

International Energy Outlook 2021 (IEO2021)



For

Center for Strategic and International Studies

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By

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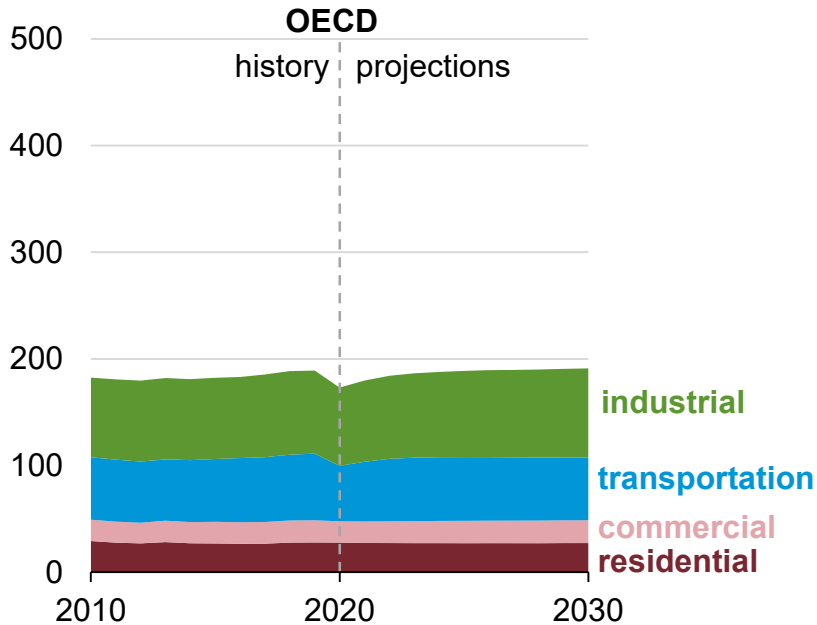
IEO2021 Highlights

- If current policy and technology trends continue, global energy consumption and energy-related carbon dioxide emissions will increase through 2050 as a result of population and economic growth.
- Renewables will be the primary source for new electricity generation, but natural gas, coal, and increasingly batteries will be used to help meet load and support grid reliability.
- Oil and natural gas production will continue to grow, mainly to support increasing energy consumption in developing Asian economies.

Energy use is projected to return to pre-pandemic levels quickly in non-OECD regions

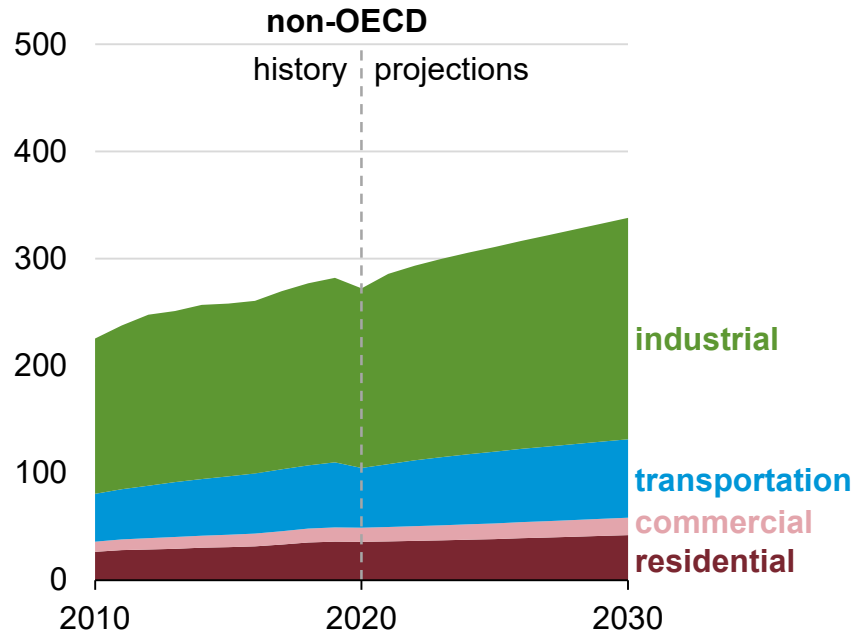
Energy consumption by sector

quadrillion British thermal units



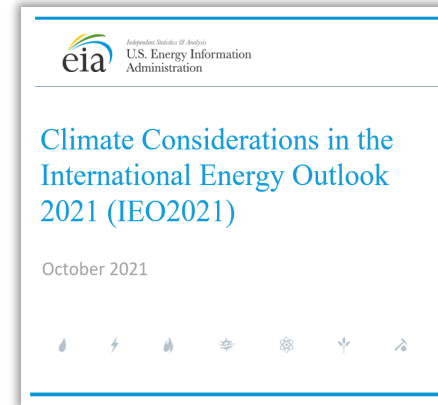
Energy consumption by sector

quadrillion British thermal units



IEO2021 includes COVID-19 impacts; Side cases include alternative assumptions and newly expanded results

- IEO2021 Reference case
 - Incorporates global COVID-19 impacts on the energy sector
 - Uses the U.S. projections published in the *Annual Energy Outlook 2021*, which assumes U.S. laws and regulations as of September 2020
 - Assumes implementation of current laws and regulations as of May 2021, including existing climate law; *Climate Considerations in the International Energy Outlook (IEO2021)*¹ provides more details
 - Uses Oxford Economics' GDP projections, with a global growth rate of 2.8% per year
 - Assumes 2050 world oil price reaches \$95 per barrel (2020 dollars)
- Side cases explore alternative economic growth and oil price assumptions
 - High and Low Economic Growth cases: 3.7% per year and 2.0% per year global GDP growth rate
 - High and Low Oil Price cases: \$176 per barrel and \$45 per barrel 2050 world oil prices (2020 dollars)



¹ EIA, *Climate Considerations in the International Energy Outlook (IEO2021)*, <https://www.eia.gov/outlooks/ieo/climate.php>



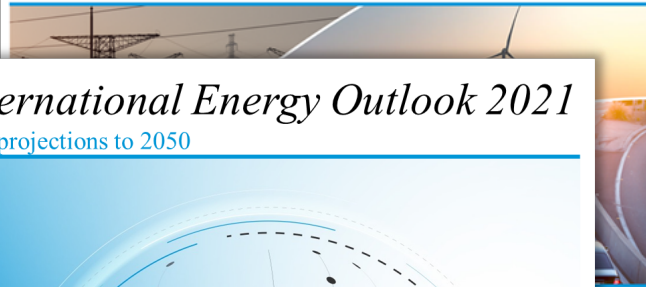
The U.S. Energy Information Administration (EIA) collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.

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.



Annual Energy Outlook 2021 with projections to 2050



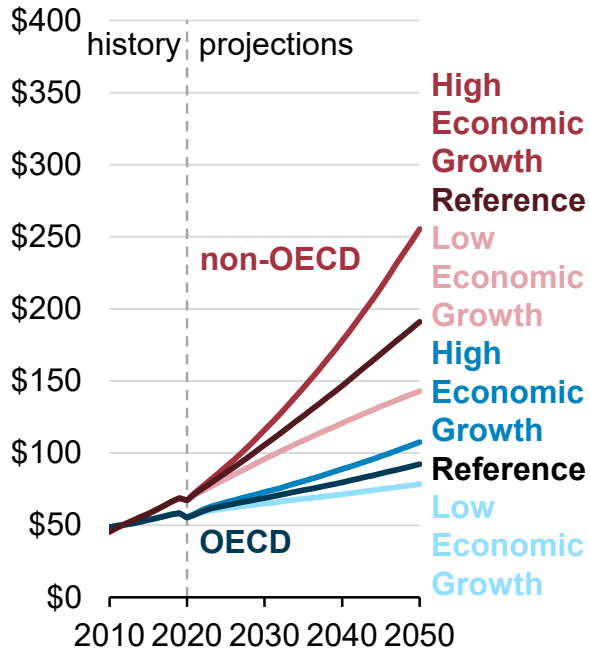
International Energy Outlook 2021 with projections to 2050



EIA assumes a range of GDP and oil prices, which affect projected energy consumption

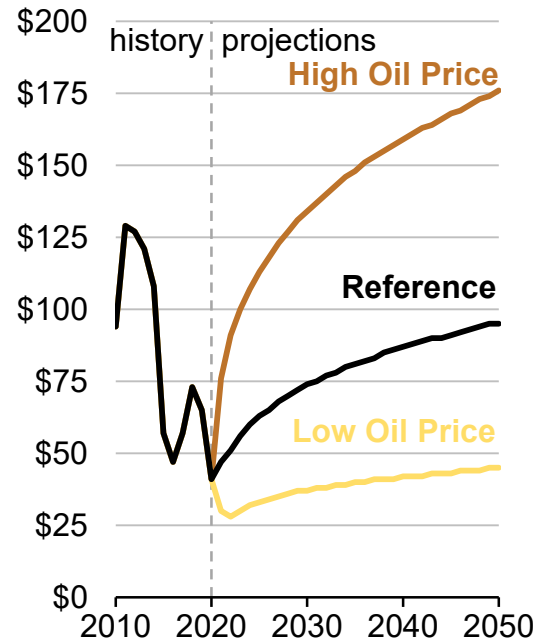
Gross domestic product

trillion 2015 dollars



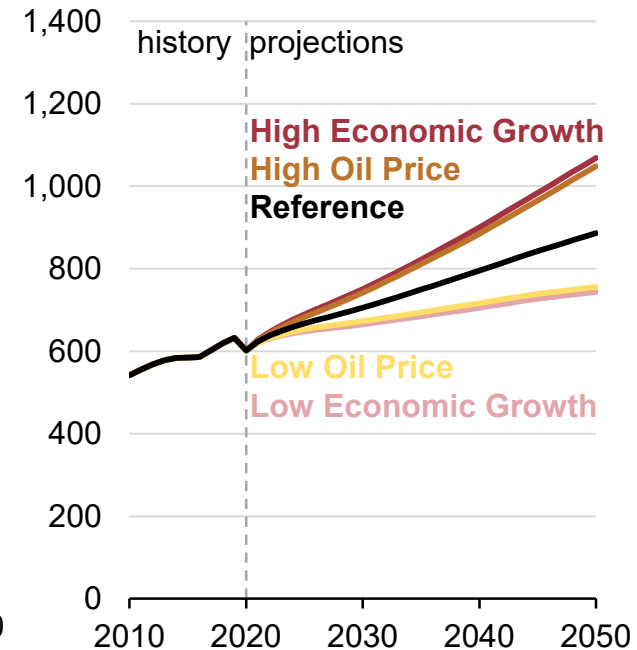
World oil prices

2020 dollars per barrel



Global energy consumption

quadrillion British thermal units



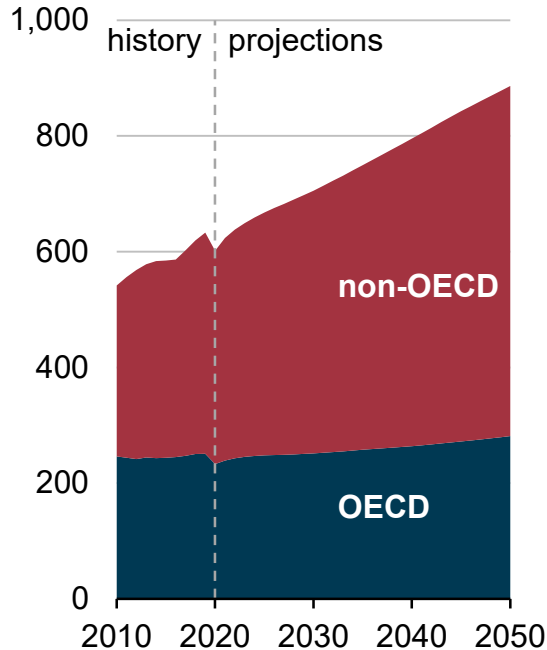
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By 2050, global energy use increases nearly 50%, driven by non-OECD economic growth and population

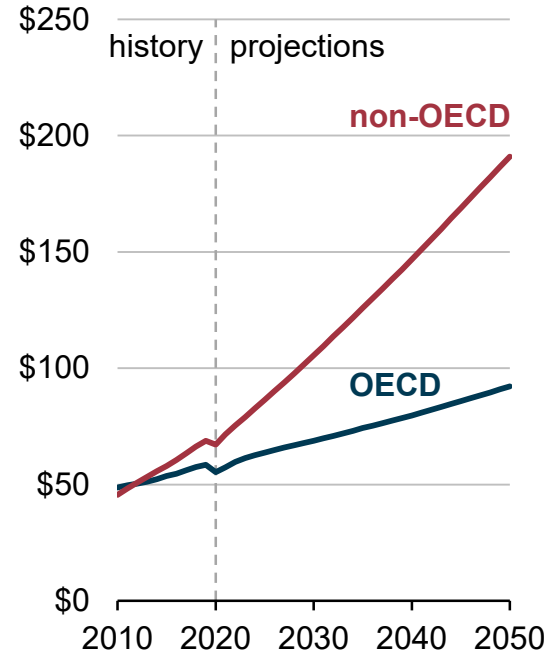
World energy consumption

quadrillion British thermal units



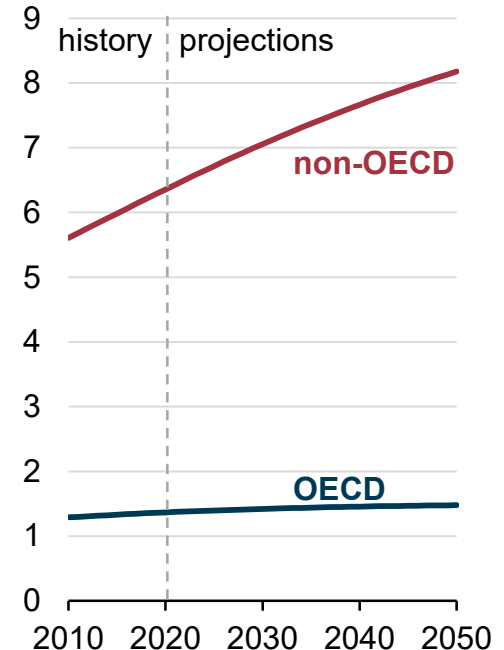
World gross domestic product (GDP)

trillion 2015 dollars, purchasing power parity



Population

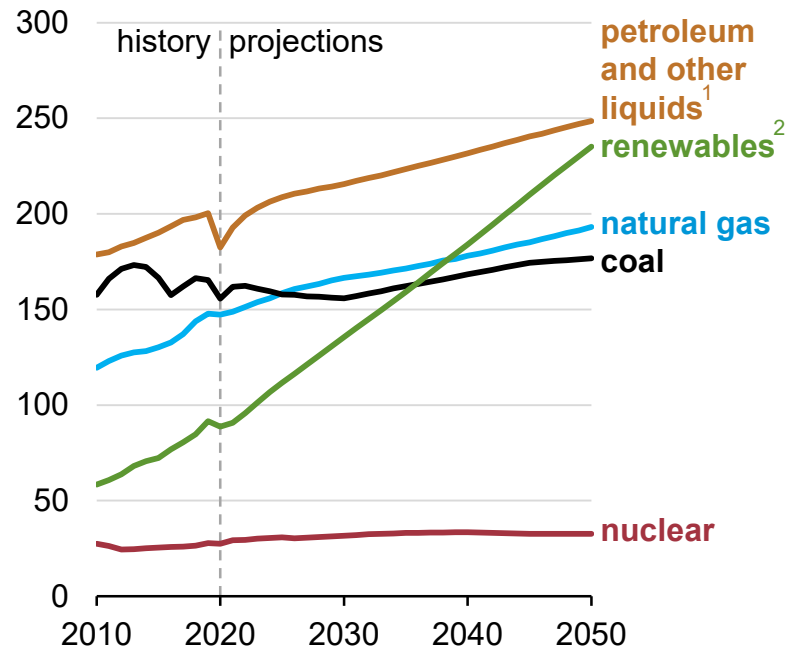
billion people



Liquid fuels remain the largest source of primary energy in the Reference case, but renewables use grows to nearly the same level

Primary energy consumption by energy source, world

quadrillion British thermal units

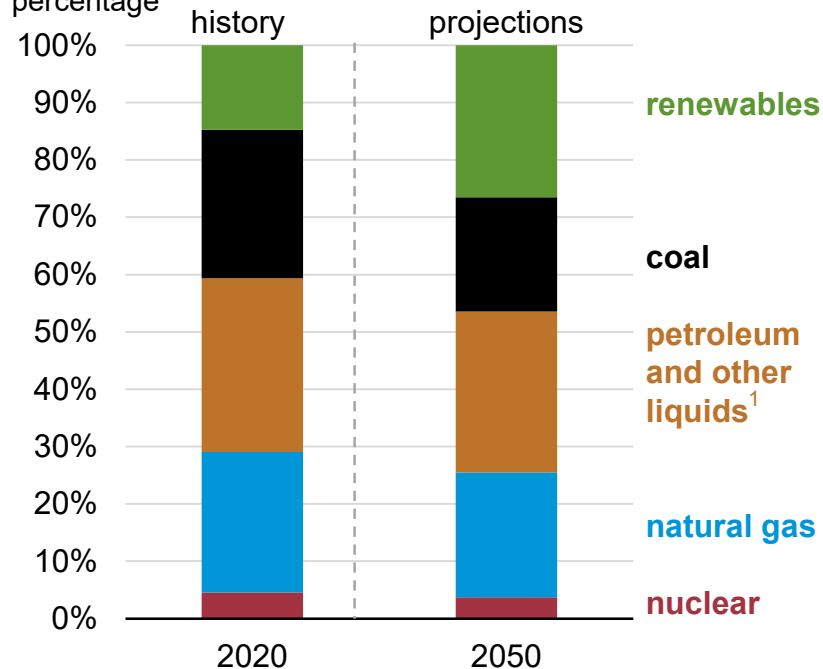


¹ Includes biofuels

² Electricity generation from renewable sources is converted to Btu at a rate of 8,124 Btu/kWh

Share of primary energy consumption by source, world

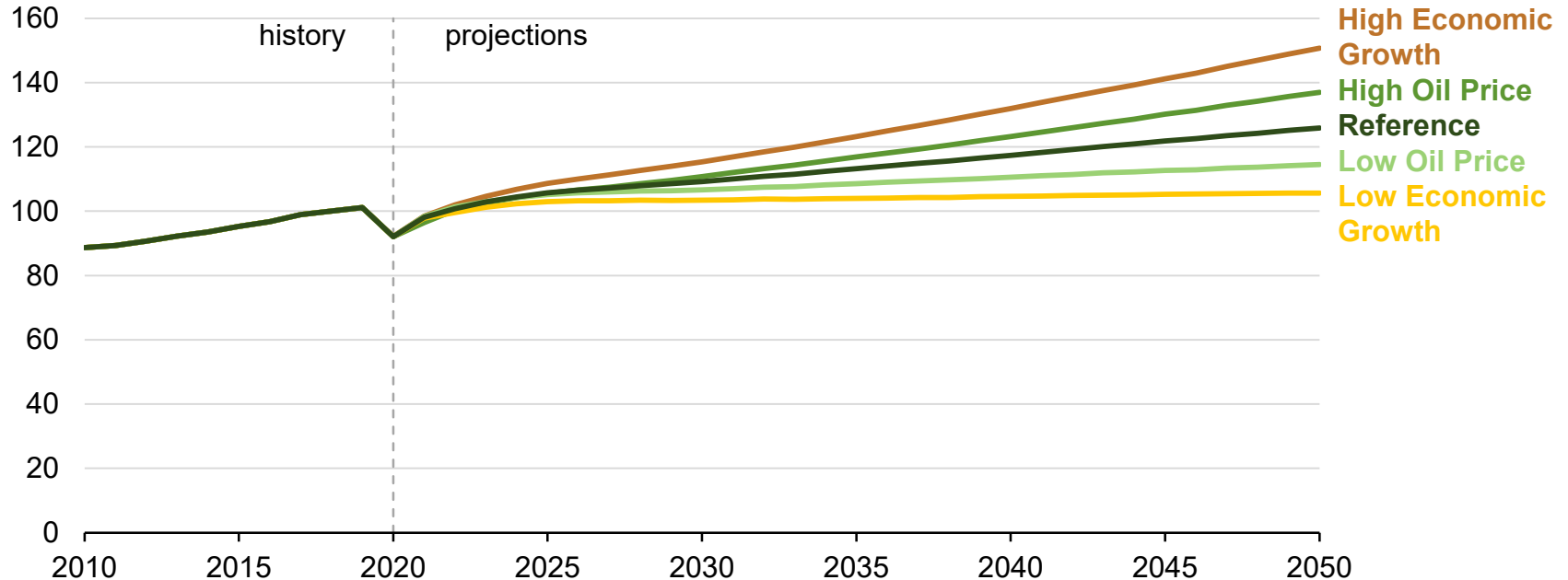
percentage



Liquid fuels consumption rises from 2020 in all IEO cases

World liquid fuels consumption

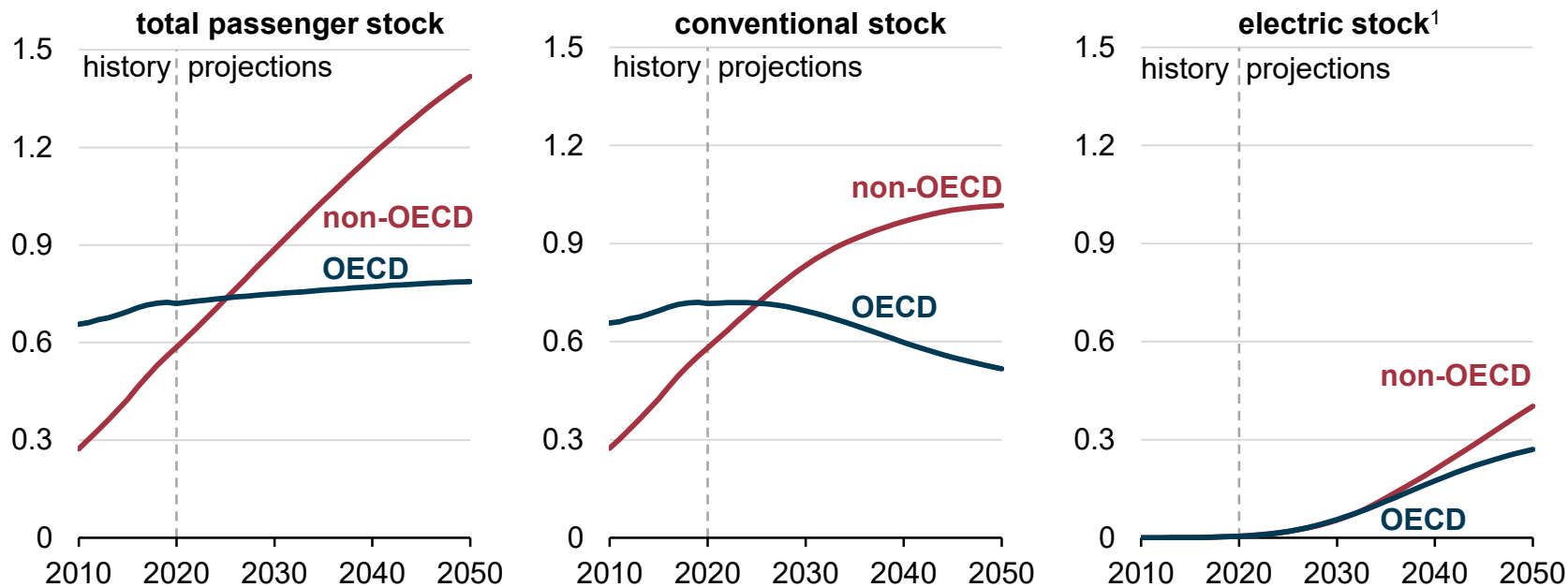
million barrels per day



Electric vehicle stock contributes to reduced emissions and represents 31% of total passenger vehicle stock by 2050

Light-duty passenger vehicle stock

billions of passenger vehicles

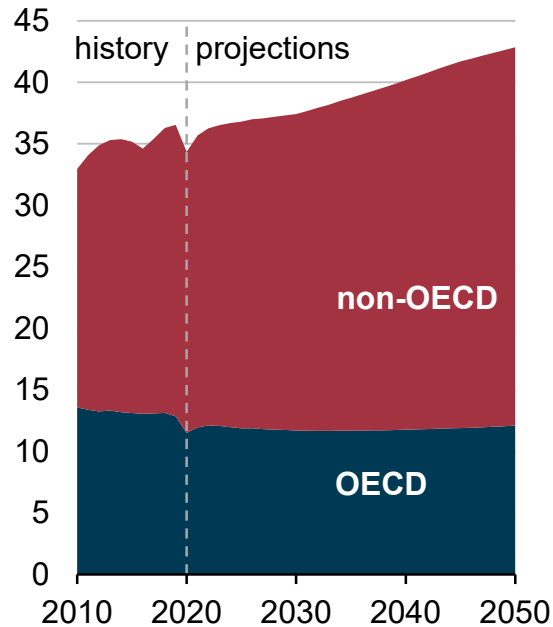


¹ Electric stock includes full battery electric vehicles (BEVs) or all-electric vehicles and plug-in hybrid electric vehicles (PHEVs) that run on liquid fuels when batteries become depleted

Energy related carbon dioxide (CO₂) emissions rise, even as carbon and energy intensity fall

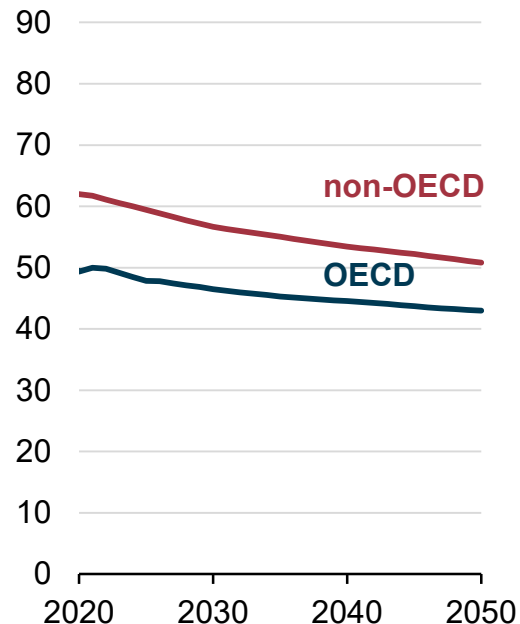
Energy-related CO₂ emissions

billion metric tons



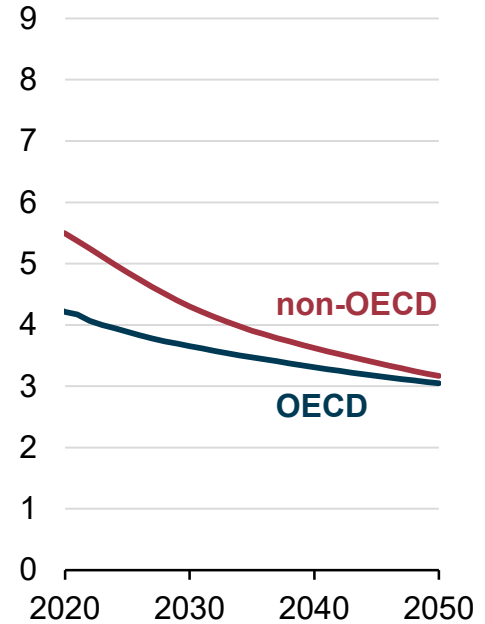
Carbon intensity

metric tons CO₂ per billion
British thermal units



Energy intensity

thousand British thermal units
per 2015 dollar of GDP

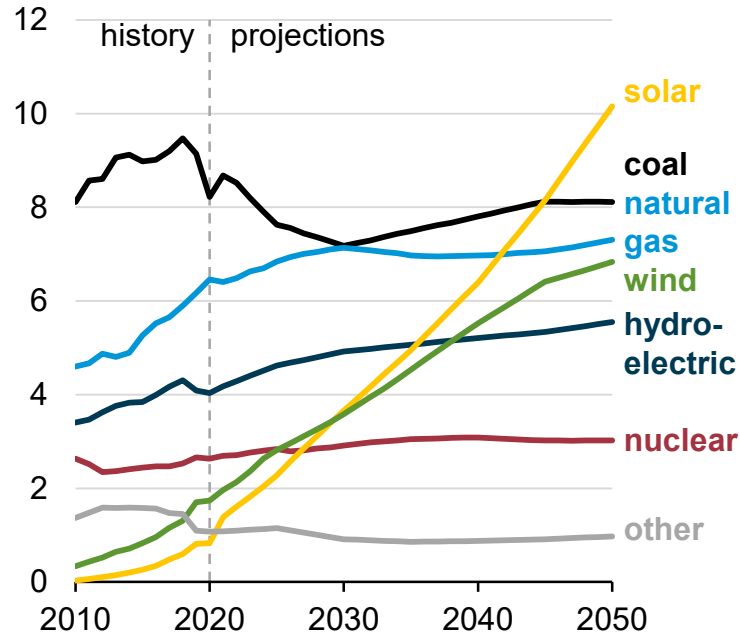


IEO2021 Highlights

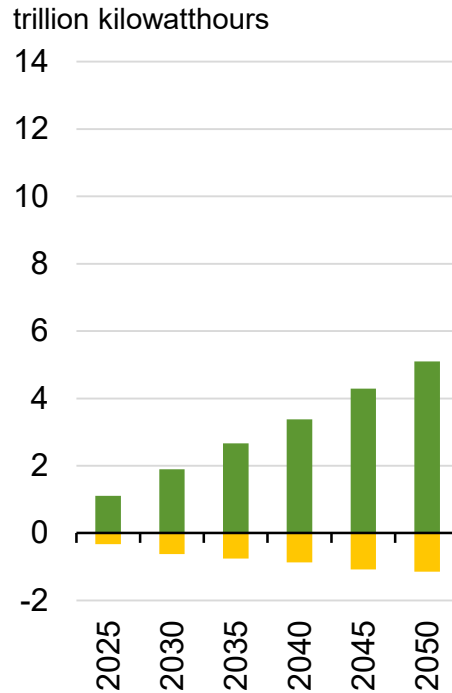
- If current policy and technology trends continue, global energy consumption and energy-related carbon dioxide emissions will increase through 2050 as a result of population and economic growth.
- **Renewables will be the primary source for new electricity generation, but natural gas, coal, and increasingly batteries will be used to help meet load and support grid reliability.**
- Oil and natural gas production will continue to grow, mainly to support increasing energy consumption in developing Asian economies.

In the electric power sector, renewable energy generation grows significantly, with support from non-intermittent sources

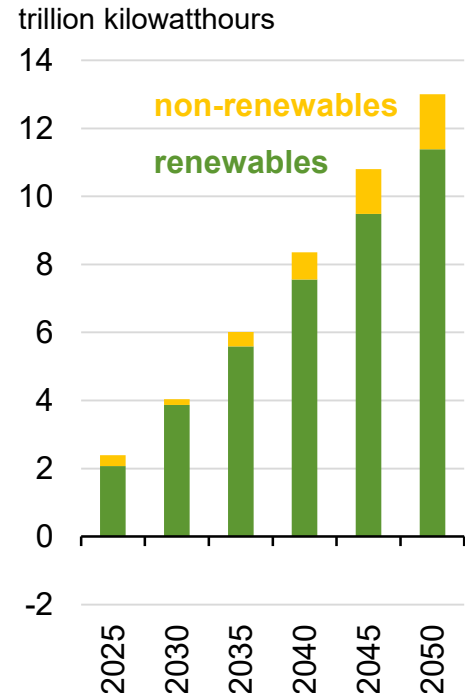
World net electricity generation by source
trillion kilowatthours



OECD electricity generation change from 2020
trillion kilowatthours

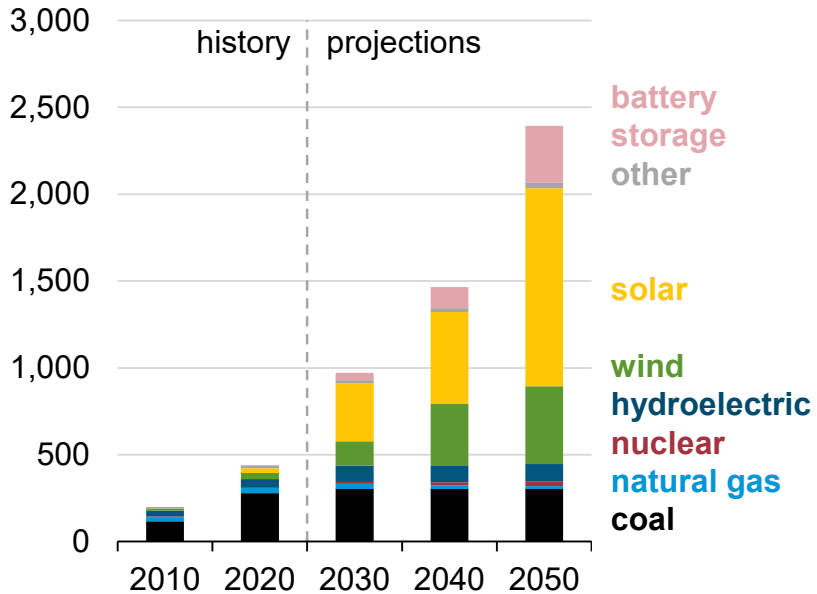


Non-OECD electricity generation change from 2020
trillion kilowatthours

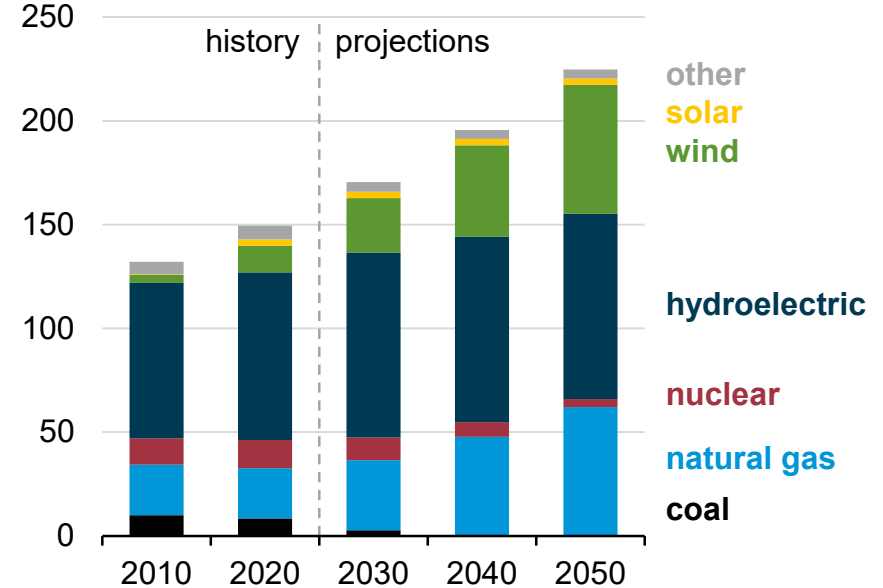


Growing intermittent generating capacity is supported by different technologies, depending on each region's respective resources

Installed electricity generating capacity, India
gigawatts



Installed electricity generating capacity, Canada
gigawatts

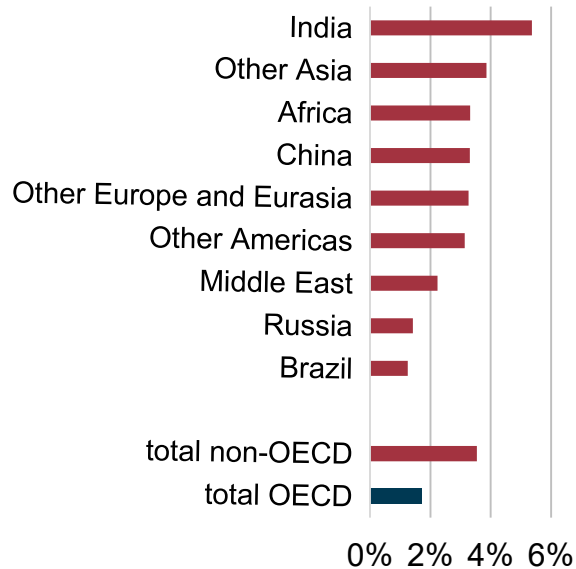


IEO2021 Highlights

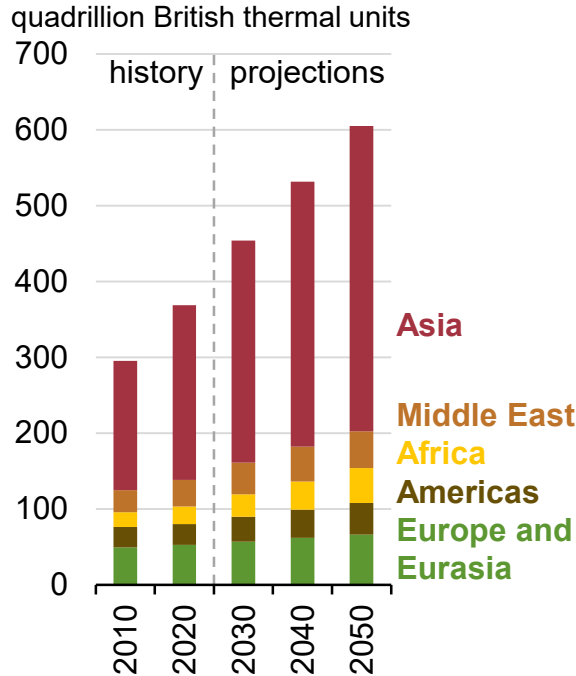
- As a result of population and economic growth, if current policy and technology trends continue, global energy consumption and energy-related carbon dioxide emissions will increase through 2050.
- Renewables will be the primary source for new electricity demand, but natural gas and coal, and increased use of batteries will be used to help meet load and support grid reliability.
- Oil and natural gas production will continue to grow, mainly to support increasing energy consumption in developing Asian economies.

Nearly all energy consumption growth occurs in non-OECD Asia, driven by economic growth

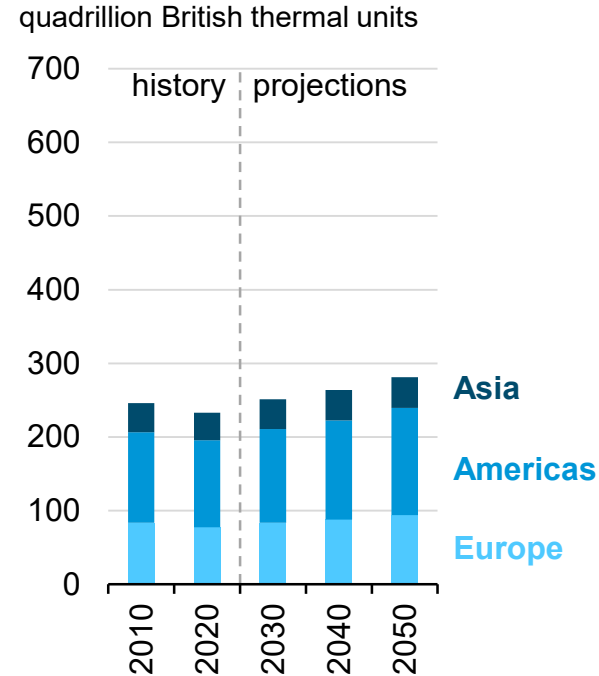
Average annual percentage change in GDP, 2020–2050, select regions
percentage



Non-OECD energy consumption by region



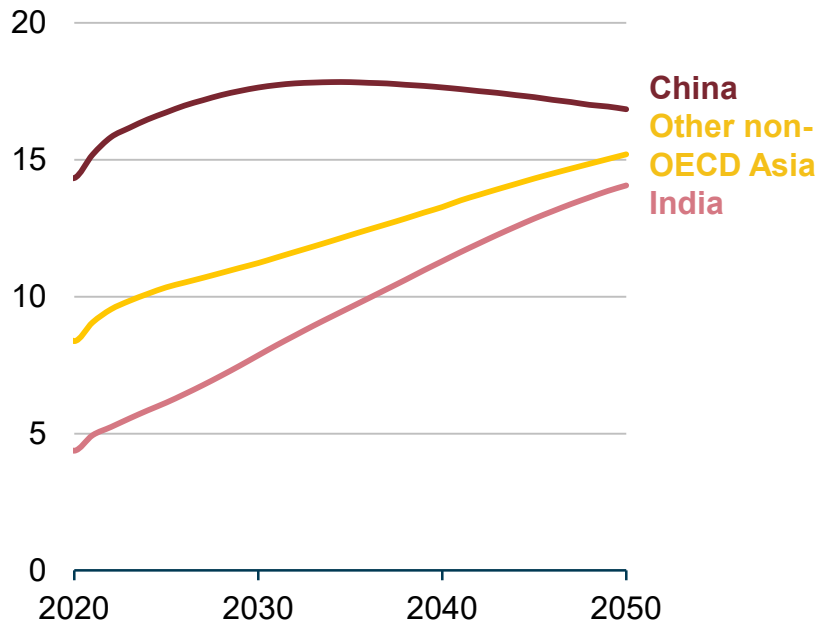
OECD energy consumption by region



Non-OECD Asia leads growth in liquid fuels consumption but has limited increases in crude oil production

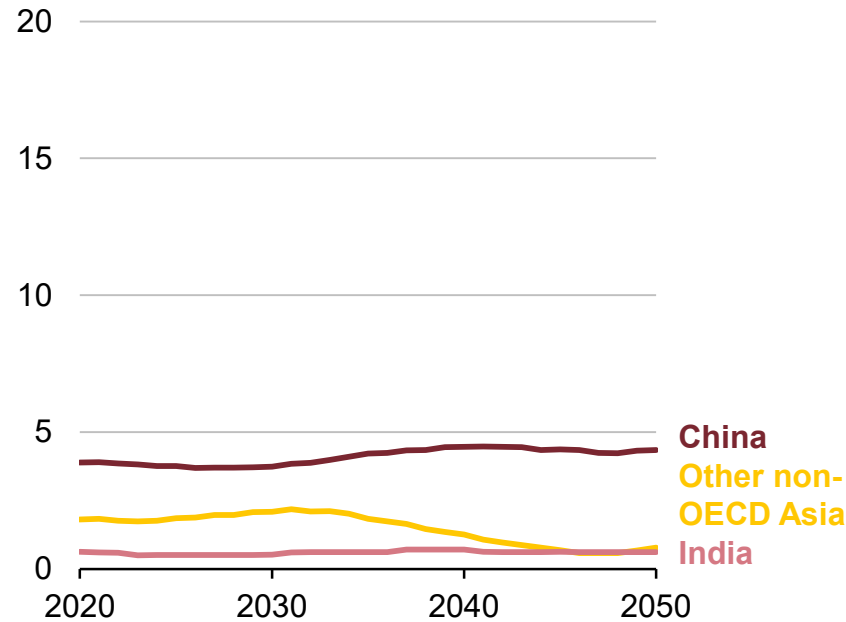
Total liquid fuels consumption by select regions

million barrels per day



Crude oil production by select regions

million barrels per day



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Upcoming IEO2021 Issues in Focus

- Energy implications of potential iron- and steel-sector decarbonization pathways
- Effects of changes in coal supply and demand on international trade and electricity generation in India and Other non-OECD Asia
- Changes in composition of economic growth in China



Independent Statistics & Analysis

U.S. Energy Information
Administration