Forecast highlights

Global liquid fuels

- Brent crude oil spot prices averaged $73 per barrel (b) in August, down almost $2 from July. EIA expects Brent spot prices will average $73/b in 2018 and $74/b in 2019. EIA expects West Texas Intermediate (WTI) crude oil prices will average about $6/b lower than Brent prices in 2018 and in 2019. NYMEX WTI futures and options contract values for December 2018 delivery that traded during the five-day period ending September 6, 2018, suggest a range of $56/b to $85/b encompasses the market expectation for December WTI prices at the 95% confidence level.

- EIA estimates that U.S. crude oil production averaged 10.9 million barrels per day (b/d) in August, up by 120,000 b/d from June. EIA forecasts that U.S. crude oil production will average 10.7 million b/d in 2018, up from 9.4 million b/d in 2017, and will average 11.5 million b/d in 2019.

- EIA forecasts total global liquid fuels inventories to decrease by 0.4 million b/d in 2018 compared with 2017, followed by an increase of 0.1 million b/d in 2019. This outlook of relatively stable inventory levels during the forecast period contributes to a forecast of monthly average Brent crude oil prices remaining relatively stable, between $72/b and $76/b, from September 2018 through the end of 2019.

Natural gas

- EIA estimates dry natural gas production in the United States was 82.2 billion cubic feet per day (Bcf/d) in August, up 0.7 Bcf/d from July. Dry natural gas production is forecast to average 81.0 Bcf/d in 2018, up by 7.4 Bcf/d from 2017 and establishing a new record high. EIA expects natural gas production will continue to rise in 2019 to an average of 84.7 Bcf/d.

- EIA forecasts that U.S. natural gas inventories will total 3.3 trillion cubic feet (Tcf) at the end of October. This level would be 13% lower than the 2017 end-of-October level and 14% below the five-year (2013–17) average for the end of October, while also marking the lowest level for that time of year since 2005.

- EIA expects Henry Hub natural gas spot prices to average $2.99/million British thermal units (MMBtu) in 2018 and $3.12/MMBtu in 2019. NYMEX futures and options contract
values for December 2018 delivery that traded during the five-day period ending September 6, 2018, suggest a range of $2.31/MMBtu to $3.77/MMBtu encompasses the market expectation for December 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 2018 and to 35% in 2019. EIA’s forecast electricity generation share from coal averages 28% in 2018 and 27% in 2019, down from 30% in 2017. The nuclear share of generation was 20% in 2017 and is forecast to be 20% in 2018 and 19% in 2019. Nonhydropower renewables provided slightly less than 10% of electricity generation in 2017, and EIA expects them to provide more than 10% in 2018 and nearly 11% in 2019. The generation share of hydropower was 7% in 2017 and is forecast to be about the same in 2018 and 2019.

- In 2017, EIA estimates that U.S. wind generation averaged 697,000 megawatthours per day (MWh/d). EIA forecasts that wind generation will rise by 8% to 756,000 MWh/d in 2018 and by 4% to 784,000 MWh/d in 2019.

- Solar power generates less electricity in the United States than wind power, but solar power also continues to grow. EIA expects solar generation will rise from 211,000 MWh/d in 2017 to 263,000 MWh/d in 2018 (an increase of 24%) and to 289,000 MWh/d in 2019 (an increase of 10%).

- EIA forecasts U.S. coal production will decline by 1% to 768 million short tons (MMst) in 2018, despite a 10% (10 MMst) increase in coal exports. The production decrease is largely attributable to a forecast decline of 2% (17 MMst) in domestic coal consumption in 2018. EIA expects coal production to decline by 2% (12 MMst) in 2019, because coal exports and coal consumption are both forecast to decrease.

- EIA estimates U.S. coal exports through the first half of 2018 were 32% (14 MMst) higher than in the same period of 2017, and June was the second month of this year that exports exceeded 10 MMst. EIA forecasts total coal exports to be 107 MMst in 2018 and 101 MMst in 2019, with U.S. coal exports to Asia expected to remain strong. Three of the top five destinations for U.S. coal exports are in Asia, with India, South Korea, and Japan accounting for more than one-third of U.S. exports through March, the most recent month for which EIA has actual data.

- After declining by 0.9% in 2017, EIA forecasts that U.S. energy-related carbon dioxide (CO2) emissions will rise by 2.3% in 2018. The increase largely reflects higher natural gas consumption because of a colder winter and a warmer summer than in 2017. Emissions are forecast to decline by 0.9% in 2019. 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 $76.50 per barrel (b) on September 6, an increase of $4.11/b from August 1. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, increased by 11 cents/b during the same period, settling at $67.77/b on September 6 (Figure 1).

![Figure 1. Crude oil front-month futures prices](image)

Although crude oil prices were up for August as a whole, crude oil prices and prices for commodities more broadly fell in early August. Significant declines in some emerging market currencies may have contributed to increased concerns about global economic growth and its potential impact on oil demand. However, oil prices rose in the second half of August following reports of reduced purchases of Iranian crude oil ahead of the United States reinstituting sanctions on Iran in November. Other supply developments likely contributed to a pull on oil inventories, which contributed to higher prices. A restart to some Canadian production after July’s oil sands outage is anticipated to be delayed until September, and tropical storm activity in the U.S. Gulf of Mexico led to the shutdown of some offshore crude oil platforms. EIA estimates that global petroleum inventories declined by almost 0.4 million barrels per day (b/d) in August, the seventh consecutive month of net inventory withdrawals.

Apparent hedging activity in the crude oil options market suggests several market participants purchased financial protection in anticipation of an increase in crude oil prices ahead of the November implementation of Iranian sanctions. Call options for the December 2018 Brent crude oil futures contract with a strike price of $80/b have been one of the most actively traded out-of-the-money contracts in recent months. A call option—which gives the buyer the right, but not the obligation, to purchase an underlying security at a specific price by a certain time—is out-of-the-money when the strike price of the option is higher than the price that the futures contract is currently trading.
Trading volume averaged more than 2,000 contracts per day since May, and trading of 10,000 or more contracts occurred on some days in July and August (Figure 2). Third-party ship tracking data indicate that several countries may have already reduced purchases of Iranian crude oil, and August estimates of waterborne crude oil exports from Iran to be 19% lower than the average during first seven months of 2018. EIA estimates that Iranian crude oil production declined 0.2 million b/d from July to August. If the reduction in Iranian crude oil production and exports is larger than expected, the disruption to the crude oil market in the fourth quarter of 2018 could result in price increases. End users could be financially hedging against this outcome through the purchase of call options, which gain in value as the underlying security price increases, among other factors.

**Figure 2. Daily trading volume for the Brent December 2018 $80/b strike call option**

![Graph showing trading volume](image)

**Crude oil price spreads:** Crude oil prices in the Permian region of Texas and New Mexico traded at wide differentials to those on the U.S. Gulf Coast in August. The WTI-Midland differential to Magellan East Houston reached a low of -$23.95/b on September 4 before settling at -$22.45/b on September 6 (Figure 3). The wide differential between Permian region prices and the Houston prices is the result of constrained pipeline capacity to move crude oil along that route, which has caused producers without pipeline space to ship crude oil using more costly modes of transportation, such as trucks. In addition to this capacity constraint, the differential in August could have been exacerbated by a fire near a storage tank that feeds the Basin Pipeline, which runs from the Permian to Cushing, Oklahoma. The fire disrupted an estimated 50,000 b/d of flow, more than 10% of the pipeline's total capacity. Although the disruption was brief, prices in Midland declined $2.15/b compared with Magellan East Houston prices on the day of the fire.
EIA’s August Drilling Productivity Report estimates that crude oil production in the Permian region will grow to 3.4 million b/d in September. Current estimates of available regional refinery intake and pipeline takeaway capacity is about 3.6 million b/d. Even though crude oil takeaway infrastructure constraints could contribute to wide price discounts for Permian crude oil through the third quarter of 2019, which would moderate production growth compared with an unconstrained scenario, EIA still expects Permian crude oil production to drive total U.S. production growth next year. Many producers in the region claim they can operate profitably with prices in the mid-$50/b level, and they might use higher cost transportation options to move crude oil to the U.S. Gulf Coast or other regions. Some producers with a geographically diverse portfolio of upstream properties could also redirect capital to other areas or decide to reduce completion activity until the transportation constraints ease.

Open interest: Brent and WTI average daily open interest declined for the third consecutive month in August. Both crude oil futures contracts’ open interest reached an all-time high in May 2018, averaging 2.6 million and 2.7 million contracts outstanding, respectively (Figure 4). Since peaking in May, average daily open interest declined to 2.3 million contracts for both Brent and WTI crude oil in August.

Based on the weekly U.S. Commodity Futures Trading Commission (CFTC) Commitments of Traders data, WTI futures open interest declined from the first week of May to the last week of August as a result of the closure of short positions from the Producers and Merchants category, followed by short position closures from Swap Dealers. Producers and Merchants reduced the largest number of long positions, followed by the Other Reportables category. The Producers and Merchants category, along with Swap Dealers, typically represent participants in the futures market whose primary purpose is risk management in the production or processing of a commodity. Fewer futures contracts held by these traders suggest some producers or end users could be reducing their hedging activity.
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 $1.95 per gallon (gal) on September 6 (Figure 5), a decrease of 9 cents/gal from August 1. The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) decreased by 19 cents/gal to settle at 13 cents/gal during the same period. The RBOB–Brent crack spread declined for most of August and then fell further at the beginning of September, when the front-month contract rolled to October delivery, which reflects winter-grade gasoline that is cheaper for refineries to produce.

U.S. motor gasoline inventories: For the four weeks ending August 31, finished motor gasoline production averaged slightly higher than the August 2017 monthly average. Consumption
including exports, however, declined from last year’s record high for August to an estimated 10.3 million barrels per day (b/d) in August 2018. The higher production and lower consumption (including exports) resulted in a rare increase in total motor gasoline inventories for the month of August (Figure 6). Total motor gasoline inventories ended the month slightly higher than the top of the five-year (2013–17) range for August.

**Figure 6. Change in August U.S. gasoline inventories**

![Chart showing change in August U.S. gasoline inventories from 2013 to 2018](image)

**Ultra-low sulfur diesel prices**: The front-month futures price of ultra-low sulfur diesel (ULSD) settled at $2.21/gal on September 6 (Figure 7), an increase of 11 cents/gal from August 1. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) rose by 1 cent/gal to settle at 39 cents/gal during the same period. ULSD crack spreads were at or higher than the five-year average in August in the United States and also in major international trading hubs such as Northwest Europe and Singapore. Strong global economic growth has contributed to higher demand for distillate fuel for much of the past year. In addition, a fire and temporary shutdown of Brazil’s largest refinery in late August resulted in Petrobras, Brazil’s national oil company, purchasing several distillate cargoes from the United States, which also contributed to higher ULSD crack spreads.
U.S. distillate inventories: In the United States, distillate consumption during the first five months of 2018 was the highest since 2007, which helped to pull inventories below the five-year range in May (Figure 8). Since May, however, U.S. consumption including exports of distillate have shown year-on-year declines largely because of lower export growth. Refinery distillate production in June reached a record high for the month, and weekly estimates indicate similar record production levels for July and August, if confirmed in monthly data. The high production levels and lower consumption (including exports) levels contributed to inventory builds in each of the past three months that were higher than the five-year average, bringing distillate inventories back into the five-year range by the end of August.

The disruption at the Brazilian refinery, which has restarted at reduced operating rates, may provide some additional demand for distillate exports from the United States in the near term, but whether the recent slowdown in U.S. distillate exports is temporary or whether it indicates a longer-term slowing of trade flows is unclear.
Natural Gas

**Prices:** The front-month natural gas futures contract for delivery at the Henry Hub settled at $2.77/million British thermal units (MMBtu) on September 6, an increase of 1 cent/MMBtu from August 1 (**Figure 9**). The Henry Hub natural gas spot price averaged $2.96/MMBtu in August, 12 cents/MMBtu higher than in July. Cooling degree days (CDD) in the United States averaged 13% higher than the 10-year (2008–17) average in August, which contributed to high natural gas demand for power generation.

**U.S. natural gas inventory:** Natural gas inventories have been low compared with the five-year (2013–17) average during most of 2018. The low inventory levels reflect high residential and commercial consumption in early 2018 and growth in both liquefied natural gas and pipeline exports over the past year. High natural gas use for electric power generation during July and
August also likely slowed the pace of inventory injections. EIA estimates that working gas in underground storage at the end of August totaled 2,606 Bcf, which is 577 billion cubic feet (Bcf), or 18%, lower than the five-year average at the end of August.

The end of October is typically considered the end of the natural gas storage injection season, although injections often occur into the first weeks of November. EIA forecasts that inventories will rise to 3,308 Bcf at the end of October, which would be the lowest end-of-October natural gas inventory level since 2005 (Figure 10). Despite low inventory levels, price increases have been moderate. Significant month-over-month production growth in 2018 helped keep futures prices lower than $3/MMBtu for most of the summer. Total U.S. dry natural gas production reached an estimated 82.2 billion cubic feet per day in August. Implied volatility, which is based on futures and options, has also remained low, indicating lower expectations by market participants for large price increases in the near future.

**Figure 10. Increase in U.S. natural gas inventory from August to October**

![Graph showing increase in U.S. natural gas inventory from August to October](Image)

### Notable forecast changes

- **EIA forecasts that U.S. crude oil production will average 11.5 million barrels per day (b/d) in 2019, which is 0.2 million b/d lower than forecast in the August STEO. The lower production reflects more severe constraints in Permian region pipeline takeaway capacity than previously expected, which results in slower expected crude oil production growth in that region. The lower forecast is also the result of a reevaluation of projects in the U.S. Gulf of Mexico. EIA now expects production in that region to proceed at a slightly slower pace than previously assumed.**

- **EIA forecasts Brent crude oil prices to average $74 per barrel (b) and West Texas Intermediate (WTI) crude oil prices to average more than $67/b in 2019. Both of these forecasts are $3/b higher than the forecast from the August STEO. The higher price**
forecast reflects a lower forecast for global oil supply in 2019 based on lower expected production from the United States, Canada, and OPEC noncrude oil liquids. The lower production forecast is only partially offset by lower forecast oil demand for next year. EIA expects global oil inventories to rise by about 0.1 million b/d next year, which is 0.2 million b/d lower than previously forecast.

- EIA expects U.S. coal exports to be 107 million short tons (MMst) in 2018 and 101 MMst in 2019, which are 5 MMst and 4 MMst higher, respectively, than expected in the August STEO. The higher forecast reflects the incorporation of higher than expected exports during the first half of 2018, which has raised the base for the rest of the forecast period.

- EIA uses IHS Markit to provide history and forecasts for macroeconomic data in STEO. Beginning with this forecast, IHS Markit incorporated revised historical data and rebased 2012-dollar concepts from the Bureau of Economic Analysis comprehensive revisions. Therefore, national income accounting variables are now stated in 2012 dollars instead of in 2009 dollars as reported in the previous STEO. This change results in a level shift upward for several of the macroeconomic variables reported in STEO, most notably U.S. gross domestic product (GDP). In this forecast, GDP is forecast to average $18.6 trillion in 2018 and $19.1 trillion in 2019, compared with $17.6 trillion and $18.1 trillion, respectively, for those years in the August STEO.

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