Global liquid fuels

- North Sea Brent crude oil spot prices averaged $65 per barrel (b) in February, a decrease of $4/b from the January level and the first month-over-month average decrease since June 2017. EIA forecasts Brent spot prices will average about $62/b in both 2018 and 2019 compared with an average of $54/b in 2017.

- EIA expects West Texas Intermediate (WTI) crude oil prices to average $4/b lower than Brent prices in both 2018 and 2019. NYMEX WTI contract values for May 2018 delivery traded during the five-day period ending March 1, 2018, suggest a range of $51/b to $76/b encompasses the market expectation for June 2018 WTI prices at the 95% confidence level.

- EIA estimates that U.S. crude oil production averaged 10.3 million barrels per day (b/d) in February, up 230,000 b/d from the January level, when there were some well freeze-offs in the Permian and Bakken. EIA has reported that total U.S. crude oil production averaged 9.3 million b/d in 2017, ending the year with production of 9.9 million b/d in December. EIA projects that U.S. crude oil production will average 10.7 million b/d in 2018, which would mark the highest annual average U.S. crude oil production level, surpassing the previous record of 9.6 million b/d set in 1970. EIA forecasts that 2019 crude oil production will average 11.3 million b/d.

- EIA estimates that inventories of global petroleum and other liquid fuels declined by 0.6 million b/d in 2017. In this forecast, global inventories grow by about 0.4 million b/d in 2018 and by another 0.3 million b/d in 2019.

Natural gas

- EIA estimates that U.S. dry natural gas production averaged 73.6 billion cubic feet per day (Bcf/d) in 2017. EIA forecasts that natural gas production will average 81.7 Bcf/d in 2018, establishing a new record. That level would be 8.1 Bcf/d higher than the 2017 level and the highest annual average growth on record. EIA expects natural gas production will also increase in 2019, with forecast growth of 1.0 Bcf/d.

- In February, the U.S. benchmark Henry Hub natural gas spot price averaged $2.66 per million British thermal units (MMBtu), down $1.03/MMBtu from January. Winter
weather moderated in February after extremely cold temperatures in much of the country during the first half of January. U.S. heating degree days were an estimated 17% lower than the 10-year average for February, which contributed to lower consumption and prices.

- EIA expects natural gas prices to moderate in the coming months, based on a forecast of record natural gas production levels. EIA expects Henry Hub spot prices to average $2.72/MMBtu in March and $2.99/MMBtu for all of 2018. In 2019, EIA forecasts prices will average $3.07/MMBtu. NYMEX contract values for June 2018 delivery that traded during the five-day period ending March 1, 2018, suggest that a range of $2.16/MMBtu to $3.49/MMBtu encompasses the market expectation for June 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 34% in both 2018 and 2019. The forecast generation share from coal in both 2018 and 2019 averages 29%, down from 30% in 2017. The nuclear share of generation was 20% in 2017 and is forecast to average 20% in 2018 and 19% in 2019. Nonhydropower renewables provided slightly less than 10% of electricity generation in 2017 and are expected to provide 10% in 2018 and nearly 11% in 2019. The generation share of hydropower was over 7% in 2017 and is forecast to fall below 7% in both 2018 and 2019.

- EIA forecasts coal production to decline by almost 5% to 736 million short tons (MMst) in 2018 and then increase by 1% to 745 MMst in 2019. Lower expected global demand for U.S. coal exports (down 17% in 2018 and another 5% in 2019) and lower forecasts of coal use in the electric power sector (down 5% in 2018) contribute to the forecast of lower coal production.

- U.S. coal exports were 97 MMst in 2017, a 61% increase from the previous year, but they are expected to decrease in both 2018 and 2019. Exports of metallurgical coal, which are used in the steelmaking process, remain at 55 MMst in 2018 and decline to 54 MMst in 2019. Steam coal exports, which were an estimated 42 MMst in 2017, are expected to decline to 26 MMst and 23 MMst in 2018 and 2019, respectively.

- In 2017, EIA estimates that wind generated on average 697,000 megawatthours per day (MWh/d). EIA projects that generation from wind will rise to 722,000 MWh/d in 2018 and to 778,000 MWh/d in 2019. If factors such as precipitation and snowpack remain as forecast, conventional hydropower is projected to generate 747,000 MWh/d in 2019, which would make it the first year that wind generation exceeds hydropower generation.
• Total solar electricity generation averaged an estimated 211,000 MWh/d in 2017. EIA projects that it will reach 246,000 MWh/d in 2018 and 294,000 MWh/d in 2019.

• After declining by 0.6% in 2017, EIA projects that energy-related carbon dioxide (CO2) emissions will increase by 1.0% in 2018 and by another 0.8% in 2019. 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 $63.83 per barrel (b) on March 1, a decrease of $5.82/b since February 1. Front-month futures prices for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, decreased $4.81/b over the same period, settling at $60.99/b on March 1 (Figure 1). February Brent and WTI monthly average spot prices were $3.76/b and $1.49/b lower than the January average spot prices, respectively.

![Crude oil front-month futures prices](image)

Crude oil prices declined in February after seven consecutive months of increases. Despite the recent price declines, most fundamental crude oil supply and demand indicators suggest global petroleum inventories are declining. EIA estimates that total commercial petroleum inventories in countries in the Organization for Economic Cooperation and Development (OECD) declined to 2.83 billion barrels in February 2018, a decrease of 211 million barrels since February 2017 and the largest annual decrease in inventories since 2003. Inventories are 40 million barrels (1.4%) higher than the five-year average level for February, the narrowest difference to five-year average levels since November 2014, suggesting an increasingly balanced market.

A significant increase in price volatility after prices started declining in equity and bond markets likely affected crude oil prices as well. The rolling 60-day correlation between daily price
changes of WTI crude oil and the S&P 500 index recently increased from near zero at the beginning of January to over 0.3 in late February. The VIX, a measure of implied volatility (the market’s expected range of near-term price changes) on S&P 500 index options, closed above the OVX, a measure of implied volatility on crude oil options prices, for four consecutive days in early February. Not only was this the first time since 2008 that the VIX closed above the OVX, but the VIX has only closed above the OVX four other times since the inception of the OVX in 2007 (Figure 2).

Under typical trading conditions, a single commodity would be expected to have higher volatility than an index whose underlying value consists of a basket of 500 large capitalization stocks, representing a variety of U.S. companies. Although the direct causes of increased equity market volatility remain uncertain, increased trading volume of inverse VIX exchange-traded funds (ETF) and exchange-traded notes, as well as direct selling of VIX futures contracts, could have contributed to the increase. A significant increase in volatility may have prompted the inverse VIX ETF to close positions. Several inverse VIX products have ceased trading, having lost more than 80% of their value in one day on some of the highest trading volume in the many ETFs’ history. Both the VIX and the OVX have declined since their early February increases, but remain at higher levels than at the beginning of 2018.

The Brent-WTI price spread narrowed to its lowest level in more than six months, closing at $3.03/b on March 1 (Figure 3). Several factors specific to the crude oil market in the U.S. midcontinent could be contributing to a narrowing spread. Crude oil stocks in Cushing, Oklahoma, the delivery point for the U.S. light sweet crude oil futures contract, continued to decrease in February. Stocks declined to less than 29 million barrels the week ending February 23, 2018, the lowest level in more than three years, and they are being drawn down at the largest rolling 13-week rate since EIA began publishing Cushing stock levels in 2004. Recent trade press reports that the Keystone pipeline, which flows directly into Cushing, is still operating below nameplate capacity. Crude oil inputs to refineries in Petroleum Administration
for Defense District (PADD) 2 averaged 3.7 million barrels per day (b/d) for the four weeks ending February 23, 2018, according to EIA’s Weekly Petroleum Supply Report, which would be an all-time high for the month of February.

In addition to high refinery demand in PADD 2, higher export demand could be contributing to near-term price support for U.S. light sweet crude oil. Weekly U.S. crude oil exports were more than 2 million b/d for the week ending February 16, 2018, the second highest level since EIA began publishing weekly export data from U.S. Customs and Border Protection in 2016 (Figure 4). The Louisiana Offshore Oil Port (LOOP) is the largest crude oil import terminal in the United States, but recently the port began to test loading crude oil for export. LOOP loaded a Very Large Crude Carrier (VLCC) on February 18, which can hold approximately 2 million barrels of crude oil. Further infrastructure developments along the U.S. Gulf Coast (PADD 3) could allow more U.S. crude oil exports.
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 $1.90 per gallon (gal) on March 1 (Figure 5), virtually unchanged since February 1. The RBOB-Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) increased by 14 cents/gal over the same period to settle at 38 cents/gal. The RBOB-Brent crack spread declined 5 cents/gal in February before the contract changed to summer grade gasoline on March 1, causing a significant one day increase in the crack spread.

Gasoline inventories, which typically decline between January and February, rose this year in all regions of the United States. Total U.S. gasoline stocks rose 6.3 million barrels between the weeks ending February 2 and February 23. Total U.S. gasoline stocks have declined between January and February on average by 5.8 million barrels over the past five years, according to EIA’s Petroleum Supply Monthly (PSM).

Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price decreased 20 cents/gal from February 1 to settle at $1.89/gal on March 1. The ULSD-Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) decreased by 7 cents/gal over the same period, settling at 37 cents/gal (Figure 6).

Similar to the movements seen in the gasoline market, distillate crack spreads fell in February, as distillate inventories rose counter-seasonally. In the Central Atlantic (PADD 1B), which includes the New York Harbor delivery point of the ULSD futures contract, distillate inventories rose 0.7 million barrels between the weeks ending February 2 and February 23. In comparison, distillate inventories in PADD 1B declined 2.7 million barrels on average between January and February in the past five years, according to the PSM. For much of February, the U.S. East Coast and the U.S. Northeast experienced warmer-than-normal temperatures, which likely reduced demand for home heating.
In recent months, year-over-year growth in total U.S. liquid fuels consumption and exports has accelerated to levels not seen since 2015. Since October 2017, year-over-year growth in total liquid fuels consumption and exports averaged 1.0 million b/d, with an increasing portion of the growth coming from hydrocarbon gas liquids (HGL), which includes propane and ethane (Figure 7).

EIA expects U.S. liquid fuels consumption to grow 0.47 million b/d (2.4%) in 2018, the highest growth rate since 2013. EIA projects that most of the consumption growth will come from natural gas-sourced products. HGL consumption is expected to account for 0.34 million b/d of total liquid fuels consumption growth. Ethane is expected to account for almost 65% of this HGL consumption growth, as new domestic ethylene crackers begin operating.
Natural Gas

The front-month natural gas futures contract for delivery at Henry Hub settled at $2.70/million British thermal units (MMBtu) on March 1, a decrease of 16 cents/MMBtu from February 1 (Figure 8). Warmer weather in the second half of January and in February contributed to the fall in natural gas prices. U.S. population-weighted heating degree days (HDD) averaged 12% below normal for the four weeks ending February 22, which put downward pressure on natural gas prices throughout the month. The Henry Hub natural gas spot price averaged $2.66/MMBtu in February, $1.03/MMBtu lower than January.

![Figure 8. Natural gas front-month futures prices and actual minus historical average HDD and CDD](image)

The historical and implied volatilities of natural gas prices both increased in January, as typically happens each winter (Figure 9). Historical volatility reached 67% on February 5, the highest level since January 2017, reflecting the price spikes at the beginning of January and significant price declines at the end of the month. Implied volatility, however, declined quickly at the end of January and fell to 26% on February 28, the lowest implied volatility since June 2014. Implied volatility represents the market’s expectation about near-term price movements; as a result, the low natural gas price implied volatility may indicate that strong production growth will be sufficient to meet demand, despite inventories that are currently below their five-year average.
Natural gas futures prices fell in the front-month contract, and substantial price decreases occurred in contracts several months into the future. These price declines significantly reduced the market-derived probability of the July 2018 Henry Hub futures contract expiring above $3/MMBtu; the probabilities fell from 42% at the beginning of the month to 28% on March 1 (Figure 10). Natural gas inventory withdrawals for the four weeks ending February 23 were 53 billion cubic feet (9%) below the five-year average, which likely contributed to an improved supply outlook for the next several months.
Notable forecast changes

EIA forecasts U.S. hydrocarbon gas liquids consumption to average 2.94 million barrels per day (b/d) in 2018 and 3.19 million b/d in 2019, which are about 50,000 b/d and 60,000 b/d higher, respectively, than forecast in the February STEO. The March forecast incorporates higher-than-expected monthly ethane consumption data for November and December, which provide a higher starting point for expected growth from new ethane-consuming petrochemical plants.