Independent Statistics & Analysis
U.S. Energy Information Administration

May 2019

Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- Brent crude oil spot prices averaged $71 per barrel (b) in April, up $5/b from March 2019 and just below the price in April of last year. EIA forecasts Brent spot prices will average $70/b in 2019 and $67/b in 2020, both about $5/b higher than in last month's STEO, compared with an average of $71/b in 2018. EIA's higher Brent crude oil price forecast reflects tighter expected global oil market balances in mid-2019 and increasing supply disruption risks globally.

- EIA forecasts that crude oil production in the Organization of the Petroleum Exporting Countries (OPEC) will average 30.3 million barrels per day (b/d) in 2019, down by 1.7 million b/d from 2018. In 2020, EIA expects OPEC crude oil production to fall by 0.4 million b/d to an average of 29.8 million b/d. Production in Venezuela and Iran account for most of the OPEC output declines in 2019 and in 2020, but EIA expects these declines to be partially offset by production increases from other OPEC members.

- EIA forecasts global oil inventories will decline by 0.2 million b/d in 2019 and then increase by 0.1 million b/d in 2020. Global demand outpaces supply in 2019 in EIA's forecast, but global liquid fuels supply then rises by 1.9 million b/d in 2020, with 1.5 million of that growth coming from the United States. Global oil demand rises by 1.5 million b/d in 2020 in the forecast, up from expected growth of 1.4 million b/d in 2019.

- For the 2019 summer driving season, which runs from April through September, EIA forecasts that U.S. regular gasoline retail prices will average $2.92 per gallon (gal), up from an average of $2.85/gal last summer. The higher forecast gasoline prices primarily reflect EIA's expectation of higher gasoline refining margins this summer, despite slightly lower crude oil prices.

Natural gas

- The Henry Hub natural gas spot price averaged $2.64/million British thermal units (MMBtu) in April, down 31 cents/MMBtu from March. Prices fell as a result of warmer-than-normal temperatures across much of the United States, which reduced the use of natural gas for space heating and contributed to above-average inventory injections during the month. EIA expects strong growth in U.S. natural gas production to put downward pressure on prices in 2019 and in 2020. EIA expects Henry Hub natural gas

spot prices will average $2.79/MMBtu in 2019, down 36 cents/MMBtu from 2018. The forecasted 2020 average Henry Hub spot price is $2.78/MMBtu.

- EIA forecasts that dry natural gas production will average 90.3 billion cubic feet per day (Bcf/d) in 2019, up 6.9 Bcf/d from 2018. EIA expects natural gas production will continue to grow in 2020 to an average of 92.2 Bcf/d.

- EIA estimates that natural gas inventories ended March at 1.2 trillion cubic feet (Tcf), 16% lower than levels from a year earlier and 29% lower than the five-year (2014–18) average. EIA forecasts that natural gas storage injections will outpace the previous five-year average during the April-through-October injection season and that inventories will reach 3.7 Tcf at the end of October, which would be 15% higher than October 2018 levels and about equal to the five-year average.

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 35% in 2018 to 37% in 2019 and to 38% in 2020. EIA forecasts that the share of electricity generation from coal will average 24% in 2019 and 22% in 2020, down from 27% in 2018. The nuclear share of generation was 19% in 2018, and EIA forecasts that it will stay near that level in 2019 and in 2020. The generation share of hydropower averages 7% of total generation in EIA's forecast for 2019 and 2020, similar to 2018. Wind, solar, and other nonhydropower renewables together provided about 10% of electricity generation in 2018. EIA expects they will provide 11% in 2019 and 13% in 2020.

- EIA forecasts that all renewable fuels, including wind, solar, and hydropower, will produce 18% of U.S. electricity in 2019 and almost 20% in 2020. EIA expects that wind generation will surpass hydropower generation for the first time to become the leading source of renewable electricity generation in 2019 and maintain that position in 2020.

- EIA estimates that U.S. coal production in the first quarter of 2019 was 170 million short tons (MMst), 22 MMst (12%) lower than the previous quarter and 17 MMst (9%) lower than production in the first quarter of 2018. EIA expects that coal production will fall during the forecast period as demand for coal (domestic consumption and exports) declines. EIA forecasts that coal production will total 700 MMst in 2019 and 638 MMst in 2020 (declining by 7% and 9%, respectively).

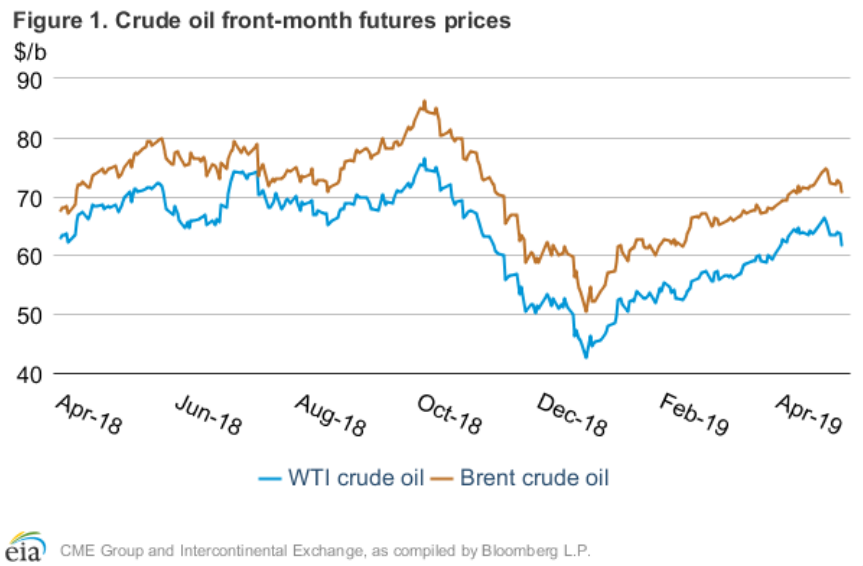
- After rising by 2.7% in 2018, EIA forecasts that U.S. energy-related carbon dioxide (CO_2) emissions will decline by 2.1% in 2019 and by 0.8% in 2020. EIA expects emissions to fall in 2019 and in 2020 as forecast temperatures return to near normal after a warm summer and cold winter in 2018 and because the forecast share of electricity generated from natural gas and renewables increases while the forecast share generated from coal, which produces more CO_2 emissions, decreases. Energy-related CO_2 emissions are sensitive to 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 $70.75 per barrel (b) on May 2, 2019, an increase of $1.74/b from April 1. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, increased by 22 cents/b during the same period, settling at $61.81/b on May 2 **(Figure 1)**.

Figure 1. Crude oil front-month futures prices



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

Crude oil prices increased for the fourth consecutive month in April, approaching six-month highs near the end of the month. Price increases have generally reflected a decline in global oil inventories during the first four months of the year, more recently occurring amid a backdrop of heightened market perceptions of oil supply risk. On April 22, 2019, the United States notified the eight countries that were initially granted sanction waivers allowing them to continue to import Iranian crude oil and condensate that the waivers will not be extended past their May 2 expiration. Front-month Brent crude oil prices increased by $2/b on April 22, but as of the time of writing, prices had declined to levels from before the announcement.

Although EIA forecasts Iranian crude oil production and exports to decline, crude oil supply from other countries—including some from the Organization of the Petroleum Exporting Countries (OPEC)—are expected to mostly offset the lost Iranian barrels in the coming months. EIA expects increases in crude oil production in Saudi Arabia, the United Arab Emirates, Kuwait, and Russia to largely backfill the lower Iranian production, though these countries will likely wait until their June meeting to make any decisions regarding production increases. In addition, EIA expects recent crude oil price increases, and expected higher oil prices through the forecast period, to contribute to an increase in drilling activity in the United States. The expected increase in drilling activity led EIA to revise the U.S. crude oil production forecast to 13.4 million barrels per day (b/d) in 2020, 0.3 million b/d higher than in the April STEO. These crude oil supply responses,

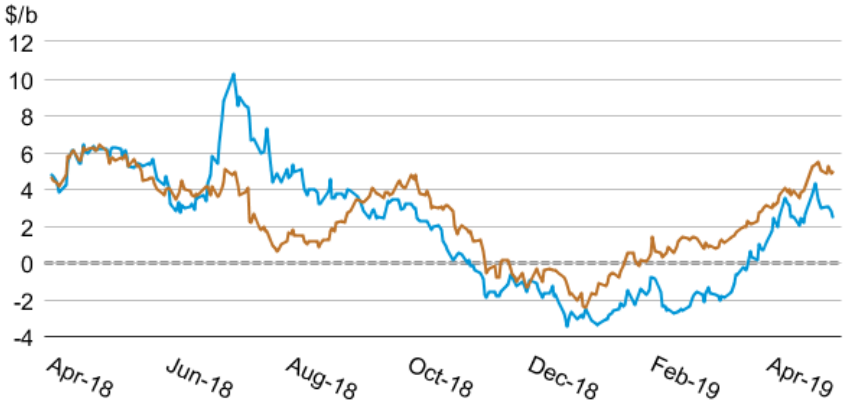
however, will take several months to materialize completely, whereas the disruption from Iran is likely to occur within weeks.

Given the expected delayed response of global crude oil production to current oil market fundamentals, EIA now expects average net global oil inventory withdrawals of about 0.4 million b/d during the second and third quarters of 2019. As a result of near-term market tightness, EIA expects second and third quarter Brent prices to average $73/b, which is $5/b higher than previously forecast. EIA forecasts prices to decline to an average of $67/b in 2020 as the market moves to slight inventory builds.

The higher forecast prices in this STEO also reflects increased geopolitical risk. Unrest within Venezuela contributes to a highly uncertain situation that could immediately disrupt the remaining oil production there. Even if the ongoing unrest does not cause additional disruptions, EIA forecasts that Venezuela's production will continue to see significant declines through 2020. Similarly, although recent fighting in Libya had not affected any crude oil production or export infrastructure as of the time of writing, the civil unrest has increased the disruption risk significantly.

With the timing of any backfill of lost crude oil production and the risk of oil supply disruptions remaining uncertain, the shape of the crude oil futures curve reflects recent calls on available inventory to meet global oil demand. The Brent and WTI 1st–13th spread increased by $1.97/b and 78 cents/b since April 1, respectively, settling at $4.88/b and $2.46/b on May 2, respectively **(Figure 2)**. EIA estimates that liquid fuels inventories for countries in the Organization for Economic Cooperation and Development (OECD), on a days-of-supply basis, ended April slightly below their five-year (2014–18) average level. The price increases in the futures market have been primarily concentrated in the near-month contracts, indicating current market prices are accounting for potential effects for near-term crude oil supply disruptions and inventory withdrawals without as large a price increase on longer-dated crude oil contracts.

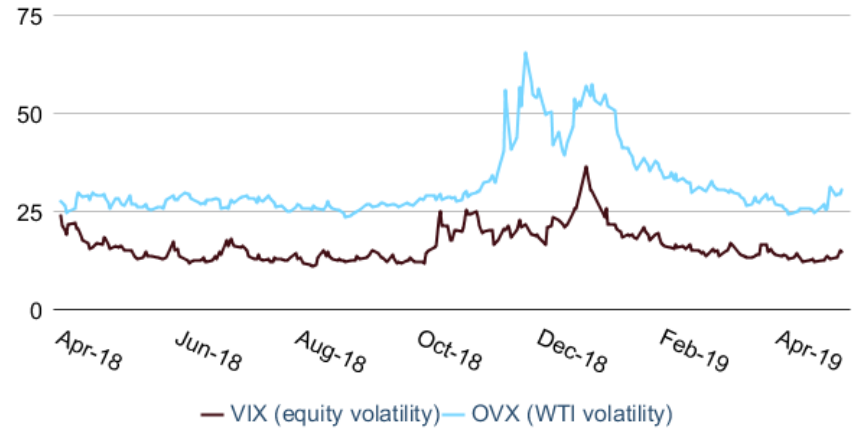
Figure 2. Crude oil front-month to 13th month futures price spread



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

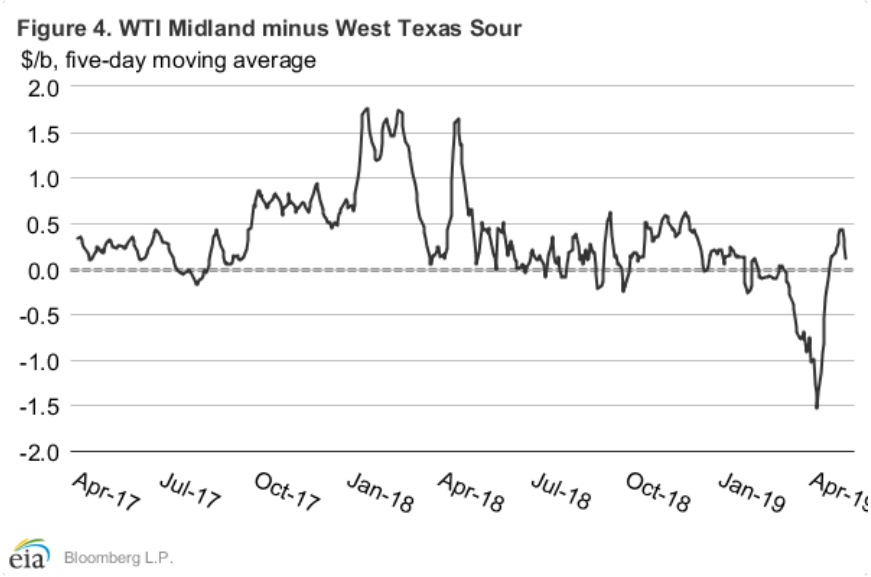
Volatility: Implied volatility for both WTI crude oil and the S&P 500 Index reached the lowest levels since late 2018 in April **(Figure 3)**. Both crude oil and equity prices have exhibited high price correlation since 2018, indicating the two assets may be responding to similar fundamental economic information, such as economic growth. U.S. GDP increased 3.2% in the first quarter of 2019, which was higher than market expectations. In addition, both the U.S. Federal Reserve and the European Central Bank made announcements that they will remain generally accommodative and less restrictive in their monetary policy decisions. Stable macroeconomic growth can reduce uncertainty in expectations for crude oil demand and contribute to lower price volatility. These same factors are also likely contributing to lower volatility in the S&P 500 index. Crude oil implied volatility increased by six percentage points from April 18 through May 2, when concerns about crude oil supply availability emerged after Iranian import waivers were not extended.

Figure 3. Equity and crude oil volatility indices



eia Chicago Board of Options Exchange, as compiled by Bloomberg L.P.

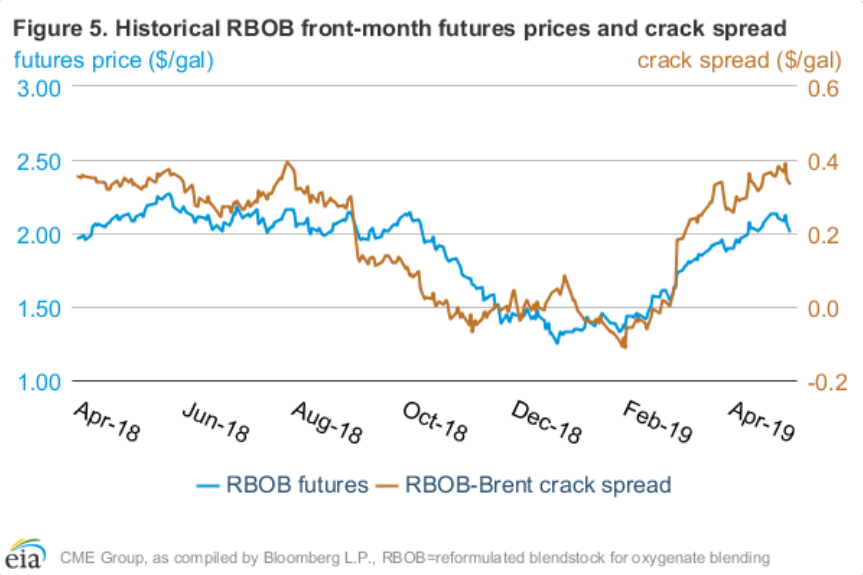
Crude oil price spreads: Light, sweet crude oil prices in the Midland hub, the area where crude oil produced from the Permian region is traded, developed a rare and significant discount to light, sour crude oil prices in the region in April. The five-day moving average of the differential between WTI Midland and West Texas Sour (WTS) crude oil prices neared a four-year low of -$1.54/b on April 4, 2019. The spread increased $1.65/b since then to settle at 11 cents/b on May 2 **(Figure 4)**. Trade press reports from Reuters indicate that new WTI Midland production has been lighter than the WTI Cushing specifications, which may have been reflected in the discount. The price spread reached 42 cents/b in the last week of April, near the 2018 average premium of 47 cents/b, likely because producers and marketers began offering a separate stream of higher API gravity crude oil, called West Texas Light, for delivery. This segregation appears to have successfully amended the specification problems with WTI Midland spot deliveries.



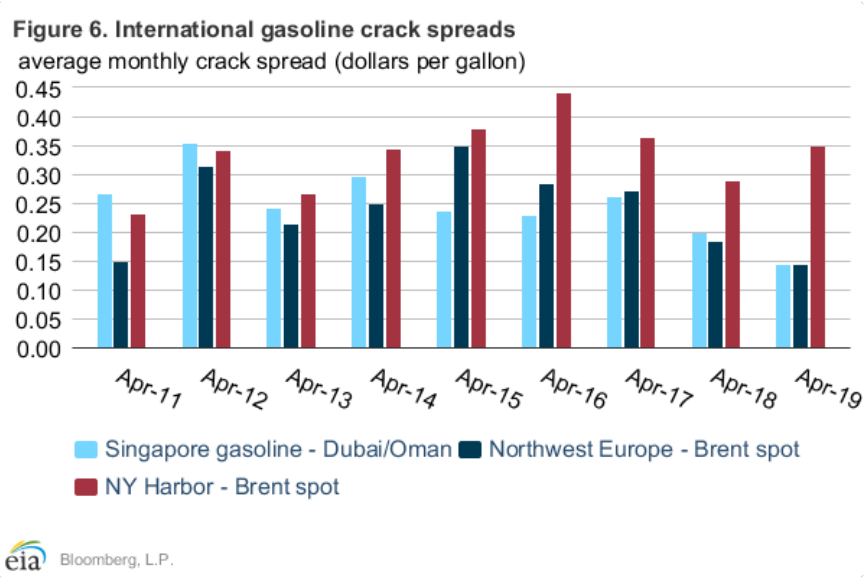
Petroleum products

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 $2.02 per gallon (gal) on May 2, 2019, an increase of 12 cents/gal since April 1 **(Figure 5)**. The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) increased by 8 cents/gal to settle at 33 cents/gal during the same period.

The RBOB–Brent crack spread averaged 33 cents/gal in April, the lowest for April since 2010. However, the average crack spread increased by seven cents/gal from March, more than the five-year (2014–18) average increase of one cent/gal for this time period. The higher-than-normal increase signals that the RBOB crack spread may be returning to average seasonal levels after a record-low first quarter of 2019. EIA estimates that U.S. gasoline consumption averaged 9.35 million barrels per day (b/d) in April, an increase of 0.16 million b/d from the same period last year. In addition, April gasoline stocks ended 8.1 million barrels lower than the five-year average for that month, declining for the third consecutive month after ending January 2019 at 261.3 million barrels, which was 11.2 million barrels higher than the five-year average for that month.



Historically low gasoline crack spreads have recovered less quickly in other regions of the world. The Northwest Europe gasoline–Brent spot price crack spread averaged 14 cents/gal in April. Each month in 2019 has been the lowest crack spread for that month since at least 2011 **(Figure 6)**. The Singapore gasoline–Dubai/Oman spot price crack spread also averaged 14 cents/gal in April, the lowest since at least 2011 and 10 cents/gal less than the five-year average for the month.

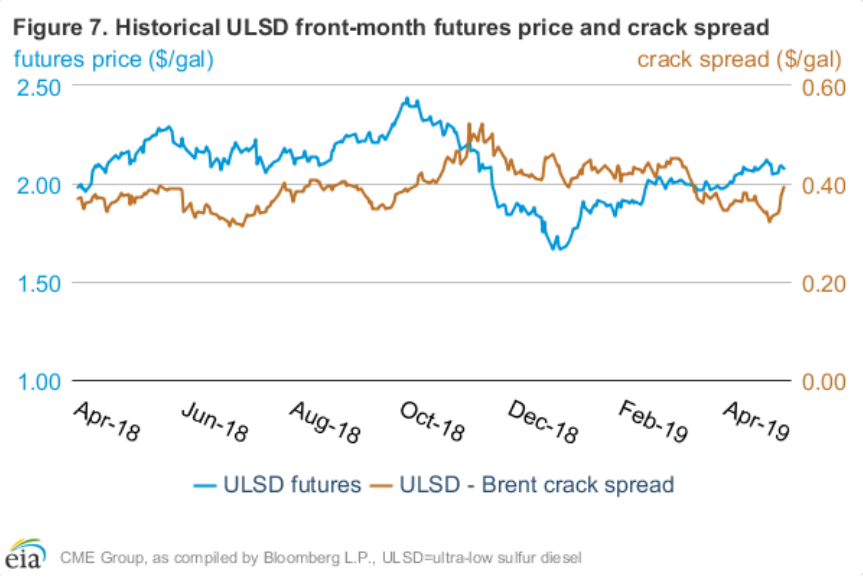


Light distillate stocks (which include gasoline) in Singapore have declined since reaching record inventory levels in February, yet remain higher than the five-year average. Gasoline stocks in the Amsterdam-Rotterdam-Antwerp trade hub in Europe were below the five-year average in April, after remaining above the five-year range for the first two months. Economic indicators signaling slower economic growth in the region could have contributed to lower consumption levels and slower stock draws. In addition, trade press indicates that low water levels on the

Rhine River in Germany slowed the transport of gasoline from storage hubs to regional distribution centers in late April. Previously high gasoline inventories in Europe may be tempered in the coming weeks by the potential for increased exports to the United States, as U.S. gasoline consumption reaches its seasonal high and if shippers take advantage of the opportunity to sell European gasoline at higher prices in the United States.

Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price increased 9 cents/gal from April 1 to settle at $2.08/gal on May 2. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) increased by 5 cent/gal to settle at 39 cents/gal during the same period **(Figure 7)**.

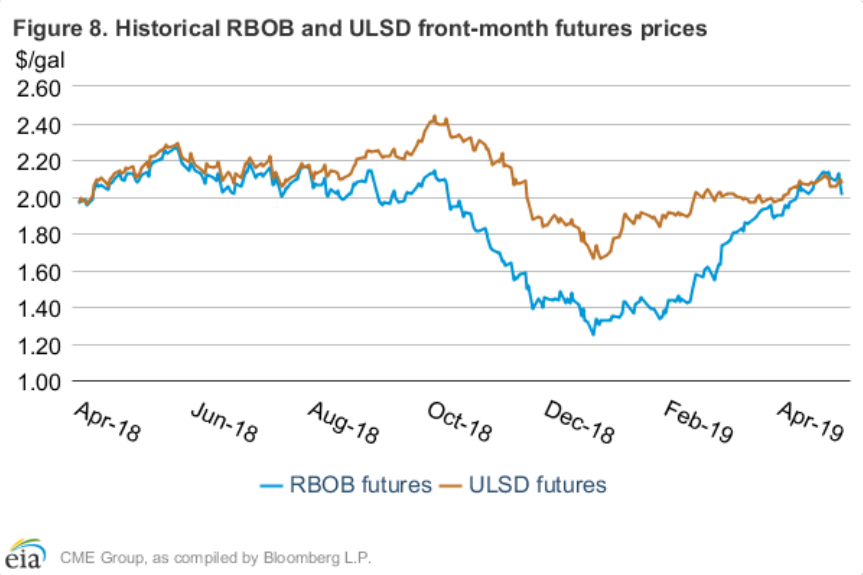
Figure 7. Historical ULSD front-month futures price and crack spread



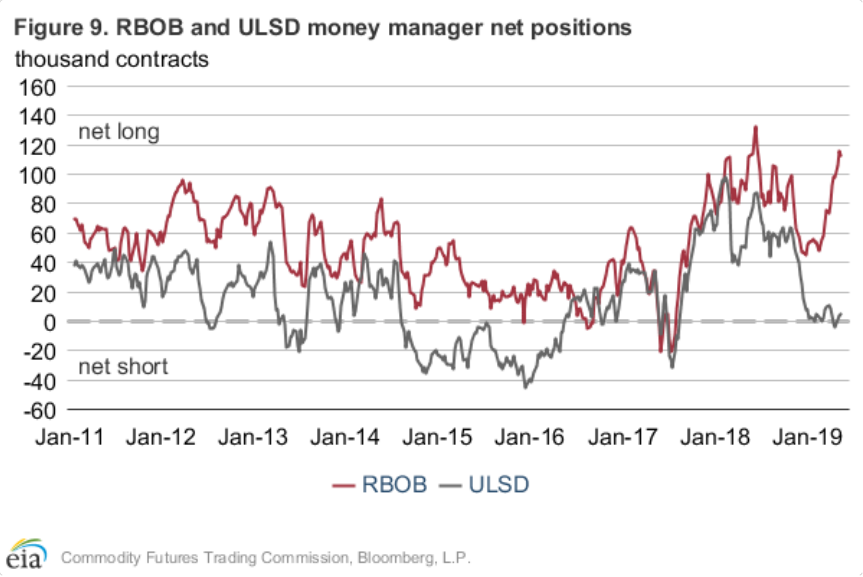
eia CME Group, as compiled by Bloomberg L.P., ULSD=ultra-low sulfur diesel

EIA estimates that U.S. distillate consumption—measured as product supplied—was 3.93 million b/d in April, a decrease of 0.18 million b/d from March 2019 and a decrease of 0.22 million b/d from April 2018, which possibly contributed to lower distillate crack spreads. U.S. distillate stocks in April ended 5.1 million barrels higher than in April 2018 but still 9.7 million barrels lower than the five-year average. Initial estimates for distillate exports indicate exports averaged 1.45 million b/d for the four weeks ending April 26, 2019, which if confirmed in the monthly data, would be close to the record high for the month of April set last year.

The monthly average ULSD front-month futures price had remained at a premium to RBOB front-month futures prices since April 2018, but narrowed during April 2019. The daily ULSD front-month futures price began trading at a discount to RBOB front-month futures prices beginning on April 18, 2019, for the first time since July 27, 2018 **(Figure 8)**. Gasoline prices generally start trading at a premium to ULSD prices in March, when the RBOB futures contract represents the more expensive summer grade of gasoline. Historically low gasoline prices during the winter had delayed this seasonal pattern, however, as prices had to recover a greater differential to ULSD.



Money manager positions: Futures and options positions held by money managers for RBOB and ULSD contracts have moved in opposite directions since the beginning of March. The money manager category of the *Commitments of Traders* report, published weekly by the Commodity Futures Trading Commission, includes fund managers that conduct organized futures trading on behalf of clients, and they are not involved in physical oil trading as their business activity. The ULSD money manager positions were briefly net short in April, whereas net long positions for RBOB significantly increased **(Figure 9)**. The movements in money manager positions reflect recent price changes noted above, where ULSD futures prices, which had been at a substantial premium to RBOB futures prices for several months, briefly fell below RBOB prices in late April.

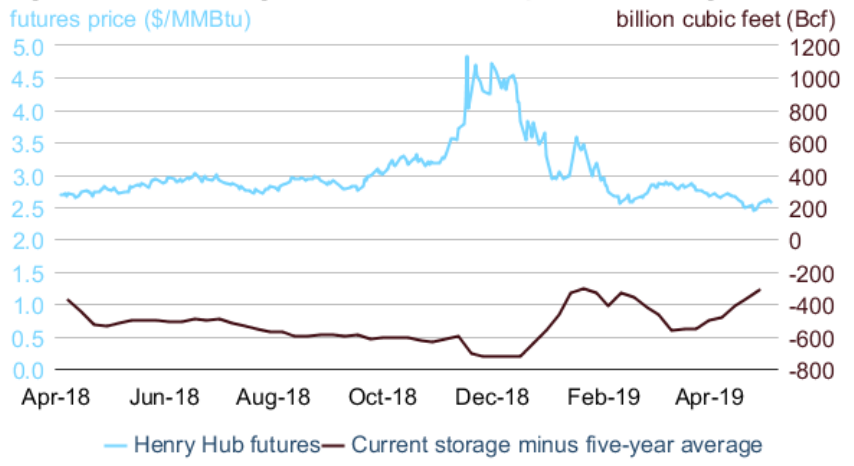


Natural Gas

Prices: The front-month natural gas futures contract for delivery at Henry Hub settled at $2.59 per million British thermal units (MMBtu) on May 2, a decrease of 12 cents/MMBtu from April 1 **(Figure 10)**. April 2019 was the second-warmest April in the past 23 years. EIA estimates that relatively warm temperatures, combined with ongoing increases in natural gas production, contributed to the largest injection of natural gas into U.S. working storage in April based on historical data going back to 1976.

The larger-than-normal April injections brought U.S. storage levels closer to the five-year (2014–18) average. EIA estimates that working natural gas inventories in the United States at the end of April were 314 billion cubic feet (Bcf) (17%) lower than the five-year average, compared with 486 Bcf (29%) lower at the end of March. If this estimate is confirmed in monthly data, April 2019 would be the first month since November 2016 to show a year-on-year increase in natural gas working inventories. Above-average inventory builds contributed to downward natural gas price movements throughout April. EIA forecasts that higher natural gas production during the injection season will continue to reduce the storage deficit relative to the five-year average and contribute to Henry Hub spot prices remaining lower than $2.70/MMBtu on average in the second and third quarters of this year.

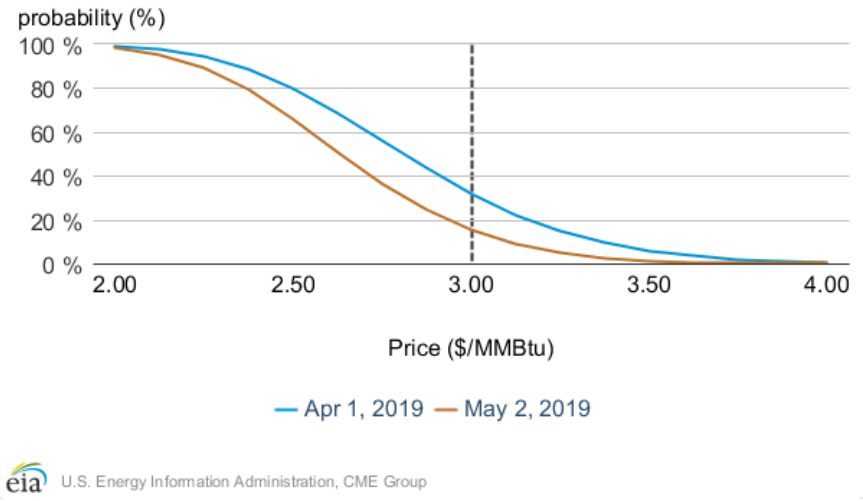
Figure 10. U.S. natural gas front-month futures prices and storage



Market-derived probability: At the beginning of April, the market-derived probability of the August 2019 Henry Hub futures contract expiring at more than $3/MMBtu was 32% **(Figure 11)**. The probability—calculated using futures and options data—of the contract expiring at more than $3/MMBtu decreased significantly throughout the month, reaching 15% on May 2. The lower probability was driven by the declining futures price amid relatively low implied volatility, which indicates lower expectations by market participants that prices will change significantly in the near future. Implied volatility has remained lower than the five-year range for three

consecutive months. Lower natural gas consumption contributed to higher rates of injection into storage, which has helped to reduce supply concerns and put downward pressure on prices.

Figure 11. Probability of the August 2019 Henry Hub contract expiring higher than specified price levels

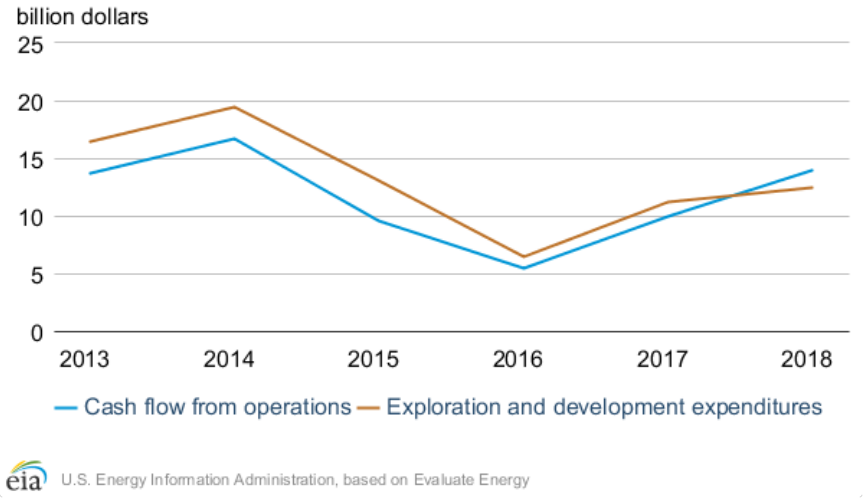


U.S. Energy Information Administration, CME Group

Annual 2018 financials: A review of annual financial reports for 25 U.S. natural gas producers shows that cash flow from operations in 2018 for this group exceeded expenditures for exploration and development for the first time in the past six years **(Figure 12)**. However, because these companies were not selected as a statistically representative sample, their results cannot be considered representative of the U.S. natural gas production industry as a whole. The group consists of producers that report their financial results publicly, that EIA has followed for some time, and that have natural gas production that is at least 60% of their total output and at least 75% of their production is in the United States. EIA published a similar analysis for a different set of companies that are primarily oil producers in a recent *This Week in Petroleum*.

Cash flow from operations for these 25 natural gas-focused companies rose for the past two years with increases in both natural gas prices and production. Exploration and development expenditures for this set of companies also rose in 2018 but by less than the increase in cash flow from operations. The larger increase in cash flow from operations reduced the net amount of funds that this group of producers needed from other funding sources, such as equity or debt. Even though spending on exploration and development was less than cash flow from operations, this group of producers added more than twice the amount of proved natural gas reserves than the natural gas they produced in 2018, which increased their resource base for future production. This analysis supports EIA's forecast of rising U.S. dry natural gas production, which is forecast to increase by 6.9 billion cubic feet per day (Bcf/d) in 2019 and by 1.9 Bcf/d in 2020.

Figure 12. Cash flow from operations and exploration and development expenditures for 25 U.S. natural gas producers



Notable forecast changes

- EIA forecasts Brent crude oil prices to average $70 per barrel (b) in 2019 and $67/b in 2020, both up about $5/b from last month's STEO forecast. Global oil inventories are expected to fall by 0.2 million barrels per day (b/d) in 2019, compared with a build of 0.1 million b/d forecast in the April STEO. Inventories are then forecast to increase by 0.1 million b/d in 2020, compared with a build of 0.4 million b/d forecast in the April STEO. The tighter balances largely reflect updated assumptions about Iranian crude oil and condensate production and exports following the U.S. announcement that it would not renew waivers granted to eight countries in November 2018 to import Iranian crude oil. Although EIA's previous forecasts had assumed no waivers would be granted to import Iranian oil after existing exemptions expired on May 2, EIA lowered its forecast of Iranian production in the May STEO to reflect increased certainty regarding waiver policy and enforcement. Partly offsetting the lower Iranian production compared with the last forecast is higher forecast crude oil supply from other OPEC members and Russia once the Vienna agreement expires in June and higher crude oil production in the United States as result of higher expected crude oil prices. Oil price outcomes are highly dependent on global levels of crude oil production disruptions, OPEC's response to any disruptions, and the price responsiveness of U.S. tight oil production.

- EIA forecast U.S. crude oil production will average 13.4 million b/d in 2020, which is 0.3 million b/d higher than the 2020 forecast in the April STEO. The higher crude oil production is the result of higher forecast prices in 2019 that have a lagged effect on production.

- For more information, see the detailed table of STEO 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.