

Annual Energy Outlook 2022 (AEO2022)



For

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By

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AEO2022 Highlights

- Petroleum and natural gas remain the most-consumed sources of energy in the United States through 2050, but renewable energy is the fastest growing
- Wind and solar incentives, along with falling technology costs, support robust competition with natural gas for electricity generation, while the shares of coal and nuclear power decrease in the U.S. electricity mix
- U.S. crude oil production reaches record highs, while natural gas production is increasingly driven by natural gas exports

AEO2022 examines a range of conditions from 2020 to 2050

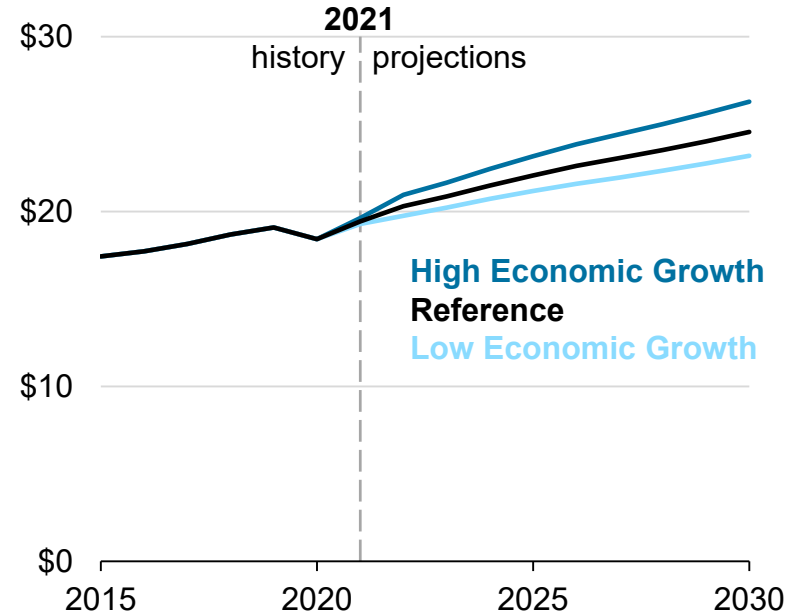
Assumptions

- Current laws and regulations as of November 2021
- Current views on economic and demographic trends, and technology improvements
- Compound annual growth rate for real U.S. gross domestic product (GDP) is 2.2% (Reference case)
 - High Economic Growth case (2.7%) and Low Economic Growth case (1.8%)
- The Brent crude oil price by 2050 is \$90 per barrel (b) in constant 2021 dollars (Reference case)
 - High Oil Price case (\$170/b) and Low Oil Price case (\$45/b)
- Oil and natural gas supply cases
 - High: more accessible resources and lower extraction technology costs than the Reference case
 - Low: fewer accessible resources and higher extraction technology costs than the Reference case
- Renewables cost cases
 - High: no cost reductions in renewable technologies
 - Low: renewables achieve 40% lower overnight capital costs by 2050 compared to Reference case

Changes in AEO2022: Pandemic and Legislation

- COVID-19 continues to be a major source of uncertainty, especially in the near term.
- AEO2022 includes provisions from the [Bipartisan Infrastructure Law](#)

U.S. gross domestic product assumptions
AEO2022 economic growth cases
trillion 2012 dollars





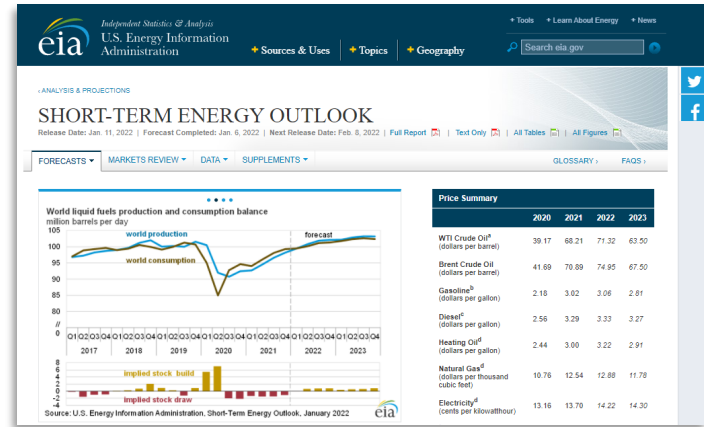
Independent Statistics & Analysis

U.S. Energy Information Administration

The U.S. Energy Information Administration (EIA) collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.

EIA's role is unique — by providing an unbiased view of energy markets, EIA increases transparency and promotes public understanding of important energy issues.

EIA has expanded its program in recent years to provide a growing customer base with coverage of increasingly complex and interrelated energy markets.



AEO2022 core cases vary technical and macroeconomic assumptions

Policy assumptions

Current laws and regulations
as of November 2021

Potential
new laws

Technical and
macroeconomic
assumptions

Higher

High Economic Growth case
High Oil Price case
High Oil and Gas Supply case
High Renewables Cost case

Expected

Reference case

Lower

Low Economic Growth case
Low Oil Price case
Low Oil and Gas Supply case
Low Renewables Cost case

Upcoming AEO2022 Issue in Focus cases vary technical, macroeconomic, and policy assumptions

- Alternative policies assumptions
 - Carbon fee
 - Sunset credits
 - Extended credits
 - No new pipelines
- Alternative technical and macroeconomic assumptions
 - Alternative weather assumptions
 - Use cases for battery storage

AEO2022 Highlights

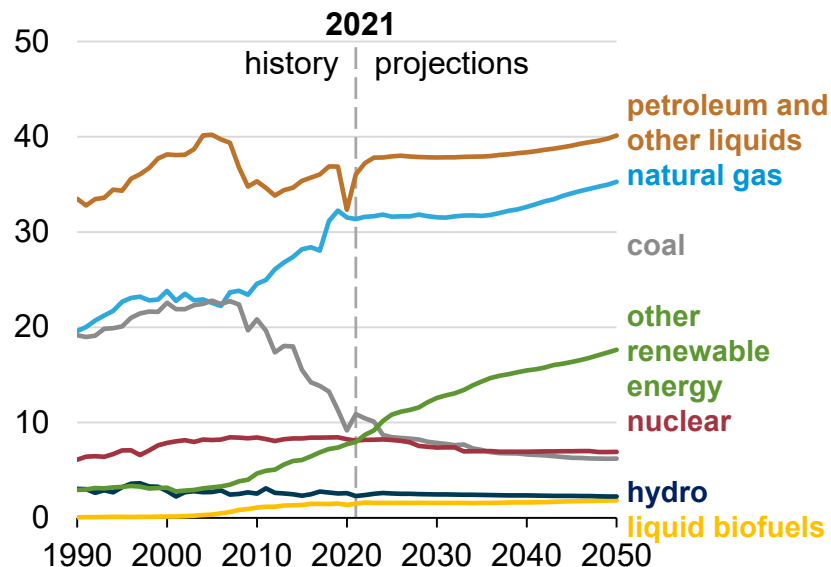
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Renewables consumption grows fastest but remains far below petroleum and other liquids consumption in 2050

Energy consumption by fuel

AEO2022 Reference case

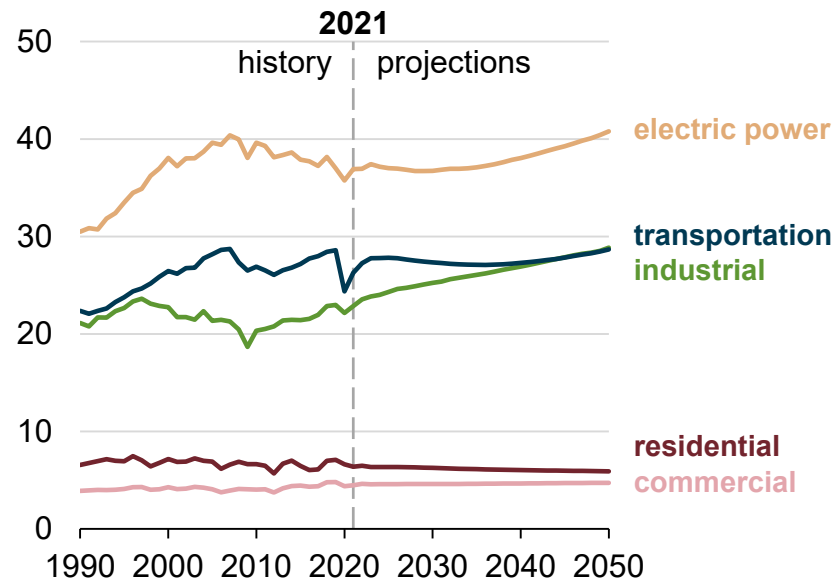
quadrillion British thermal units



Energy consumption by sector

AEO2022 Reference case

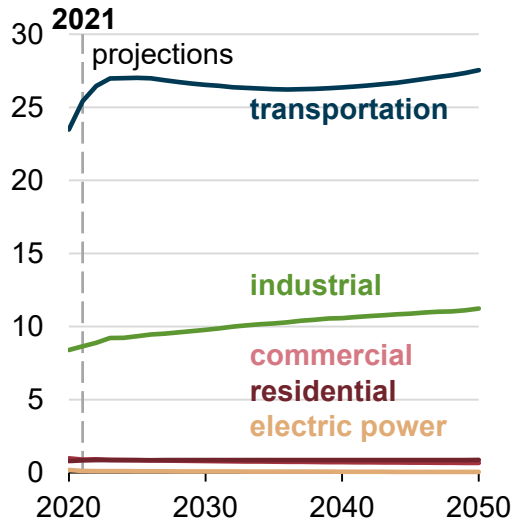
quadrillion British thermal units



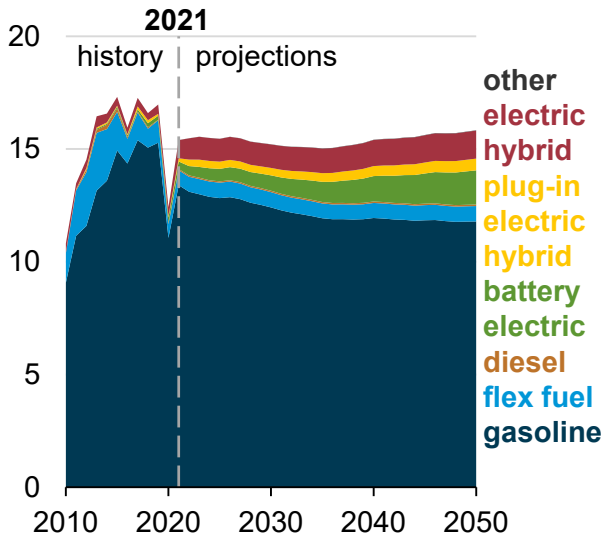
Note: Biofuels are shown separately and included in petroleum and other liquids.

Petroleum and other liquids are largely consumed by sectors with slow turnover to electric equipment

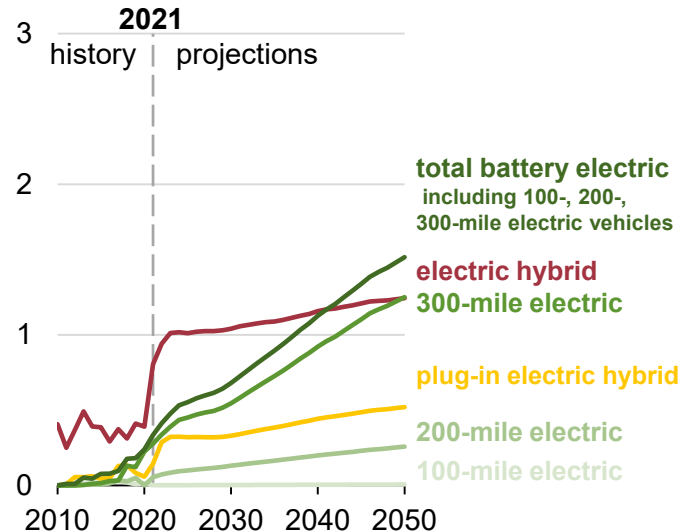
Petroleum and other liquids consumption by sector
AEO2022 Reference case
 quadrillion British thermal units



Light-duty vehicle sales by technology or fuel
AEO2022 Reference case
 millions of vehicles



New vehicle sales of battery-powered vehicles
AEO2022 Reference case
 millions of vehicles

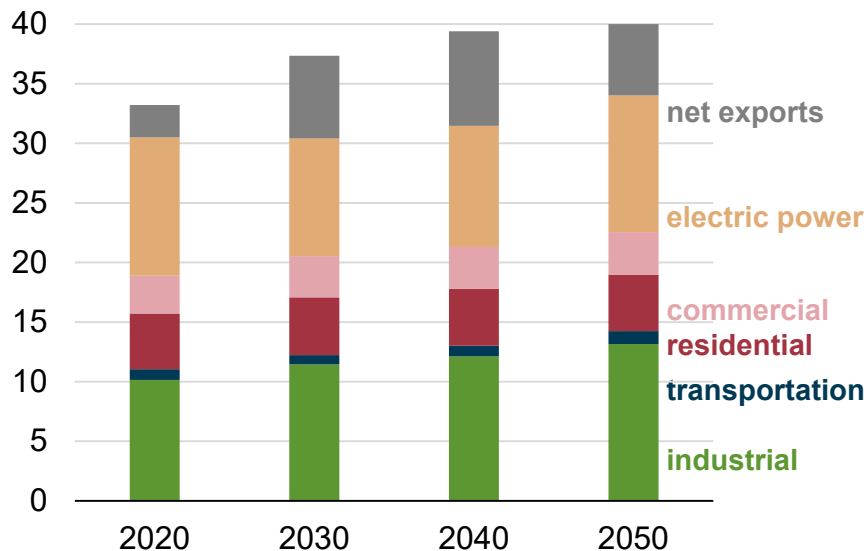


Natural gas consumption rises mostly because of industrial use and exports

Natural gas disposition and net exports

AEO2022 Reference case

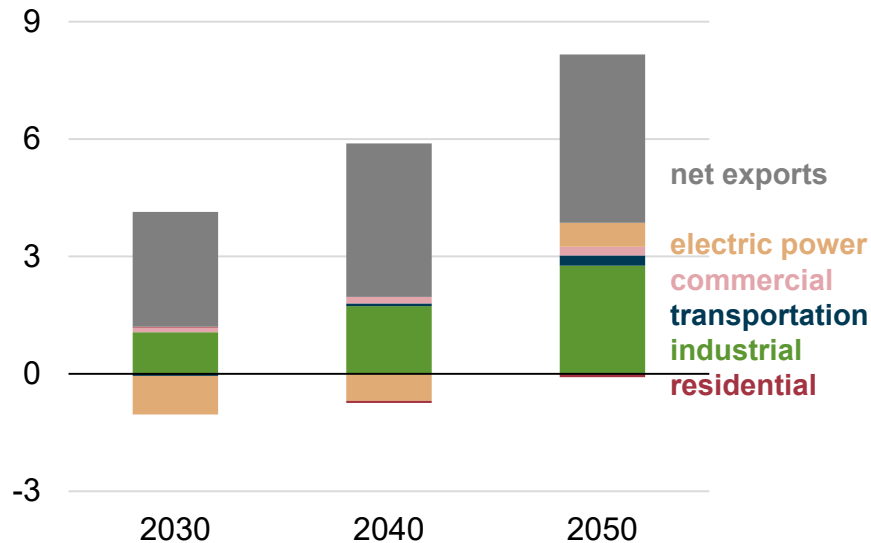
trillion cubic feet



Change in natural gas disposition and net exports

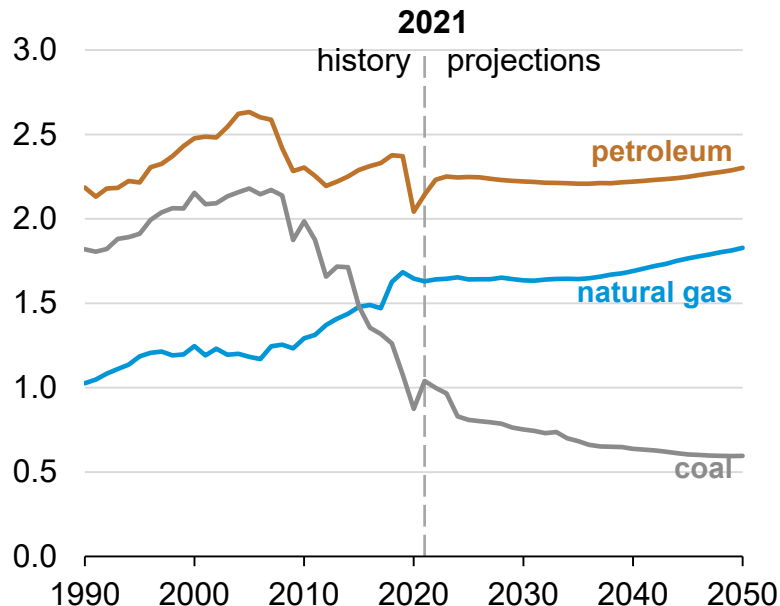
AEO2022 Reference case

relative to 2021 in trillion cubic feet

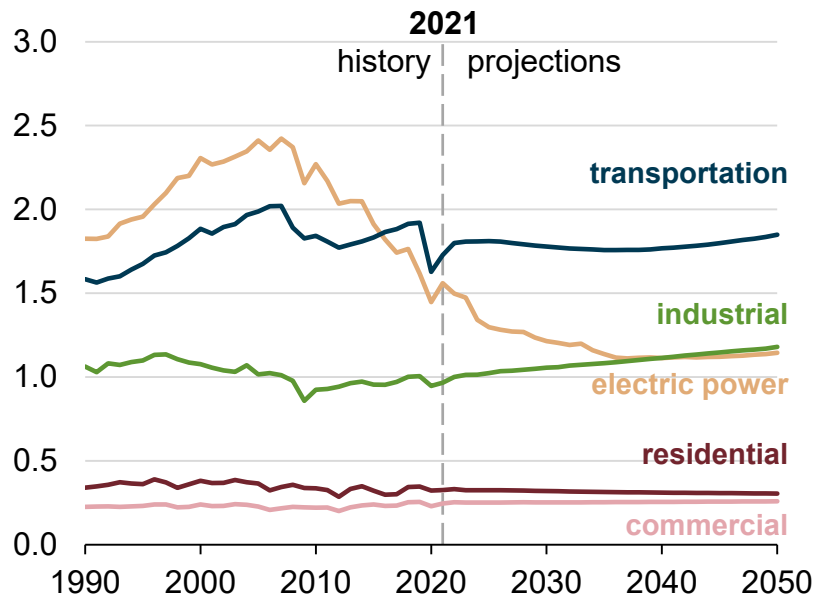


Energy-related CO₂ emissions by sector and fuel

Energy-related CO₂ emissions by fuel
AEO2022 Reference case
 billion metric tons



Energy-related CO₂ emissions by sector
AEO2022 Reference case
 billion metric tons



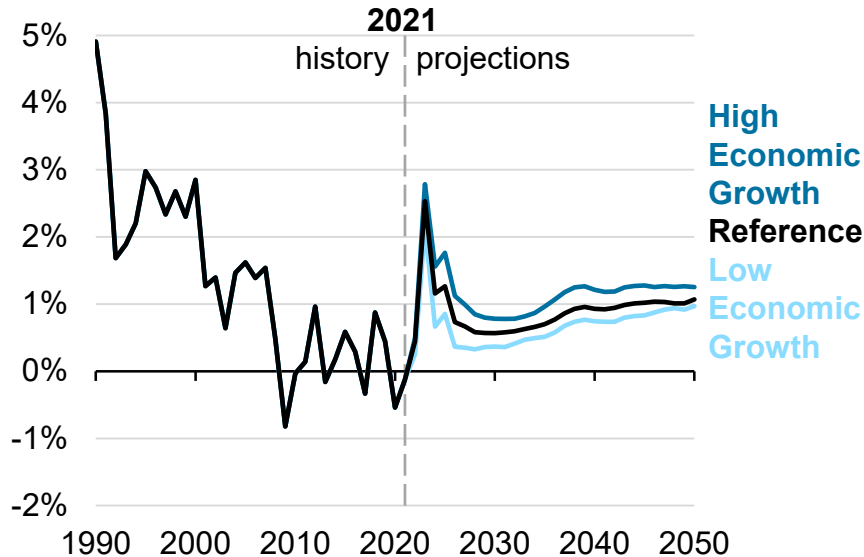
Note: Series does not include greenhouse gases other than CO₂. Industrial sector CO₂ emissions do not include process emissions, such as the emissions from cement clinker production.

AEO2022 Highlights

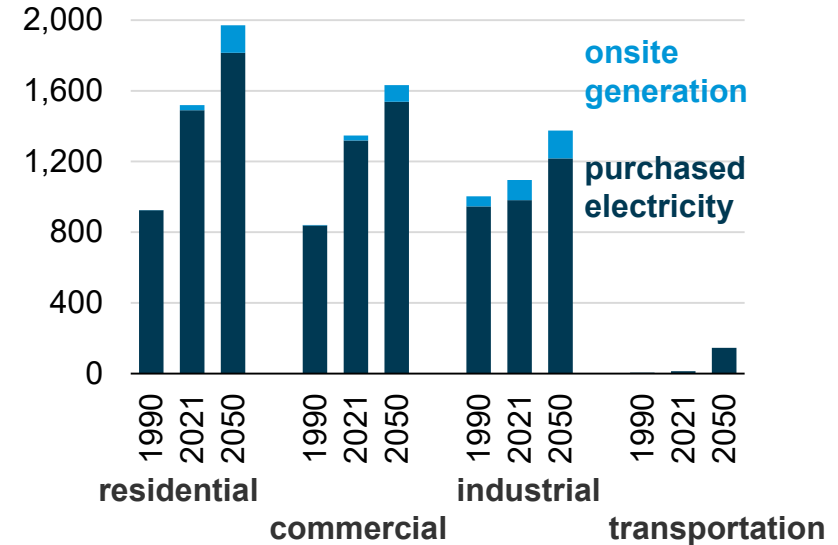
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The U.S. annual average electricity growth rate remains below 1% across much of the projection period in the Reference case

U.S. electricity use growth rate, three-year rolling average
AEO2022 economic growth cases
 percentage growth



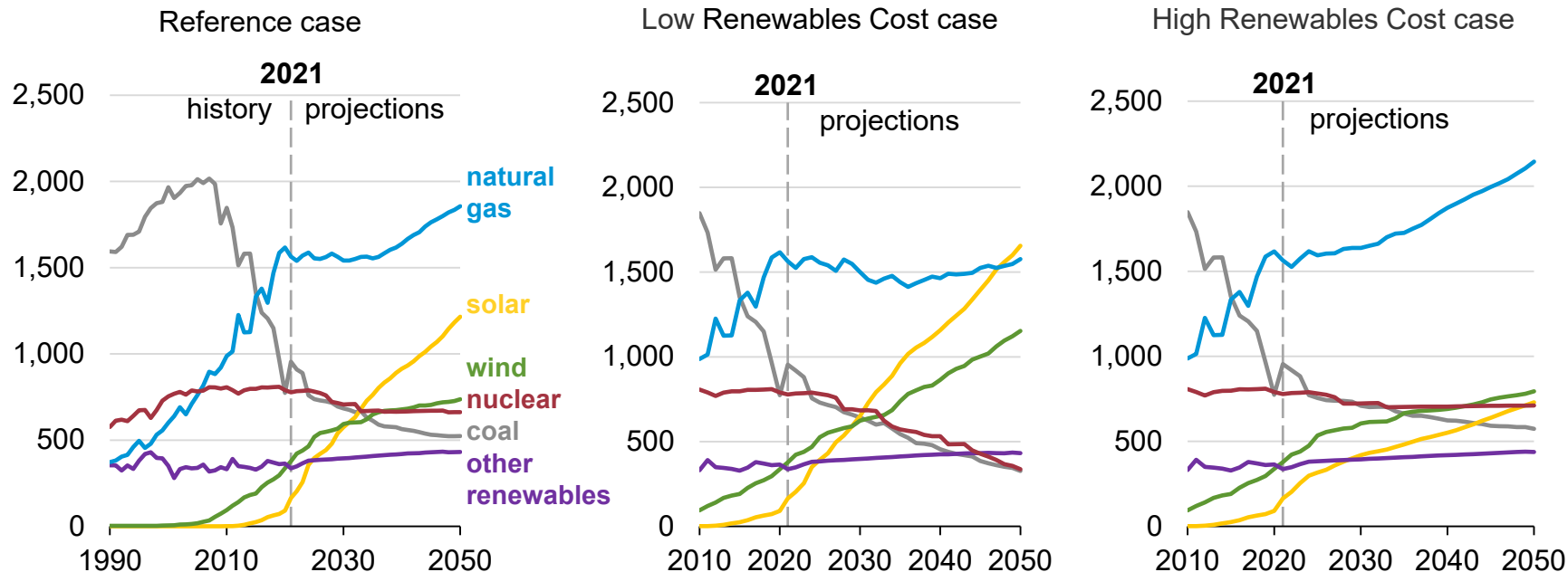
U.S. electricity use by end-use sector
AEO2022 Reference case
 billion kilowatthours



Renewables consumption for electricity generation grows significantly in all cases, even as it trades off with nuclear, coal, and natural gas

U.S. electricity generation

billion kilowatthours

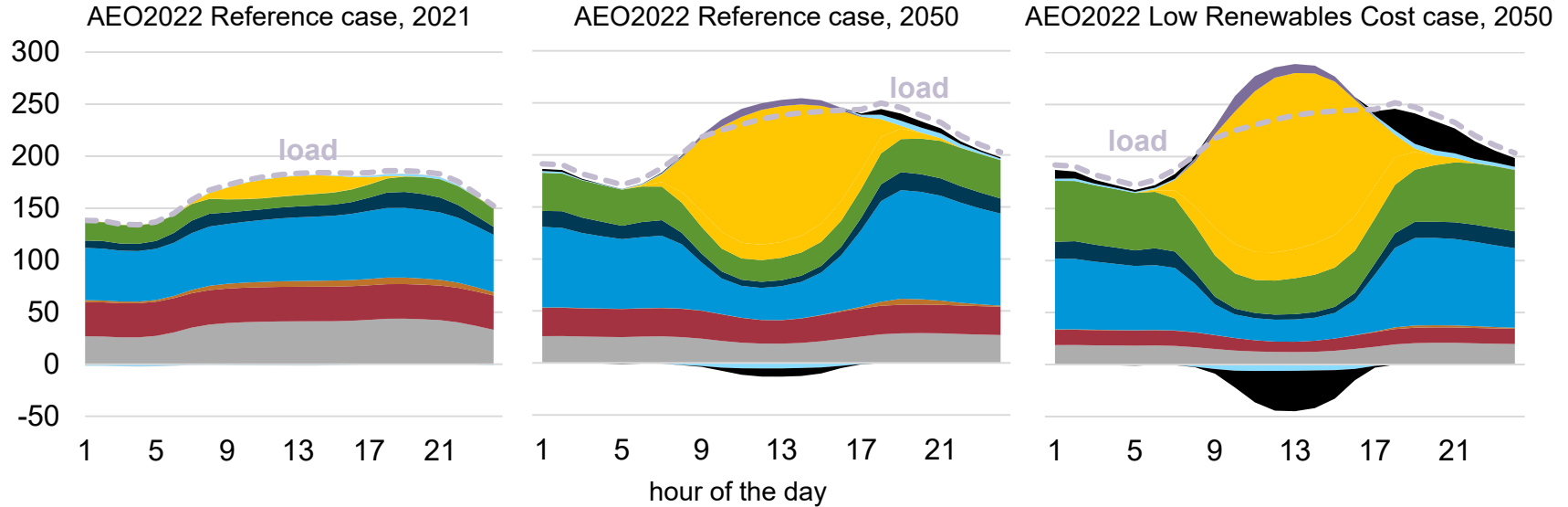


Note: Other renewables category includes electricity generation from hydroelectric, geothermal, wood, and other biomass sources.

Significant renewables growth leads to additional battery storage

Hourly U.S. electricity generation and load by fuel for selected cases and years

billion kilowatthours



curtailment battery storage pumped storage solar wind hydroelectric natural gas combined-cycle natural gas and oil peakers nuclear coal

Note: Negative generation represents charging of energy storage technologies such as pumped hydro and battery storage. Hourly dispatch estimates are illustrative and are developed to determine curtailment and storage operations; final dispatch estimates are developed separately and may differ from total utilization as this figure shows. Solar includes both utility-scale and end-use photovoltaic electricity generation.

AEO2022 Highlights

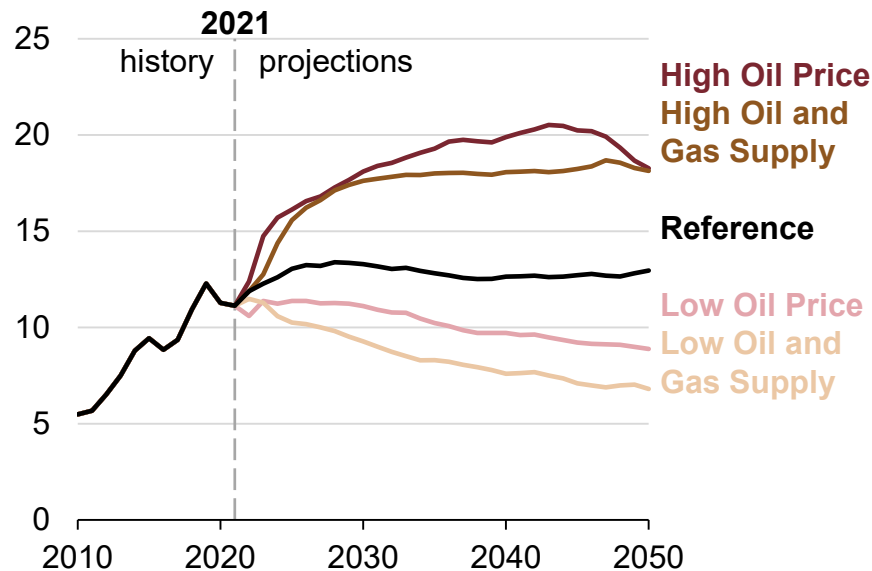
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Production of U.S. crude oil rises early in the projection and remains largely flat in the Reference case

U.S. crude oil production

AEO2022 Reference case and side cases

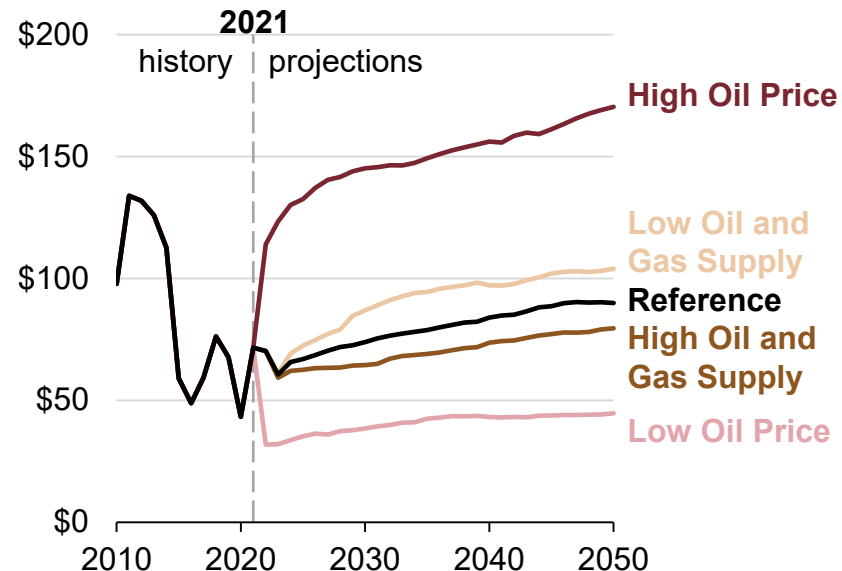
million barrels per day



North Sea Brent crude oil price

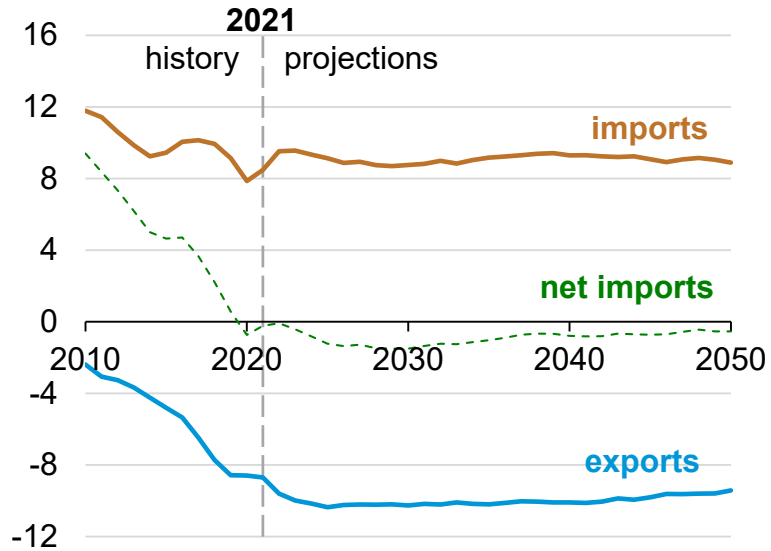
AEO2022 side cases

2021 dollars per barrel

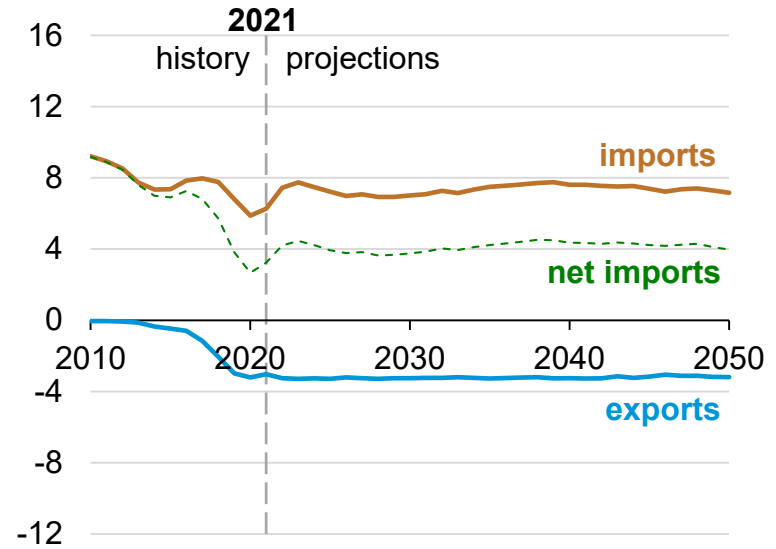


The United States remains a net exporter of total liquids and a net importer of crude oil in the Reference case

Total petroleum and other liquids trade
AEO2022 Reference case
million barrels per day



Crude oil trade
AEO2022 Reference case
million barrels per day

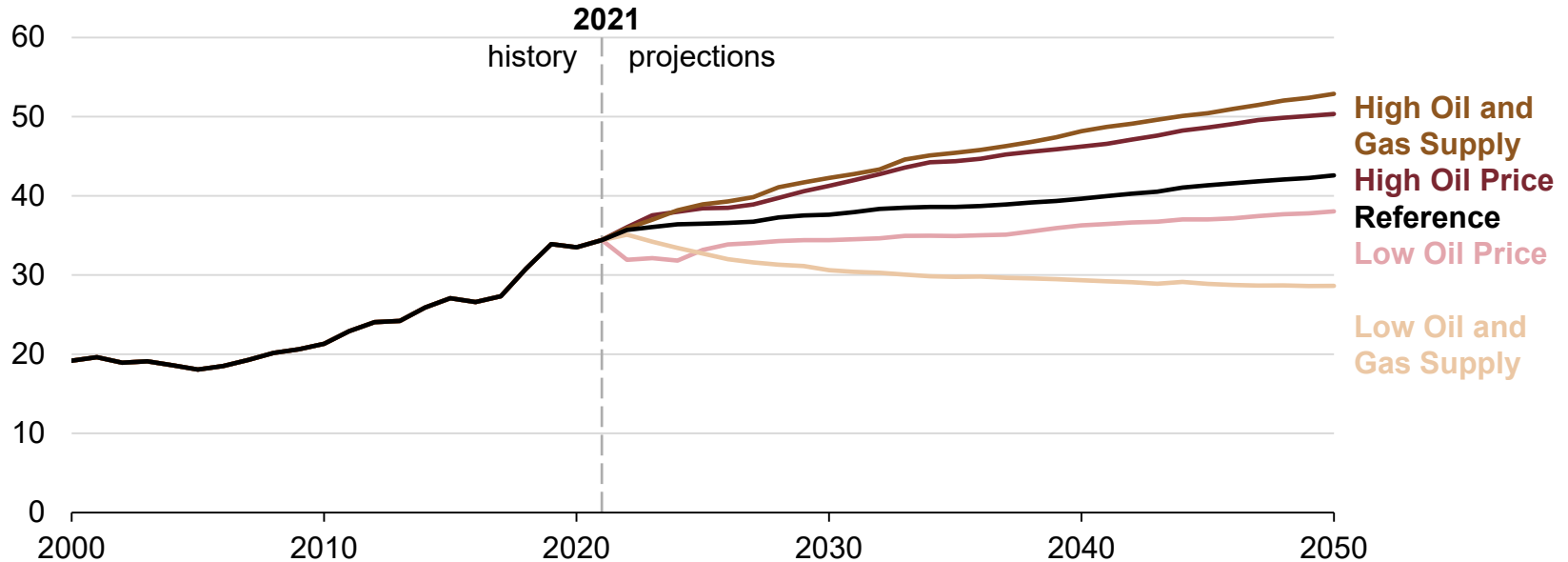


U.S. natural gas production grows in most cases, but price and technology assumptions play a central role

Dry natural gas production

AEO2022 side cases

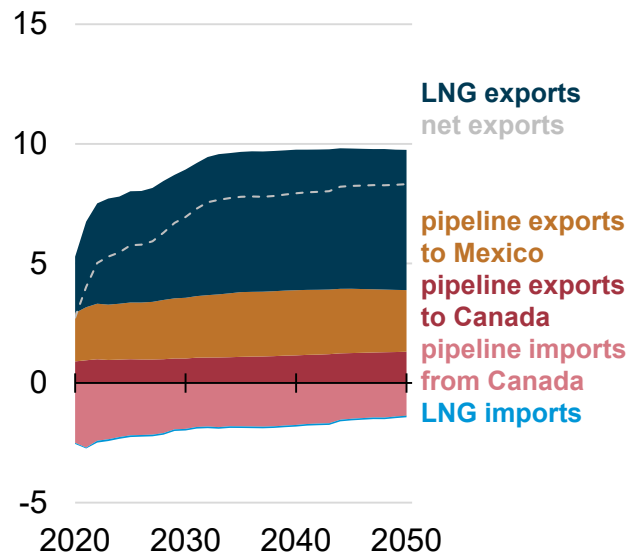
trillion cubic feet



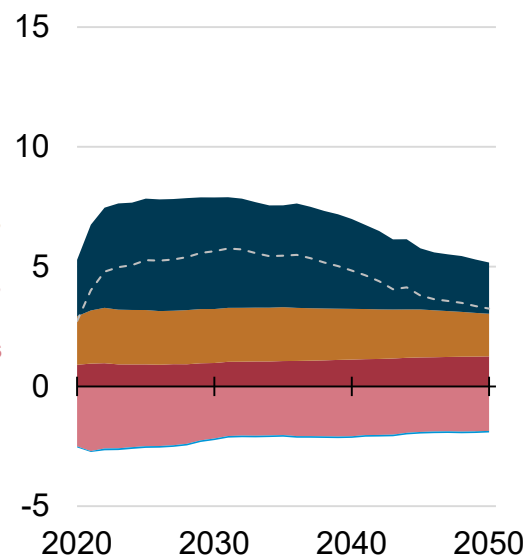
Natural gas and liquefied natural gas (LNG) trade reaches 8 trillion cubic feet in the Reference case

U.S. natural gas trade, AEO2022 oil and natural gas supply cases

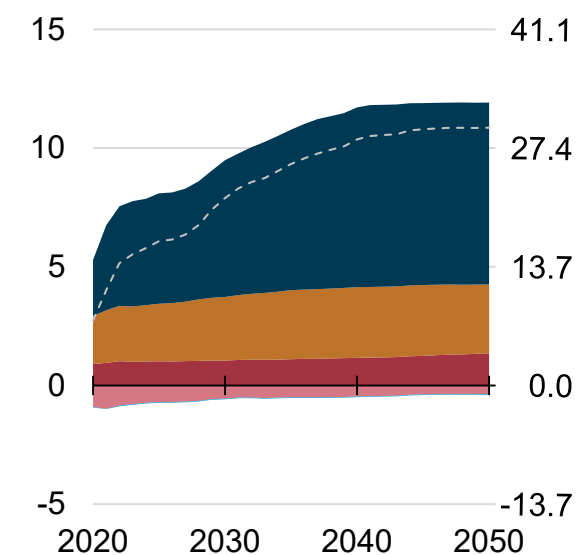
Reference case
trillion cubic feet



Low Oil and Gas Supply case
trillion cubic feet



High Oil and Gas Supply case
trillion cubic feet billion cubic feet per day



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