

AEO2023 Macro-Industrial Working Group Meeting

Updates and preliminary results



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By

Office of Integrated and International Energy Analysis

Office of Long-Term Energy Modeling

Annual Energy Outlook 2023 (AEO2023) Macro-Industrial Working Group: Overview

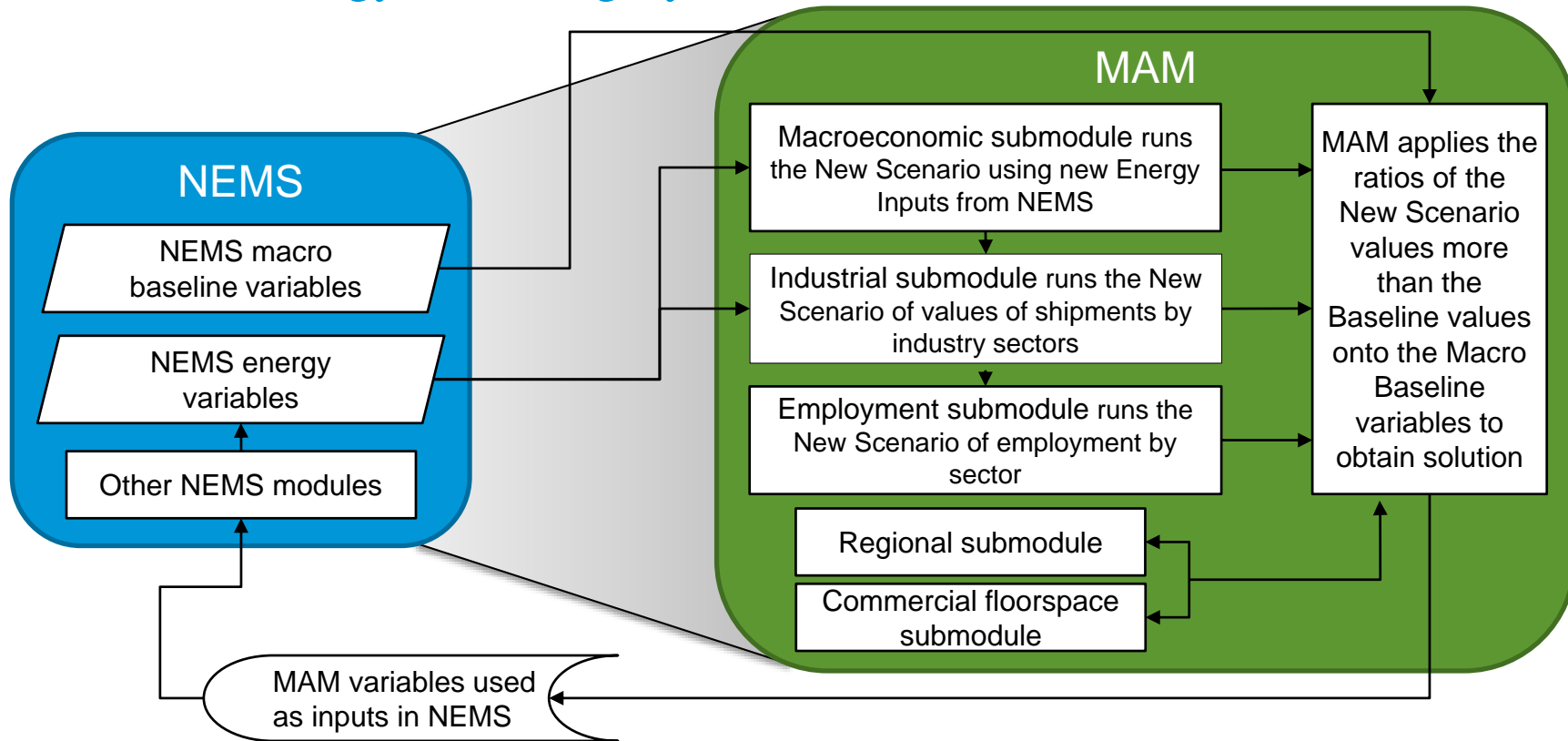
- AEO2023 macroeconomic updates and preliminary results
- Review of *Annual Energy Outlook 2022 (AEO2022)* industrial results
- AEO2023 industrial updates
- Longer-term plans for industrial modeling
- Discussion and questions

Review of preliminary AEO2023 macroeconomic results

Key preliminary AEO2023 macro results

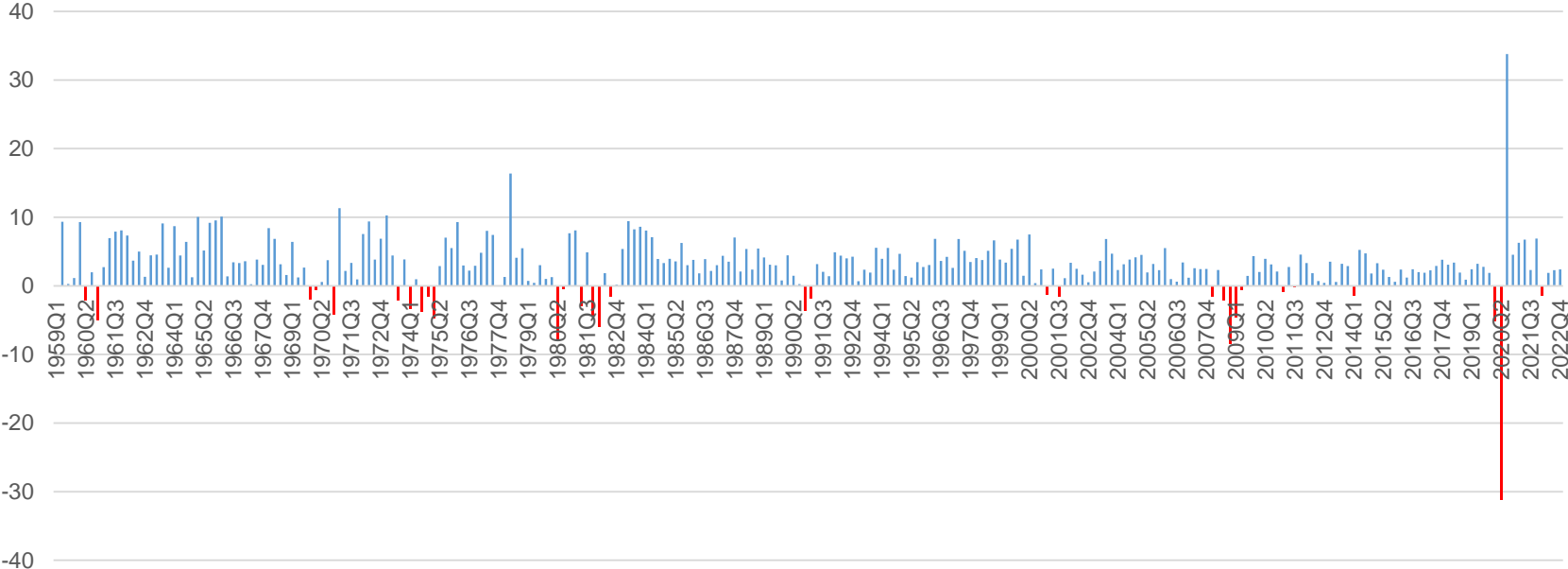
- AEO2023 real GDP grows an average of 2.1% per year from 2022 to 2050
- Average growth of consumption is 2.4% over the projection period
- Nonresidential fixed investment is projected to grow 2.7% per year from 2022 to 2050 in the AEO2023
- Growth of nonfarm business productivity averages 2.1% over the projection period

Summary of the Macroeconomic Activity Module (MAM) in the National Energy Modeling System (NEMS)



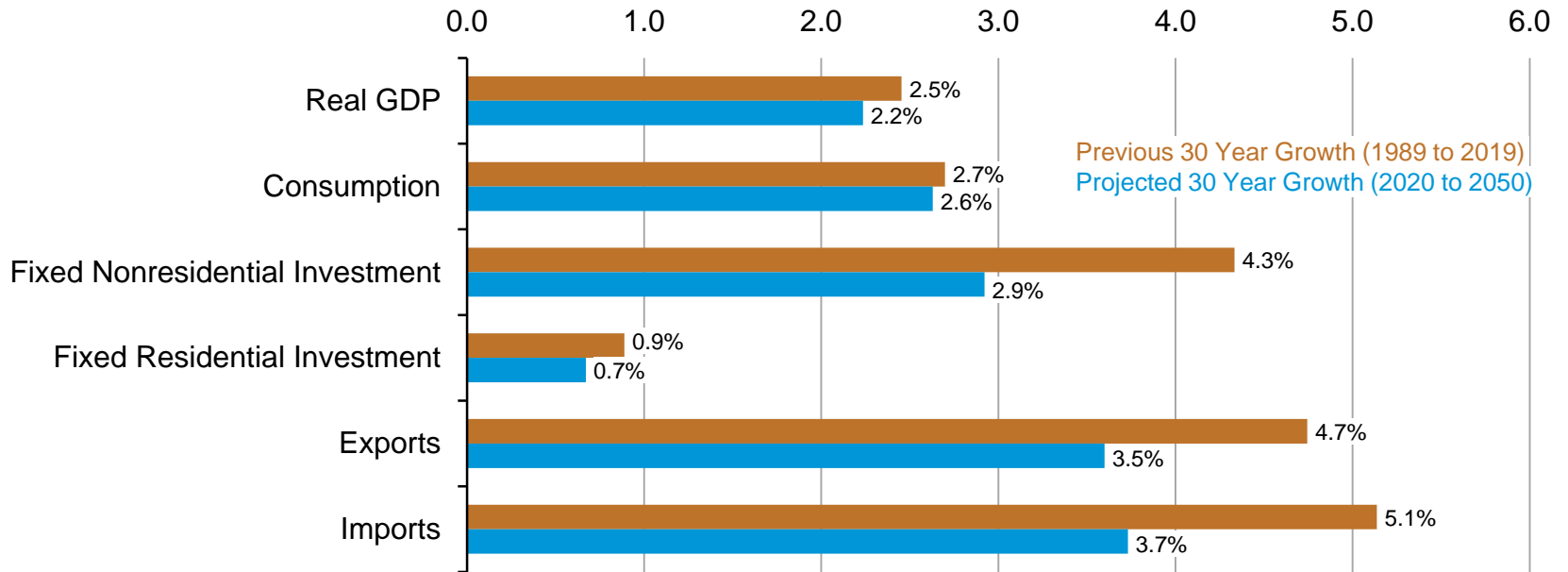
U.S. economy recovered in 2nd quarter of 2021 from 31.2% contraction in real GDP in the 2nd quarter of 2020

average annual percent growth



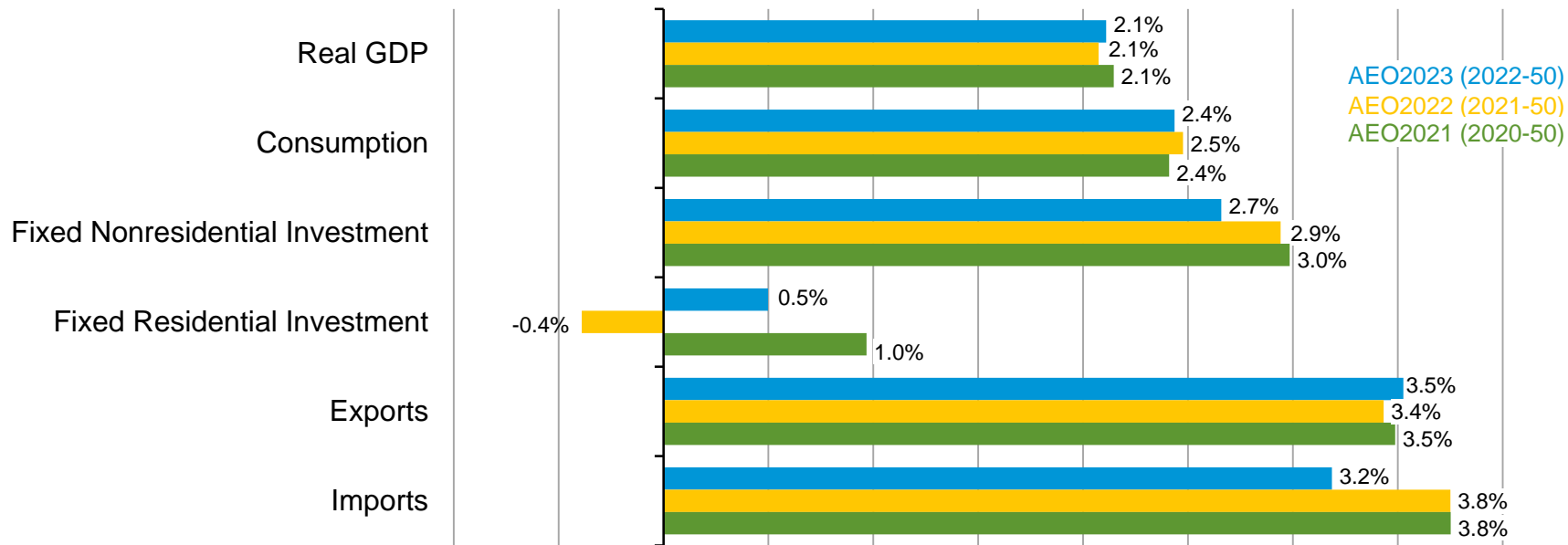
Growth of GDP and its components is slower in the AEO2023 projection as compared to history

average annual percent growth

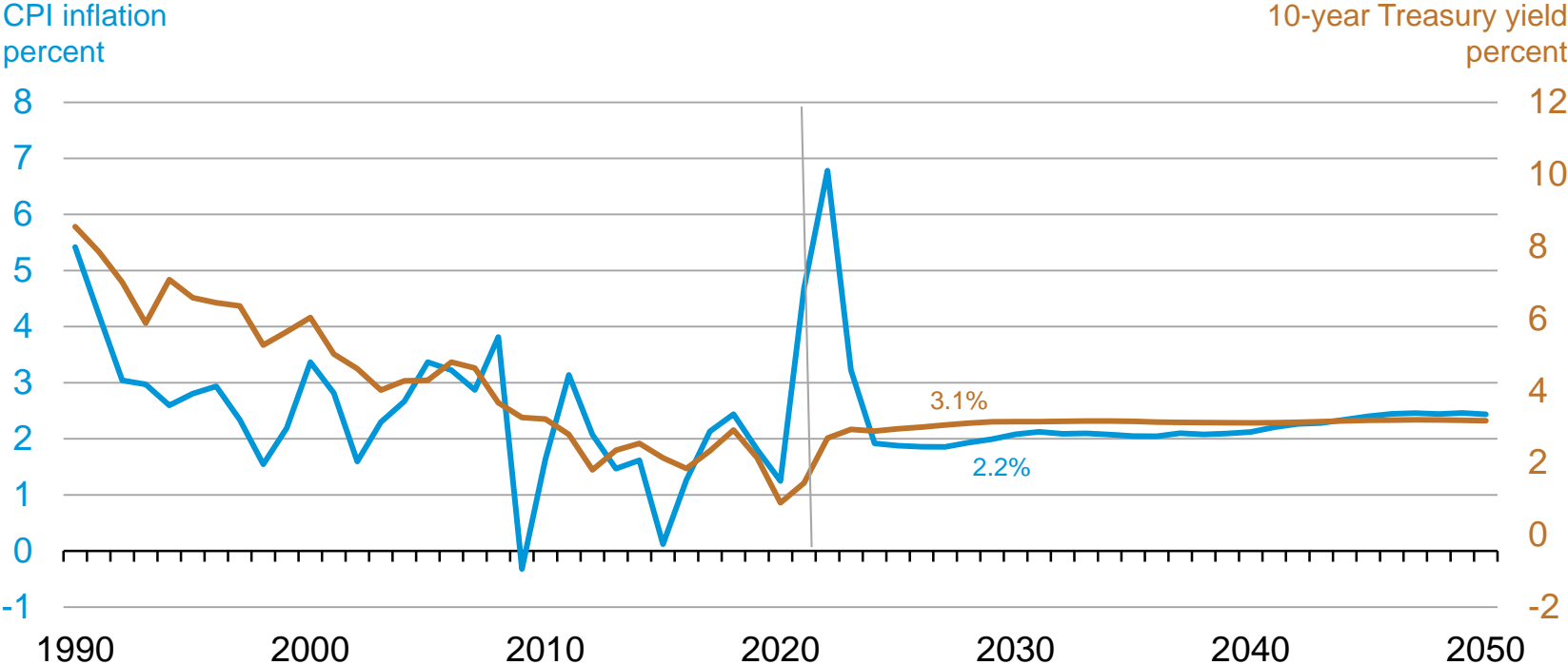


Preliminary AEO2023 projections are comparable to past AEOs

average annual percent growth

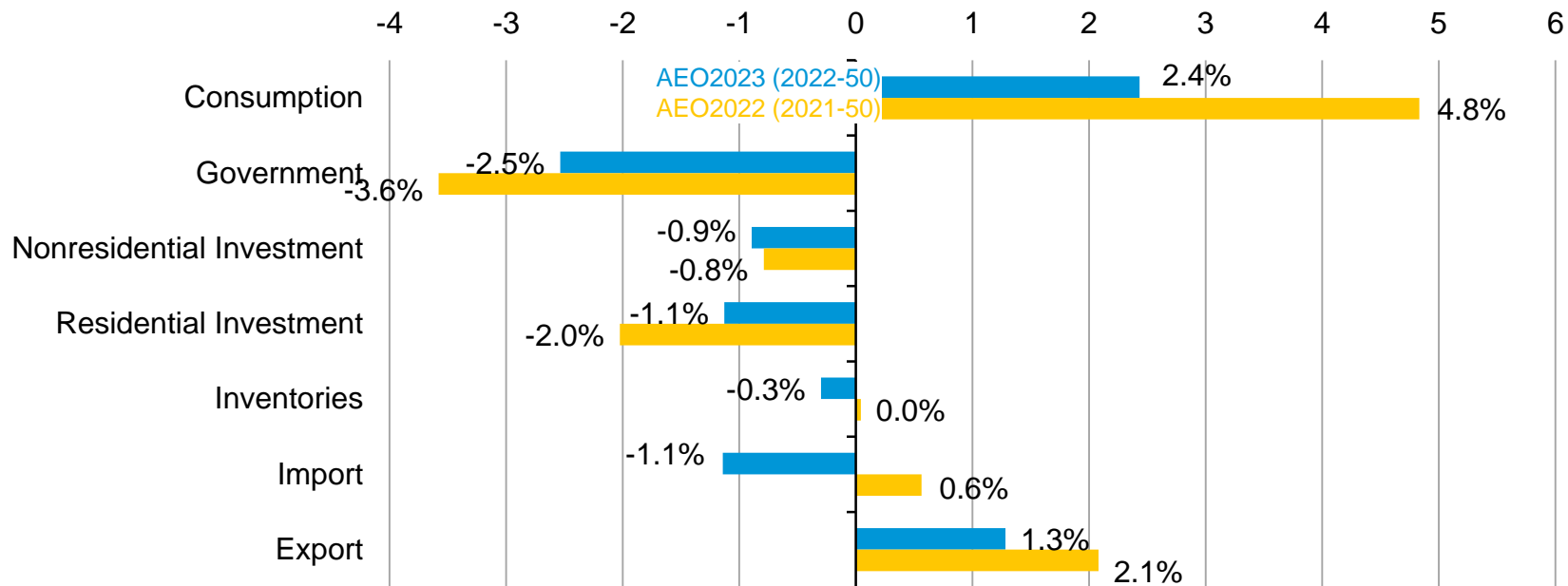


Near-term spike in inflation before moderating and bond yields gradually rise from historic lows



Consumption's share of the demand mix declines

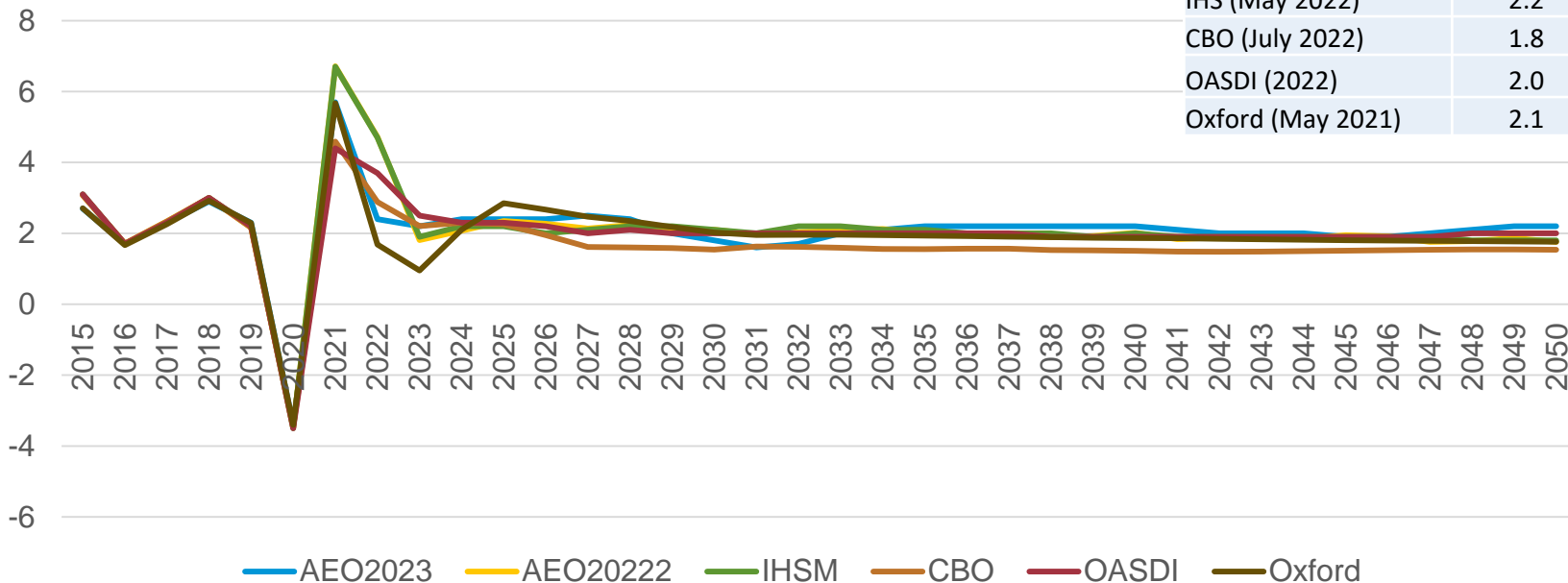
change in GDP share over projection period
percentage points



AEO2023 real GDP growth is similar to other projections

Projection	2020-50
AEO 2023	2.2
AEO 2022	2.2
IHS (May 2022)	2.2
CBO (July 2022)	1.8
OASDI (2022)	2.0
Oxford (May 2021)	2.1

annual average growth in real GDP



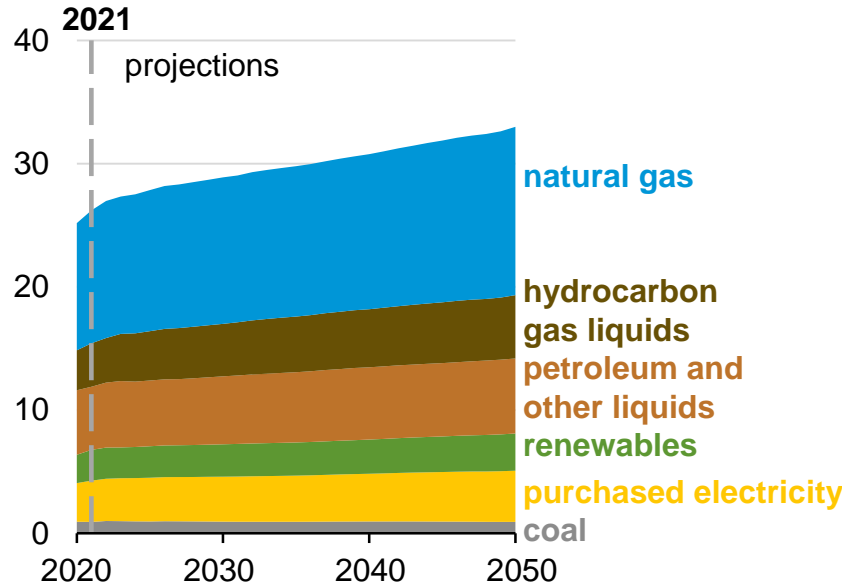
Macroeconomic Module changes for AEO2023

- Update of IHS Markit US macroeconomic model
- Update of Commercial Floor Space data and model

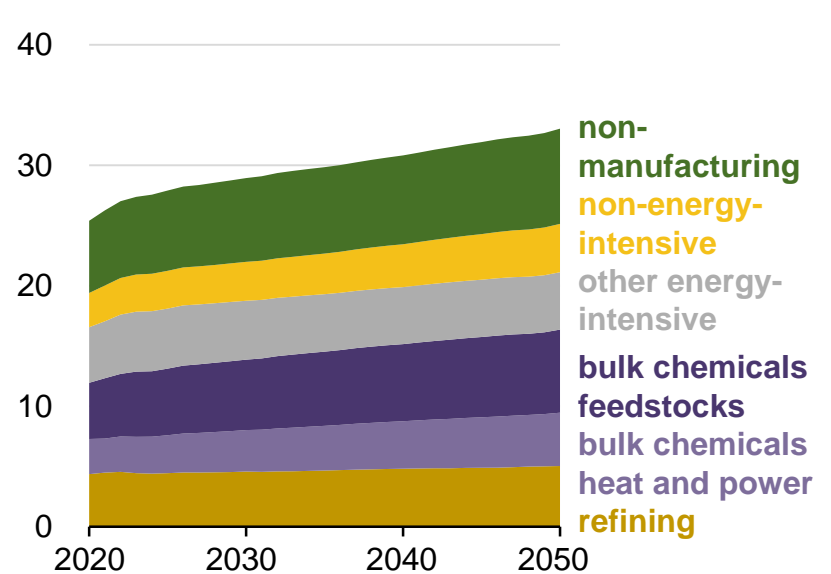
Review of AEO2022 industrial results

AEO2022 Reference case industrial sector energy consumption by fuel and sector

Industrial energy consumption by fuel
AEO2022 Reference case
 quadrillion British thermal units



Industrial energy consumption by subsector
AEO2022 Reference case
 quadrillion British thermal units

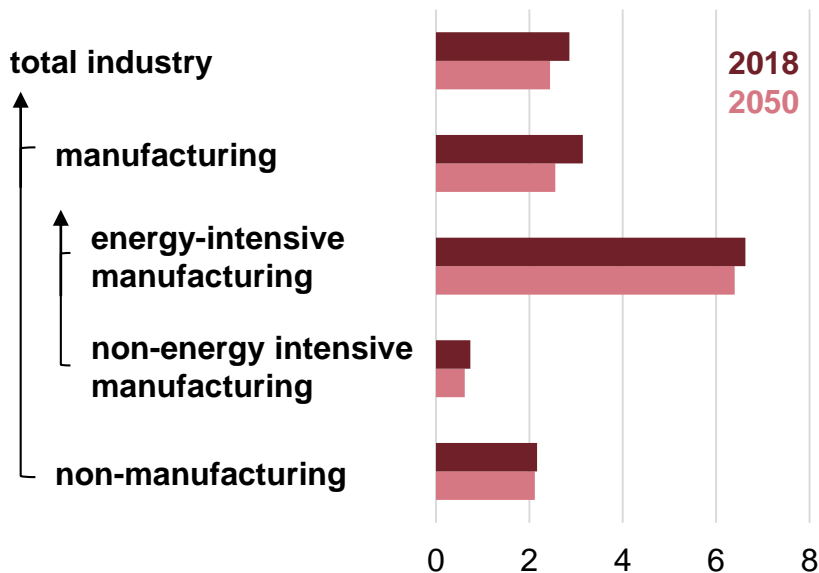


AEO2022 Reference case industrial sector energy intensity

Energy intensity by subsector

AEO2022 Reference case

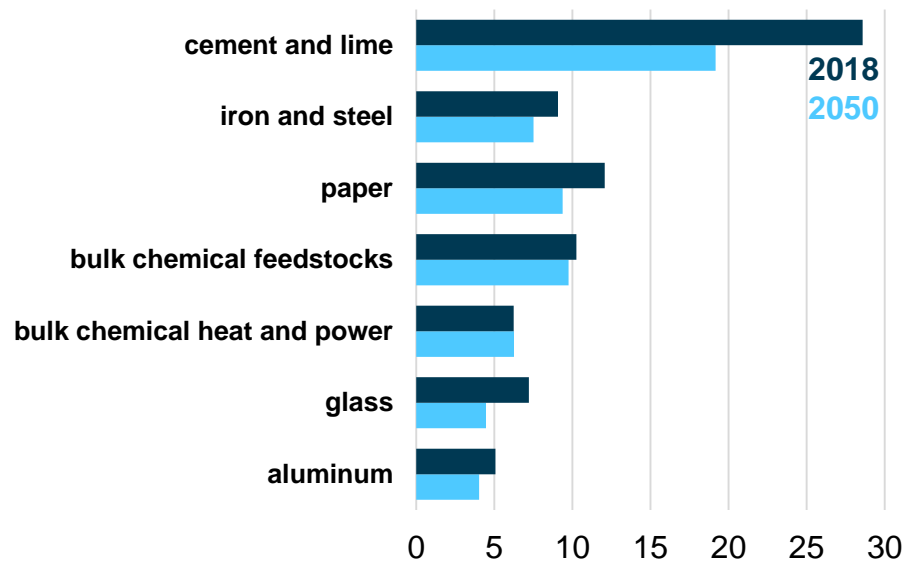
trillion British thermal units per billion 2012 dollar shipments



Energy-intensive manufacturing by industry

AEO2022 Reference case

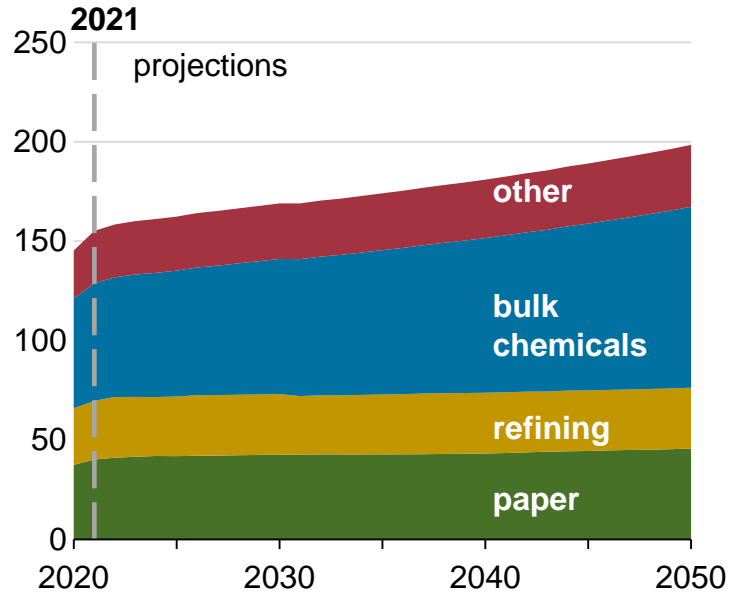
trillion British thermal units per billion 2012 dollar shipments



AEO2022 Reference case industrial sector combined-heat-and-power (CHP) generation

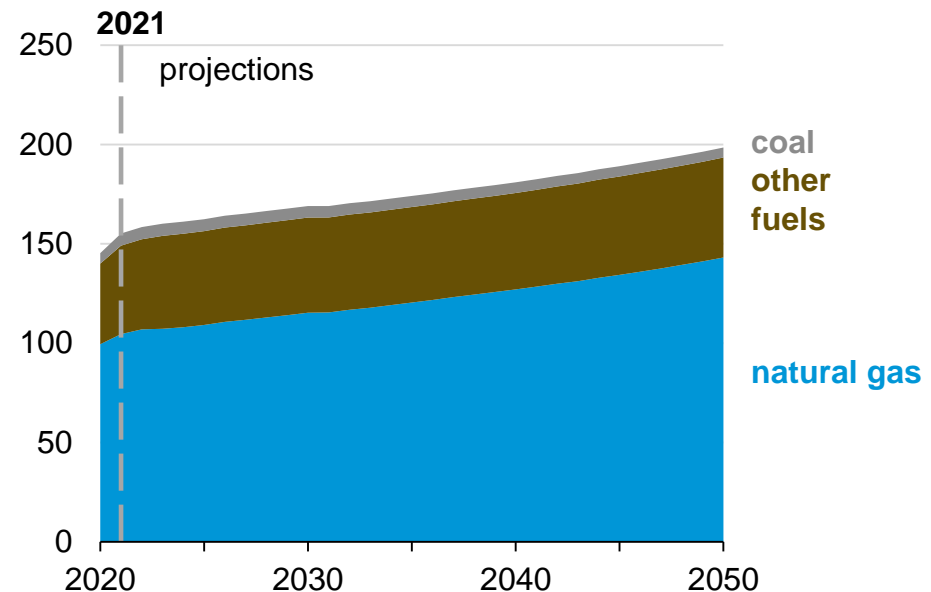
CHP generation by industry
AEO2022 Reference case

billion kilowatthours



CHP generation by fuel
AEO2022 Reference case

billion kilowatthours



Note: Other fuels includes renewables and other petroleum.

AEO2023 industrial updates

AEO2023 major updates for industrial—current status

- Use industry-level data from EIA's *Quarterly Coal Report* to benchmark steam coal use by manufacturing industry (completed)
- Modify cement fuel use, including by assuming no new coal-fired capacity (completed)
- Make the iron and steel industry furnace technology choice more sensitive to fuel price (completed)
- Break out balance of manufacturing into four separate industries (in progress)
- Add electric boilers as a technology choice (in progress)
- Publish cement and lime process emissions (in progress)

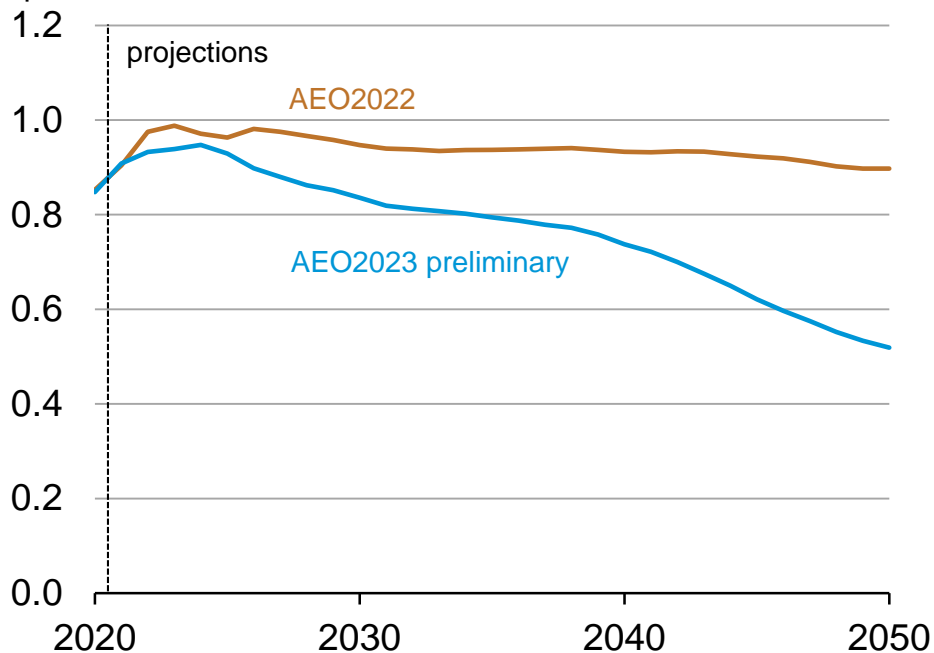
Potential changes resulting from the Inflation Reduction Act

- Combined-heat-and-power tax credits extended through the end of 2024 (completed)
- Clean hydrogen production credits (not in AEO2023 but will be reflected once NEMS implements a hydrogen module)
- Enhancement to carbon capture, utilization, and storage (CCUS) tax credits (not in AEO2023, but will be reflected once NEMS implements CCUS)
- \$5.8 billion in financial assistance for clean energy investment for energy-intensive industries (not in AEO2023 but will review for potential inclusion in future AEOs)

Industrial coal consumption is lower in AEO2023

- Decrease in steam coal consumption from:
 - *Quarterly Coal Report* benchmarking
 - New assumption that no new coal-fired cement kilns will be built
- Decrease in met coal consumption because steel submodule changes increase use of electric arc furnaces and decrease use of basic oxygen furnaces

Total industrial coal consumption
quadrillion British thermal units



Note: Graph includes steam coal and met coal consumption

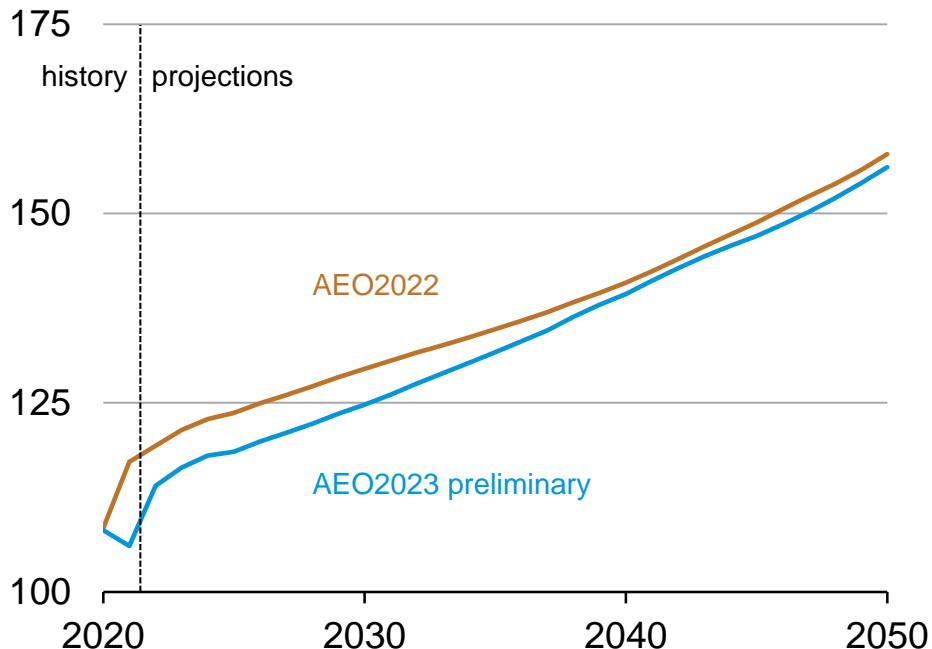
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*, *Annual Energy Outlook 2023* preliminary run

Combined heat and power (CHP)

- Changes primarily from preliminary historical data update (still subject to change)
- Inflation Reduction Act extends CHP investment tax credit through 2024, but also allows for bonus credits
 - Baseline credit: 10% (used in AEO2023)
 - If meet wage & apprenticeship requirements: 30%
 - If meet domestic content requirements: +8%
 - If sited in an energy community: +8%
- Bonus credits *not* in AEO2023; do any of you plan to take advantage of them?

Combined-heat-and-power electricity generation

billion kilowatthours



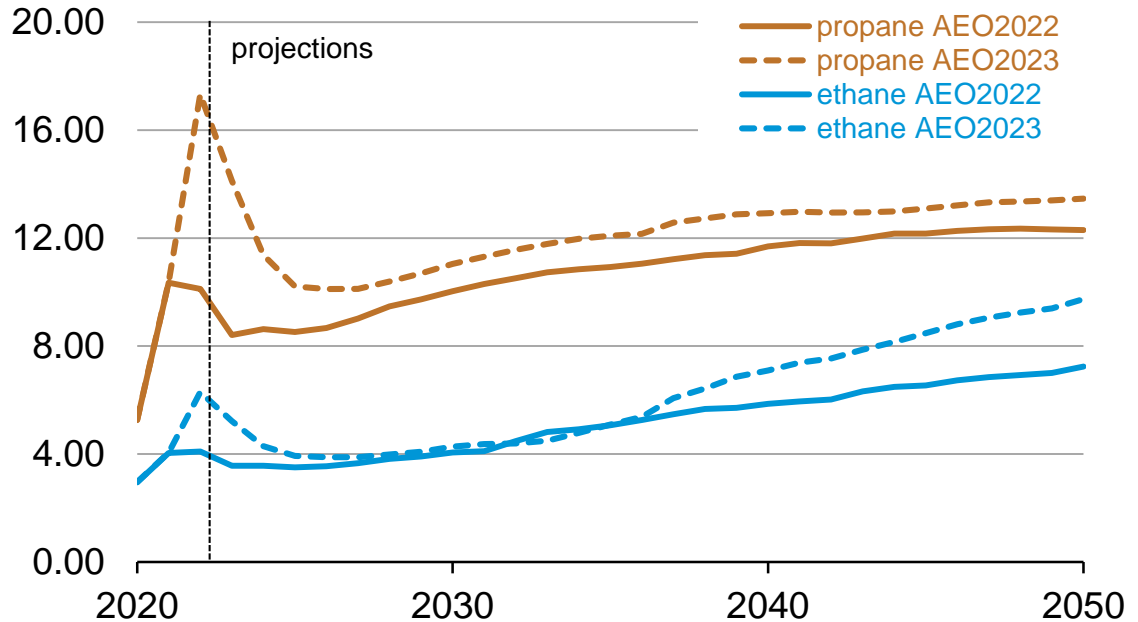
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*, *Annual Energy Outlook 2023* preliminary run

Updated ethane and propane prices projection

- Prices spike in the short term following disruptions in the oil and natural gas markets
- Prices remain higher in the long term compared to last year
- All ethane produced will go to domestic ethylene cracking by about 2030 (no more exports), resulting in higher ethane

Ethane and propane price

2021 dollars per million British thermal units



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022*, *Annual Energy Outlook 2023* preliminary run

Longer-term modeling and data enhancements

- Update technology parameters for process flow industries (iron & steel, cement & lime, pulp & paper, aluminum, and glass)
- Enhance parts of chemical industry (greater detail, prepare to track hydrogen)
- Consider more process emissions (bulk chemicals, iron & steel, others?)
- Benchmark electricity by industry to data from the Annual Survey of Manufactures
- Add more low-carbon functionality (hydrogen, electrification, carbon capture)
- Restructure the industrial module more broadly: convert some parts into Python, allow for more systematic data importation from annual data sources

Questions or comments?

AEO economic activity and STEO macroeconomic projections

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