



Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- Significant disruptions in the U.S. energy market have occurred in recent weeks as a result of Hurricane Harvey. At the time of publication, continuing uncertainty exists regarding the timeline for the return to normal operations for a broad range of upstream production, refining, pipeline, and terminal and distribution infrastructure. The severity and duration of these outages create additional uncertainty about the path of energy prices in the coming weeks and months. Although this STEO attempts to incorporate a baseline scenario for energy production, flows, and prices, actual outcomes could deviate significantly from this forecast. This month's forecast does not include any projected effects from Hurricane Irma, which made landfall in Florida on September 10. At the time of publication, it was too early to have meaningful information on the extent to which Hurricane Irma will cause disruptions to the U.S. energy system.
- U.S. regular gasoline retail prices reached \$2.69 per gallon (gal) on September 11, up 29 cents/gal from August 28 and the highest weekly average since August 2015. EIA forecasts the average U.S. regular gasoline retail price to be \$2.61/gal in September and then fall to \$2.40/gal in October, which are 25 cents/gal and 10 cents/gal higher, respectively, than projected in the August STEO. EIA forecasts the regular gasoline retail price to fall to \$2.23/gal in December.
- Refinery operations declined significantly following Hurricane Harvey. Based on EIA's [Weekly Petroleum Status Report](#), U.S. gross refinery runs averaged 14.8 million barrels per day (b/d) the week ending September 1, down by 3.1 million b/d from the previous week. EIA forecasts refinery runs to average 15.3 million b/d in September, down from an estimated average of 17.1 million b/d in August. Refinery runs are forecast to increase to 15.9 million b/d in October.
- EIA expects much of the reduction in refinery production of petroleum products to be offset by a decline in petroleum product net exports. EIA expects net petroleum product exports to average 1.1 million b/d in September, down from an average of 2.9 million b/d during the first eight months of 2017. A reduction in net exports can either come from a decrease in exports or an increase in imports. Additionally, the reduction in

production of petroleum products could contribute to larger-than-typical inventory draws for September.

- U.S. crude oil production is estimated to have averaged 9.2 million b/d in August, down about 40,000 b/d from the July average. Crude oil production in the Gulf of Mexico fell to a monthly average of 1.6 million b/d in August, down by 70,000 b/d from the July level. At the time of publication, many oil production platforms in the Gulf of Mexico had returned to operation, 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 9.3 million b/d for all of 2017 and 9.8 million b/d in 2018, which would mark the highest annual average production in U.S. history, surpassing the previous record of 9.6 million b/d set in 1970.
- North Sea Brent crude oil spot prices averaged \$52 per barrel (b) in August. EIA forecasts Brent spot prices to average \$51/b in 2017 and \$52/b in 2018. West Texas Intermediate (WTI) average crude oil prices are forecast to be about \$2/b lower than Brent prices in both 2017 and 2018. NYMEX contract values for December 2017 delivery that traded during the five-day period ending September 7 suggest that a range of \$39/b to \$63/b encompasses the market expectation for December WTI prices at the 95% confidence level.

Natural gas

- U.S. dry natural gas production is forecast to average 73.7 billion cubic feet per day (Bcf/d) in 2017, a 1.4 Bcf/d increase from the 2016 level. Natural gas production in 2018 is forecast to be 4.4 Bcf/d higher than the 2017 level.
- In August, the average Henry Hub natural gas spot price was \$2.90 per million British thermal units (MMBtu), down 8 cents/MMBtu from the July 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 \$3.05/MMBtu in 2017 to \$3.29/MMBtu in 2018. NYMEX contract values for December 2017 delivery that traded during the five-day period ending September 7 suggest that a range of \$2.39/MMBtu to \$4.34/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 to 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 generation shares for natural gas and coal in 2018 average 31% and 32%, respectively.

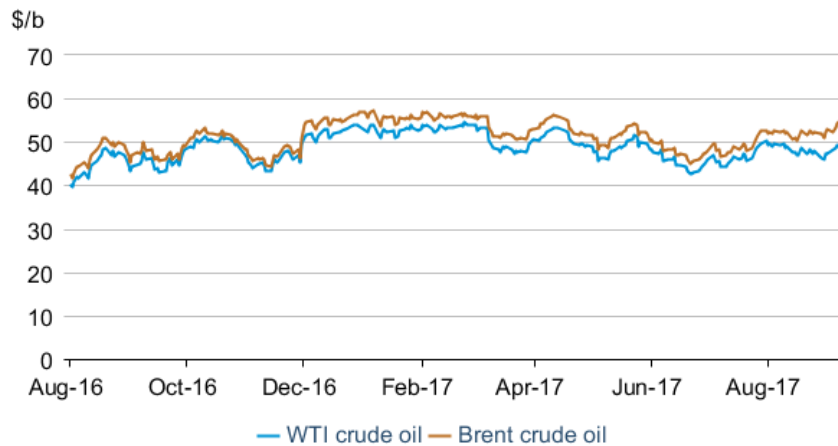
- Coal production for August 2017 is estimated to have been 74 million short tons (MMst), 6 MMst (8%) higher than last August. August is also the first month that had production higher than 70 MMst since October 2015. Production for the first eight months of 2017 is estimated to have been 528 MMst, 64 MMst (14%) higher than production for the same period in 2016. Production is expected to increase by 8% in 2017 and by 2% in 2018.
- Coal exports for the first six months of 2017 were 55% higher than exports over the same period last year. EIA expects growth in coal exports to slow in the coming months, with exports for all of 2017 forecast at 73 MMst, 21% higher than the 2016 level.
- [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 29 GW by the end of 2017 and to 33 GW by the end of 2018.
- After declining 1.7% in 2016, energy-related carbon dioxide (CO₂) emissions are projected to decrease by 0.5% in 2017 and then to increase by 2.6% 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: Crude oil benchmark Brent front-month futures prices increased by \$2.71 per barrel (b) from August 1, settling at \$54.49/b on September 7. The West Texas Intermediate (WTI) crude oil price declined 7 cents/b during the same period, settling at \$49.09/b (**Figure 1**). August Brent and WTI monthly average spot prices were \$3.28/b and \$1.41/b higher, respectively, than the July average spot prices.

Figure 1. Crude oil front-month futures prices



U.S. crude oil and petroleum product markets were significantly disrupted by [Hurricane Harvey's](#) landfall in Texas and Louisiana at the end of August. At the peak of disruption, an estimated [3.9 million barrels per day \(b/d\)](#) of U.S. Gulf Coast refining capacity was taken offline. Oil transportation capacity in the region was also restricted after the hurricane.

According to the [Department of Energy's hurricane Situation Reports](#), as of September 11, [0.7 million b/d](#) of refining capacity on the U.S. Gulf Coast remained offline, and an additional 3.6 million b/d was operating at reduced rates and/or had begun to restart operations. After averaging 17.1 million b/d in August, EIA estimates that U.S. refinery runs will average 15.3 million b/d in September and 15.9 million b/d in October, which are 1.5 million b/d and 0.1 million b/d lower, respectively, than projected in the August STEO. Ports and crude oil pipelines along the Texas Gulf Coast were closed because of the hurricane. These closures limited the movement of crude oil in the region. The lower refinery demand for crude oil and limited ability to move crude oil resulted in crude oil inventory builds at Cushing, Oklahoma and on the Gulf Coast of 0.8 million barrels and 1.7 million barrels, respectively, for the week ending September 1.

U.S. crude oil production is estimated to have averaged 9.2 million b/d in August, down about 40,000 b/d from the July average. Crude oil production in the Gulf of Mexico fell to a monthly average of 1.6 million b/d in August, down by 70,000 b/d from the July level. Producers also curtailed production in the Eagle Ford region of South Texas. However, production declines there were offset by growth in other areas of the Lower 48 states onshore region.

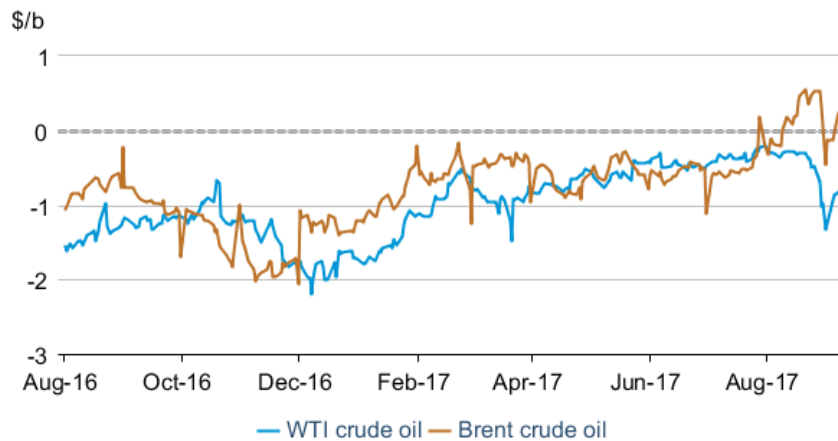
The petroleum supply system on the Gulf Coast was beginning to return to service at the time of publication. However, some facilities remain offline or operating at reduced rates. Certain ports in the region are open for limited vessel traffic, and some pipelines in Texas are beginning to resume operations. Several refineries had restarted, or were beginning to restart operations, but some might be offline for several more weeks. Additionally, oil producers have begun to ramp up production in areas that were disrupted.

Lower refinery demand for crude oil in the Gulf Coast region more than offset reductions in crude oil production as a result of the storm, which contributed to lower WTI prices, while simultaneously contributing to higher product prices. WTI front-month futures prices from August 28-31, the height of hurricane-related disruptions, were about \$2/b lower than during the average price during the first 19 trading days of the month.

Despite lower WTI prices because of lower refinery demand for crude oil and transportation constraints, Brent prices were supported by global supply reductions. Libya’s crude oil production declined by an estimated 150,000 b/d from July to August because of oil field closures. August oil production in Norway and the United Kingdom, the two main countries for North Sea oil production, fell by a combined 50,000 b/d from the July level, which led to the lowest amount of Brent crude oil scheduled for loading for the month of August since 2014. In addition, crude oil exports from the Organization of the Petroleum Exporting Countries (OPEC) declined by an estimated 1.3 million b/d from July to August.

Because of these diverging situations in the U.S. and global crude oil markets, front-month WTI prices fell against longer-dated contracts while Brent front-month prices increased. The Brent 1st–3rd futures price spread increased by 56 cents/b to 23 cents/b from August 1 to September 7, reaching a three-year high of 54 cents/b on August 21 (**Figure 2**). In addition, trade press reports indicated demand for North Sea crude oils from South America and Asia had increased, which may have kept Brent front-month prices elevated compared with later-dated contracts for most of August. In contrast, the WTI 1st–3rd futures price spread declined by 55 cents/b to -82 cents/b.

Figure 2. Crude oil front-month - third-month futures price spread



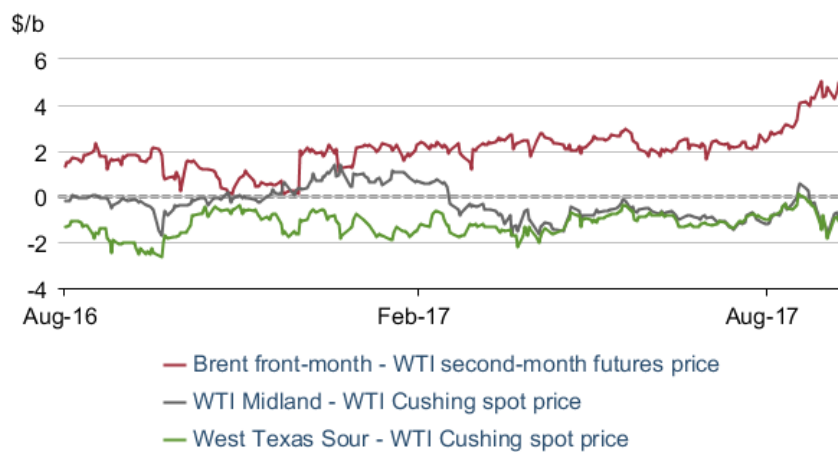
Crude oil price spreads: The spread between Brent and WTI futures prices rose to \$5.00/b on August 29, which reflects lower refinery demand in the U.S. crude oil market (**Figure 3**). With the spread between international and domestic crude oil benchmarks rising, U.S. oil producers may find more export opportunities. Higher demand for U.S. crude oil from international customers, slower growth in U.S. crude oil production, and U.S. Gulf Coast refineries returning to normal


operations could, however, eventually reduce the Brent-WTI price spread. EIA forecasts the WTI spot price to be \$3.50/b lower than the Brent spot price in September and October before narrowing to \$2.00/b lower in November, when domestic oil infrastructure is expected to be operating normally.

Prior to Hurricane Harvey, some domestic crude oil prices were increasing against the benchmark WTI crude oil priced at Cushing, Oklahoma. Both WTI priced in Midland, Texas and West Texas Sour (WTS) crude oils briefly reached a premium to benchmark WTI prices in mid-August. WTI Midland and WTS spot prices likely reached a premium because of increased demand for exports. Trade press reported that refineries in countries including India and South Korea have purchased WTI Midland crude oil for the first time.

However, near the end of August, WTI Midland and WTS spot prices weakened against WTI Cushing spot prices. The decline can be attributed to existing supply dynamics in the U.S. Midwest as well as unplanned refinery and transportation outages on the U.S. Gulf Coast because of the hurricane. With refineries in the U.S. Midwest processing a [record amount of crude oil as of August 25](#) and [crude oil inventories in Cushing, Oklahoma](#), rising by 2.2 million barrels from July 28 to September 1, demand for crude oil produced in West Texas to be transported to the U.S. Midwest may be low. Further, with reduced refinery demand from the U.S. Gulf Coast and limited transportation options, producers' ability to move crude oil out of West Texas was constrained, and crude oil prices declined. The BridgeTex and Longhorn pipelines, which [transport crude oil](#) from the Permian Basin to the U.S. Gulf Coast, were taken offline in anticipation of the hurricane. Both pipelines are reported to have restarted operations at the beginning of September.

Figure 3. West Texas crude oil spot price differentials



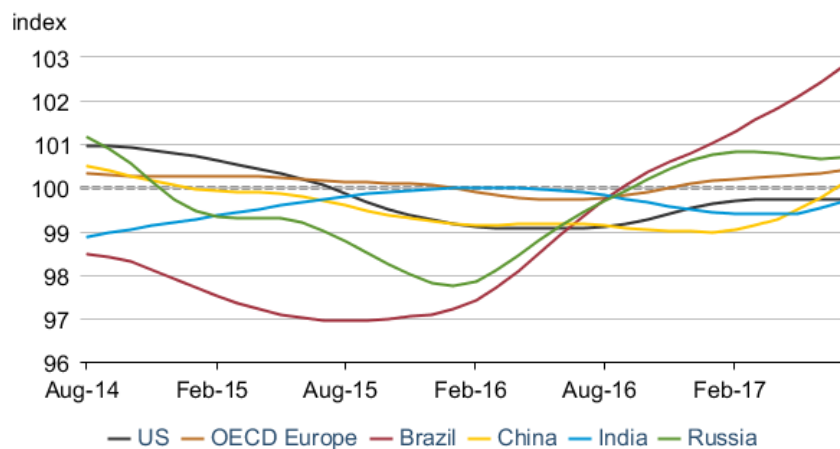
 Bloomberg L.P., U.S. Energy Information Administration

Economic growth indicators: STEO estimates global liquid fuels demand to increase by 1.4 million b/d in 2017 and by 1.7 million b/d in 2018. Economic indicators from developed and emerging markets point to continued economic improvement and support growth in liquid fuels demand. The Organization for Economic Cooperation and Development (OECD) provides

monthly [composite leading indicators](#) (CLI) for the economic activity of every member OECD country and several emerging market economies. Each CLI is composed of many data series unique to each respective country, with an index of 100 representing that country's long-term potential economic output. These indicators are constructed so that peaks and troughs in the series signal a possible change in the country's business cycle [six to nine months ahead of time](#).

As of July, the CLI for OECD Europe and some major emerging market economies indicate that economic activity could either remain higher than each country's respective long-term potential output or could begin to accelerate in the next six to nine months (**Figure 4**). The CLI for OECD Europe has been rising since June 2016 and is above 100, suggesting that the region may experience economic activity stronger than its long-term potential growth. The CLI for Brazil continues to increase as the country recovers from its recession. Brazil's unemployment rate is beginning to fall, retail spending is increasing, and interest rates are declining. The CLI for China in July was higher than 100 for the first time since late 2014. Although interest rates have been rising and credit growth has slowed, increased activity in both the manufacturing and service sectors of the economy points to economic growth. The CLI for India remains below 100 but rose slightly in June and July. India has experienced some economic disruptions because of [demonetization](#) and the implementation of a goods and services tax. However, these effects are expected to subside over time.

Figure 4. OECD composite leading indicators

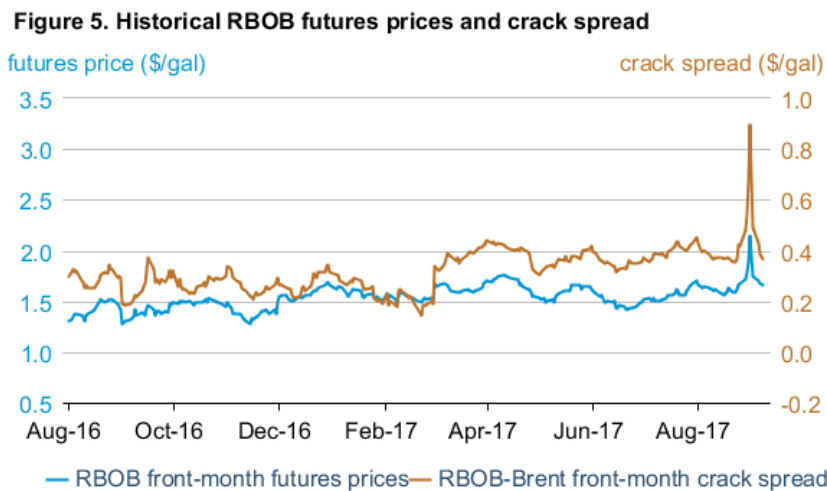


 Organization for Economic Cooperation and Development

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) was unchanged from August 1, settling at \$1.66 per gallon (gal) on September 7 (**Figure 5**). The RBOB-Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) declined 6 cents/gal over the same period, settling at 36 cents/gal. EIA compares

RBOB prices to Brent prices because [EIA research indicates U.S. gasoline prices move with Brent prices](#).



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

Landfall of [Hurricane Harvey](#) in late August closed several refineries on the U.S. Gulf Coast and damaged petroleum-related infrastructure, creating considerable uncertainty for gasoline supply and demand and contributing to [large price increases](#). Moreover, reduced open interest in September RBOB futures contracts near expiration at the end of August likely added to increased price volatility. On September 1, the RBOB front-month futures price declined as the October RBOB front-month futures contract became the active contract, which reflects winter-grade gasoline that is cheaper for refineries to produce. However, the October RBOB futures contract rose 23 cents/gal from August 1 to August 31, suggesting the effects of the hurricane on the gasoline market may last into October.

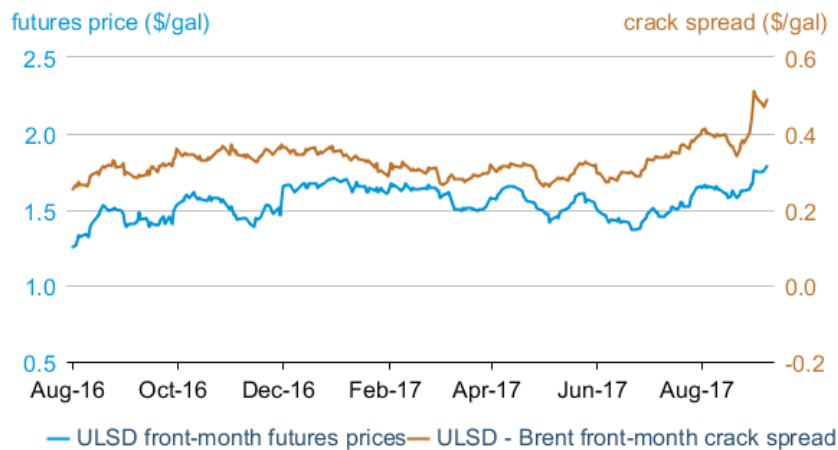
The [Colonial pipeline](#), a 2.5-million-b/d pipeline that typically runs at full capacity supplying petroleum products from the U.S. Gulf Coast to the U.S. East Coast, was forced to run intermittently following the storm because of decreased supplies available for shipping. Refineries in the Gulf Coast [began restarting](#) during the week of September 4, and continuous operations on the Colonial pipeline were restored, albeit at reduced rates, on September 6. However, it remains unclear when the pipeline will resume normal operations.

Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) futures price rose 14 cents/gal since August 1, settling at \$1.79/gal on September 7. The ULSD-Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) rose by 8 cents/gal, settling at 49 cents/gal (**Figure 6**).

ULSD prices and crack spreads also increased because of uncertainty surrounding Hurricane Harvey's effects on refined product supplies. The shutdowns of the export facilities along the Houston Ship Channel, among other areas, likely affected international distillate markets, as the U.S. Gulf Coast accounts for nearly 90% of [U.S. distillate exports](#). Several ports along the Gulf

Coast began to reopen the week of September 4 with certain draft restrictions. Future port utilization and exports will depend on the pace of recovery from area refineries. Typical purchasers of U.S. distillate—including [Mexico, Brazil, and the Netherlands](#)—will likely have to seek other sources of supply until U.S. distillate exports resume.

Figure 6. Historical ULSD futures price and crack spread



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

RBOB and ULSD futures curves: The refinery outages from Hurricane Harvey reduced [U.S. Gulf Coast refinery production](#) of gasoline and distillate by about 36% and 24%, respectively, from the week of August 25 to September 1. The outages placed a significant pull on gasoline and distillate inventories, which is reflected in the shape of the futures curves for RBOB and ULSD. The RBOB 1st-13th spread closed at the highest level in nearly five years on August 31, settling at 50 cents/gal, whereas the ULSD 1st-13th spread closed at 10 cents/gal, the highest since February 2015 (**Figure 7**). The RBOB 1st-13th spread fell by 28 cents/gal on September 1, as the October contract became the front-month contract. The ULSD 1st-13th spread fell by 2 cents/gal on September 1, as the October contract became the front-month contract. The falling spreads for the October contracts indicate the market expects some easing of the supply situation by October.

On a [days-of-supply](#) basis, total U.S. [gasoline](#) and [distillate](#) inventories were lower by 0.3 days and 5.4 days, respectively, in the week before hurricane landfall (August 25) compared with the days of supply at the end of August 2016, according to EIA's [Petroleum Supply Monthly](#). The increase in front-month prices compared to longer-dated prices typically occurs during supply disruptions, when inventory drawdowns are needed to meet demand.

Figure 7. 1st-13th month futures spread

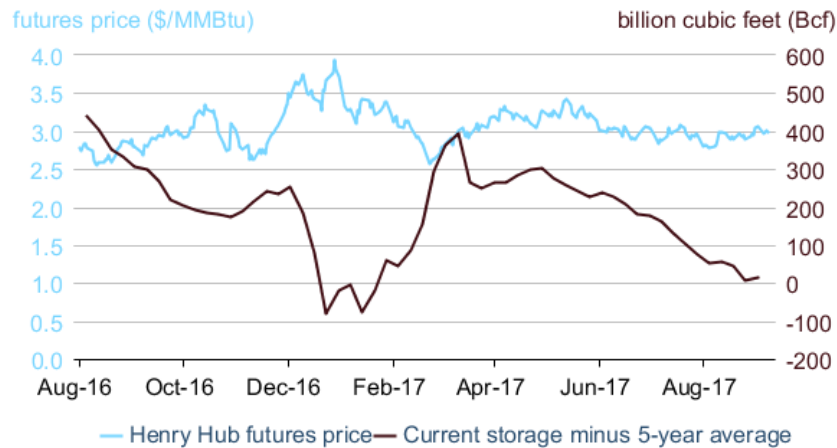


 U.S. EIA, Bloomberg LP

Natural Gas

Prices: The front-month natural gas futures contract for delivery at Henry Hub settled at \$2.98/million British thermal units (MMBtu) on September 7, an increase of 16 cents/MMBtu from August 1 (**Figure 8**). Natural gas prices traded within a relatively narrow range for most of August as supply and demand factors kept the market in relative balance. Injections into underground storage for the four weeks ending September 1 were 37 billion cubic feet lower than the five-year average build for that period, bringing inventory levels closer to the five-year average and ending the month 0.5% higher than the average. Most of the Lower 48 states experienced temperatures close to normal or cooler than normal, which reduced cooling degree days and the need for air conditioning, which likely limited natural gas used to generate electricity. The South Census region, where more than half of the natural gas used for electricity generation is consumed, had temperatures that were 16% cooler than average for the four weeks ending August 31. The Henry Hub natural gas spot price averaged \$2.90/MMBtu in August, 8 cents/MMBtu lower than in July.

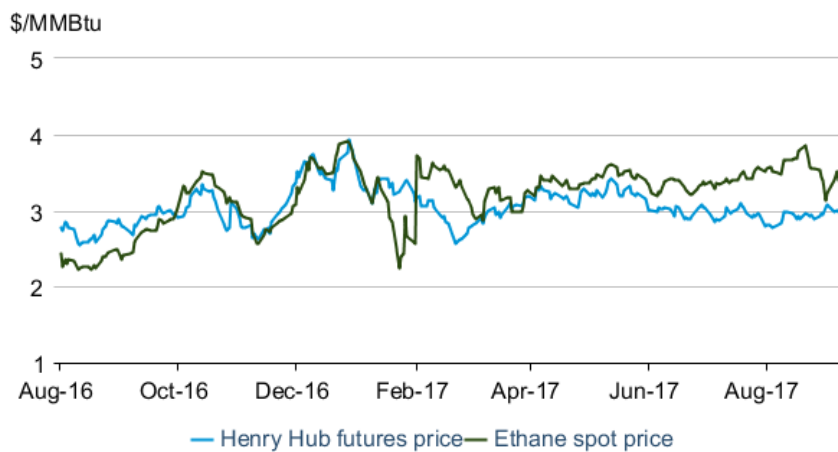
Figure 8. U.S. natural gas prices and storage



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

Natural gas and ethane price spreads: Marketed ethane production reached a high of 1.4 million b/d in the second quarter of 2017. STEO projects ethane production to rise to 1.8 million b/d by 2018. Ethane is used primarily as a petrochemical feedstock in ethylene crackers. Ethane prices declined substantially in 2012 and have remained relatively low since then. This lower-priced environment prompted companies to expand ethylene capacity, which has come online in recent years. Ethylene cracker capacity increased from 92,000 b/d in the first quarter of 2015 to 320,000 b/d during the second quarter of 2017. More projects are underway. Ethane net exports have also risen, reaching a record high of 191,000 b/d in May 2017. The increased demand for ethane has contributed to a wider spread between ethane and natural gas prices (Figure 9). Ethane sold for an average of \$0.68/MMBtu higher than natural gas futures prices in August. Ethylene cracker operations in the U.S. Gulf Coast were reduced considerably by the effects of Hurricane Harvey, leading to a sharp drop in ethane prices, but prices have begun to recover.

Figure 9. Natural gas futures and ethane spot prices



eia Bloomberg L.P.

Notable forecast changes

- EIA estimates that U.S. refinery runs will average 15.3 million b/d in September and 15.9 million b/d in October, which are 1.5 million b/d and 0.1 million b/d lower, respectively, than projected in the August STEO.
- EIA forecasts the average U.S. regular gasoline retail price to be \$2.61/gal in September and be \$2.40/gal in October which are 25 cents/gal and 10 cents/gal higher, respectively, than projected in the August STEO.
- EIA estimates that U.S. net petroleum product exports will average 1.1 million b/d in September and 2.6 million b/d in October, which are 1.6 million b/d and 0.2 million b/d lower, respectively, than projected in the August STEO.
- 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.