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COMMITTEE ON ENERGY AND NATURAL RESOURCES  
UNITED STATES SENATE  
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Chairman Murkowski, Ranking Member Cantwell and Members of the Committee, I appreciate the opportunity to appear before you today to provide testimony on the U.S. energy outlook.

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. EIA is the Nation's primary source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views expressed in our reports, therefore, should not be construed as representing those of the Department of Energy or other federal agencies.

The energy data and projections that I will discuss today are widely used by government agencies, the private sector, and academia as a starting point for their own energy analyses. For the U.S. energy sector, EIA prepares both short-term energy outlooks, examining monthly trends over the next one to two years, and long-term outlooks, with annual projections over the next 20-to-25 years. I will summarize some key findings from our January Short-Term Energy Outlook (STEO), as well as some of EIA's recently published 2015 data reviews that provide context for the outlook. The Annual Energy Outlook 2016 (AEO2016), which takes a longer-term perspective, will be released in late spring.

## ***Developments in 2015***

During the past year there were major changes in global commodity prices, energy technologies and U.S. energy and environmental policies, including the statutory removal of longstanding restrictions on U.S. crude oil exports, issuance of the final Clean Power Plan rule, and extensions of tax credits for wind and solar generation technologies.

### ***Crude oil, natural gas, and coal commodity prices started 2015 relatively low and ended the year even lower.***

Crude Oil: Crude oil prices ended 2015 with North Sea Brent and West Texas Intermediate (WTI) below \$40 per barrel (b), the lowest level since early 2009. (Figure 1) Price declines have continued into the first two weeks of 2016 with prices near \$30/b on January 12. U.S. crude oil production began to decline in the second quarter of 2015 led by reductions in Lower 48 onshore production. Even with the recent price decline, U.S. production averaged an estimated 9.4 million barrels per day (b/d) in 2015, an 8% increase over 2014 and the highest rate since 1972.

EIA estimates that total Organization of the Petroleum Exporting Countries (OPEC) crude oil and other liquids production increased 3% to 38.3 million b/d in 2015, led by production growth in Iraq. Global oversupply relative to demand lead to increases in inventories in each quarter of 2015, with a net global inventory build of 1.9 million barrels per day, the highest rate since at least 1994. (Figure 2)

*Natural Gas:* Natural gas spot prices in 2015 at the Henry Hub in Louisiana averaged \$2.63 per million British thermal unit (MMBtu), \$1.76/MMBtu below the 2014 average. (Figure 3) Spot

prices fell throughout 2015, as production and storage inventories hit record levels and fourth-quarter temperatures were much warmer than normal. Although the natural gas-directed rig count was cut in half over the year, the remaining rigs were highly productive with continuing gains in drilling efficiency. As a result, total dry natural gas production in 2015 reached an estimated 74.5 billion cubic feet per day (Bcf/d), 5.6% higher than in 2014. (Figure 4)

Coal: Coal production in 2015 is estimated to have fallen below 900 million short tons (MMst), 11% lower than in 2014 and the lowest level since 1986. (Figure 5) Regionally, production from the Appalachian Basin experienced the largest percentage decline in production. Low natural gas prices, slower international coal demand growth, and environmental regulations have contributed to reduced demand for coal. In April 2015, natural gas-fired electricity generation surpassed that of coal-fired generation on a monthly basis for the first time in history, and it did so again in each of the months from July through at least October, the latest monthly data available. The most recent [Short-Term Energy Outlook](#) estimates 2015 power sector coal consumption at about 754 MMst, the lowest level since the late 1980s.

### ***Commodity prices, weather and investment drive changes in electricity***

Wholesale electricity prices at major trading hubs on a monthly average basis for on-peak hours were down 27%-37% across the nation in 2015 compared with 2014. Lower natural gas prices have been a key driver of lower wholesale electricity prices because natural gas-fired generation sets the marginal price in many regional markets. Capacity factors, which measure actual generation as a percent of a potential maximum, averaged 57% for combined-cycle natural gas

plants through October, well above the 49% average in each of the two previous January-October periods.

Nuclear generation was the highest since 2010 (through October) as low levels of outages led to high capacity factors. Nuclear outages were less than 3% of capacity this summer and dropped to nearly zero during four days in August, the lowest levels on record.

Among renewable sources, hydroelectricity continued to provide the most generation in 2015, accounting for 6% of the nation's total generation through October, despite lower-than-normal water and snowpack levels in several regions with significant hydro resources. Through October, generation from wind and solar plants provided 4% and 1%, respectively, of total generation. Net generation from distributed solar photovoltaic (PV) systems increased 28% and utility-scale solar PV generation increased 50% over the first 10 months of 2015 compared to the same period in 2014. Beginning with the November Electric Power Monthly, EIA now reports monthly estimates of capacity and generation from small-scale distributed solar PV by sector and state alongside data for utility-scale generation. Previously, EIA had provided only annual estimates at the national level for small-scale distributed solar PV.

Nearly all new utility-scale capacity of 1 megawatt (MW) or greater that was added in 2015 consisted of natural gas, wind, and solar units. Coal units accounted for most generator retirements during the year—more than 11,000 MW of coal-fired capacity retired through October 2015, with an additional 2,600 MW estimated to have retired by December.

### ***EIA Short-Term Energy Outlook (STEO)***

EIA's STEO provides a monthly forecast covering the current and upcoming calendar years.

The Outlook published January 12, 2016, is the first to include forecasts for 2017.

### ***Crude oil and refined product prices in 2016 are forecast to be lower than in 2015***

North Sea Brent crude oil prices averaged \$52/b in 2015 as growth in global liquids inventories put downward pressure on Brent prices. By December the price was \$38/b, a \$6/b decrease from November, and the lowest monthly average price since June 2004. EIA forecasts the average Brent crude oil prices at \$40/b in 2016 and \$50/b in 2017. EIA forecasts West Texas Intermediate (WTI) crude averages \$2/b lower than Brent in 2016 and \$3/b lower in 2017.

However, the current values of futures and options contracts continue to suggest high uncertainty in the price outlook (Figure 6). For example, EIA's forecast for the average WTI price in April 2016 of \$37/b should be considered in the context of recent futures and options contract values for April 2016 delivery suggesting that the market expects WTI prices to range from \$25/b to \$56/b (at the 95% confidence interval).

### ***Lower gasoline prices are expected to save average household \$280 in 2016 compared with 2015***

The price of U.S. retail regular gasoline is forecast to average \$2.03/gallon (gal) in 2016 and \$2.21/gal in 2017, compared with \$2.43/gal in 2015. In December, average retail regular gasoline prices were \$2.04/gal, a decrease of 12 cents/gal from November and 51 cents/gal lower than in December 2014. EIA expects monthly retail prices of U.S. regular gasoline to reach a seven-year low of \$1.90/gal in February 2016, before rising during the spring.

## **U.S. crude oil production is expected to decline through 2016 and most of 2017**

U.S. crude oil production in December fell 80,000 b/d from the November 2015 level, and declines are expected to continue for much of the next two years. Crude oil production averaged an estimated 9.4 million b/d in 2015, and is forecast to average 8.7 million b/d in 2016 and 8.5 million b/d in 2017.

EIA estimates that global oil inventories increased by about 1.9 million b/d in 2015, marking the second consecutive year of inventory builds. The excess of supply over demand has contributed to oil prices reaching the lowest monthly average level since mid-2004. Inventories are forecast to continue rising in 2016, before the global oil market becomes more balanced in 2017. (Figure 2) The first draw on global oil inventories in 15 consecutive quarters is expected in the third quarter of 2017.

EIA estimates global consumption of petroleum and other liquids grew by 1.4 million b/d in 2015, averaging 93.8 million b/d for the year. Forecast real gross domestic product (GDP) for the world, weighted by oil consumption, grew by an estimated 2.4% in 2015 and is expected to increase at the rates of 2.7% in 2016 and by 3.2% in 2017. EIA expects global consumption of petroleum and other liquids to continue growing by 1.4 million b/d in both 2016 and 2017.

Non-OPEC production is estimated to decline by 0.6 million b/d in 2016, the first decline since 2008, and at a slower rate in 2017. The outlook for non-OPEC production is driven largely by changes in U.S. tight oil production, which is characterized by high decline rates and relatively short investment horizons that make it among the most price sensitive production globally. As

low oil prices contribute to drilling rig counts falling below levels required to sustain current production levels, forecast total U.S. liquids production declines by 0.4 million b/d in 2016 and remains relatively flat in 2017.

Outside of the United States, forecast non-OPEC production declines by 0.2 million b/d in 2016 and by 0.1 million b/d in 2017. Despite low crude oil prices, production declines are relatively minor because of past investments in Canada and Brazil, in particular, where project commitments were made when oil prices were higher. Production in Canada is expected to increase by 50,000 b/d in both 2016 and 2017, as a number of oil sands projects are scheduled to come online by the end of 2016.

OPEC crude oil production averaged nearly 31.6 million b/d in 2015 (including recently rejoined Indonesia), an increase of 0.9 million b/d from 2014. Iraq led the OPEC increase as its production rose by 0.7 million b/d in 2015, and Saudi Arabia boosted production by 0.3 million b/d in 2015.

EIA forecasts a 0.5 million b/d increase in OPEC crude oil production in 2016. In developing the latest STEO, EIA assumed that sanctions targeting Iran's oil sector would be lifted in the first quarter of 2016. Forecast OPEC crude oil production is expected to increase in 2017 by 0.6 million b/d, with Iran again accounting for most of the increase. Iran's crude oil production is forecast to grow by an average of about 0.3 million b/d in 2016 and by 0.5 million b/d in 2017.



OPEC surplus crude oil production capacity, which averaged 1.6 million b/d in 2015, is expected to increase to 2.0 million b/d in 2016 and then average 1.9 million b/d 2017. Surplus capacity below 2.5 million b/d has often been viewed as an indication of tight oil market conditions. However, given the current excess of supply over demand and high current and forecast levels of global oil inventories, the projected low level of surplus capacity is less significant.

**U.S. natural gas demand is expected to increase as supply growth moderates, resulting in prices rising from their end-of-2015 level**

EIA forecasts Henry Hub spot prices to average \$2.65/MMBtu in 2016, close to the 2015 average of \$2.63/MMBtu, and \$3.22/MMBtu in 2017. While average price levels in 2015 and 2016 are expected to be similar, 2015 was marked by generally decreasing prices, and Henry Hub prices began 2016 near \$2/MMBtu, a level from which they are forecast to rise through much of the year. The forecast price increase reflects consumption growth, mainly from the industrial sector. EIA expects production growth will be relatively flat in 2016, partly in response to lower prices and declining rig activity. With higher prices in 2017, and as new consumption and more export capacity comes online, EIA projects production will pick up slightly.

EIA's forecast of U.S. total natural gas consumption averages 76.6 billion cubic feet/day (Bcf/d) in 2016 and 77.2 Bcf/d in 2017, compared with 75.5 Bcf/d in 2015. Increases in industrial sector consumption drive total consumption growth in 2016 and 2017. Industrial sector consumption of natural gas increases by 3.5% in 2016 and by 2.5% in 2017, as new projects in the fertilizer and chemicals sectors come online. For power generation, EIA expects a 0.1 Bcf/d (0.3%) decline in

consumption in 2016 and a 1.4% decrease in 2017, as natural gas prices rise and hydroelectric generation in the West and wind and solar generation increase. Natural gas consumption in the residential and commercial sectors is projected to increase in 2016 and 2017, reflecting slightly higher heating demand in those years.

Total marketed production of natural gas is estimated to have averaged 79.1 Bcf/d over 2015, 5.7% higher than 2014. EIA projects growth will slow to 0.7% in 2016, as low natural gas prices and declining rig activity begin to affect production. By 2017, however, forecast production growth increases to 1.8%, as prices rise and more demand comes from industrial sectors and exports.

U.S. natural gas exports, by both pipeline and liquefied natural gas (LNG) tanker shipments, are expected to increase through 2017. Although overall domestic demand growth levels off, production remains high, reducing demand for natural gas imports from Canada while supporting growing exports to Mexico. Growing demand from Mexico's electric power sector coupled with flat natural gas production in Mexico creates a growth opportunity for U.S. pipeline gas. With the startup of Cheniere's Sabine Pass liquefaction plant in early 2016 and subsequent increases in liquefaction capacity, EIA projects LNG gross exports will increase to an average of 0.7 Bcf/d in 2016 and 1.4 Bcf/d in 2017.

Natural gas working inventories were 3,475 billion cubic feet (Bcf) on January 8, 20% higher than during the same week last year and 16% higher than the previous five-year average (2011-

15) for the week. EIA forecasts inventories will end the winter heating season (March 31) at 2,043 Bcf, 38% above the level at the same time last year.

### **Coal demand expected to remain weak**

EIA estimates that coal consumption decreased by 11% in 2015, mainly as a result of an 11% drop in electric power sector consumption. Higher forecast natural gas prices in 2016 and 2017 are expected to contribute to higher utilization rates among the remaining coal-fired power plants. This higher utilization rate offsets the effect of lower consumption from coal-plant retirements. Coal consumption in the electric power sector is forecast to remain relatively unchanged in 2016. In 2017, increases in electricity generation from renewables and nuclear are forecast to contribute to a 1% decline in electric power sector coal consumption.

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 over the next few years. EIA estimates U.S. coal exports decreased by 20 MMst (21%) in 2015. The current global coal market trends are expected to continue, and coal exports are forecast to decline by an additional 9 MMst (12%) in 2016 and by 2 MMst (4%) in 2017.

Forecast U.S. coal production is projected to fall by 38 MMst (4%) in 2016 and by an additional 9 MMst (1%) in 2017.

### **The electricity generation mix is expected to continue changing**

The mix of generating units that supply electricity in the United States has been undergoing a significant transformation. (Table 1) Many older coal plants are being retired as the industry adapts to sustained low costs of competing natural gas generating units, growing renewable generation, and the effects of environmental regulations. EIA estimates that at least 14 gigawatts (GW) of coal-fired capacity were retired during 2015, equal to nearly 5% of the operable coal capacity existing at the end of 2014. Power plant operators have reported to EIA that they plan to retire at least 10.7 GW of additional coal capacity during 2016 and 2017.

A decline in power generation from fossil fuels in the forecast period is offset by an increase from renewable sources. The share of generation from natural gas falls from 33% in 2015 to 31% in 2017, as natural gas prices rise, hydroelectric generation in the West increases, and other renewable generation increases. Coal's share of generation falls from 34% in 2015 to 33% in 2017. For renewables, the forecast share of total generation supplied by hydropower rises from 6% in 2015 to 7% in 2017, and the forecast share for other renewables increases from 7% in 2015 to 9% in 2017.

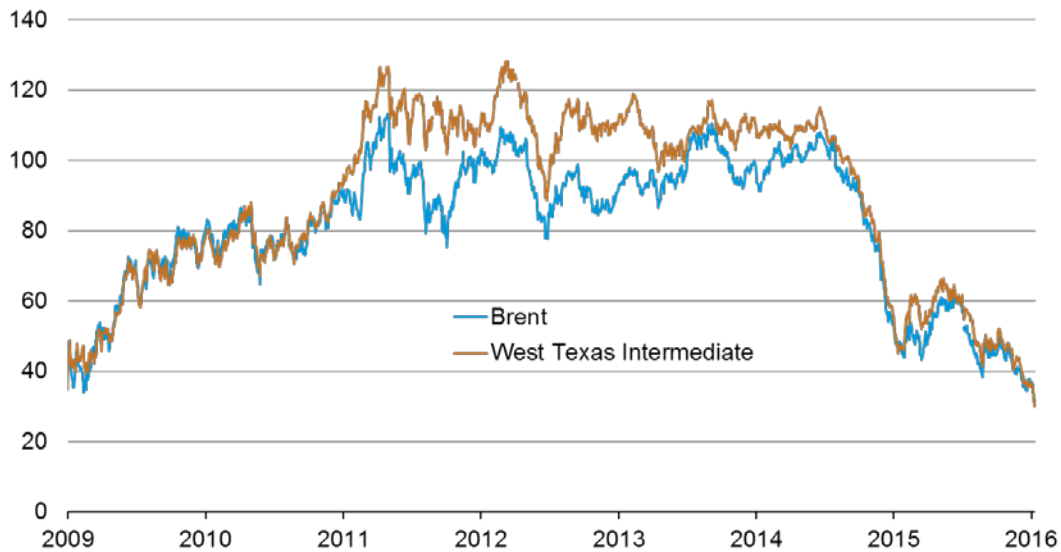
The U.S. retail price of electricity in the residential sector is projected to average 12.7 cents per kilowatthour (kWh) in 2016, unchanged from 2015. The U.S. retail price in 2017 is expected to increase 3%.

### **Conclusion**

This concludes my testimony, Madam Chairman and Members of the Committee. I would be happy to answer any questions you may have.

## Figure 1: Brent and West Texas Intermediate (WTI) spot prices

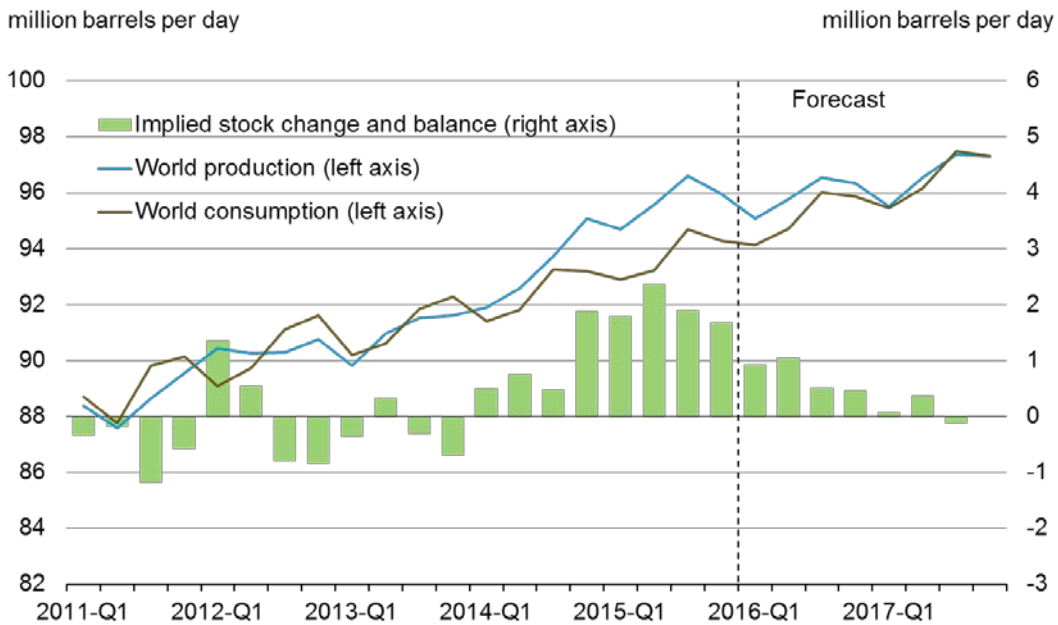
Daily crude oil spot prices, 2009-16  
dollars per barrel



Source: U.S. Energy Information Administration, based on Thomson Reuters

## Figure 2: Oil supply and demand begin to rebalance in 2017

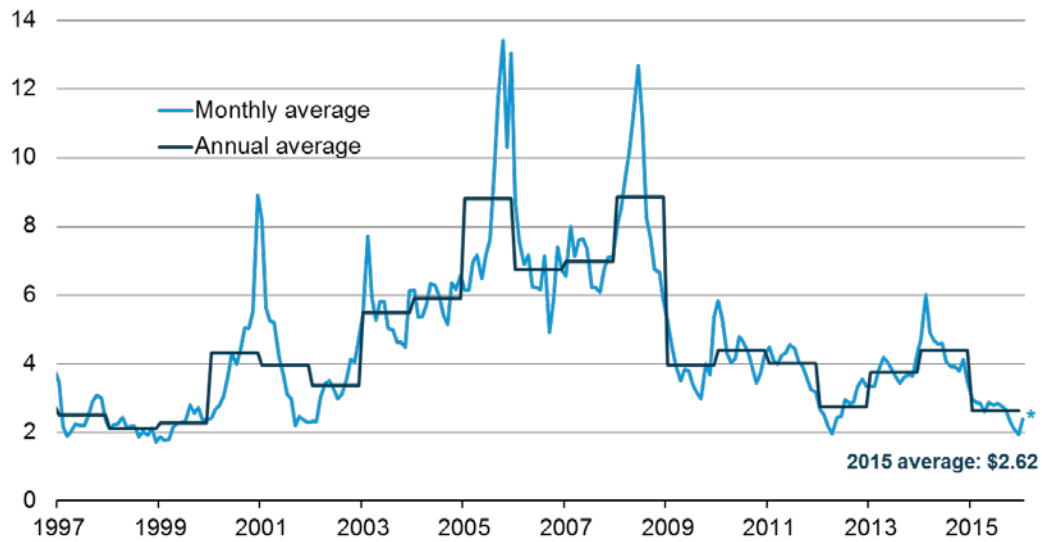
World Liquid Fuels Production and Consumption Balance  
million barrels per day



Source: EIA, Short-Term Energy Outlook, January 2016

### Figure 3: Average annual natural gas spot price in 2015 was at lowest level since 1999

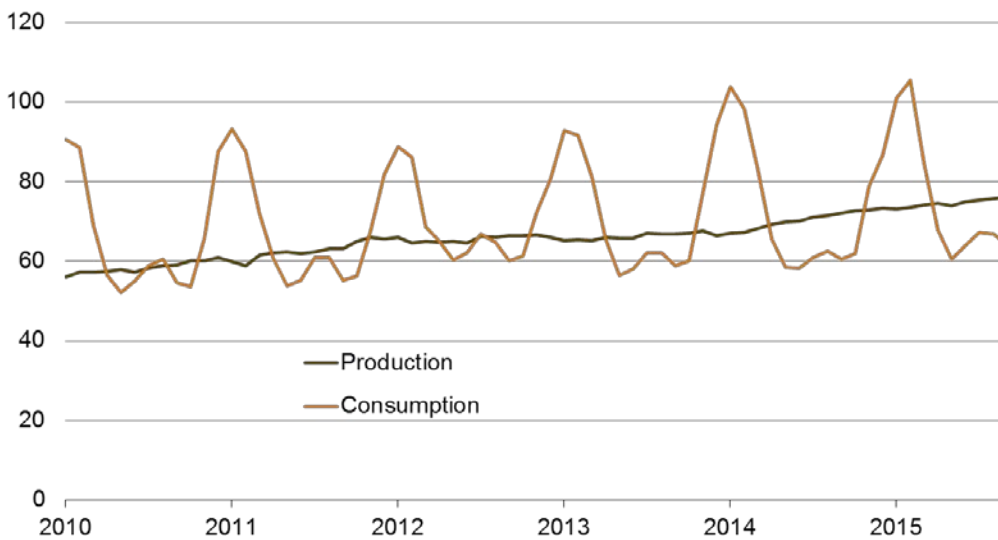
Monthly and annual average natural gas spot price at Henry Hub (1997-2015)  
dollars per million British thermal unit



Source: U.S. Energy Information Administration, based on Thomson Reuters and Natural Gas Intelligence  
Note: \*2016 data are year-to-date average through January 11, 2016

### Figure 4: U.S. natural gas production and consumption have increased

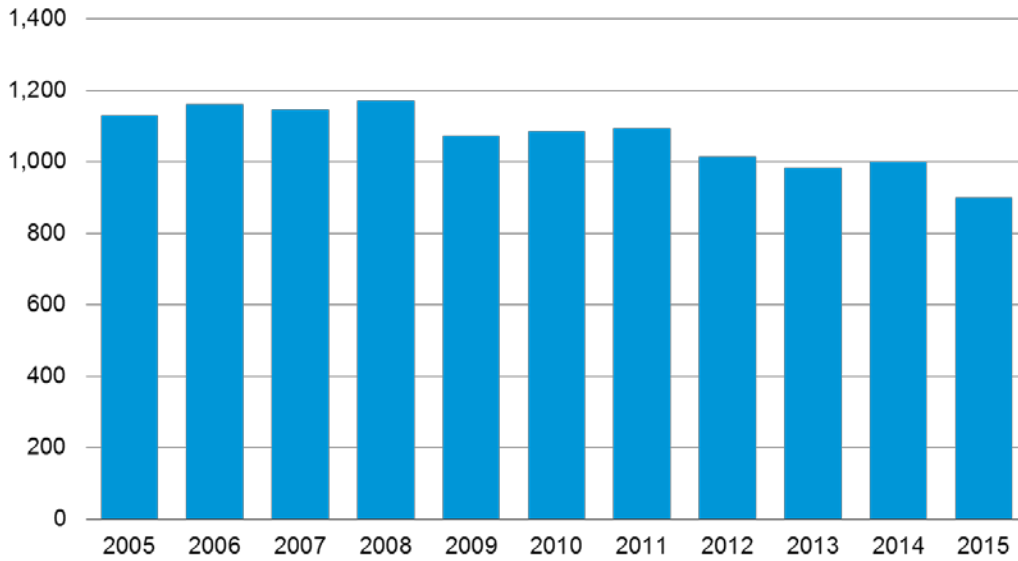
U.S. total monthly natural gas production and consumption  
billion cubic feet per day



Source: U.S. Energy Information Administration

Figure 5: U.S. coal production declined in 2015

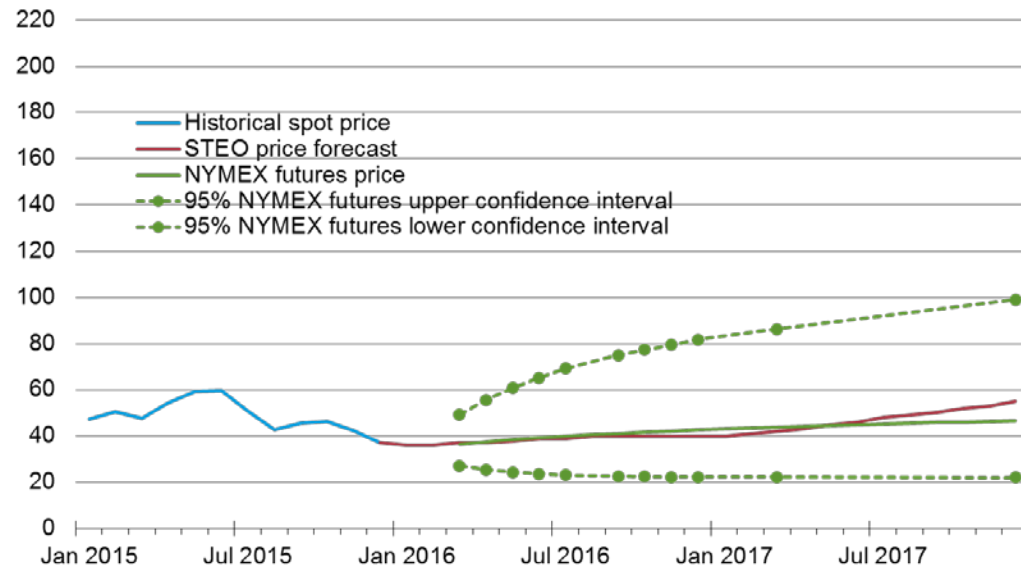
U.S. coal production  
million short tons



Source: U.S. Energy Information Administration, Coal Data Browser

Figure 6: West Texas Intermediate (WTI) crude oil price and Nymex confidence intervals

WTI crude oil price  
dollars per barrel



Source: EIA, Short-Term Energy Outlook, January 2016

**Table 1: Non-hydro renewables expected to make up 9% of electricity generation by 2017**

U.S. electricity generation by fuel, all sectors  
share of total generation

<b>Year</b>	<b>Coal</b>	<b>Natural Gas</b>	<b>Petroleum</b>	<b>Nuclear</b>	<b>Hydro Power</b>	<b>Non-hydro Renewables</b>	<b>Other</b>
2008	48.2%	21.4%	1.1%	19.6%	6.0%	3.1%	0.6%
2009	44.4%	23.3%	1.0%	20.2%	6.8%	3.7%	0.6%
2010	44.8%	23.9%	0.9%	19.6%	6.2%	4.1%	0.6%
2011	42.3%	24.7%	0.7%	19.3%	7.6%	4.7%	0.6%
2012	37.4%	30.3%	0.6%	19.0%	6.7%	5.4%	0.6%
2013	38.9%	27.7%	0.7%	19.4%	6.5%	6.2%	0.7%
2014	38.6%	27.5%	0.7%	19.5%	6.2%	6.8%	0.6%
2015	33.8%	32.5%	0.7%	19.5%	5.7%	7.1%	0.6%
2016	33.6%	32.2%	0.7%	18.9%	6.0%	8.0%	0.6%
2017	33.0%	31.4%	0.7%	18.9%	6.4%	8.9%	0.6%

Source: Energy Information Administration, Short-Term Energy Outlook, January 2016