



Short-Term Energy Outlook (STEO)

Highlights

- North Sea Brent crude oil prices averaged \$48/barrel (b) in October, a \$1/b increase from September. Daily Brent prices have ranged between \$45/b and \$53/b since the beginning of September. Oil price volatility was lower during October than during August and September, but it remains elevated compared with levels in recent years.
- EIA forecasts that Brent crude oil prices will average \$54/b in 2015 and \$56/b in 2016. The 2015 forecast price is unchanged from last month's STEO, and the 2016 forecast price is \$2/b lower. Forecast West Texas Intermediate (WTI) crude oil prices average \$4/b lower than the Brent price in 2015 and \$5/b lower in 2016. The current values of futures and options contracts for February 2016 delivery ([Market Prices and Uncertainty Report](#)) suggest the market expects WTI prices to range from \$35/b to \$66/b (at the 95% confidence interval) in February 2016.
- The monthly average price of U.S. regular retail gasoline was \$2.29/gallon (gal) in October, a decrease of 8 cents/gal from September and 88 cents/gal lower than in October 2014. EIA expects monthly gasoline prices to decline to an average of \$2.06/gal in December 2015. EIA forecasts U.S. regular gasoline retail prices to average \$2.33/gal in 2016.
- EIA estimates that total U.S. crude oil production declined by 40,000 barrels per day (b/d) in October compared with September. Crude oil production is forecast to decrease through the third quarter of 2016 before growth resumes late in 2016. Projected U.S. crude oil production averages 9.3 million b/d in 2015 and 8.8 million b/d in 2016.
- Natural gas working inventories were 3,929 billion cubic feet (Bcf) on October 30, which matches the previous weekly record set November 2, 2012. The October 30 level was 10% higher than a year ago and 4% higher than the previous five-year average (2010-14) for that week. EIA expects the Henry Hub natural gas spot price to average \$2.59/million British thermal units (MMBtu) this winter (October 2015–March 2016) compared with \$3.35/MMBtu last winter.

Global Petroleum and Other Liquids

Global petroleum and other liquids production continues to outpace consumption, leading to inventory builds throughout the forecast period. Global oil inventory builds in the third quarter

of 2015 averaged 1.6 million b/d, down from 2.0 million b/d in the second quarter, which had the highest level of inventory builds since the fourth quarter of 2008. The pace of inventory builds is expected to slow in the fourth quarter to roughly 1.2 million b/d. In 2016, inventory builds are expected to slow further to an average of 0.4 million b/d as global liquids output is expected to be unchanged from 2015. The 0.4 million b/d reduction in projected 2016 inventory builds from last month's STEO mostly reflects lower forecast oil production in Canada and the United States.

Global Petroleum and Other Liquids Consumption. EIA estimates global consumption of petroleum and other liquids grew by 1.2 million b/d in 2014, averaging 92.4 million b/d for the year. EIA expects global consumption of petroleum and other liquids to grow by 1.4 million b/d in both 2015 and 2016. Projected real gross domestic product (GDP) for the world weighted by oil consumption, which increased by 2.7% in 2014, is expected to rise by 2.3% in 2015 and by 2.7% in 2016.

Consumption of petroleum and other liquids in countries outside the Organization for Economic Cooperation and Development (OECD) increased by 1.4 million b/d in 2014 and is projected to grow by 0.8 million b/d in 2015 and by 1.2 million b/d in 2016. China continues to be the main driver of non-OECD oil consumption growth, despite the slowdown in the country's economic growth that began in the second half of 2014. China's consumption growth is expected to average 0.3 million b/d in 2015 and in 2016, below the 0.4 million b/d growth in 2014. Iran is expected to experience an uptick in economic activity and petroleum consumption in 2016, assuming implementation of the Joint Comprehensive Plan of Action (JCPOA) between Iran and the five permanent members of the United Nations Security Council plus Germany (P5+1) announced on July 14.

After falling by 0.3 million b/d in 2014, OECD petroleum and other liquids consumption is expected to rise by 0.6 million b/d in 2015 and by 0.2 million b/d in 2016, reaching an average of 46.5 million b/d, the highest annual average level of OECD consumption since 2010. U.S. consumption is expected to grow by an average of 0.3 million b/d in 2015 and by 0.1 million b/d in 2016. Economic conditions improved in several OECD countries in Europe and Asia as they emerged from recessions, contributing to 2015 oil demand growth. Also, colder-than-normal weather early in 2015 across OECD Europe contributed to a projected 0.2 million b/d increase in 2015 oil consumption. Consumption in OECD Europe is forecast to remain relatively unchanged in 2016. Consumption in Turkey in 2015 was revised upward to account for higher-than-forecast use of jet fuel, particularly in the third quarter of the year. In the same quarter, Japan saw an uptick in petroleum consumption for electricity generation, which made up for lower hydropower electricity generation. However, consumption in Japan is forecast to decline by an average of 0.1 million b/d in 2015 and 2016.

Non-OPEC Petroleum and Other Liquids Supply. EIA estimates that petroleum and other liquids production in countries outside of the Organization of the Petroleum Exporting Countries (OPEC) grew by 2.5 million b/d in 2014, which mainly reflects production growth in the United States. EIA expects non-OPEC production to grow by 1.1 million b/d in 2015, and then decline by 0.3

million b/d in 2016, which would be the first annual decline in non-OPEC production since 2008. In last month's STEO, non-OPEC production was forecast to increase by 0.1 million b/d. The shift in expectation from non-OPEC production growth to declines in 2016 is mostly because of lower expected growth in Canada and larger expected declines in U.S. onshore production.

Non-OPEC production growth in 2015 is largely attributable to investments committed to projects before the oil price decline that began in mid-2014. For example, the decisions to invest in the Golden Eagle, Peregrine, and Kinnoull fields in the United Kingdom's sector of the North Sea, which started producing at the end of 2014 and the beginning of 2015, were made in the second half of 2011. Redirection of investment away from exploration towards currently producing fields has also helped maintain or grow production levels in other non-OPEC countries. This strategy has helped maintain production levels in the short term, but likely will result in lower future production in areas that depend on continued exploration successes for output growth.

Production growth in Canada is expected to average 0.1 million b/d in both 2015 and 2016, levels that are 0.1 million b/d and 0.2 million b/d, respectively, lower than in last month's forecast. The reduction in forecast growth in Canada reflects persistently low oil prices resulting in announced delays or cancellations of projects previously scheduled to come online during the forecast period, including Shell's October announcement canceling the 80,000 b/d Camron Creek project. However, some oil sands projects continue as planned, including the Imperial Oil and Cenovus oil sands projects scheduled to come online by the end of 2016.

Unplanned supply disruptions among non-OPEC producers averaged almost 0.7 million b/d in October, a decrease of 0.2 million b/d from the previous month. The Syncrude oil sands development in northern Alberta returned to operation after an August fire damaged processing unit equipment. In early November, in what appears to be a widespread industrial action, Brazilian oil workers began striking, which caused more than 0.3 million b/d to be shut in during the first week of the month. At the time of writing, Petrobras and a number of workers unions involved in the industrial action have failed to come to an agreement to end the strike.

OPEC Petroleum and Other Liquids Supply. EIA estimates that OPEC crude oil production averaged 30.1 million b/d in 2014, relatively unchanged from the previous year. Crude oil production declines in Libya, Angola, Algeria, and Kuwait offset [production growth in Iraq](#) and Iran. EIA forecasts OPEC crude oil production to increase by 0.9 million b/d in 2015, led by production increases in Iraq. Forecast OPEC crude oil production increases by 0.2 million b/d in 2016, with Iran forecast to increase production once international sanctions targeting its oil sector are suspended. Under the [JCPOA between the P5+1 and Iran](#) that was announced on July 14, sanctions relief is contingent on verification by the International Atomic Energy Agency (IAEA) that Iran has complied with key nuclear-related steps.

While much uncertainty remains as to the timing of sanctions relief, EIA assumes its implementation occurs in the second quarter of 2016, clearing the way to ease the sanctions at

that time. As a result, EIA forecasts Iranian crude oil supplies will increase by more than 0.2 million b/d on average in 2016, reaching roughly 3.3 million b/d by the end of the year.

Some OPEC member countries will see production declines in the near term. Saudi Arabia's production is expected to respond to lower direct crude burn for electric power generation as seasonal power demand abates. Also, there is considerable uncertainty regarding Iraq's ability to sustain its higher production and export levels, particularly in light of budgetary constraints that have prompted the Iraqi government to request international oil companies operating in the south to reduce spending plans next year.

OPEC noncrude liquids production, which averaged 6.3 million b/d in 2014, is expected to increase by 0.2 million b/d in 2015 and by 0.3 million b/d in 2016, led by production increases in Iran, Qatar, and Kuwait.

In October, unplanned crude oil supply disruptions among OPEC producers averaged 2.9 million b/d, more than 0.2 million b/d above the previous month. In Iraq, bad weather in the Basra Gulf caused southern exports to decrease by 0.3 million b/d. The disruption in Iraq was partially offset by a less than 0.1 million b/d increase to Libya's production. In Libya, the brief reopening of the Zueitina export terminal allowed some production to restart in October, but the port was shut down again in the beginning of November. Kuwait and Saudi Arabia continue to have a total of 0.5 million b/d disrupted at the Wafra and Khafji fields in the Neutral Zone that straddles the two countries.

EIA's estimates of unplanned production outages are calculated as the difference between estimated effective production capacity ([the level of supply that could be available within one year](#)) and estimated production. EIA lowered its historical estimates of unplanned OPEC crude oil supply disruptions in 2015, as Libya's crude oil production capacity was lowered by 150,000 b/d to 1.4 million b/d. The change reflects the extensive damage at oil fields in the Sirte Basin caused by militant groups.

EIA expects OPEC surplus crude oil production capacity to average 1.5 million b/d in 2015 and 2.0 million b/d in 2016, after averaging 2.0 million b/d in 2014. EIA estimates that Iran's crude oil production capacity is 3.6 million b/d, which is 0.8 million b/d higher than its current estimated production level. EIA currently categorizes that 0.8 million b/d as a disruption because Iran's production is restricted by sanctions that affect the country's ability to sell its oil. However, if sanctions are lifted next year, any difference between its crude oil production capacity and its crude oil production level would henceforth be considered surplus capacity.

Surplus capacity is typically an indicator of market conditions, and surplus capacity below 2.5 million b/d indicates a relatively tight oil market, but the high current and forecast levels of global inventory builds make the projected low surplus capacity level in 2015 less significant.

OECD Petroleum Inventories. EIA estimates that OECD commercial crude oil and other liquids inventories totaled 2.70 billion barrels at the end of 2014, equivalent to roughly 59 days of

consumption. Forecast OECD inventories rise to 2.95 billion barrels at the end of 2015 and then to 2.98 billion barrels at the end of 2016.

Crude Oil Prices. Brent crude oil spot prices increased by \$1/b in October to a monthly average of \$48/b. Although oil price volatility declined during October, it remained elevated compared with 2013-14 levels, as Brent spot prices changed by at least 3% on four different trading days during the month.

Continuing [increases in global liquids inventories](#) have put significant downward pressure on prices in 2015. Inventories rose by an estimated 1.8 million b/d through the first three quarters of 2015, compared with an average build of 0.5 million b/d over the same period in 2014. Global liquid fuels inventory builds are expected to slow to an average 1.2 million b/d in the fourth quarter of 2015, and then slow further to an average of 0.4 million b/d in 2016.

The monthly average WTI crude oil spot price averaged \$46/b in October. October WTI prices were up slightly from the average in September, as end-of-October crude oil inventories at the Cushing, Oklahoma, storage hub were relatively unchanged from levels a month earlier despite heavy refinery maintenance that reduced crude oil flows into Midwest refineries.

EIA forecasts that Brent crude oil prices will average \$54/b in 2015 and \$56/b in 2016. The 2015 forecast price is unchanged from last month's STEO, and the 2016 forecast price is \$2/b lower. Forecast WTI crude oil prices average \$4/b lower than the Brent price in 2015 and \$5/b lower in 2016.

EIA's crude oil price forecast remains subject to significant uncertainties as the oil market moves toward balance. During this period of price discovery, oil prices could continue to experience periods of heightened volatility. The oil market faces many uncertainties heading into 2016, including the pace and volume at which Iranian oil reenters the market, the strength of oil consumption growth, and the responsiveness of non-OPEC production to low oil prices.

The current values of futures and options contracts continue to suggest high uncertainty in the price outlook ([Market Prices and Uncertainty Report](#)). WTI futures contracts for February 2016 delivery, traded during the five-day period ending November 5, averaged \$48/b, while implied volatility averaged 38%. These levels established the lower and upper limits of the 95% confidence interval for the market's expectations of monthly average WTI prices in February 2016 at \$35/b and \$66/b, respectively. The 95% confidence interval for market expectations widens over time, with lower and upper limits of \$28/b and \$95/b for prices in December 2016. Last year at this time, WTI for February 2015 delivery averaged \$79/b, and implied volatility averaged 28%. The corresponding lower and upper limits of the 95% confidence interval were \$63/b and \$99/b.

U.S. Petroleum and Other Liquids

Monthly data show gasoline consumption in the United States increased by 2.7% during the first eight months of 2015 compared with same period in 2014. U.S. gasoline consumption growth

reflects strong increases in employment and lower gasoline prices. Growing domestic consumption and strong gasoline consumption growth globally contributed to [high refinery wholesale gasoline margins](#) (the difference between the wholesale price of gasoline and the price of Brent crude oil) for most of 2015. Average wholesale gasoline margins reached a high of 73 cents/gal in August, which was the highest monthly average since May 2007. Margins returned closer to typical seasonal levels in October. Wholesale gasoline margins averaged 31 cents/gal in October, down 13 cents/gal from the level in September and 5 cents/gal above the October 2014 level.

In October, regular gasoline retail prices fell across all regions except in PADD 2 (Midwest), where [high levels of planned and unplanned refinery outages](#) reduced gasoline supplies. U.S. average regular gasoline retail prices fell from \$2.37/gal in September to \$2.29/gal in October. Monthly average regional gasoline retail prices ranged from a low of \$2.01/gal in PADD 3 (Gulf Coast) to a high of \$2.73/gal in PADD 5 (West Coast). EIA expects gasoline prices to fall from current levels, with the U.S. regular gasoline price averaging \$2.06/gal in December 2015.

Liquid Fuels Consumption. Total U.S. liquid fuels consumption is projected to increase by 330,000 b/d (1.7%) in 2015, up from an increase of 140,000 b/d (0.8%) last year. U.S. consumption has been stimulated by continuing [employment and economic growth](#) and lower petroleum product prices. Total liquid fuels consumption growth in 2016 is forecast to be 120,000 b/d (0.6%).

Consumption growth in 2015 is led by motor gasoline, which is forecast to increase by 190,000 b/d (2.1%) to an average of 9.1 million b/d in 2015, the highest level since the record of 9.3 million b/d in 2007. Although total nonfarm employment and total highway travel have increased by 2.9% and 3.5%, respectively, over the past eight years, improving vehicle fuel economy continues to keep gasoline consumption below its previous peak. Gasoline consumption growth is forecast to slow to 20,000 b/d (0.2%) in 2016, as a long-term trend toward vehicles that are more fuel-efficient continues to offset the effects of economic and population growth on highway travel.

Jet fuel consumption, which grew by 40,000 b/d in 2014, is forecast to rise by 60,000 b/d (3.9%) in 2015. Forecast jet fuel consumption is roughly flat in 2016, with improvement in average airline fleet fuel economy offsetting growth in freight and passenger travel.

Consumption of distillate fuel, which includes diesel fuel and heating oil, is forecast to fall by 30,000 b/d (0.7%) in 2015 and increase by 60,000 b/d (1.4%) in 2016. The 2016 growth is driven by increases in manufacturing output, foreign trade, and marine fuel use.

Hydrocarbon gas liquids (HGL) consumption, which fell by 50,000 b/d (1.9%) in 2014, is projected to increase by 70,000 b/d in 2015 and 40,000 b/d in 2016, as new petrochemical plant capacity increases the use of HGL as a feedstock. [New HGL export terminal capacity](#) contributes to an increase in HGL net exports from an average of 560,000 b/d in 2014 to 1.2 million b/d in 2016.

Liquid Fuels Supply. U.S. crude oil production is projected to increase from an average of 8.7 million b/d in 2014 to 9.3 million b/d in 2015 and then decrease to 8.8 million b/d in 2016. Forecast crude oil production in 2016 is 0.1 million b/d lower than in last month's STEO. Lower forecast production reflects lower crude oil prices and rig counts in 2016 than projected in last month's STEO.

According to the latest [survey-based reporting](#) of monthly crude oil production estimates, U.S. production averaged 9.4 million b/d through the first eight months of 2015. This level is 0.1 million b/d higher than the average production during the fourth quarter of 2014, despite a more than 60% decline in the total U.S. oil-directed rig count since October 2014. However, monthly crude oil production started to decrease in the second quarter of 2015, led by Lower 48 onshore production. From March 2015 through October 2015, Lower 48 onshore output has fallen from more than 7.6 million b/d to about 7.1 million b/d.

EIA estimates total crude oil production has declined almost 0.5 million b/d since April, averaging 9.1 million b/d in October. EIA expects U.S. crude oil production declines to continue through September 2016, when total production is forecast to average 8.5 million b/d. This level of production would be almost 1.1 million b/d less than the 2015 peak reached in April. Forecast production begins increasing in late 2016, returning to an average of 8.8 million b/d in the fourth quarter.

Expected crude oil production declines through September 2016 are largely attributable to unattractive economic returns in some areas of both emerging and mature onshore oil production regions, as well as seasonal factors such as anticipated hurricane-related production disruptions in the Gulf of Mexico. Reductions in 2015 cash flows and capital expenditures have prompted companies to defer or redirect investment away from marginal exploration and research drilling to focus on core areas of major tight oil plays. Reduced investment has resulted in the lowest count of oil-directed rigs in about five years and in well completions that are significantly behind 2014 levels.

Oil prices, particularly in the second quarter of 2015, remained high enough to support continued developmental drilling in the core areas within the Bakken, Eagle Ford, Niobrara, and Permian formations, with July and August showing the first consecutive month-to-month increases in the oil-directed rig count since September and October 2014. However, with WTI prices below \$50/b since August, oil-directed rig counts have resumed declining. Projected oil prices below \$60/b throughout the forecast period are expected to limit onshore drilling activity and well completion totals, despite continued increases in rig and well productivity and falling drilling and completion costs. The forecast remains sensitive to actual wellhead prices and rapidly changing drilling economics that vary across regions and operators.

While projected oil production in the Gulf of Mexico rises during the forecast period, oil production in Alaska falls. Production in these areas is less sensitive to short-term price movements than onshore production in the Lower 48 states and reflects anticipated growth from new projects in the Gulf of Mexico and declines from legacy fields in Alaska. Twelve

projects are scheduled to come online in the Gulf of Mexico in 2015 and 2016, pushing up production from an average of 1.4 million b/d in the fourth quarter of 2014 to 1.6 million b/d in the fourth quarter of 2016. It is possible some projects might begin later than expected, shifting some of the anticipated production gains from late 2016 into early 2017.

HGL production at natural gas processing plants reached 3.32 million b/d in August 2015, and it is projected to average 3.28 million b/d in 2015 and 3.56 million b/d in 2016. EIA expects higher ethane recovery rates in 2016 following planned increases in petrochemical plant feedstock demand in the United States and abroad. New terminals and expansions and a growing ship fleet are expected to allow higher quantities of domestically produced ethane, propane, and butanes to reach international markets. Forecast net HGL exports average 1.2 million b/d in 2016.

Petroleum Product Prices. Narrowing wholesale gasoline margins contributed to U.S. regular gasoline retail prices declining to an average of \$2.29/gal in October, down from an average of \$2.60/gal in the third quarter. EIA expects monthly average gasoline prices to continue declining in the coming months as refineries continue to produce high levels of gasoline and as the market transitions to lower-cost, winter-grade gasoline. EIA projects regular gasoline retail prices to average \$2.18/gal in the fourth quarter of 2015.

The U.S. regular gasoline retail price, which averaged \$3.36/gal in 2014, is projected to average \$2.43/gal in 2015 and \$2.33/gal in 2016. The 2016 forecast price is 5 cents/gal lower than in the October STEO. The diesel fuel retail price, which averaged \$3.83/gal in 2014, is projected to average \$2.72/gal in 2015 and \$2.70/gal in 2016.

Lower projected crude oil prices this winter compared with last winter contribute to a reduction in the forecast residential heating oil price and average household heating oil expenditures this winter. The average household that uses heating oil as its primary space heating fuel is expected to pay an average of \$2.50/gal this winter, 54 cents/gal lower than last winter. The average household is now expected to spend \$1,360 for heating oil this winter, \$493 less than last winter. The reduction in expenditures also reflects lower forecast consumption because of warmer forecast temperatures this winter compared with last winter.

Propane prices this winter are expected to be 4% lower in the Northeast and 12% lower in the Midwest, contributing to households spending 14% and 20% less on propane in those regions, respectively.

Natural Gas

Working natural gas inventories for the week ending October 30 reached 3,929 Bcf, which [matched the previous record high](#) set on November 2, 2012, according to EIA's [Weekly Natural Gas Storage Report](#). Although the storage injection season is commonly considered to end on October 31, builds often continue into November, and it is possible inventories could reach 4 trillion cubic feet in the coming weeks. Looking ahead to March 2016, EIA projects inventories

will end the winter at 1,862 Bcf, reflecting a slightly lower-than-average overall winter drawdown based on projections for warmer-than-normal temperatures.

Strong inventory builds, continuing production growth, and expectations for warm winter temperatures contributed to natural gas prices reaching three-year lows, as Henry Hub spot prices fell below \$2/MMBtu on October 30 for the first time since April 2012.

Based on lower expected residential natural gas prices than last winter and a forecast of warmer temperatures across much of the United States, EIA expects household heating expenditures for consumers using natural gas as their primary space heating fuel to average about 13% lower this winter compared with last winter.

Natural Gas Consumption. EIA's forecast of U.S. total natural gas consumption averages 76.3 Bcf/day (Bcf/d) in 2015 and 76.8 Bcf/d in 2016, compared with 73.1 Bcf/d in 2014. EIA projects natural gas consumption in the power sector to increase by 16.8% in 2015 and then to decrease by 1.2% in 2016. Natural gas spot prices, which are expected to remain below \$3/MMBtu through mid-2016, support high consumption of natural gas for electricity generation in 2015 and 2016. Industrial sector consumption of natural gas remains flat in 2015 and increases by 4.2% in 2016, as new industrial projects, particularly in the fertilizer and chemicals sectors, come online in the next few months. Natural gas consumption in the residential and commercial sectors is projected to decline in both 2015 and 2016, which largely reflects lower heating demand this winter compared with last winter.

Natural Gas Production and Trade. In August, total marketed production hit a record high of 81.3 Bcf/d. EIA expects that marketed natural gas production will increase by 4.7 Bcf/d (6.3%) and by 1.6 Bcf/d (2.0%) in 2015 and 2016, respectively. Increases in drilling efficiency will continue to support growing natural gas production in the forecast despite low natural gas prices and declining rig activity. Most of the growth is expected to come from the Marcellus Shale, as the backlog of uncompleted wells is reduced and as new pipelines come online to deliver Marcellus natural gas to markets in the Northeast.

Increases in domestic natural gas production are expected to reduce demand for natural gas imports from Canada and to support growth in exports to Mexico. In August, natural gas net imports fell to 2.2 Bcf/d, the lowest monthly level since 1987. EIA expects natural gas exports to Mexico, particularly from the Eagle Ford Shale in South Texas, to increase because of growing demand from Mexico's electric power sector coupled with flat natural gas production in Mexico. EIA projects LNG gross exports will increase to an average of 0.7 Bcf/d in 2016, with the startup of Cheniere's Sabine Pass LNG liquefaction plant in the Lower 48 states planned for early 2016.

Natural Gas Inventories. On October 30, natural gas working inventories totaled 3,929 Bcf, 371 Bcf (10%) above the level at the same time in 2014 and 147 Bcf (4%) above the five-year average for that week. Forecast end-of-March 2016 inventories are 1,862 Bcf, which would be 240 Bcf above the five-year average.

Natural Gas Prices. The Henry Hub natural gas spot price averaged \$2.34/MMBtu in October, a decrease of 32 cents/MMBtu from the September price. Warm weather at the end of October, strong inventory builds, continuing production growth, and expectations for a warm winter contributed to spot prices falling to three-year lows in recent weeks. Monthly average Henry Hub spot prices are forecast to remain lower than \$3/MMBtu through June 2016, and lower than \$3.50/MMBtu through the rest of the forecast. The projected Henry Hub natural gas price averages \$2.69/MMBtu in 2015 and \$3.00/MMBtu in 2016.

Natural gas futures contracts for February 2016 delivery traded during the five-day period ending November 5 averaged \$2.50/MMBtu. Current options and futures prices imply market participants place the lower and upper bounds for the 95% confidence interval for February 2016 contracts at \$1.60/MMBtu and \$3.92/MMBtu, respectively. At this time in 2014, the natural gas futures contract for February 2015 delivery averaged \$4.19/MMBtu, and the corresponding lower and upper limits of the 95% confidence interval were \$2.76/MMBtu and \$6.38/MMBtu, respectively.

Coal

Coal Supply. Forecast U.S. coal production in 2015 declines by 92 million short tons (MMst) (9%). Forecast production decreases in all coal-producing regions, with the largest percentage decrease occurring in the Appalachian region (12%). Interior region production, which includes the Illinois Basin, is expected to decline by 7%, the first annual decline since 2009, while Western region production is expected to fall by 8%, dropping below 500 MMst for the first time since 1998. U.S. coal production is expected to decrease by an additional 27 MMst (3%) in 2016, but Interior region production is projected to grow by nearly 3%, reflecting competitive advantages compared with other coal-producing regions. These factors include the higher heat content of the coal, closer proximity to major markets than coal produced in the Western region, and lower mining costs than Appalachian-produced coal.

Electric power sector coal stockpiles were 158 MMst in August, a 1% decrease from July. This decrease in coal stockpiles follows the normal seasonal pattern of coal stockpiles falling during the summer months. Despite this decrease, coal stockpiles are still relatively high because of the loss in market share to natural gas for power generation. August coal inventories averaged 145 MMst during the previous 10 years (2005-14).

Coal Consumption. EIA forecasts total coal consumption to decrease by 9% in 2015, mainly as a result of a 9% drop in electric power sector consumption. Lower natural gas prices are the key factor driving the decrease in coal consumption. Low natural gas prices make it more economic to increase utilization at natural gas-fired generating units and to decrease utilization at coal units. The retirements of coal-fired power plants, stemming from both increased competition with natural gas generation and the implementation of the [Mercury and Air Toxics Standards \(MATS\)](#), also reduce coal-fired capacity in the power sector in 2015, but the full effect will not be evident until 2016.

Higher forecast natural gas prices in 2016 are expected to contribute to higher utilization rates among the remaining coal-fired power plants, which partially offsets the effect of coal-plant retirements. Coal consumption in the electric power sector is forecast to remain relatively unchanged in 2016.

Coal Trade. Slower growth in world coal demand and lower international coal prices have contributed to a decline in U.S. coal exports. Lower mining costs, cheaper transportation costs, and favorable exchange rates will continue to provide an advantage to mines in other major coal-exporting countries compared with U.S. producers. Coal exports for the first eight months of 2015 are down 21% compared with the same period in 2014. Forecast coal exports fall by 18 MMst (19%) to 79 MMst in 2015, and then decrease by another 7 MMst (9%) in 2016 as the current global coal market trends continue. Forecast U.S. coal imports, which increased by 2 MMst in 2014 to more than 11 MMst, stay near that level in 2015 and 2016.

Coal Prices. The annual average coal price to the electric power sector averaged \$2.36/MMBtu in 2014. EIA expects the delivered coal price to average \$2.25/MMBtu in 2015 and to increase by one cent to average \$2.26/MMBtu in 2016.

Electricity

Power plant operators have [announced the retirement](#) of more than 2,000 megawatts (MW) of nuclear generating capacity by 2020 (equal to 2% of current U.S. capacity). These planned retirements are in addition to the five nuclear reactors (totaling more than 4,000 MW of capacity) that have shut down over the past four years. The most recent retirement was the Vermont Yankee plant (604 MW) last December. None of these planned retirements is expected to occur before the end of 2016, which is the forecast horizon for the current STEO. Five new reactors are currently under construction and are expected to add more than 5,000 MW of new capacity by 2020. Watts Bar Unit 2 has received its operating license and anticipates beginning commercial operation next year.

Electricity Consumption. U.S. heating degree days are expected to be about 8% lower this winter compared with the winter of 2014-15. The milder winter weather is expected in most areas of the eastern United States, including the southern states, where a majority of households use electric heat pumps for primary space heating. The reduced need for heating contributes to EIA's forecast of a 1.6% decline in winter retail sales of electricity to the residential sector. For the full year, EIA projects residential electricity sales will fall by 0.3% in 2016 after growing 1.1% this year.

Electricity Generation. Natural gas prices continue to fall, with the Henry Hub price in October averaging \$2.34/MMBtu compared with \$3.78/MMBtu in October 2014. Falling natural gas prices have led EIA to raise its forecast of natural gas generation from last month's STEO. Electricity generation fueled by natural gas is now expected to grow by 17% in 2015. Although natural gas prices are expected to increase slightly in 2016, EIA does not expect power generators will significantly switch back from natural gas to coal next year, as forecast natural gas prices remain very low compared with recent years. Generation from both natural gas and

coal are expected to decline in 2016, by 1.3% and 0.3%, respectively, while generation from hydropower and other renewables rises.

Electricity Retail Prices. The U.S. retail price of electricity to the residential sector is projected to average 12.6 cents per kilowatthour in 2015, 0.5% higher than the average price last year. The largest price increases are projected to be in New England, where residential electricity prices are forecast to increase by 8.4% in 2015, as electricity distribution companies recover higher generation and power purchase costs incurred during 2014. However, wholesale power prices in New England have been relatively low this year, and utilities in New England have been lowering retail prices in the past few months from their peak in March and April.

Renewables and Carbon Dioxide Emissions

Electricity and Heat Generation from Renewables. EIA expects total renewables used in the electric power sector to decrease by 2.0% in 2015. Hydropower generation is forecast to decrease by 8.6%, and nonhydropower renewable power generation is forecast to increase by 4.4%. The 2015 decrease in hydropower generation reflects the effects of the [California drought](#). Forecast hydropower generation in the electric power sector increases by 7.0% in 2016.

EIA expects continued growth in utility-scale solar power generation, which is projected to average 90 gigawatthours per day (GWh/d) in 2016. Because the growth is from a small base, utility-scale solar power averages 0.8% of total U.S. electricity generation in 2016. Although solar growth has historically been concentrated in customer-sited distributed generation installations (rooftop panels), EIA expects utility-scale solar capacity will increase by 118% (12 GW) between the end of 2014 and the end of 2016, with 4.6 GW of new capacity being built in California. Other leading states in utility-scale solar capacity include North Carolina and Nevada, which, combined with California, account for about two-thirds of the projected utility-scale capacity additions for 2015 and 2016.

Wind capacity, which starts from a significantly larger installed capacity base than solar, grew by 8% in 2014, and is forecast to increase by 13% in 2015 and 14% in 2016.

Liquid Biofuels. On May 29, the U.S. Environmental Protection Agency (EPA) proposed a rule setting Renewable Fuel Standard (RFS) volumes for 2014 through 2016. Although these volumes could be modified before the final rule is issued, the proposed rules are used to develop the current STEO forecast. Ethanol production, which averaged 934,000 b/d in 2014, is forecast to average more than 950,000 b/d in both 2015 and 2016. Ethanol consumption, which averaged 877,000 b/d in 2014, is forecast to average slightly more than 900,000 b/d in both 2015 and 2016, resulting in an average 9.9% ethanol share of the total gasoline pool. EIA does not expect significant increases in E15 or E85 consumption over the forecast period.

EIA expects the largest effect of the proposed RFS targets will be on biodiesel consumption, which contributes to meeting the biomass-based diesel, advanced biofuel, and total renewable fuel RFS targets. Biodiesel production averaged 83,000 b/d in 2014 and is forecast to average

91,000 b/d in 2015 and 98,000 b/d in 2016. Net imports of biomass-based diesel are also expected to increase from 15,000 b/d in 2014 to 26,000 b/d in 2015, and to 35,000 b/d in 2016.

Energy-Related Carbon Dioxide Emissions. EIA estimates that emissions of CO₂ grew by 0.9% in 2014. Emissions are projected to fall by 0.9% in 2015 and then increase by 0.3% in 2016. These forecasts are sensitive to assumptions about weather and economic growth.

U.S. Economic Assumptions

Recent Economic Indicators. The Bureau of Economic Analysis reported that [real GDP](#) increased at an annual rate of 1.5% in the third quarter of 2015, following growth of 3.9% in the second quarter. The increase in real GDP in the third quarter reflected positive contributions from personal consumption expenditures, state and local government spending, and fixed investment. The primary negative contribution was a decrease in private inventory investment.

EIA used the October 2015 version of the IHS macroeconomic model with EIA's energy price forecasts as model inputs to develop the economic projections in the STEO.

Production, Income, and Employment. Forecast real GDP growth reaches 2.5% in 2015 and 2.7% in 2016—the same as forecast last month for 2015, but above the 2.5% forecast last month for 2016. Real disposable income grows by 3.3% in 2015 and by 3.1% in 2016. Total industrial production grows at 1.4% in 2015 and 1.8% in 2016. Projected growth in nonfarm employment averages 2.1% in 2015 and 1.4% in 2016.

Expenditures. Forecast private real fixed investment growth averages 4.7% and 7.1% in 2015 and 2016, respectively. Real consumption expenditures grow faster than real GDP, at 3.2% in 2015 and at 3.0% in 2016. Durable goods expenditures drive consumption spending in both years. Export growth is 1.7% and 3.4% over the same two years, while import growth is 5.8% in 2015 and 5.3% in 2016. Total government expenditures rise 0.7% in 2015 and 0.6% in 2016.

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