



Short-Term Energy Outlook (STEO)

Forecast highlights

Global liquid fuels

- Although all market outlooks are subject to many risks, the April edition of EIA's *Short-Term Energy Outlook* is subject to heightened levels of uncertainty because the impacts of the [2019 novel coronavirus_disease \(COVID-19\)](#) on energy markets are still evolving. The COVID-19 pandemic has caused significant changes in energy fuel supply and demand patterns. Crude oil prices, in particular, have fallen significantly since the beginning of 2020, largely driven by the economic contraction caused by COVID-19 and a sudden increase in crude oil supply following the suspension of previously agreed upon production cuts among the [Organization of the Petroleum Exporting Countries \(OPEC\)](#) and partner countries. Similar uncertainties persist across EIA's outlook for other energy sources, including natural gas and electricity. Despite recent news of OPEC+ emergency meetings within the next few days to discuss production levels, without an agreement actually in place, EIA assumes no re-implementation of an OPEC+ agreement during the forecast period. If there is ultimately an agreement, this forecast will incorporate that information into its ensuing release.
- EIA forecasts that the United States will return to being a net importer of crude oil and petroleum products in the third quarter of 2020 and remain a net importer in most months through the end of the forecast period. This is a result of higher net imports of crude oil and lower net exports of petroleum products. Net crude oil imports are expected to increase because as U.S. crude oil production declines, there will be fewer barrels available for export. On the petroleum product side, net exports will be lowest in the third quarter of 2020, when U.S. refinery runs are expected to decline significantly.
- Brent crude oil prices averaged \$32/barrel (b) in March, a decrease of \$24/b from the average in February and the lowest monthly average since January 2016. EIA forecasts Brent crude oil prices will average \$33/b in 2020, \$10/b lower than in last month's STEO and down from an average of \$64/b in 2019. EIA expects prices will average \$23/b during the second quarter of 2020 before increasing to \$30/b during the second half of the year. EIA forecasts that average Brent prices will rise to an average of \$46/b in 2021, \$10/b lower than forecast last month, as a return to declining global oil inventories puts upward pressure on prices.

- EIA estimates global petroleum and liquid fuels consumption averaged 94.4 million barrels per day (b/d) in the first quarter of 2020, a decline of 5.6 million b/d from the same period in 2019. EIA expects global petroleum and liquid fuels demand will decrease by 5.2 million b/d in 2020 from an average of 100.7 million b/d last year before increasing by 6.4 million b/d in 2021. Lower global oil demand growth for 2020 in the April STEO reflects growing evidence of significant disruptions to global economic activity along with reduced expected travel globally because of COVID-19.
- EIA expects that global liquid fuels inventories will grow by an average of 3.9 million b/d in 2020 after falling by about 0.2 million b/d in 2019. EIA expects inventory builds will be largest in the first half of 2020, rising at a rate of 5.7 million b/d in the first quarter and increasing to builds of 11.4 million b/d in the second quarter as a result of widespread travel limitations and sharp reductions in economic activity. Firmer demand growth as the global economy begins to recover and slower supply growth will contribute to global oil inventory draws beginning in the fourth quarter of 2020. EIA expects global liquid fuels inventories will decline by 1.7 million b/d in 2021.
- EIA forecasts significant decreases in U.S. liquid fuels demand during the first half of 2020 as a result of COVID-19 travel restrictions and significant disruptions to business and economic activity. EIA expects that the largest impacts will occur in the second quarter of 2020, before gradually dissipating over the course of the next 18 months. EIA expects U.S. motor gasoline consumption to fall by 1.7 million b/d from the first quarter of 2020 to an average of 7.1 million b/d in the second quarter, before gradually increasing to 8.9 million b/d in the second half of the year. U.S. jet fuel consumption will fall by 0.4 million b/d from the first quarter of 2020 to average 1.2 million b/d in the second quarter. U.S. distillate fuel oil consumption would see a smaller decline, falling by 0.2 million b/d to average 3.8 million b/d over the same period. In 2020, EIA forecasts that U.S. motor gasoline consumption will average 8.4 million b/d, a decrease of 9% compared with 2019, while jet fuel and distillate fuel oil consumption will fall by 10% and 5%, respectively over the same period.
- For the April–September 2020 summer driving season, EIA forecasts U.S. regular gasoline retail prices will average \$1.58 per gallon (gal), down from an average of \$2.72/gal last summer ([Summer Fuels Outlook](#)). The lower forecast gasoline prices reflect lower forecast crude oil prices and significantly lower gasoline demand in the second quarter of 2020 driven by COVID-19 travel restrictions and disruptions to domestic economic activity. For all of 2020, EIA expects U.S. regular gasoline retail prices to average \$1.86/gal and gasoline retail prices for all grades to average \$1.97/gal.
- EIA has revised its current forecast of domestic crude oil production down from the March STEO, as a result of lower crude oil prices. EIA forecasts U.S. crude oil production will average 11.8 million b/d in 2020, down 0.5 million b/d from 2019. In 2021, EIA expects U.S. crude production to decline further by 0.7 million b/d. If realized, the 2020 production decline would mark the first annual decline since 2016. Typically, price

changes impact production after about a six-month lag. However, current market conditions, combined with the COVID-19 pandemic, will likely reduce this lag as many producers have already announced plans to reduce capital spending and drilling levels.

Natural gas

- In March, the Henry Hub natural gas spot price averaged \$1.74 per million British thermal units (MMBtu). Warmer-than-normal temperatures in March reduced demand for space heating and put downward pressure on prices. EIA forecasts that prices will begin to rise at the end of the second quarter of 2020 as U.S. natural gas production declines and natural gas use for power generation increases the demand for natural gas. EIA forecasts that Henry Hub natural gas spot prices will average \$2.11/MMBtu in 2020 and then increase in 2021, reaching an annual average of \$2.98/MMBtu because of lower natural gas production compared to 2020.
- EIA expects residential consumption of natural gas to average 12.9 billion cubic feet per day (Bcf/d) in 2020, down 5.8% from the 2019 average primarily because of warmer-than-normal weather in the first quarter. Similarly, EIA expects commercial consumption of natural gas to average 9.0 Bcf/d in 2020, a decrease of 7.1%, as a result of warm weather and the slowing economy. EIA forecasts industrial natural gas consumption to average 22.9 Bcf/d in 2020, about the same as in 2019. The industrial forecast is down from the previously expected 6.5% growth in the March STEO, as less manufacturing activity in 2020 weakens the growth potential for industrial natural gas consumption.
- U.S. dry natural gas production [set a record in 2019](#), averaging 92.2 Bcf/d. EIA forecasts dry natural gas production will average 91.7 Bcf/d in 2020, with monthly production falling from an estimated 94.4 Bcf/d in March to 87.5 Bcf/d in December. Natural gas production declines the most in the Appalachian and Permian regions. In the Appalachian region, low natural gas prices are discouraging producers from engaging in natural gas-directed drilling, and in the Permian region, low oil prices reduce associated gas output from oil-directed wells. In 2021, forecast dry natural gas production averages 87.5 Bcf/d, rising in the second half of 2021 in response to higher prices.
- EIA estimates that total U.S. working natural gas in storage ended March at 2.0 trillion cubic feet (Tcf), 17% more than the five-year (2015–19) average. In the forecast, inventories rise by 1.9 Tcf during the April through October injection season to reach almost 3.9 Tcf on October 31.
- EIA forecasts that U.S. liquefied natural gas exports will average 6.6 billion cubic feet per day (Bcf/d) in the second quarter of 2020 and 6.0 Bcf/d in the third quarter of 2020. Liquefied natural gas exports in the third quarter 2020 are 0.3 bcf/d lower compared with the March STEO forecast because of lower expected global demand for natural gas.

Electricity, coal, renewables, and emissions

- The economic slowdown and stay-at-home orders are likely to affect U.S. electricity consumption over the next few months. EIA expects the largest impact will occur in the commercial sector where forecast retail sales of electricity fall by 4.7% in 2020 due to the closure of many businesses. Similarly, EIA expects retail sales of electricity to the industrial sector will fall by 4.2% in 2020 as many factories cut back production. Forecast U.S. sales of electricity to the residential sector fall by 0.8% in 2020, as reduced power usage resulting from milder winter and summer weather is offset by increased household electricity consumption as much of the population stays at home.
- EIA forecasts that total U.S. electric power sector generation will decline by 3% in 2020. Renewable energy sources account for the largest proportion of new generating capacity in 2020, driving EIA's forecast that renewable generation by the electric power sector will grow by 11% this year. Renewable energy is typically dispatched whenever it is available because of its low operating cost. The forecast for lower overall electricity demand leads to an expected decline in fossil-fuel generation, especially at coal-fired power plants. EIA expects that coal generation will fall by 20% in 2020. Forecast natural gas generation rises by 1% this year, reflecting favorable fuel costs and the addition of new generating capacity.
- Although EIA expects renewable energy to be the fastest growing source of electricity generation in 2020, the effects of COVID-19 and the resulting economic slowdown are likely to have an impact on new generating capacity builds over the next few months. EIA expects that the electric power sector will add 19.4 gigawatts of new wind capacity and 12.6 gigawatts of utility-scale solar capacity in 2020. These annual wind and solar capacity additions are 5% and 10% lower, respectively, than expected in the previous STEO.
- EIA forecasts that U.S. coal production will total 537 million short tons (MMst) in 2020, down 153 MMst (22%) from 2019. Lower production reflects declining demand for coal in the electric power sector, lower demand for U.S. exports, and a number of coal mines that have been idled for extended periods as a result of COVID-19. EIA forecasts that total coal consumption will decrease by 19% in 2020, driven primarily by electric power sector demand, which will fall by 107 MMst (20%) in 2020. Total coal exports also decline, as European demand is affected by economic slowdown.
- After decreasing by 2.7% in 2019, EIA forecasts that energy-related carbon dioxide (CO₂) emissions will decrease by 7.5% in 2020 as the result of the slowing economy and restrictions on business and travel activity related to COVID-19. In 2021, EIA forecasts that energy-related CO₂ emissions will increase by 3.6%. Energy-related CO₂ emissions are sensitive to changes in weather, economic growth, energy prices, and fuel mix.

Forecast Assumptions

Because of the heightened uncertainty surrounding this month's STEO, we have included some of the driving assumptions that affected our forecast this month.

Global Liquid Fuels

Global Petroleum and Other Liquid Fuels Consumption

In the April STEO, EIA's 2020 global oil consumption forecast has undergone major revisions to reflect the most up-to-date information available.

Similar to the March STEO, EIA analyzed reductions in oil demand by evaluating three main drivers: lower economic growth, less air travel, and other reductions in demand not captured by these two categories. In the March STEO, reductions in gross domestic product (GDP) and oil consumption were primarily limited to China, South Korea, Japan, and Italy. As a result of more government lockdowns across most of Europe, the United States, India, and other countries, the oil consumption effects now span a significantly larger segment of the world's population.

According to some estimates, about 40% of the world's population is currently advised to stay home to limit the spread of COVID-19. The shutdown orders have contributed to significant contractions in service industries—including travel, tourism, and restaurants, among others—leading to a rapid increase in layoffs and [unemployment](#). Although governments introduced fiscal and monetary responses, the effects of this stimulus on oil demand could be minimal given the significant restrictions on travel. The outlook for global economic growth is highly uncertain, and the high level of volatility in the markets presents considerable challenges in forecasting oil prices and the level of global oil consumption in the coming months.

Non-OPEC Petroleum and Other Liquid Fuels Supply

EIA assumes that non-OPEC petroleum and other liquid fuels supply will decline slightly in 2020, because of the impacts of COVID-19 and low oil prices that started in March 2020. Production increases in Norway and Brazil will be more than offset by declines from the United States, India, and other non-OPEC countries.

EIA expects non-OPEC petroleum and other liquid fuels production to increase slightly in 2021, when supply growth, mainly in Brazil and Canada, is expected to offset production declines in the United States and other non-OPEC countries.

EIA expects Canada's total liquid fuels production to fall by 0.1 million barrels per day (b/d) in 2020 instead of the previously forecast supply growth. This decrease is a result of 2019 government-ordered production cuts in Alberta, continued pipeline constraints, and economic shut-ins because of the effect of low oil prices and falling demand for oil exports. In 2021, EIA expects Canada's production to increase after new pipeline capacity is available but by less than previously forecast. EIA does not expect any additional production from new upstream projects to come online during the forecast period, only expansions of existing projects.

EIA expects Brazil's petroleum and other liquid fuels production to grow more slowly than previously forecast. Near the end of March, Brazil's national oil company Petroleo Brasileiro, S.A. (Petrobras) announced a 100,000 b/d production cut for the remainder of 2020. Petrobras will idle some shallow-water platforms with higher production costs in the Sergipe, Rio Grande do Norte, and Ceará states to achieve these cuts. Additionally, production volumes from the P-70 floating, production, storage, and offloading vessel (FPSO) will be delayed until 2021. The P-70 was damaged in a storm in February 2020, and was originally scheduled to begin producing in the first half of 2020. The main driver for Brazil's production growth in 2021 will be the start-up of P-70 and two other FPSOs in 2021 that EIA does not expect will be affected by events in 2020 at this time.

EIA expects Asia, China and India to shut in about 250 million b/d of production during the next few months as a result of immediate COVID-19 impacts on labor mobility and other logistics. In addition, the significantly lower oil price environment will reduce capital expenditure of upstream investors and shutter production at higher production cost fields, such as China's tight oil plays in the north central and northwest of the country and the mature fields that require enhanced oil recovery. Crude oil production projections for both China and India are lower than in last month's STEO, and EIA expects declines to deepen in 2020 and 2021. India plans to begin oil production from the deepwater KG-DWN-98/2 oil and natural gas project in early 2021, which will offset some production declines from mature basins in 2021.

OPEC Petroleum and Other Liquid Fuels Supply

The [Organization of the Petroleum Exporting Countries \(OPEC\)](#) and [partner countries \(OPEC+\)](#) suspended agreed-upon production cuts in March 2020. Despite the resulting oversupply in markets and recent news of OPEC+ emergency meetings to discuss production levels, EIA assumes no re-implementation of an OPEC+ agreement during the forecast period. Instead, EIA assumes that OPEC members with surplus production capacity will increase their production in an effort to gain additional market share. EIA assumes that although production in some oil fields will be affected by COVID-19, OPEC countries will try to increase production as long as they can find buyers in this weaker demand environment.

EIA assumes that Saudi Arabia will ramp up its crude oil production to near full capacity in the second quarter of 2020. Saudi Arabia will keep its production above recent production levels throughout the forecast in an attempt to regain global market share as higher-cost production declines elsewhere.

EIA assumes that sanctions on both Iran and Venezuela remain in place throughout the forecast period and that both countries' production will be lower compared with the March STEO.

Venezuela's production declines further as a result of additional sanctions that took effect in mid-February on Rosneft Trading, which had been a principal distributor of Venezuela's oil. These new sanctions, coupled with low global oil demand will make it more difficult for Venezuela to find buyers for its oil.

After reaching production levels of 1.2 million b/d in late 2019, Libya's crude oil output averaged 100,000 b/d in March 2020, after most of the country's export ports closed and several oil fields

were shut-in, including El Sharara and El Feel, in January 2020. With the ongoing civil war in Libya, EIA does not expect production to increase until late 2020. Once currently shuttered export terminals and oil fields reopen, EIA expects that Libya will boost production to near-capacity despite low oil prices.

In Nigeria and Angola, EIA expects new projects that have not yet reached the final investment decision (FID) stage will be delayed beyond 2021. In addition, growth from fields recently brought online will be flat for 2020. Lower production for the forecast period is driven by decreased demand as a result of COVID-19 as well as the expected surge in global crude oil supply resulting from the OPEC+ production cuts that were suspended.

EIA expects that OPEC surplus crude oil production capacity, which averaged 2.5 million b/d in and 3 million b/d in the first quarter of 2020, will decline to 1.5 million b/d in the second quarter of 2020. This is a result of Saudi Arabia ramping up its production to near full capacity during the second quarter of 2020, following the suspension of OPEC+ agreed-upon production cuts in March 2020. This decline will occur despite the Neutral Zone production ramp up that will start in May.

OECD Petroleum Inventories

An unprecedented drop in global oil demand in 2020, combined with the breakdown of the OPEC+ agreement to restrict oil production, leads EIA to forecast a global oil inventory build more than twice as large as the largest annual inventory build (1.8 million b/d in 1998) over the 40 years that EIA has tracked international data. EIA estimates that the 2020 build could add 1.6 billion barrels to global inventories, which would fill them at or near their estimated full storage capacity levels. Because of storage constraints, EIA believes the 2021 global oil market will need to be mostly balanced or inventory withdrawals will occur simply because there will be no room to store additional large inventory builds.

Crude Oil Prices

EIA assumes that the sharp reductions in global crude oil prices, which occurred during March 2020 as a result of COVID-19, will persist through the second quarter before prices begin gradually increasing through the end of the forecast. EIA expects that considerable decreases in liquid fuel consumption will result from containment measures and economic disruptions related to COVID-19, which will affect U.S. refinery activity and, consequently, demand for crude oil. However, crude oil supply will increase in the short term as a result of agreed production cuts among OPEC+ that were suspended. EIA assumes that these two factors will keep global crude oil prices at multi-year low averages through the first half of 2020. Only gradual increases in crude oil prices are expected through all of 2020 as these factors persist, which could lead to record levels of expected global oil inventory builds in the first half of 2020.

U.S. Liquid Fuels

Consumption

EIA assumes significantly lower levels of U.S. liquid fuels consumption during much of 2020 as a result of the disruptions to economic and business activity because of COVID-19 and the strict containment measures that have dramatically reduced all forms of travel. These impacts are expected to be most pronounced during the second quarter of 2020, when most containment measures and wide-scale reductions in business activity are assumed to be in place. EIA expects these impacts to persist through most of 2020, but in the second half of 2020, EIA expects liquid fuels consumption will gradually increase from these low levels as some business activity resumes and stay-at-home orders gradually ease. EIA forecasts these travel disruptions will have the largest impacts on gasoline and jet fuel consumption in 2020, but expects distillate fuel oil consumption to be affected less because of assumed increases in trucking activity both for distribution and expected increases in personal deliveries of goods and food services. The rise in U.S. liquid fuels consumption in the second half of 2020 drives the United States to return to being a net importer of crude oil and petroleum products in the third quarter of 2020 and remaining a net importer in most months through the end of the forecast period.

EIA forecasts that U.S. annual average hydrocarbon gas liquids consumption will decline by 1.6% in 2020 and then increase by 12% in 2021. This 2020 decline is mainly the result of the expected slowdown in manufacturing, which would keep ethane demand as a petrochemical feedstock below 2019 levels for the remainder of this year. Ethane consumption begins to rise in the second quarter of 2021 as manufacturing begins to recover, and both new and existing ethane-fed petrochemical plants increase utilization.

Crude Oil Supply

EIA's model for Lower 48 production includes structural parameters that reduce the forecast for rigs and wells when WTI price falls below \$45/b or the Henry Hub price falls below \$2/MMBtu, based on historical trends in each region. In addition to this model-based drop, EIA assumes a further 15% reduction in activity on average in the second quarter of 2020 and a 12% reduction in the third quarter of 2020 to account for the unprecedented effects of COVID-19 on the level of drilling activity as many producers have already announced plans to reduce capital spending and drilling levels. The decline in U.S. crude oil production in the second half of 2020 and 2021, combined with rising U.S. liquid fuels consumption, results in the United States returning to being a net importer of crude oil and petroleum products in the third quarter of 2020 and remaining a net importer in most months through the end of the forecast period.

EIA assumes that all oil stripper wells are shut in. These wells are characterized as producing no more than 15 barrels of oil equivalent per day (BOE/d) during a 12-month period.

In addition, even though some companies operating in the Permian Basin have asked for a hearing with the Texas Railroad Commission to determine mandatory crude oil production cuts for Permian producers, EIA assume no such proration of production in the model until the Texas Railroad Commission actually orders production cuts.

Product Prices

EIA expects that COVID-19 will drive sharp reductions in crude oil prices and U.S. liquid fuels demand during the second quarter of 2020, which will significantly reduce prices for gasoline and diesel fuel during the same period. Significant reductions in personal travel, both for normal commuting and vacation travel typical for the summer driving season, will decrease gasoline prices more dramatically than diesel fuel prices.

The shock to gasoline demand and EIA's corresponding expectation of near-term oversupply has been reflected in forecast U.S. refinery wholesale margins. In late March 2020, refinery wholesale margins for gasoline fell to near-zero levels in some regions, while diesel fuel margins remained relatively strong. EIA expects that stronger refinery wholesale margins for diesel fuel relative to gasoline will not only encourage refiners to maximize distillate production while reducing gasoline production, but in some cases, to idle some production units, which will drive refinery utilization rates to some of their lowest levels since the 2008 recession.

As a result, EIA forecasts that U.S. gasoline retail prices will reach some of their lowest levels in 20 years in the second quarter of 2020, before gradually increasing throughout the year as travel and business activity slowly recovers. Comparatively, diesel fuel prices only see minor decreases during the forecast period as increased demand for diesel fuel to meet expected near-term increases in long haul trucking and last-mile delivery activity.

Natural Gas

Natural Gas Consumption

The April STEO assumes minor shifts in space heating demand in March and April as more people stay at home rather than go to work or shop at retail establishments as a result of the COVID-19 pandemic. This shift increases residential natural gas demand while decreasing commercial natural gas demand. Commercial natural gas demand sees further reductions in the near term under the assumption that restaurants and other food establishments, which use more natural gas for cooking food and for hot water heating, compared with other segments of the commercial sector, will see a particularly high number of closings.

EIA forecasts that industrial demand for natural gas will decrease significantly because of the weakening economic outlook, leading to a lower forecast natural gas-weighted manufacturing index that declines through September 2020.

The April STEO forecast assumes that a combination of lower global natural gas demand as a result of the COVID-19 pandemic and an unfavorable liquefied natural gas (LNG) pricing environment will lower U.S. LNG exports, primarily in the third quarter of 2020.

Natural Gas Supply

EIA's model for Lower 48 production includes structural parameters that reduce the forecast for rigs and wells when the WTI price falls below \$45/b or the Henry Hub price falls below \$2/MMBtu, based on historical trends. In addition to this model-based drop, EIA assumes a further 15% reduction in activity on average in the second quarter of 2020 and a 12% reduction

in the third quarter of 2020 to account for the unprecedented effects of COVID-19 on the level of drilling activity as many producers have already announced plans to reduce capital spending and drilling levels.

EIA assumes that natural gas stripper wells remain economic, on average, and thus continue to produce through the forecast. These wells are characterized as producing no more than 90 thousand cubic feet per day during a 12-month period.

In addition, even though some companies operating in the Permian Basin have asked for a hearing with the Texas Railroad Commission to determine mandatory production cuts for Permian producers, EIA will assume no such proration of production in the model until the Texas Railroad Commission actually orders production cuts.

Natural Gas Inventories

EIA's natural gas storage forecast assumes a summer (March through October) storage build that is slightly below average because of strong natural gas consumption for power generation in 2020, combined with declining production in the second half of 2020. Less production in the first half of 2021 compared with recent years also puts downward pressure on storage in 2021.

Natural Gas Prices

The April STEO assumes that the Henry Hub spot price will remain low compared with historical levels in the near term as reduced business activity and higher-than-average storage levels entering the summer injection season contribute to keeping prices low. In the third quarter of 2020, slowing natural gas production, combined with increasing industrial demand and higher winter demand for space heating, encourage increases in the natural gas price.

Coal

Coal Supply

Many coal mines across the United States have shut down or idled, citing public health concerns. Some large producers have stipulated that their mines will be shut down or idled for two-weeks, while others have not implied a date to resume normal operations. EIA expects that these decreases in overall production will have a noticeable effect on supply, contributing to a steeper decline than would have occurred had these measures not been put into place.

Coal Consumption

Coal consumption is closely related to overall electricity generation demand, which is trending downward. Secondary stocks (at power plants) are high, and even with decreased production, coal plants do not expect shortfalls in the next few months. EIA projects that industrial consumption will also decline as coal coke demand is slowed by unfavorable market conditions and decreased raw steel production.

Coal Trade

EIA estimates that U.S. coal exports will decrease through 2020. Atlantic markets, which are the primary outlet for U.S. coal exports, are showing significantly decreased demand because of the global economic slowdown. India, the top destination for U.S. exports, had maintained near-normal consumption of steam coal during the first two months of 2020. Other important U.S. coal export destinations, such as South Korea and Japan, have seen economic effects already in 2020 and thus, have not been strong. Health-related lockdowns affecting large seaborne market suppliers, including South Africa, Indonesia, and Australia, have dampened global supply, providing some support to international prices but not enough to overcome the overarching shortfalls in demand.

Coal Prices

EIA estimates the delivered coal price to U.S. electricity generators averaged \$2.02 per million British thermal units (MMBtu) in 2019, which was 4 cents/MMBtu lower than in 2018. EIA forecasts that coal prices will decrease in 2020 to \$2.00 and increase in 2021 to \$2.04/MMBtu.

Electricity

The COVID-19 pandemic and its associated economic effects also create a high level of uncertainty regarding EIA's short-term outlook for U.S. electricity markets. EIA has developed some initial assumptions about potential effects. As EIA receives new survey data over the coming weeks, future STEO forecasts will incorporate this information.

Electricity Consumption

Many states have implemented stay-at-home orders or similar restrictions, which have caused a significant number of commercial businesses and industrial facilities to stop operating. In addition, many commercial employees are now working from home instead of going into the office. The current STEO forecast incorporates new macroeconomic projections, which lead to declines in forecast retail sales of electricity to the commercial and industrial sectors. However, EIA also assumes the unique aspects of the stay-at-home orders will depress industrial and commercial electricity demand more than the impact of the slowing economy.

As a result of the stay-at-home orders, weather-adjusted electricity consumption by the residential sector is likely to increase in the near term, in contrast to the effects on the commercial and industrial sectors. EIA assumes, in particular, that household usage of electronic equipment such as computers and televisions will increase. Other uses of electricity, such as for cooking and for heating water, may also rise. Household use of air conditioning during the summer months is also likely to be higher than normal as more people stay home during the daytime.

Electricity Generation

The effects on electricity supply are also very uncertain because of rapidly changing economic conditions. In terms of building new generating capacity, component supply chains and the construction workforce is likely to be affected in the near term in many areas of the country.

Most of the generating capacity that had been scheduled to come online in 2020 is fueled by renewable energy sources—including solar and wind—and by natural gas.

To represent these impacts on electricity supply, EIA assumes in the current STEO that half of the generating capacity previously expected to enter service in the second quarter of 2020 will be postponed to sometime beyond the STEO forecast period, as will one-quarter of the capacity expected for the third quarter of 2020. As EIA continues to collect updates for project development activities reported on our surveys, we will revise these assumptions in future STEO forecasts.

Electricity Prices

The forecast reduction in overall electricity demand resulting from the economic slowdown, along with lower expected natural gas fuel costs for power generation, drives EIA's expectation that wholesale electricity prices will be lower in 2020 throughout the country. The lower costs of electricity supply will likely not affect retail electricity prices in the near term but may be reflected in lower retail prices in the future as utilities make adjustments to their electric rates over the coming months.

U.S. Economic Assumptions and Energy-Related Carbon Dioxide Emissions

Recent Economic Indicators

The STEO is based on macroeconomic projections by Oxford Economics (for countries other than the United States) and by IHS Markit (for the United States). Given the tremendous uncertainty in both the spread and severity of COVID-19 and in the policy responses, these forecasts are significantly more uncertain than normal.

The Oxford forecast projects that global GDP will contract by 2% in the first quarter of 2020 and by 0.4% in the second quarter. However, this contraction is followed by a rapid recovery in the second half of 2020, leading to flat global GDP growth for the year.

For the United States, EIA used the March 20, 2020 version of the IHS Markit macroeconomic model with EIA's energy prices. The resulting U.S. economic forecast, which is used in this STEO, reflects a return to growth in the fourth quarter of 2020, and an expectation that employment does not return to pre-pandemic levels by the end of the STEO forecast period.

Energy-Related Carbon Dioxide Emissions.

EIA estimates energy-related carbon dioxide (CO₂) emissions based on energy consumption and carbon factors, the amounts of CO₂ that are released when fuels are burned, are unique to each fuel. Total CO₂ emissions depend on total energy consumption and the fuel mix of the energy consumed. Coal has the highest carbon factor of the major fossil fuels. However, because more petroleum products (such as motor gasoline) are consumed than coal, petroleum is the largest source of CO₂ emissions in the United States. Natural gas is the least carbon-intensive fossil fuel, but in recent years, because of its increasing consumption, it generates more U.S. CO₂ emissions

than coal. Non-fossil fuels, such as nuclear power and renewable generation sources, emit no direct CO₂. As these noncarbon generation sources enter the fuel mix, energy demands can be met without proportional increases in energy-related CO₂.

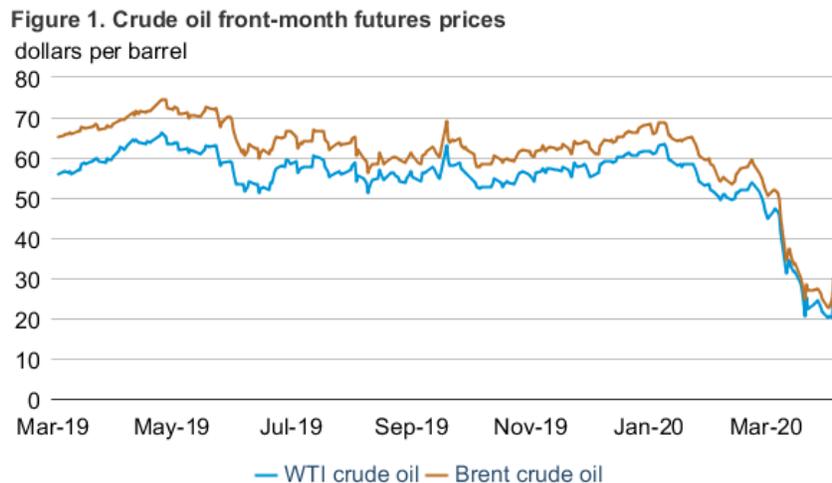
Notable forecast changes

- For more information, see the [detailed table of forecast changes](#).

Petroleum and natural gas markets review

Crude oil

Prices: The front-month futures price for Brent crude oil settled at \$29.94 per barrel (b) on April 2, 2020, down \$21.96/b from March 2. The front-month futures price for West Texas Intermediate (WTI) crude oil for delivery at Cushing, Oklahoma, decreased by \$21.43 /b during the same period, settling at \$25.32/b on April 2 (**Figure 1**).



 CME Group and Intercontinental Exchange, as compiled by Bloomberg L.P.; WTI=West Texas Intermediate

Oil and other financial markets reached all-time high levels of **volatility** in March. Several economic indicators suggest the global economy entered a recession, primarily as a result of containment efforts related to the 2019 novel coronavirus disease (**COVID-19**).

Although real-time data remain limited, EIA estimates global liquid fuels consumption declined by 11.4 million barrels per day (b/d) in March from the 2019 annual average and forecasts demand to decline by 17.1 million b/d in April from the 2019 average. For 2020, EIA estimates that global liquid fuels consumption will average 95.5 million b/d, down 5.2 million b/d (5.2%)

from 2019. If realized, 2020 would see the largest year-over-year percentage decline in global oil consumption since at least 1990, the year EIA began tracking global consumption levels. In the United States, EIA forecasts that total oil consumption will decline 6.5% in 2020 to average 19.1 million b/d, which would be the largest percentage decline in consumption since 1980 and the second-largest decline since 1949, the earliest EIA data available.

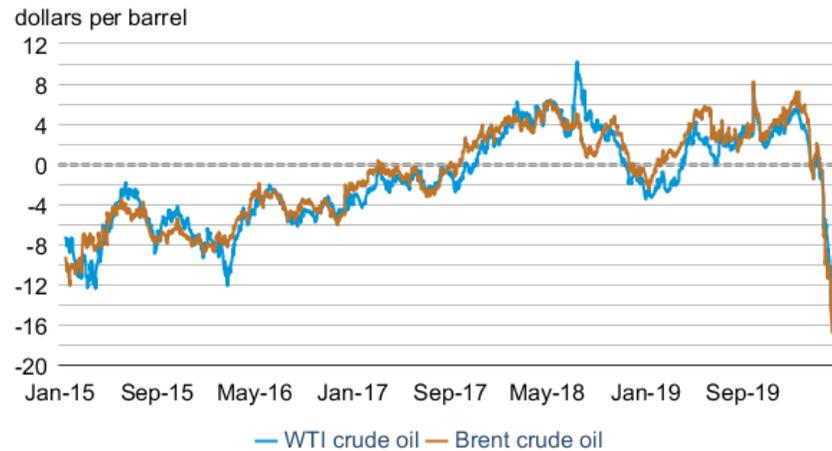
Aside from these significant changes to oil demand, EIA expects global oil supply to remain near first-quarter 2020 levels in the coming months. Upstream supply projects from countries outside the Organization of the Petroleum Exporting Countries (OPEC) require years of development and, once brought online, continue producing in low oil price environments as operating costs per barrel are generally low. However, EIA forecasts that low oil prices will immediately reduce U.S. Lower 48 crude oil production in the second quarter of 2020 as drilling activity slows significantly. In addition, as a result of OPEC and partner countries no longer restraining production, several [OPEC members](#) have begun increasing crude oil production by bringing previously idle spare production capacity online and selling additional crude oil from storage.

These supply and demand developments are contributing to significant increases in liquid fuels inventories. EIA estimates that second-quarter 2020 global petroleum inventories will increase at an average rate of 11.4 million b/d, which would be the largest rate of inventory increases since EIA record keeping began. Within the Organization for Economic Cooperation and Development (OECD), the highest stock levels recorded dating back to 2003 was in July 2016, when total commercial petroleum inventories ended the month at slightly more than 3.1 billion barrels. EIA forecasts inventories will surpass this level, but it remains uncertain how much commercially available storage capacity exists globally, particularly in non-OECD countries. Trade press is reporting an increase in unconventional forms of storage, such as [floating storage](#), as becoming used increasingly as on-land storage quickly fills.

EIA expects these large stock builds to keep downward price pressure on crude oil prices for several months. As a result, EIA forecasts Brent crude oil to average \$23/b in the second quarter of 2020. As non-OPEC crude oil production begins declining in the fourth quarter of 2020, and global liquid fuels demand increases, prices will increase gradually. EIA forecasts Brent crude oil will increase from the lows of the second quarter of 2020 to average \$46/b in 2021.

Crude oil price spreads: In addition to the decline in front-month crude oil futures prices, the market structure for crude oil along the futures curve developed significant levels of contango (when near-term crude oil prices are lower than longer-dated ones). Both the Brent and WTI 1st–13th spreads declined to the lowest levels since the global financial crisis of 2008–09, settling at -\$9.20/b and -\$9.59/b, respectively, on April 2 (**Figure 2**). The immediate and large loss of demand means that oil must be put in storage, as options for reducing crude oil production are limited in the short-term. Various trade press reports indicate that market participants are leasing tankers for floating storage, which is significantly more expensive than on-land storage.

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



eia CME Group and Intercontinental Exchange, as compiled by Bloomberg L.P.; WTI=West Texas Intermediate

Not only do crude oil inventory builds reflect price contango, but changes in price spreads between WTI for delivery in Cushing, Oklahoma—the delivery point for the WTI futures contract—and other light sweet crude oils in the United States suggest on-land storage in Cushing could begin filling rapidly. WTI Midland reflects crude oil prices at the point of production in the Permian region of Texas and New Mexico, and Magellan East Houston (MEH) crude oil reflects the price of light sweet crude oil on the U.S. Gulf Coast. Both WTI Midland and MEH developed discounts to WTI Cushing in March, when they had been averaging premiums of 88 cents/b and \$3.24/b, respectively, since the fourth quarter of 2019 through February 2020 (Figure 3).

Figure 3. U.S. crude oil price spreads

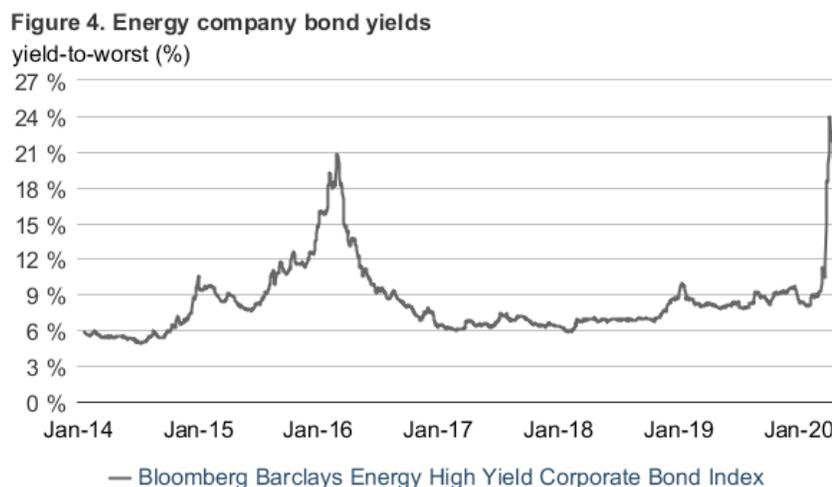


eia Bloomberg L.P., WTI=West Texas Intermediate

The WTI Midland discount to WTI Cushing was large when there was a lack of available pipeline capacity from the Permian production region to transport crude oil to Cushing. However, after several pipeline projects came online in the second half of 2019, there was more capacity than

current production, contributing to a slight premium in WTI Midland prices. Houston, on the other hand, is a destination point for crude oil from Cushing because local refineries can use it or it can be exported. The typical premium of MEH crude oil to Cushing generally reflects the cost of shipping crude oil by pipeline to the U.S. Gulf Coast. The rare discount that developed in late March provides a strong indication that barrels are being bought for storage in Cushing amid a significant decline in purchases from both U.S. and international refineries. Crude oil inventories in [Cushing](#) increased 3.5 million barrels for the week ending March 27, the largest week on week build in two years.

Oil company bond yields: Higher bond yields reflect increased risk aversion among bond investors and indicates tightening credit availability among companies. Bond yields for crude oil exploration and production companies increased in March, particularly for companies with a credit rating below Investment Grade, also called high yield bonds. The Bloomberg Barclays Energy High Yield Corporate Bond Index's yield-to-worst (YTW), which represents the minimum achievable yield on the bonds after accounting for early prepayment, increased to 23.9% on March 20, the highest since at least 2010 (**Figure 4**).



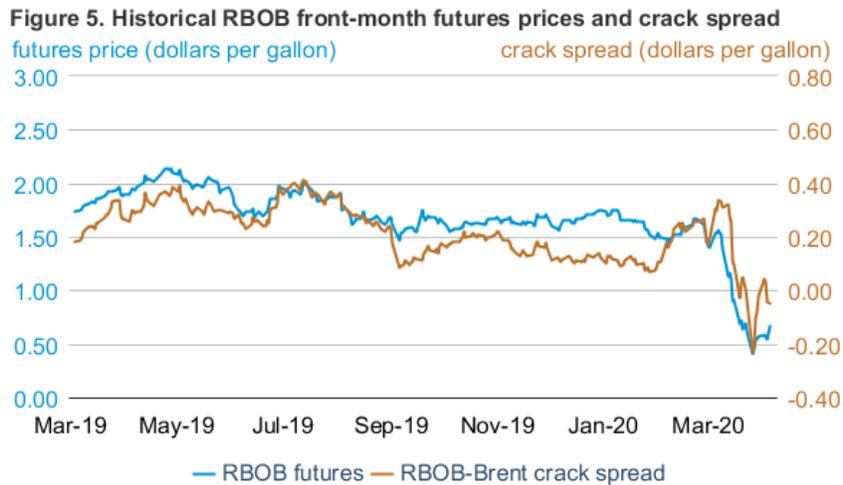
 Bloomberg L.P., Barclays

According to the latest [Dallas Fed Energy Survey](#), nearly 40% of survey respondents from exploration and production companies would be able remain solvent for two years or less if WTI crude oil prices stayed at \$40/b. As discussed in the crude oil price spreads section, many U.S. producers are receiving prices at large discounts to WTI Cushing crude oil prices, and some trades are as low as \$10/b or lower. These prices could lead to asset [impairments](#) and bankruptcies among U.S. oil companies, and perhaps some producers will shut in wells if conditions persist.

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)

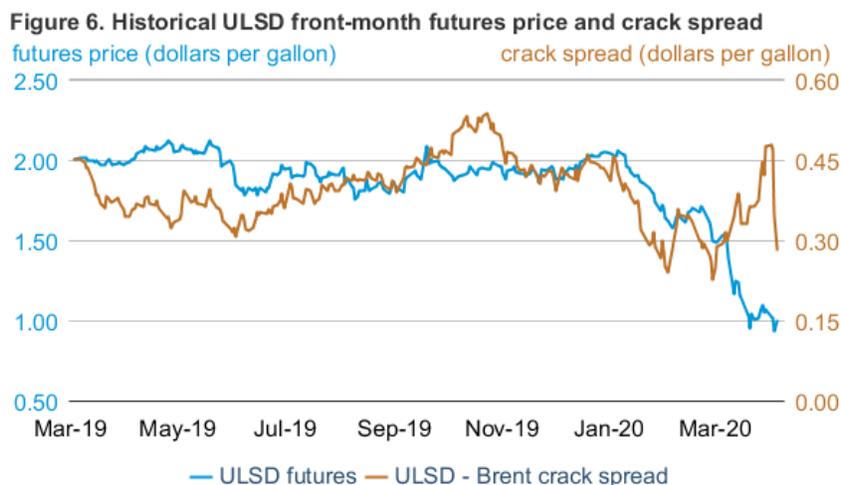
settled at \$0.66 per gallon (gal) on April 2, down 88 cents/gal since March 2, 2020 (**Figure 5**). The RBOB–Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) decreased by 35 cents/gal to settle at 5 cents/gal during the same period.



 CME Group, as compiled by Bloomberg L.P., RBOB=reformulated blendstock for oxygenate blending

RBOB prices declined substantially throughout much of March and experienced week-on-week declines for four consecutive weeks. U.S. average retail gasoline prices also declined from \$2.42/gal on March 2, 2020, to \$2.01 per gallon on March 30, 2020. Average gasoline retail prices in the East Coast (Petroleum Administration for Defense District, or PADD 1), the Midwest (PADD 2), and the Gulf Coast (PADD 3) all fell below \$2.00 /gal in March 2020, the first time since March 2016, November 2016, and February 2019, respectively. The lower prices for retail gasoline and RBOB futures prices likely reflect the interaction of two forces: the fall in the price of crude oil, the primary input cost for producing gasoline, and the fall in gasoline demand as a result of the decline in automotive travel caused by efforts to contain the outbreak of COVID-19 in North America. For example, U.S. vehicle miles traveled (VMT) fell to 8.3 billion miles in March 2020, 5% below March 2019, and EIA anticipates further declines throughout 2020 when VMT is expected to average 8.2 billion miles—the lowest level since 2012.

Ultra-low sulfur diesel prices: The ultra-low sulfur diesel (ULSD) front-month futures price for delivery in New York Harbor settled at \$1.00/gal on April 2, 2020 (**Figure 6**), down 53 cents/gal from March 2, 2020. The ULSD–Brent crack spread (the difference between the price of ULSD and the price of Brent crude oil) decreased by 1 cent/gal to settle at 28 cents/gal during the same period.



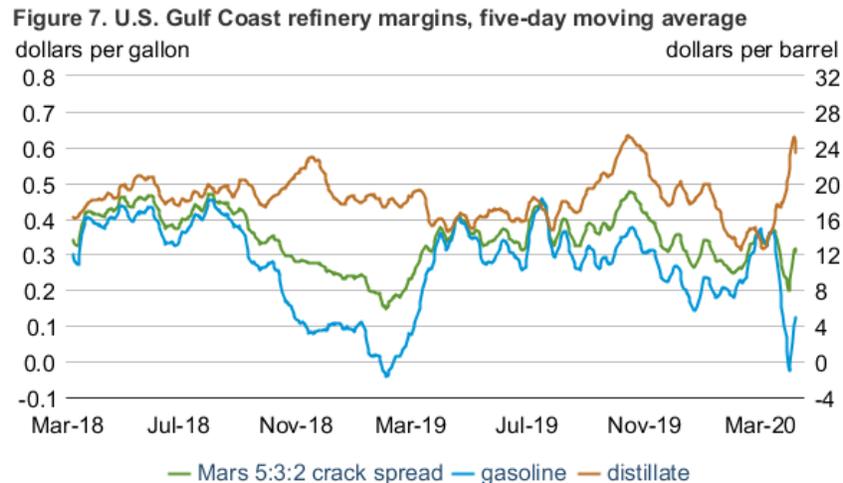
 CME Group, as compiled by Bloomberg L.P., ULSD=ultra-low sulfur diesel

Through March, the ULSD–Brent crack spread has remained well above the five-year (2015–19) average, even as ULSD and other petroleum prices fell. EIA expects the economic slowdown as a result of COVID-19 will have a much greater effect on gasoline and jet fuel than distillate fuel. EIA forecasts a 25% decline in gasoline consumption and a 34% decrease in jet fuel consumption in the second quarter 2020 compared with a 6% decline in distillate consumption. EIA’s March 2020 estimate of distillate consumption was 1% lower than the bottom of the previous five-year range, but distillate exports remained very strong. Distillate exports for the four weeks ending March 27 averaged 1.4 million barrels per day, which if confirmed by the monthly data, would be the most ever recorded for March.

More exports helped to reduce March distillate inventories below the five-year range and contributed to higher crack spreads. The ULSD–Brent crack spread fell sharply on April 1-2 as the ULSD price responded more slowly to the increase in Brent crude oil prices, but the crack spread remained near the five-year average.

Refining margins: The availability of cheaper crude oil inputs have somewhat blunted the impact of declining petroleum demand on U.S. refinery margins. EIA approximates these margins using the 5:3:2 crack spread, calculated as the combined revenue earned from selling 3 barrels of gasoline and 2 barrels of distillate less the cost of 5 barrels of crude oil inputs (using Mars, the U.S. Gulf Coast sour crude oil benchmark). Mars crude oil declined by 57% from \$48.00/b on March 2, 2020, to \$20.79/b on April 2, 2020. And although prices for distillate increased during the same period, the higher distillate price was more than offset by declines in the price for gasoline, which reduced the overall 5:3:2 crack spread by 6% to \$12.32/gal during the same period (**Figure 7**). While crack spreads for some products such as low sulfur fuel oil remain healthy, the decline in the 5:3:2 spread is likely fairly reflective of the margins realized by many U.S. Gulf Coast refiners. Because of this decrease in estimated margins, EIA expects refinery runs to decline over the next several months, with second quarter 2020 refinery distillation inputs falling by 14% relative to the preceding quarter to 14.2 million barrels per day,

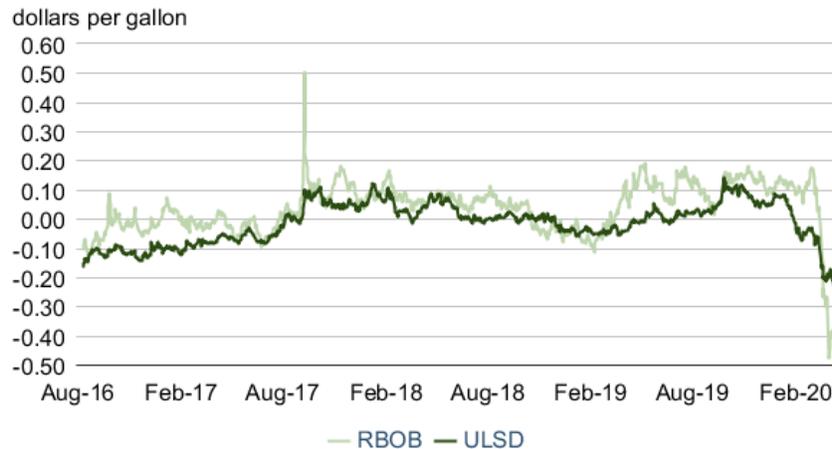
and 2020 refinery runs averaging 15.8 million barrels per day over the year, 7% less than 2019. Consequently, EIA estimates that the average U.S. refinery distillation utilization factor will fall from 87% in the first quarter 2020 to a 34 year low of 75% in the second quarter of 2020, and will average 83% throughout 2020 compared to 90% in 2019.



eia Bloomberg L.P.

Futures price spreads: The shape of the futures curves for both RBOB and ULSD shifted in early 2020 from backwardation—when near-term futures prices are higher than longer-dated ones—to contango—when near-term futures prices are lower than longer-dated ones. The 1st-13th spread (the difference between the price for a product settled in the nearest month and the price for 13 months in the future) for RBOB declined from \$0.03 per gallon on March 2, 2020, to the lowest since RBOB began trading in 2005 to -\$0.38/gal per gallon on April 2, 2020, while the 1st-13th spread for ULSD declined from -\$0.06 per gallon to -\$0.26 per gallon over the same period (**Figure 8**). The increased degree of contango likely reflects concerns of a significant decline in petroleum product demand, resulting in increases in inventory. As of March 27, U.S. commercial inventories of RBOB stood at 55.4 million barrels, 6.1 million more than their March 6 level, and 12% above the five-year average. The 1st-13th spread in ULSD declined by a smaller amount, reflecting a somewhat tighter distillate market. Expected decreases in consumption in the next few months will likely result in more product than normal moving into storage.

Figure 8. 1st-13th month futures spread

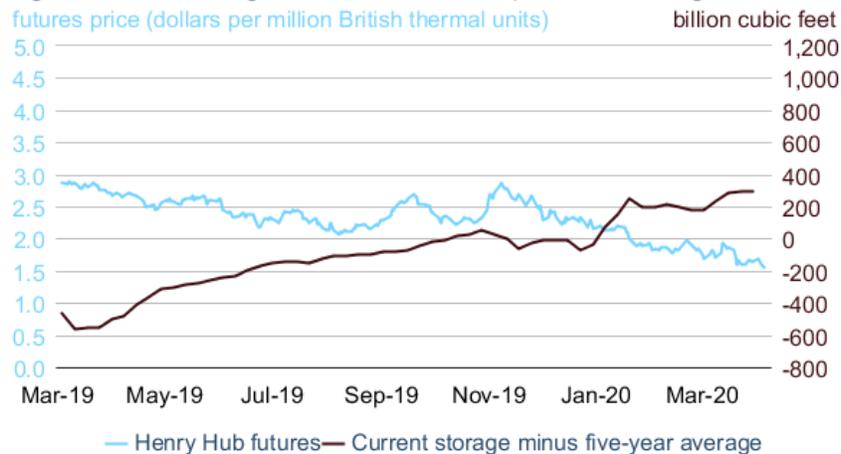


eia U.S. EIA, Bloomberg LP

Natural Gas

Prices: The front-month natural gas futures contract for May delivery at the Henry Hub settled at \$1.55 per million British thermal units (MMBtu) on April 2, down 20 cents/MMBtu from March 2 (**Figure 9**). Production gains combined with a mild winter have led to markedly higher year-over-year inventory levels compared with March 2019. Typically, March inventories are some of the lowest of the year immediately following the winter heating months.

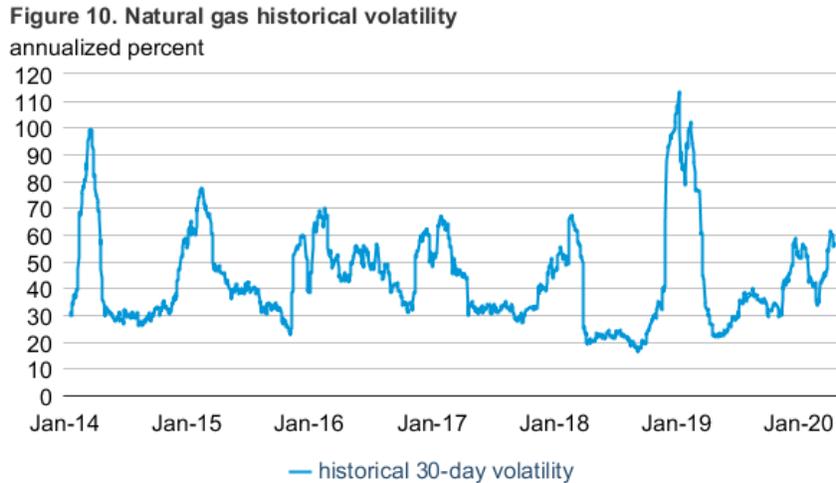
Figure 9. U.S. natural gas front-month futures prices and storage



eia U.S. Energy Information Administration, CME Group, as compiled by Bloomberg L.P.

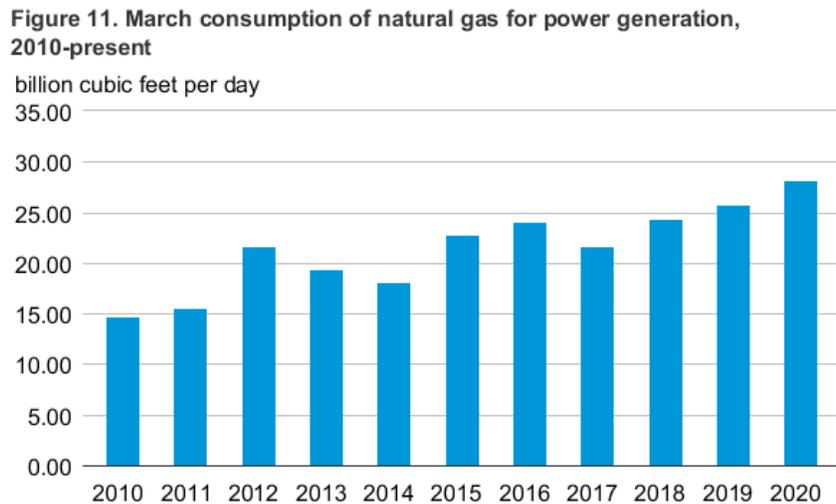
Historical Volatility: During the past month, oil prices and equities have seen significant movements that have drastically increased measures of their volatility. Natural gas volatility also increased in March but by a much smaller amount than in other markets. Historical 30-day volatility is defined as a rolling measure of the magnitude of price movements during the past 30 days (**Figure 10**). Many factors, including record production levels in 2019 and an atypically

warm winter, have led to historically low natural gas prices even before current economic conditions. This winter saw a much lower-than-usual increase in demand and prices during the winter months of late 2019 and early 2020. As a result, historical 30-day volatility peaked at significantly lower levels than several of the past winters.



eia Bloomberg L.P.

Natural gas in power generation: Power generation has been the largest source of natural gas demand for the past year. In addition, lower prices have contributed to increased competitiveness between natural gas and coal as a source of power generation. **Figure 11** displays the March natural gas consumption for power generation from 2010 to the 2020 estimate. EIA forecasts annual average natural gas consumption for electric power to increase to 31.3 billion cubic feet (Bcf) per day in 2020 compared with 31.0 Bcf/day in 2019. Although natural gas consumption for electric power is forecast to increase, total U.S. electricity consumption is expected to decline in 2020.



eia U.S. Energy Information Administration

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