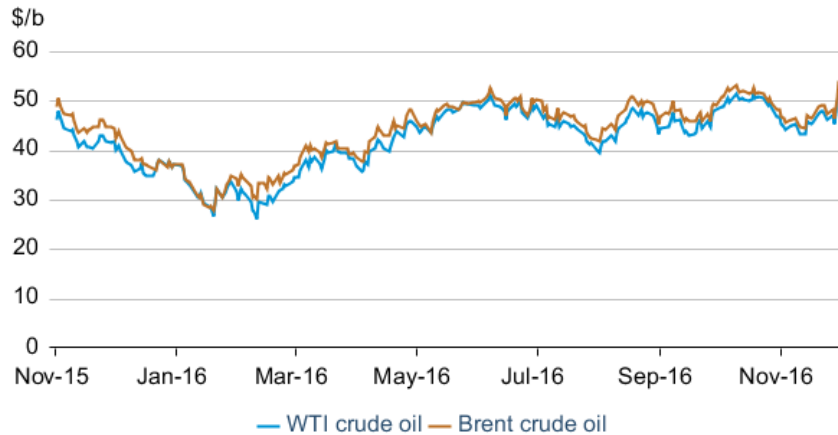
**Prices:** Crude oil prices traded below October levels for most of November before increasing significantly on the last day of the month. West Texas Intermediate (WTI) crude oil prices increased from \$46.67 per barrel (b) on November 1 to \$51.06/b on December 1, while international benchmark Brent crude oil increased by \$5.80/b over the same period to settle at \$53.94/b (**Figure 1**). WTI and Brent average spot prices in November were \$4.07/b and \$4.79/b lower, respectively, than the October averages.

At their November 30 meeting, members of the Organization of the Petroleum Exporting Countries (OPEC) announced a framework for supply reductions among most of its members. Several non-OPEC producers also announced their intention to freeze or reduce production. The extent to which the announced plans will be carried out and actually reduce supply below levels that would have occurred in their absence remains uncertain. If the agreement contributes to prices rising above \$50/b in the coming months, it could encourage a return to supply growth in U.S. tight oil more quickly than currently expected. Crude oil prices near \$50/b have led to increased investment by some U.S. production companies, particularly in the Permian Basin. A price recovery above \$50/b could contribute to supply growth in other U.S. tight oil regions and in other non-OPEC producing countries that do not participate in the OPEC-led supply reductions.

Continuing global supply growth in 2017 may postpone significant global inventory withdrawals until 2018, with the first half of 2017 showing inventory builds averaging 0.8 million b/d in our current forecast. Global inventory builds are forecast to average 0.4 million b/d for all of 2017. Despite new oil production coming online when oil inventories are at high levels globally, global economic data have been more positive than previous expectations, and increases in oil demand growth could help to support prices in the coming quarters.

The Brent crude oil price forecast for 2017 was increased by \$1/b from the November STEO, with 2017 prices expected to average \$52/b in the December STEO. Brent and WTI crude oil prices for the first half of 2017 are projected to remain near \$50/b, with prices ending the year around \$55/b. Implied volatility increased in the weeks prior to the OPEC meeting, suggesting significant uncertainty regarding both the prospects for the recent agreement and its potential implications for global oil balances.

**Figure 1. Crude oil front-month futures prices**

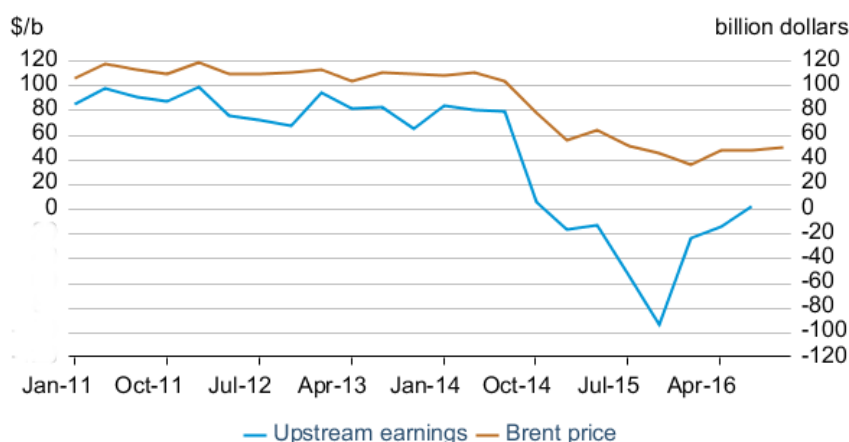


eia Bloomberg L.P.

Oil production, particularly in the United States, has been more resilient in the current oil price environment than had been expected, as reflected in improving financial conditions at oil companies. Improved profits could encourage oil producers to increase capital expenditures and expand production in 2017 and beyond, especially if oil prices increase. In the third quarter of 2016, a group of publicly traded global oil companies reported the first quarterly profit from upstream production business segments since the fourth quarter of 2014, according to recently released earnings statements from 91 companies (**Figure 2**). Collectively, the group earned almost \$2.3 billion in the third quarter when front-month Brent crude oil prices averaged \$47/b. In the same period in 2015, when prices averaged \$51/b, the group lost \$54.1 billion.

Since the fourth quarter of 2014, many companies have [written down the value of their assets](#) to reflect lower oil prices, which reduces earnings in the quarter in which a company recognizes the write-down. The increase in earnings this year is partially attributable to a reduction in asset write-downs, which declined 80% year-over-year. Additionally, company reductions in operating expenses were greater than the declines in revenue, contributing to higher profitability.

**Figure 2. Upstream earnings and Brent oil price**



eia | Bloomberg L.P., Evaluate Energy

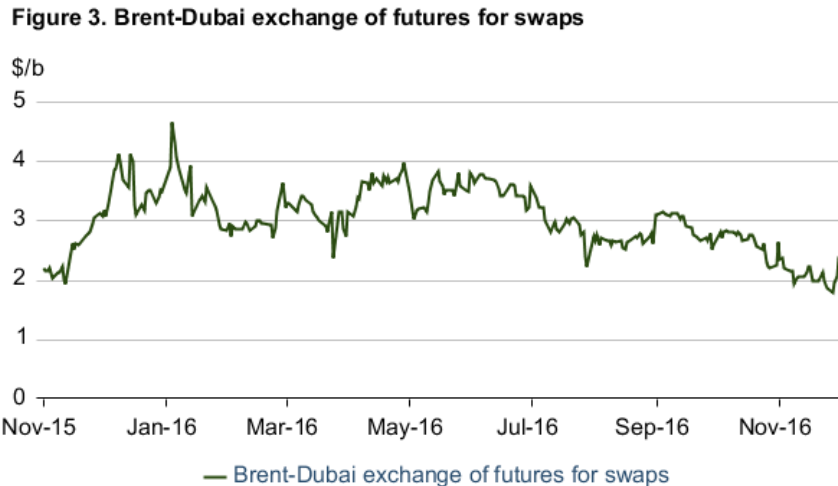
**Crude oil supply and price spreads:** EIA revised the U.S. crude oil production forecast upward from the November STEO, with average 2017 production expected to decline by less than 0.1 million b/d from 2016 levels. Total U.S. liquids production, which includes production of hydrocarbon gas liquids (HGL) and biofuels, is expected to increase by 0.2 million b/d in 2017.

Total non-OPEC liquids production is expected to grow by almost 0.4 million b/d in 2017 from 2016 levels. Outside the United States, non-OPEC total liquid fuels production is expected to increase by slightly more than 0.1 million b/d in 2017. Canada’s liquid fuels production is expected to grow by about 0.3 million b/d in 2017, making up for the low production growth in 2016, when wildfires during the summer resulted in large production shut-ins. Russia, Kazakhstan, and Brazil are also expected to see an increase in liquids output in 2017. Liquid fuels growth in these countries in 2017 is expected to be partially offset by declining production in the North Sea, China, and Mexico.

OPEC crude oil production is expected to average 33.2 million b/d in 2017. The Nigerian oil sector continues to experience setbacks as militant attacks continue to target oil infrastructure, lowering the country’s production outlook. Libya’s crude oil production was almost 0.6 million b/d at the end of November, a slight increase compared with the previous month. Additional oil production increases from Libya in the near term are not likely to occur without an agreement with the Zintani militia, which controls the pipelines that transport crude oil from some of Libya’s largest fields, including the El Sharara and El Feel fields.

A return from seasonal maintenance at North Sea offshore oil fields in the United Kingdom and Norway increased collective production by almost 0.1 million b/d in November compared with October. Sustained production near 0.6 million b/d in Libya and an increase in North Sea production could be weakening near-term Brent prices compared with Middle Eastern crude oil. Along with relatively [low shipping rates](#), weaker Brent prices have made crude oils produced in the Atlantic Basin market more competitive for refiners in Asia, whose traditional suppliers are Middle Eastern crude oil producers.

The front-month Brent-Dubai Exchange of Futures for Swaps (EFS), which is an instrument that allows trade between the Brent futures market and the Dubai swaps market and represents the price premium of Brent over Dubai crude oil, reached its lowest point so far this year towards the end of November, before rising in response to the OPEC supply cut agreement (**Figure 3**). Last November, when the spread between Brent and Dubai was similarly low, Chinese refiners increased purchases of West African crude oil. This year, some Asian refineries are purchasing Atlantic-based crude oils, with the trade press reporting that refineries in countries like South Korea and China recently purchased crude oil cargoes from the North Sea.



eia Thomson Reuters

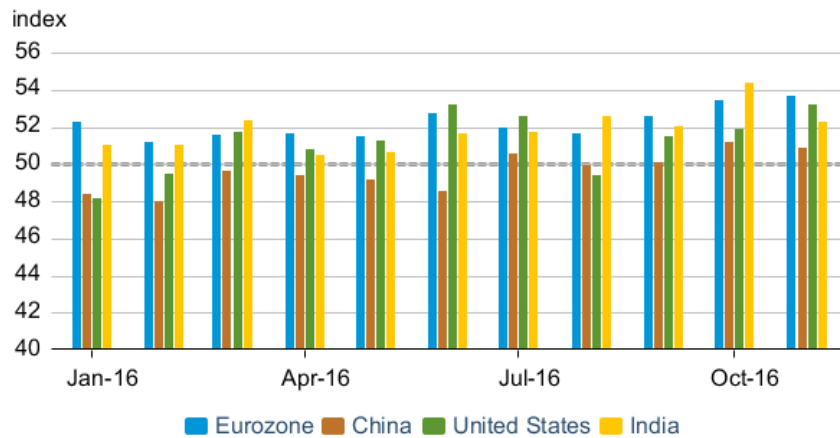
**Liquid fuels demand and economic growth indicators:** The outlook for global liquid fuels demand in the December STEO has been revised upward from the November STEO, with global oil demand now expected to grow by 1.4 and 1.6 million b/d in 2016 and 2017, respectively. The projection for real oil-weighted world GDP growth increases slightly from 2.2% in 2016 to 2.7% in 2017.

Higher expectations for demand growth are supported by relatively strong economic data released in November. U.S. GDP growth in the third quarter of 2016 was revised upward from initial estimates of 2.9% to 3.2%, according to the Bureau of Economic Analysis, and improvements in leading economic indicators across the world provide support for the increased global demand forecast. Manufacturing Purchasing Managers' Indexes (PMI) in major developed and emerging markets indicate expansion in the manufacturing sectors in these regions (**Figure 4**). A manufacturing PMI measures conditions within the manufacturing sector and is used as an indicator of economic growth. An index level above 50 indicates the manufacturing sector is expanding.

Four major manufacturing regions of the world are reporting continued expansion, indicating strength in global economic growth. The U.S. manufacturing PMI has increased over the past few months, while the latest PMI reading for the Eurozone was at its highest in nearly three years. The manufacturing PMI for China and India were at multi-year highs in October before

declining slightly in November. An expanding manufacturing sector typically leads to increasing consumption of fuels like distillate, but it can also indirectly indicate that domestic and international demand for goods is increasing, which can lead to future economic growth and oil demand.

**Figure 4. Regional Manufacturing Purchasing Managers' Indexes**



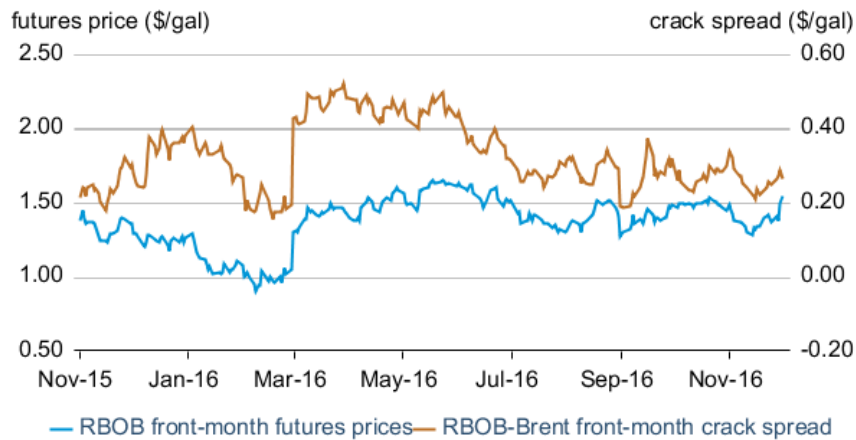
eia Bloomberg L.P., IHS Markit, Institute for Supply Management

## 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) increased in November and settled at \$1.55 per gallon (gal) on December 1 (**Figure 5**). The RBOB-Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) declined slightly in November.

Although gasoline crack spreads declined during November, the average crack spread was still a record high for the month. Strong domestic and international demand for gasoline likely supported gasoline crack spreads. Preliminary export data indicate that monthly [gasoline exports](#) set a record high in November. EIA also estimates U.S. gasoline consumption will reach a record high of 9.31 million b/d in 2016; the previous record was 9.29 million b/d set in 2007.

**Figure 5. Historical RBOB futures prices and crack spread**



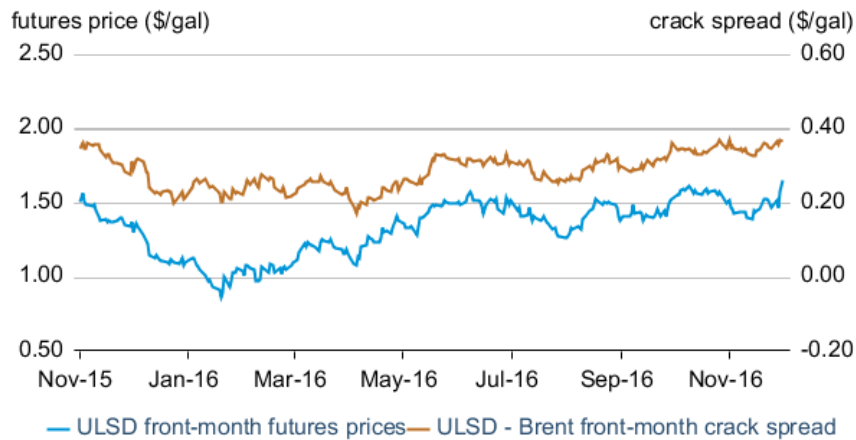
eia Bloomberg L.P.

**Ultra-low sulfur diesel prices:** The front-month futures price for the New York Harbor Ultra-low Sulfur Diesel (ULSD) contract increased by 13 cents/gal since November 1, settling at \$1.65/gal on December 1. The ULSD-Brent crack spread declined by 1 cent/gal over the same period (**Figure 6**). Crack spreads remain below the five-year average for this time of year.

Despite a warm start to the winter, which typically reduces distillate fuel use for home heating in the northeast United States, total U.S. distillate consumption increased by more than 0.2 million b/d in November compared with the same period in 2015, which was also unseasonably warm. The increase in distillate consumption in the United States could be the result of increased transportation, freight, and industrial activity related to U.S. manufacturing. Along with the increase in the U.S. manufacturing PMI, the Texas Manufacturing Outlook Survey from the Federal Reserve Bank of Dallas showed that [general business activity](#) increased in November for the first time in nearly two years, supporting renewed industrial activity in the region.



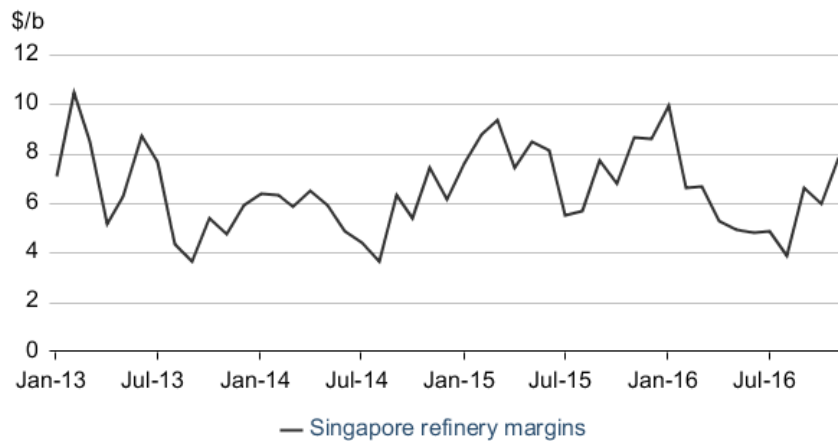
**Figure 6. Historical ULSD futures price and crack spread**



eia Bloomberg L.P.

**Asian product markets:** Refinery margins in Asia, calculated using Dubai crude oil and benchmark Singapore product prices, rose from a two-year low in August to \$7.82/b in November (**Figure 7**), a steeper rise than in previous years during this period. Declines in petroleum product stocks in the region likely supported refinery margins. Stocks of light distillates, which include gasoline, have generally declined since August and briefly declined below last year’s levels in November. The drawdown in light distillate stocks was because of seasonal maintenance at Asian and Middle Eastern refineries and strong gasoline demand from some Asian countries. Residual fuel stocks in Singapore have declined since June and have been below last year’s levels since late July. Residual fuel oil stocks declined because of the seasonal increase in demand for power generation and reduced fuel oil exports from Russia, an important supplier to the region. A tight petroleum product market in Asia could support higher regional refinery margins through the end of 2016.

**Figure 7. Singapore refinery margins**

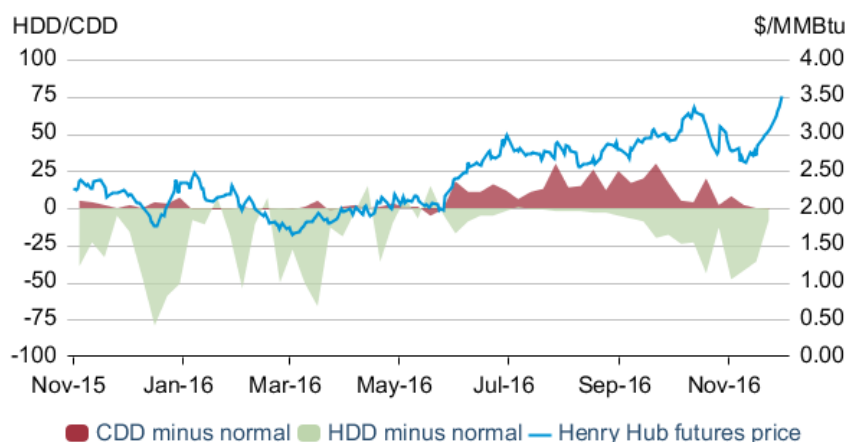


eia Thomson Reuters

## Natural gas

**Prices and temperatures:** The front-month natural gas contract for delivery at Henry Hub increased by 60 cents per million British thermal units (MMBtu) from November 1 and settled at \$3.51/MMBtu on December 1 (**Figure 8**). The monthly average natural gas spot price in November fell 43 cents/MMBtu from the October average. Both natural gas futures and spot prices declined in the first half of November as warmer-than-normal temperatures helped to push natural gas inventories to record levels. In November, U.S. population-weighted heating degree days (HDD) were 21% below the previous ten-year average and U.S. natural gas inventory levels exceeded 4 trillion cubic feet during the middle of the month. The natural gas spot price, which represents very-near-term delivery, was more greatly affected by the record high inventories and fell by a larger percentage than the futures price.

**Figure 8. Actual minus historical average HDD and CDD**



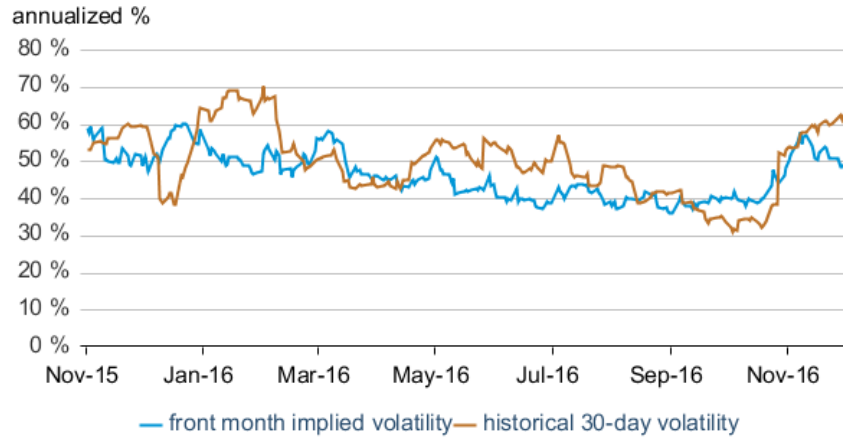
 Bloomberg L.P., U.S. EIA

After falling in the first part of November, natural gas prices began increasing in the middle of November as new weather forecasts contributed to higher demand expectations. The price variations drove historical volatility and implied volatility on the front-month futures contract to the highest levels since last winter. Volatility levels are similar to the start of winter in 2015, when inventories were also high (**Figure 9**).

Although temperatures from December 2016 through March 2017 are projected to average 3% warmer than normal, this forecast is 13% colder than the same period last year. The expectation of colder temperatures than last winter contributes to EIA's projection of a 13% year-over-year increase in residential and commercial natural gas consumption from December 2016 through March 2017. Total natural gas consumption for December through March is forecast to be 4% higher than last winter. The increase in domestic consumption, combined with ongoing [growth in pipeline](#) and liquefied natural gas (LNG) exports, is projected to reduce natural gas inventories to levels closer to historical averages at the end of the winter. The wide range of prices in

November shows how market participants are attempting to balance current high inventory levels with expectations of narrowing supply and demand fundamentals going forward.

**Figure 9. Natural gas historical and implied volatility**



eia Bloomberg L.P.

## Notable forecast changes

- For more information, see the [detailed 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.