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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 information 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 April *Short-Term Energy Outlook* (STEO) and the recently released *Annual Energy Outlook 2015* (AEO2015).

The short-term energy outlook

Crude oil prices are projected to increase over next two years

Recent values of futures and options contracts suggest very high uncertainty in the price outlook – the implied 95% confidence interval for market expectations for West Texas Intermediate (WTI) prices in December 2015 calculated for the current STEO ranges from $32/barrel (b) to $97/b. In EIA's latest monthly outlook, WTI prices in 2015 and 2016 are expected to average $7/b and $5/b, respectively, below the global waterborne market North Sea Brent, which is forecast to average $59/b in 2015 and $75/b in 2016. The projected discount of WTI crude oil to Brent, which fell with the decline in oil prices in 2014, has widened in recent months reflecting continuing large builds in U.S. crude oil inventories, including at the Cushing, Oklahoma storage hub.

On April 2, Iran and the five permanent members of the United Nations Security Council plus Germany (P5 +1) reached a framework agreement that could result in the lifting of oil related sanctions against Iran, which in turn could significantly change EIA's outlook for oil supply, demand, and prices. If and when sanctions are lifted, EIA's baseline forecast for world crude oil prices in 2016 could be reduced $5-$15/b from the level presented in EIA's April STEO.

U.S. crude oil production to remain relatively flat in 2015 and 2016

Total U.S. crude oil production, which averaged 8.7 million barrels/day (b/d) in 2014, is estimated to have averaged 9.3 million b/d in March, the same as in December 2014. Given

EIA's price forecast, projected total crude oil production averages 9.2 million b/d in 2015 and 9.3 million b/d in 2016. EIA expects onshore production to decline from June through September 2015 because of unattractive economic returns in some areas of both emerging and mature oil producing regions. Under EIA's baseline forecast of rising WTI crude oil prices during the second half of 2015, drilling activity is expected to increase again as companies take advantage of lower costs for leasing, drilling, and well completion services, resulting in a resumption of production growth in the fourth quarter.

Total liquids consumption increases through 2016

Total U.S. liquid fuels consumption fell from an average 20.8 million b/d in 2005 to 19.0 million b/d in 2014. EIA expects total consumption to rise slowly through 2016 to an average of 19.5 million b/d, driven by an increase in consumption of distillate fuel and gasoline, with jet fuel remaining flat.

Lower gasoline prices expected to save average household $700 in 2015 compared with 2014

U.S. average regular gasoline retail prices averaged $2.46/gallon (gal) in March, and are expected to remain near that level through the summer. EIA expects U.S. regular gasoline retail prices, which averaged $3.36/gal in 2014, to average $2.40/gal in 2015 and $2.73/gal in 2016. The average household is expected to spend $700 less for gasoline in 2015 compared with last year because of lower gasoline prices. Differences from EIA's baseline forecast in crude oil prices, which as noted above are subject to a wide range of market expectations, or in refinery margins would be reflected in pump prices. Additionally, prices for gasoline and other

petroleum products are very sensitive to unplanned refinery outages, and any sudden loss of gasoline supply from the market could cause gasoline prices to be higher than forecast.

Natural gas prices remain below 2014 levels in both 2015 and 2016

Natural gas storage in working inventories was 1,461 billion cubic feet (Bcf) on March 27, which was 75% higher than a year earlier, but 12% lower than the previous five-year (2010-14) average. EIA projects natural gas inventories will end October 2015 at 3,781 Bcf, a net injection of 2,310 Bcf. This would be the fourth-highest injection season on record, but it would be 420 Bcf lower than last year's net March–October injection. EIA expects the Henry Hub natural gas spot price, which averaged $4.39/million British thermal units (Btu) in 2014, to average $3.07/million Btu in 2015 and $3.45/million Btu in 2016.

Natural gas share of electric power generation expected to increase over 2014 level, reflecting lower natural gas prices

Power generators are using more natural gas than last year, primarily because of lower natural gas prices relative to coal prices. The use of natural-gas-fired generation is projected to average 30.4% of total generation in 2015 compared with 27.4% during 2014. In contrast, the share of total generation fueled by coal falls from 38.7% in 2014 to 35.8% in 2015.

Generation from renewable sources continues to rise

EIA expects the share of total electricity generation from all renewables to increase from 13.0% in 2014 to 14.2% in 2016. Total renewables used for electricity and heat generation grow by

3.4% in 2015, as a result of 6.3% growth in conventional hydropower generation and 1.9% growth in non-hydropower renewables generation. In 2016, total renewables consumption for electric power and heat generation increases by an additional 2.6% as a result of a 5.2% increase in non-hydropower renewables, partially offset by a 2.5% decline in conventional hydropower generation. Wind is the largest source of non-hydropower renewable generation, contributing 5.2% to total electricity generation in 2016.

Long-term energy outlook

Projections in the *Annual Energy Outlook 2015* (AEO2015) focus on the factors that shape U.S. energy markets through 2040 under the assumption that current laws and regulations remain generally unchanged throughout the projection period. Consistent with this approach, EPA's proposed Clean Power Plan rules for existing fossil-fired electric generating units or the effects of possible changes in current limits on crude oil exports are not considered in AEO2015. These topics will be addressed in two forthcoming EIA reports.

The AEO2015 discusses the Reference and five alternative cases (Low and High Economic Growth, Low and High Oil Prices, and a High Oil and Gas Resource). The AEO2015 cases provide the basis for examination and discussion of energy market trends and serves as a starting point for analysis of potential changes in U.S. energy policies, rules, or regulations or potential technology breakthroughs. AEO2015 is a shorter edition of the AEO completed under a newly-adopted two-year release cycle that alternates full editions containing a broader complement

of side cases and "issues in focus" discussions with shorter editions in order to free up resources in order to provide more current energy content in publications such as *Today in Energy* and the *Drilling Productivity Report* and to improve EIA's capability to address international data and market linkages which are increasingly important to domestic energy market developments and other topics of interest to policymakers. EIA will also be releasing a more extensive International Energy Outlook (IEO) later this year.

Major highlights in the AEO2015 include:

AEO2015 considers a wide range of future crude oil price paths

AEO2015 recognizes the uncertainty of future crude oil prices, which are driven by numerous factors including changes in worldwide demand for petroleum products, crude oil production, and supplies of other liquid fuels. In the AEO2015 Reference case, the price of global marker Brent crude oil rises steadily after 2015 in response to growth in global oil demand; however, downward price pressure from rising U.S. crude oil production keeps the Brent price below $80/b (in 2013 dollars)[1] through 2020. U.S. crude oil production starts to decline after 2020, but increased output from non-OECD and OPEC producers helps to keep the Brent price below $100/b through most of the next decade and limits price increases through 2040, when Brent reaches roughly $140/b.

[1] Unlike EIA's short-term outlook, which reports prices in nominal dollars, all prices in AEO2015 are reported in year 2013 dollars to avoid confusion between trends in real energy prices and general inflation.

There is significant oil price variation in the alternative cases considered in the AEO2015 (Figure 1). In the Low Oil Price case, the Brent price is $52/b in 2015 and reaches $76/b in 2040. In the High Oil Price case, the Brent price reaches $252/b in 2040. In the High Oil and Gas Resource case, with significantly more U.S. production than the Reference case, Brent is under $130/b in 2040, more than $10/b below its Reference case price.

U.S. net energy imports, aggregated across all fuels, decline and ultimately end in most AEO2015 cases.

Aggregate net energy imports decline to zero before 2030 in the AEO2015 Reference case and before 2020 in the High Oil Price and High Oil and Gas Resource cases (Figure 2). Significant net energy imports persist only in the Low Oil Price and High Economic Growth cases, where U.S. supply is lower and demand is higher. The decline in net energy imports is driven by growth in U.S. energy production—led by crude oil and natural gas—increased use of renewables, and only modest growth in demand.

Continued strong growth in domestic tight oil production reduces and possibly eliminates net liquid fuel imports.

Through 2020, strong growth in domestic crude oil production from tight formations leads to a decline in net petroleum imports and growth in condensate and product exports in all AEO2015 cases. The net import share of petroleum and other liquid products supplied falls from 26% in 2014 to 15% in 2025 and then rises slightly to 17% in 2040 in the Reference case (Figure 3). With greater U.S. crude oil production in the High Oil Price and High Oil and Gas Resource

cases, the United States becomes a net petroleum exporter after 2020.

Future natural gas prices will be influenced by a number of factors, including global energy prices, resource availability, and demand for natural gas

Projections of natural gas prices are influenced by assumptions about world energy prices, resource availability, and natural gas demand. In the Reference case, the Henry Hub natural gas spot price rises to $4.88/million Btu in 2020 and to $7.85/million Btu in 2040, as increased demand in domestic and international markets leads to the production of increasingly expensive resources.

In the AEO2015 alternative cases, the Henry Hub natural gas spot price is lowest in the High Oil and Gas Resource case, which assumes greater estimated ultimate recovery per well, closer well spacing, and greater gains in technological development, and highest in the High Oil Price case, which assumes the same level of resource availability as the AEO2015 Reference case, but much higher oil prices. In the High Oil and Gas Resource case, the Henry Hub natural gas spot price is $3.12/million Btu in 2020 (36% below the Reference case price), rising to $4.38/million Btu in 2040 (44% below the Reference case price). In the High Oil Price case, which assumes the same resource scenario as the reference case, the Henry Hub natural gas spot price remains close to the Reference case price through 2020; however, higher overseas demand for U.S. LNG exports raises the average Henry Hub price to $10.63/million Btu in 2040, which is 35% above the Reference case price.

Net natural gas trade, including LNG exports, depends largely on the effects of resource levels and world energy prices.

The United States transitions from being a net importer of natural gas to a net exporter by 2017 in all cases. U.S. export growth continues after 2017, with annual net exports in 2040 ranging from 3.0 trillion cubic feet (Tcf) in the Low Oil Price case to 13.1 Tcf in the High Oil and Gas Resource case (Figure 4).

Regional variations in domestic crude oil and natural gas production can force significant shifts in flows between regions, requiring investment in or realignment of pipelines and other midstream infrastructure.

In most AEO2015 cases, lower 48 crude oil production shows the strongest growth in the Dakotas/Rocky Mountains region, followed by the Southwest region (Figure 5). The strongest growth of natural gas production occurs in the East region, followed by the Gulf Coast onshore and the Dakotas/Rocky Mountains regions. Interregional flows to serve downstream markets vary significantly among the cases.

Technology and policy promote slower growth of energy demand.

U.S. energy use grows modestly, at an annual rate of 0.3%/year from 2013 through 2040 in the Reference case, far below the rates of economic growth (2.4%/year) and population growth (0.7%/year). Decreases in transportation and residential sector energy consumption partially offset growth in other sectors. Declines in energy use reflect the use of more energy-efficient technologies and existing policies that promote increased energy efficiency. Fuel economy

standards and changing driver behavior keep motor gasoline consumption below recent levels through 2040 in the Reference case. Diesel consumption, however, does rise over the period.

Industrial energy use rises with growth of shale gas supply

Growth in production of dry natural gas and natural gas plant liquids (NGPL) contributes to the expansion of several manufacturing industries (such as bulk chemicals and primary metals) and the increased use of NGPL feedstocks in place of petroleum-based naphtha feedstocks (Figure 6).

Electricity prices increase with rising fuel costs and expenditures on electric transmission and distribution infrastructure

Rising costs for electric power generation, transmission, and distribution, coupled with relatively slow growth of electricity demand, produce an 18% increase in the average retail price of electricity over the period from 2013 to 2040 in the AEO2015 Reference case (Figure 7).

Renewables meet much of the growth in electricity demand

Continued growth in renewable electricity production—combined with slower growth in electricity demand, rising natural gas prices, and fewer nuclear retirements—leads to relatively limited growth in natural gas use for electricity generation. (Figure 8).

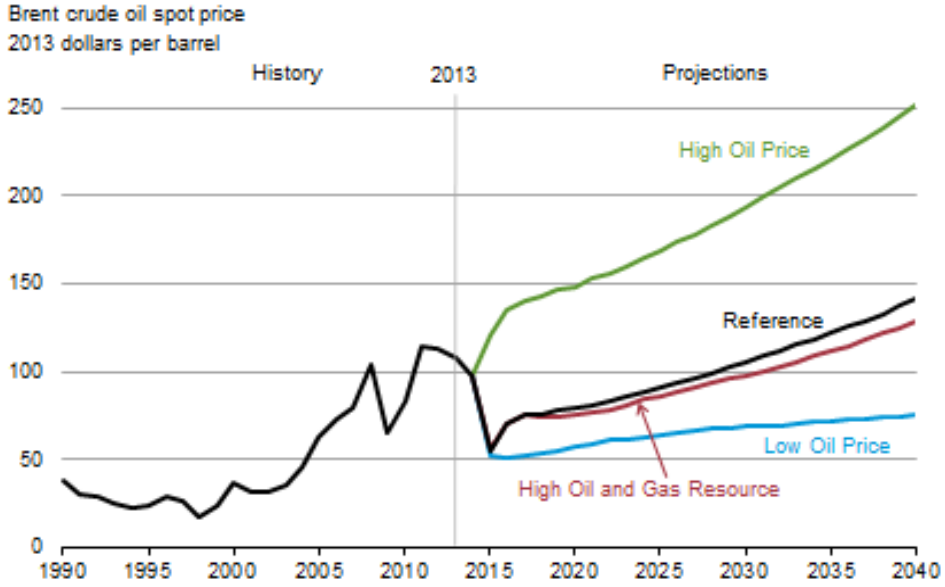
Energy-related carbon dioxide emissions stabilize with lower energy and carbon intensity. Improved efficiency in the end-use sectors and a shift away from more carbon-intensive fuels, especially for electric power, help to stabilize U.S. energy-related carbon dioxide (CO2) emissions, which remain below the 2005 level through 2040 (Figure 9).

Conclusion

As I noted at the outset, while EIA does not take policy positions, its data, analyses, and projections are meant to assist energy policymakers in their deliberations. In addition to the work on the projections that I have reviewed this morning, EIA has often responded to requests from this Committee and others for analyses of the energy and economic impacts of energy policy proposals.

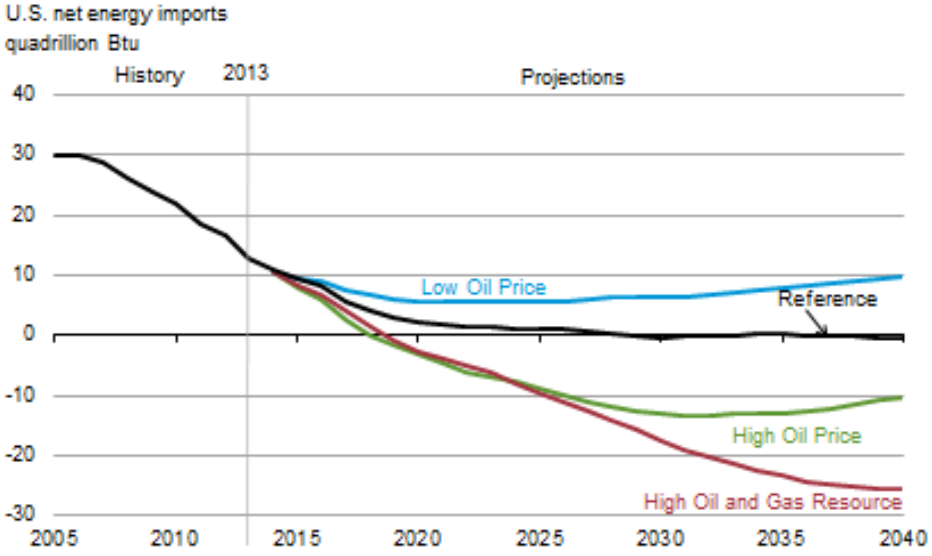
This concludes my testimony, Madam Chairman and Members of the Committee. I would be happy to answer any questions you may have.

Figure 1. AEO2015 explores scenarios that encompass a wide range of future crude oil price paths



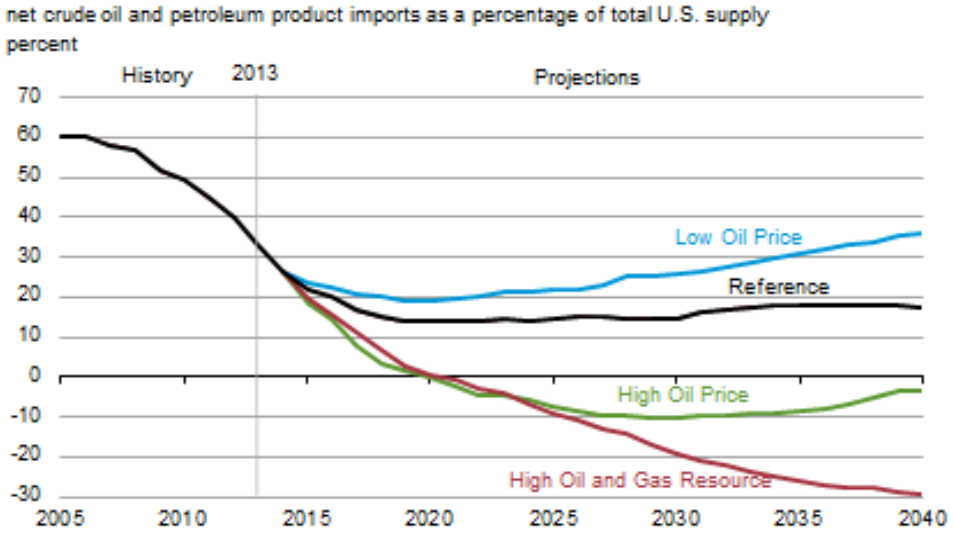
Source: EIA, Annual Energy Outlook 2015

Figure 2. U.S. net energy imports continue to decline in the near term, reflecting increased oil and natural gas production coupled with slow demand growth



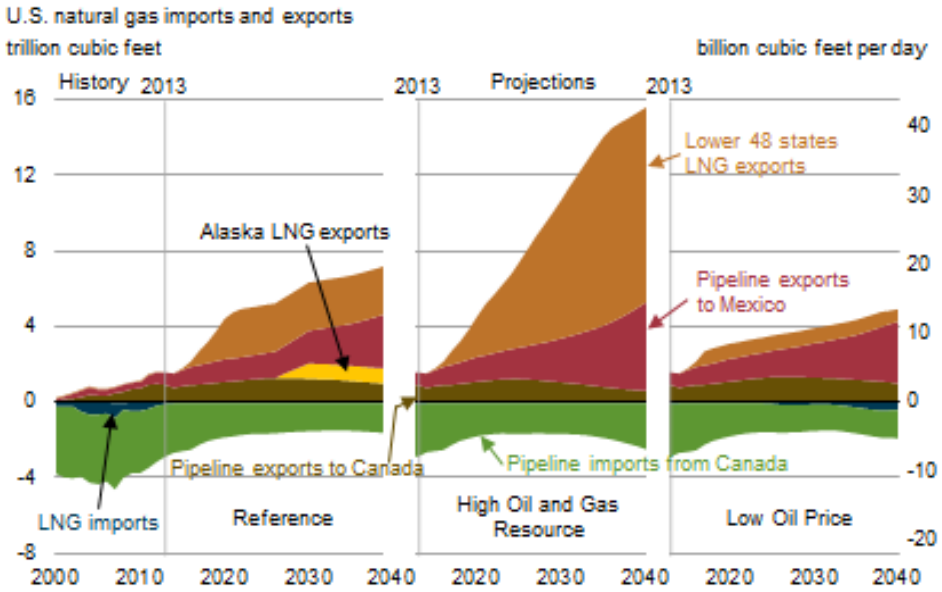
Source: EIA, Annual Energy Outlook 2015

Figure 3. Net imports provide a declining share of U.S. liquid fuels supply in most AEO2015 cases; in two cases the nation becomes a net exporter



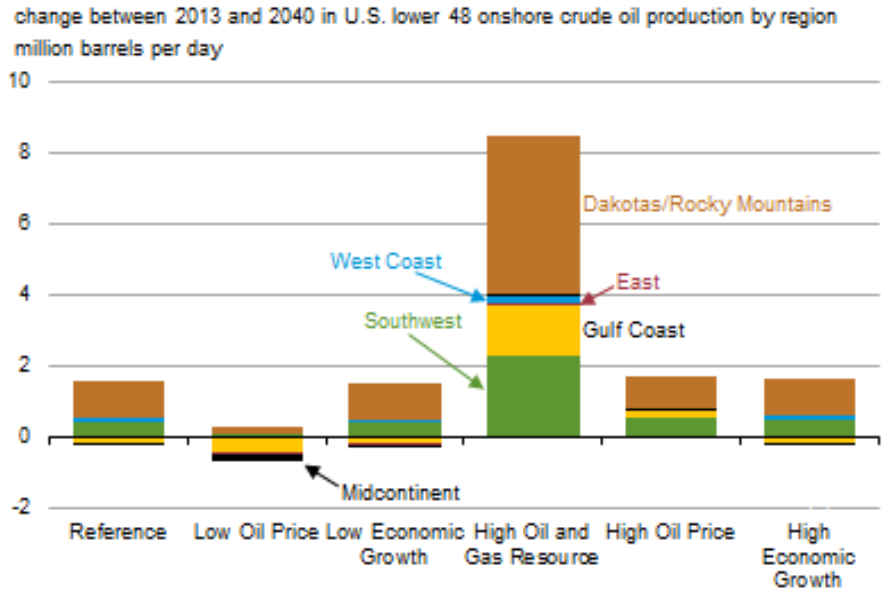
Source: EIA, Annual Energy Outlook 2015

Figure 4. Projected U.S. natural gas exports reflect the spread between domestic natural gas prices and world energy prices



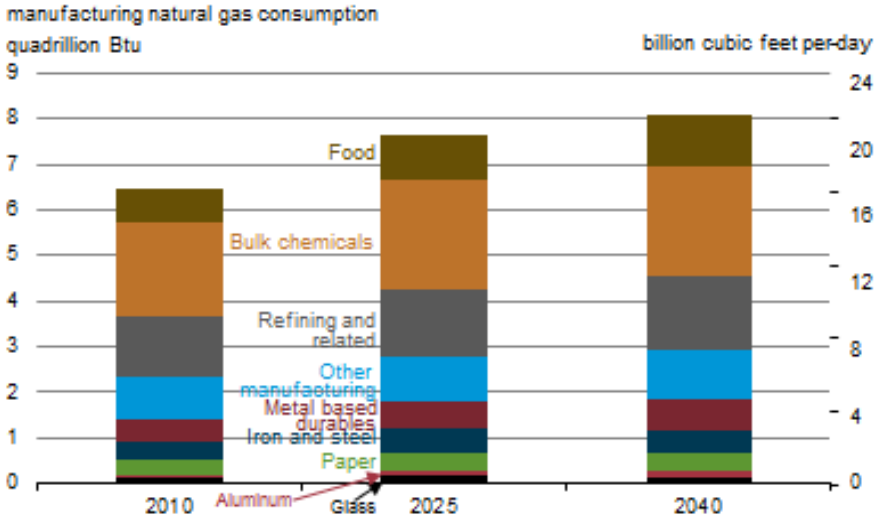
Source: EIA, Annual Energy Outlook 2015

Figure 5. Growth of onshore crude oil production varies across supply regions, affecting pipeline and midstream infrastructure needs



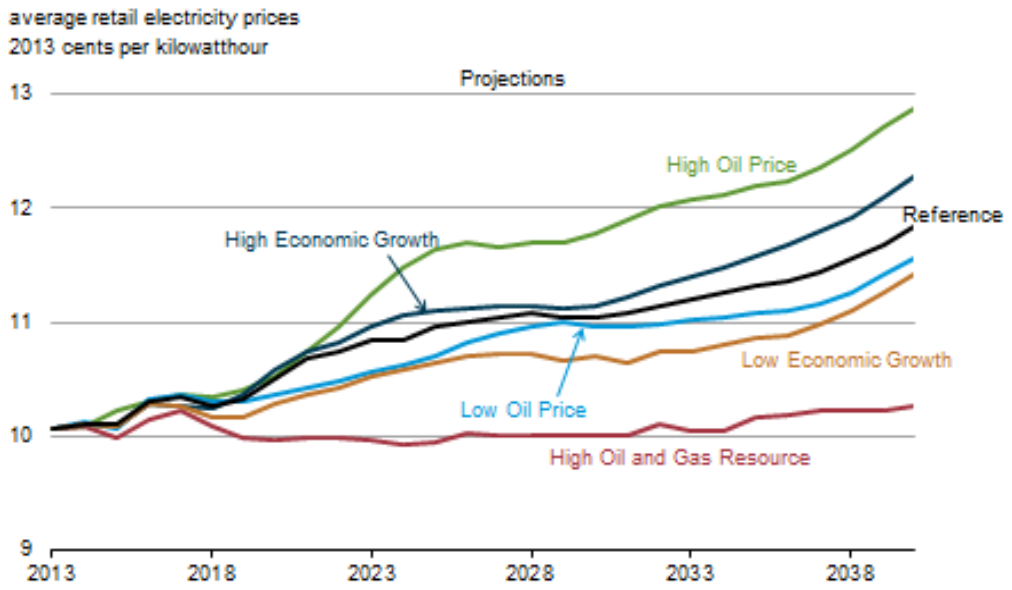
Source: EIA, Annual Energy Outlook 2015

Figure 6. Growth in manufacturing output and use of natural gas reflect high natural gas supply and low prices, particularly in the near term



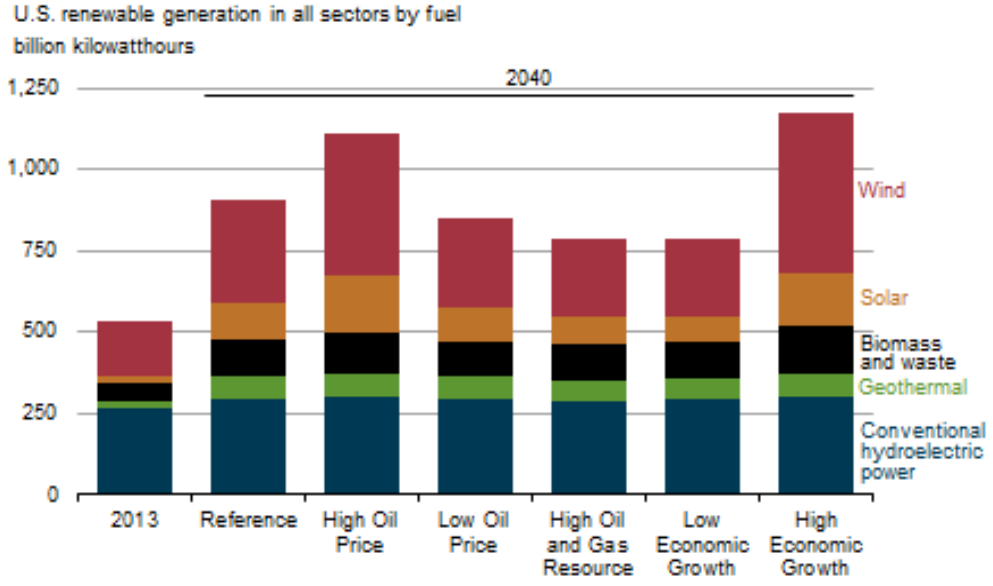
Source: EIA, Annual Energy Outlook 2015 Reference case

Figure 7. Electricity prices increase with rising fuel costs and expenditures for electric transmission and distribution infrastructure



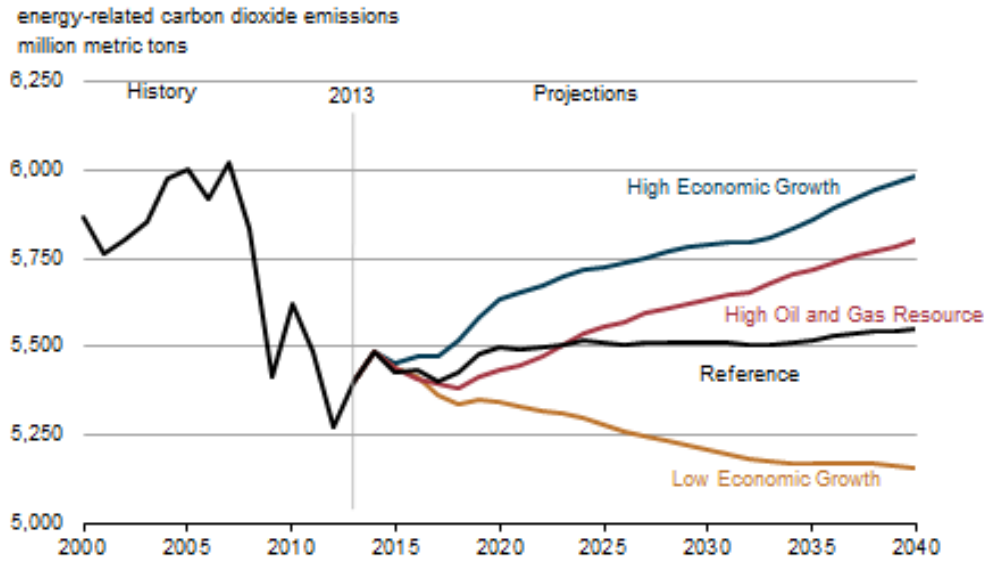
Source: EIA, Annual Energy Outlook 2015

Figure 8. Growth in wind and solar generation meets a significant portion of projected total electric load growth in all AEO2015 cases



Source: EIA, Annual Energy Outlook 2015

Figure 9. CO_2 emissions are sensitive to the influence of future economic growth and energy price trends on energy consumption



Source: EIA, Annual Energy Outlook 2015