1. Coal prices delivered to power sector nationally 2005 through 2019
   1. Prices have remained relatively steady between 2008 and 2019.
   2. Coal Prices. EIA estimates the delivered coal price to U.S. electricity generators averaged $1.94 per million British thermal units (MMBtu) in 2020, which was 8 cents/MMBtu lower than the 2019 price. EIA forecasts that coal prices will increase to $2.06/MMBtu in 2021 and $2.07 in 2022 [1].
   3. Transportation fuel prices for coal deliveries to power plants have decreased during this period, even though the share of coal delivery costs coming from transportation has increased during this time period, showing that transportation has contributed to the decrease in coal prices, but not the only reason.
2. historical average annual Henry Hub natural gas prices from 2005 though 2020
   1. natural gas production has generally increased during this time period [4]
   2. technological advances in hydraulic fracturing and horizontal drilling has allowed for production in previously inaccessible shale gas formations, resulting in a boom in natural gas production, despite a reduction in active natural gas rigs [5]
3. Annual coal and natural gas electricity generation (Megawatt-hours) from 2005 through 2019
   1. Reduced natural gas prices have led to a steady replacement of coal fired power plants with natural gas plants
   2. A recovery in domestic coal demand is not likely. Inexpensive natural gas and renewable power are not going away. New coal-fired generation capacity is much more expensive to build and more difficult to site and permit than natural gas or renewable facilities. Uncertainty about the future of climate and environmental regulation adds to the challenge, along with the potential that older coal plants will become obsolete and the potential need for significant investments for them to remain operable. [6]
   3. Read this article [7]
4. Projected annual Henry Hub natural gas prices from 2021 through 2040
   1. Electricity generation from natural gas and renewables increases as a result of lower natural gas prices and declining costs of solar and wind renewable capacity, making these fuels increasingly competitive [9]
   2. U.S. natural gas production grows at a faster rate than consumption in most cases after 2020, leading to an increase in U.S. exports of natural gas. The exception is in the AEO2020 Low Oil and Gas Supply case, where production and consumption remain relatively flat as a result of higher production costs [10].
   3. In the AEO2020 Reference case, growing demand in domestic and export markets leads to increasing natural gas spot prices at the U.S. benchmark Henry Hub through 2050 despite continued technological advances that support increased production [10].
   4. Reference Case - Natural gas prices in the AEO2020 Reference case remain lower than $4 per million British thermal units (MMBtu) through 2050 because of an abundance of lower cost resources, primarily in tight oil plays in the Permian Basin. These lower cost resources allow higher production levels at lower prices during the projection period.[10]
   5. Fringe High and Low Natural Gas Price Cases - The AEO2020 High Oil and Gas Supply case--which reflects lower finding, development, and production costs and greater resource availability--shows an increase in U.S. natural gas production and lower prices relative to the Reference case. In the Low Oil and Gas Supply case, high prices, which result from higher costs and fewer available resources, result in less domestic consumption and exports during the projection period.
   6. The level of drilling in oil formations primarily depends on crude oil prices rather than natural gas prices. Increased natural gas production from oil-directed drilling puts downward pressure on natural gas prices throughout the projection period.[10]

图表, 折线图

描述已自动生成

图形用户界面, 文本, 应用程序

描述已自动生成

1. Coal and Natural gas predictions
   1. Coal plants typically last for 40 years [8]
   2. Average Natural Gas Power Plant Growth - Although coal-fired and nuclear generation decline through the mid-2020’s as a result of retirements, generation from these sources stabilizes over the longer term as the more economically viable plants remain in service. At projected Reference case prices, natural gas-fired generation is the marginal fuel source to fulfill incremental demand and increases in the later projection years, averaging 0.8% growth per year through 2050 [9]
   3. High and Low Case Natural Gas Power Plant Growth As a result of projected lower natural gas prices in the High Oil and Gas Supply case, natural gas-fired generation increases 1.9% per year through the projection period, reaching a 51% share of the generation mix by 2050. In contrast, under the projected higher natural gas prices in the Low Oil and Gas Supply case, natural gas-fired generation declines 1.4% per year through 2050, reaching a 19% share of the generation mix by 2050 [9].
   4. Coal Power Plant Retirement Assumptions - Most of the electric generation capacity retirements assumed in the AEO2020 Reference case occur by 2025. Although the final schedule will depend upon state-level implementation plans, in AEO2020 EIA assumes that coal-fired plants must either invest in heat rate improvement technologies by 2025 or retire to comply with the Affordable Clean Energy (ACE) rule. Heat rate improvement technologies increase the efficiency of power plants. The remaining coal plants are more efficient and continue to operate throughout the projection period. Low natural gas prices in the early years also contribute to the retirements of coal-fired and nuclear plants because both coal and nuclear generators are less profitable in these years [9]
   5. Projected Electricity Growth - The annual growth in electricity demand averages about 1% throughout the projection period (2019-2050) in the AEO2020 Reference case. [9]
2. Annual Coal Capacity Retirements
   1. That’s largely because of the shale gas revolution, which suddenly made natural gas cheaper than coal for generating electricity. [8]
   2. Lower than expected demand meant excess generating capacity and a smaller market in which coal plants could compete [7]
   3. More importantly, Through a combination of horizontal drilling, hydraulic fracturing, and seismic imaging, US companies have unlocked oil and gas from previously inaccessible shale and other unconventional resources [7]
   4. In 2008, the average US power plant paid $10 per thousand cubic feet (tcf) for delivered natural gas (in real 2016 dollars). In 2016 they paid $3, a 71 percent decline from 2008 levels. [7]
   5. This price decline has dramatically improved the competitiveness of natural gas versus coal, particularly in the East and Midwest. During the same period of time, the average delivered cost of coal only decreased by 8 percent in real terms.[7]
   6. Doing this kind of analysis at the interconnect level, we estimate that natural gas is responsible for 48.9 percent of the decline in coal production nationwide, renewables (including hydro and biomass) are responsible for 17.8 percent, and nuclear is responsible for 7.7 percent [7]
   7. weaker electricity demand than expected in the 2006 AEO accounts for 25.6 percent of the lower-than-expected coal-fired power generation in 2016[7]
   8. New coal-fired generation capacity is much more expensive to build and more difficult to site and permit than natural gas or renewable facilities [6]
   9. The decline of the U.S. coal industry is the result of market forces, not a policy “war on coal.” Any successful policy to revive the industry will be working against economic headwinds, and thus difficult to maintain over the long term [6]

[1] https://www.eia.gov/outlooks/steo/report/coal.php

[2] https://www.eia.gov/energyexplained/coal/prices-and-outlook.php#:~:text=In%202019%2C%20the%20national%20average,was%20%2438.53%20per%20short%20ton

[3] https://www.eia.gov/coal/data.php#coalplants

[4] https://www.eia.gov/energyexplained/natural-gas/factors-affecting-natural-gas-prices.php

[5] https://www.eia.gov/todayinenergy/detail.php?id=13551

[6] https://www.brookings.edu/blog/planetpolicy/2019/01/16/why-theres-no-bringing-coal-back/

[7] https://www.energypolicy.columbia.edu/research/report/can-coal-make-comeback

[8] https://energy.stanford.edu/news/qa-stanford-expert-explains-why-we-continue-burning-coal-energy

[9] AEO2020 Electricity

[10] AEO2020 Natural Gas