



14

IEA IEF OPEC
Symposium on
Energy Outlooks



Outlooks Comparison Report

February 2024

Overview

- High-Level Messages
- Historical Baseline Data Comparability
- Short-Term Outlooks to 2025
- Medium-Term Outlooks to 2030
- Long-Term Outlooks to 2045
- IEA and OPEC Outlooks in Context

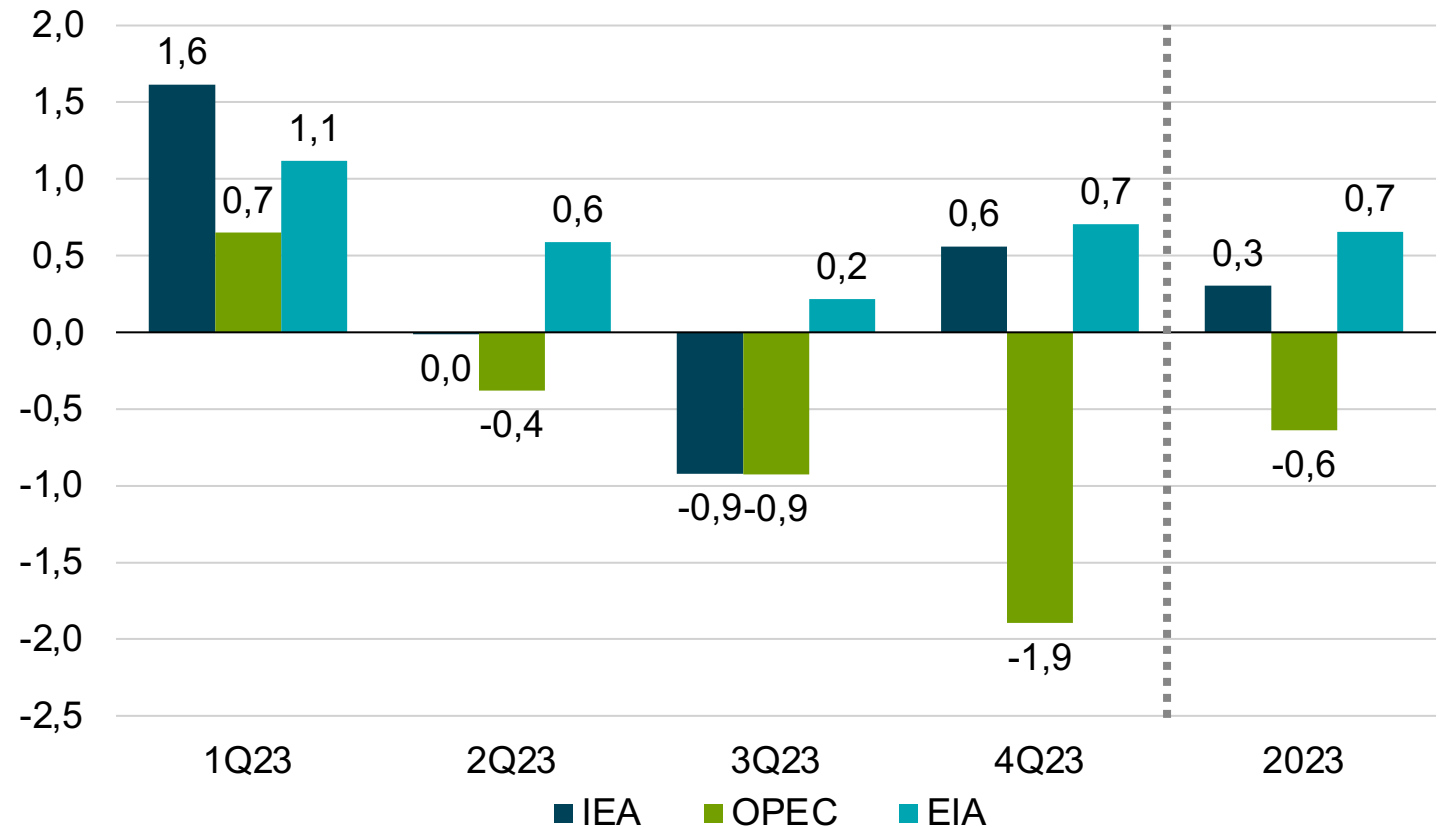
IEA-IEF-OPEC trilateral program bolsters energy data transparency, market stability, trade and investment

1. Greater transparency of energy outlook methodologies, assumptions, and data comparability enables policy and investment decisions to restore market stability, facilitate transitions and bridge divisions.
2. Unprecedented levels of investment and cooperation across governments and energy and technology sectors are needed to achieve climate goals and ensure accessible and affordable energy for all.
3. **Better baseline data comparability, Clear model assumption descriptions, and a Probability ranking of scenarios** enhances the utility of outlooks for real world policy and investment decisions.

2023 has come to an end, but oil balances still show large divergences

A 1.3 mb/d range for 2023 and is more than three times greater than the range in estimates for 2022 (a 0.4 mb/d gap).

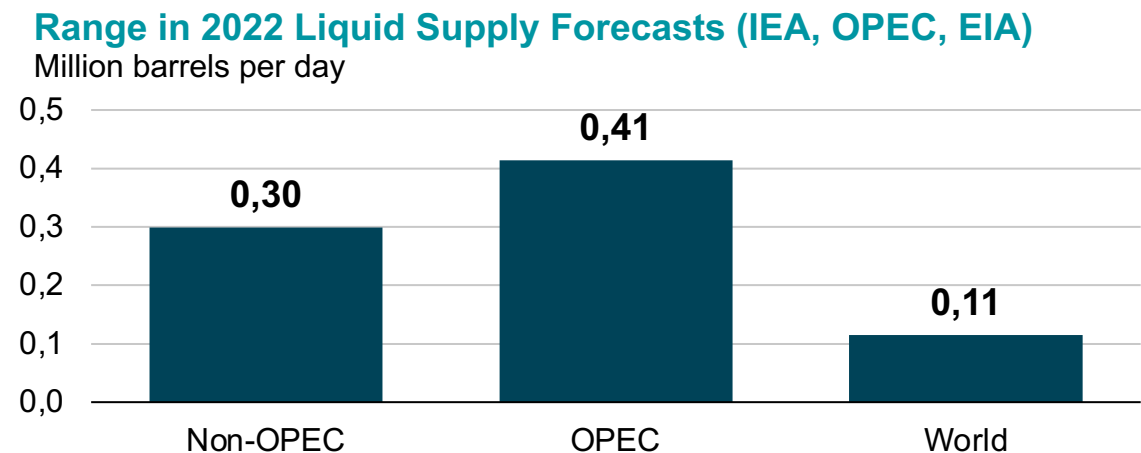
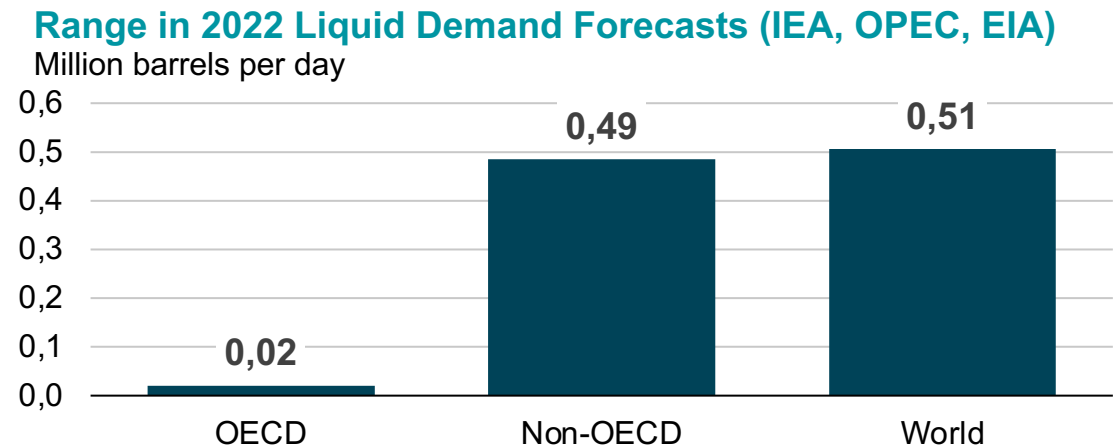
2023 Global Liquids Stock Change
million barrels per day



Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

Divergences still exist in historical liquids baseline data – particularly for non-OECD demand and OPEC supply estimates

- Comparability of baseline historical data is the first step toward enhancing comparability of outlooks.
- **IEA and OPEC have made significant progress in making data comparable, but some issues still exist:**
 - In the classification of bunker fuels, biofuels, and some other products.
 - While OPEC includes biofuels in each region's total liquids supply, IEA only includes global biofuels supply separately.



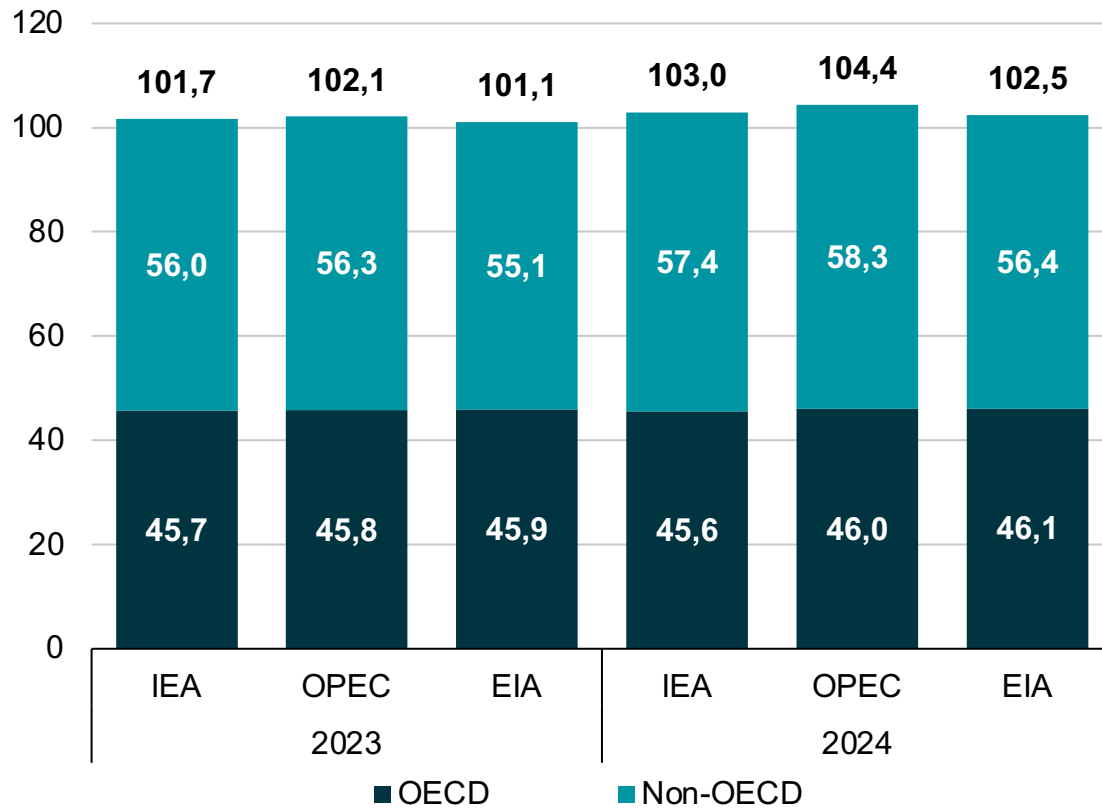
IEA and OPEC Outlooks to 2025

Demand forecast divergences continue into 2024 where growth forecasts diverge by 1.0 mb/d and levels diverge by 1.4 mb/d

The largest range in demand forecasts are in China and the Middle East

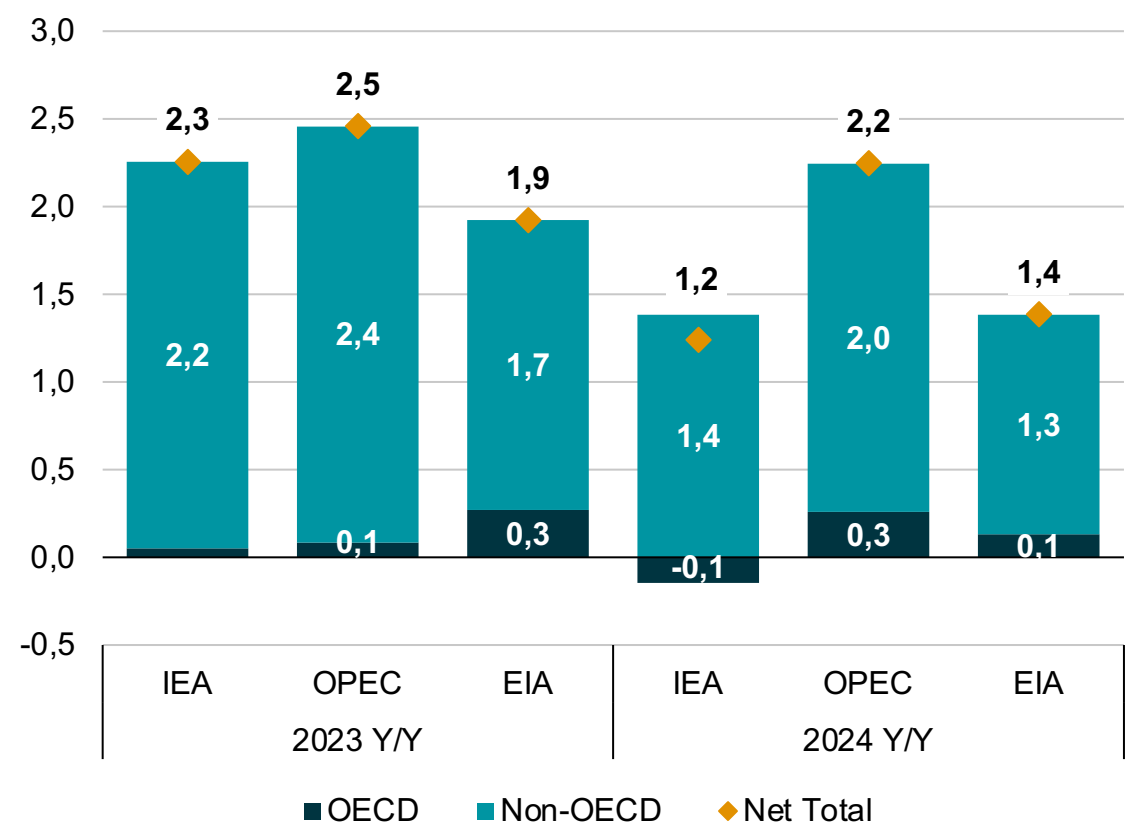
2023 & 2024 Liquid Demand Forecasts By Agency

Million barrels per day



2023 & 2024 Y/Y Demand Growth By Agency

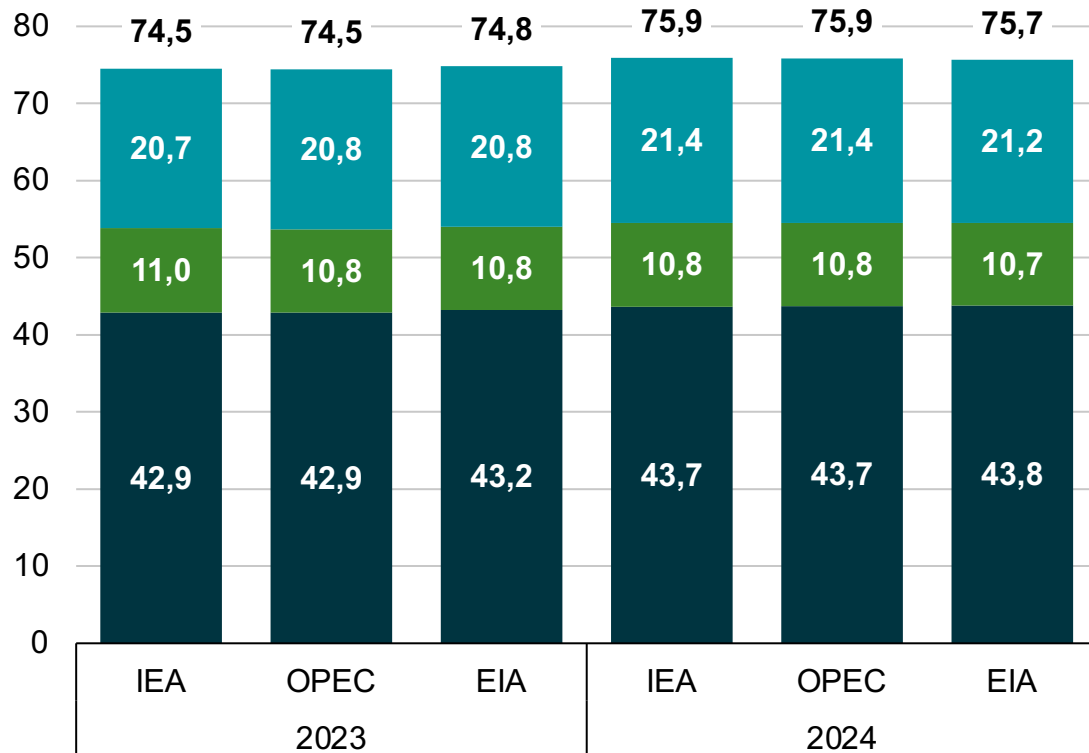
Million barrels per day



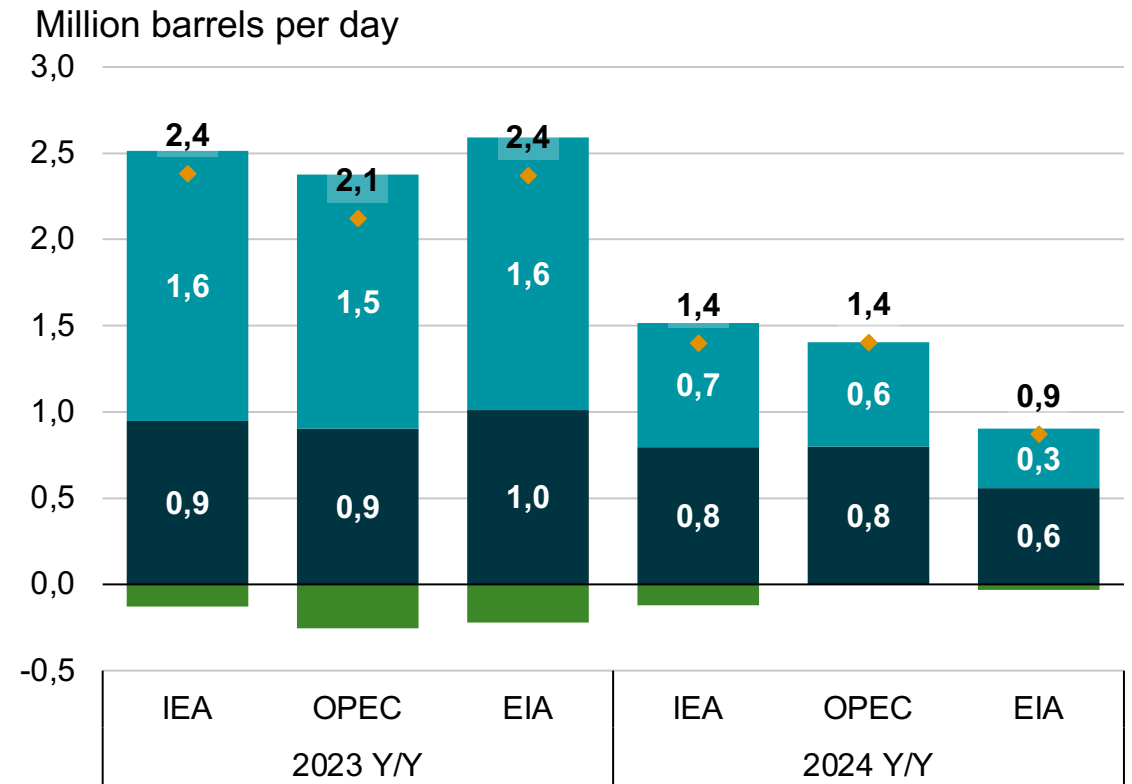
Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

Non-OPEC supply growth is set to slow significantly in 2024 as US supply growth falls by more than 50% y-on-y

2023 & 2024 Non-OPEC and OPEC NGLs Supply Forecasts
Million barrels per day



2023 & 2024 Non-OPEC and OPEC NGLs Supply Growth Forecasts
Million barrels per day



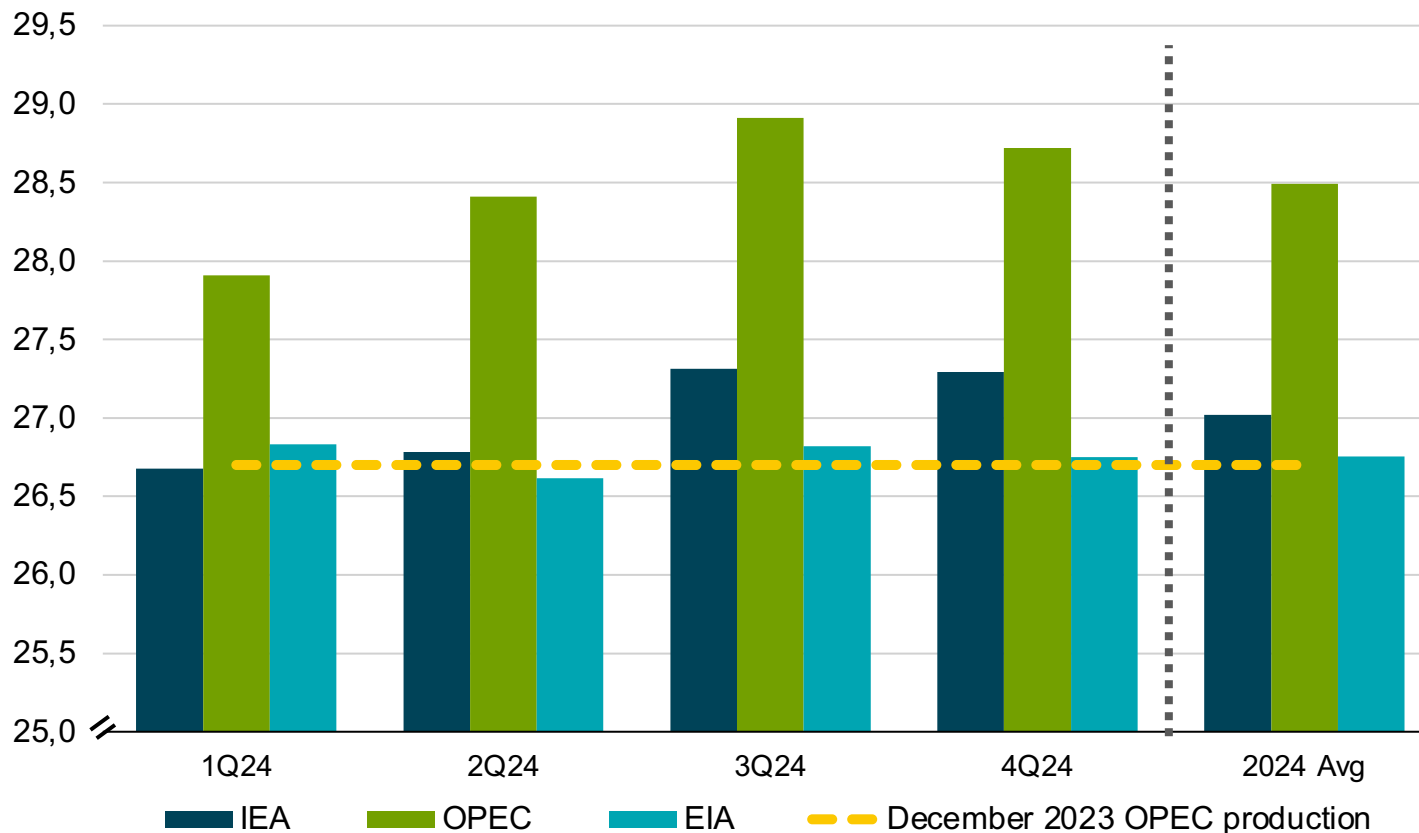
■ Other Non-OPEC, OPEC NGLs, & Processing Gains ■ Russia ■ US

■ US ■ Russia ■ Other Non-OPEC, OPEC NGLs, & Processing Gains ◆ Net Total

Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

OPEC sees a much higher “call on OPEC” in 2024 vs. IEA due to a more robust demand outlook

2024 Call on OPEC and Recent OPEC Production Levels
million barrels per day



- OPEC sees a 1.5 mb/d higher call on OPEC this year vs. IEA primarily due to its higher global demand forecast (104.4 mb/d vs. IEA's 103.0 mb/d).

Source: IEF, IEA OMR, EIA STEO, OPEC MOMR

IEA and OPEC Outlooks to 2030

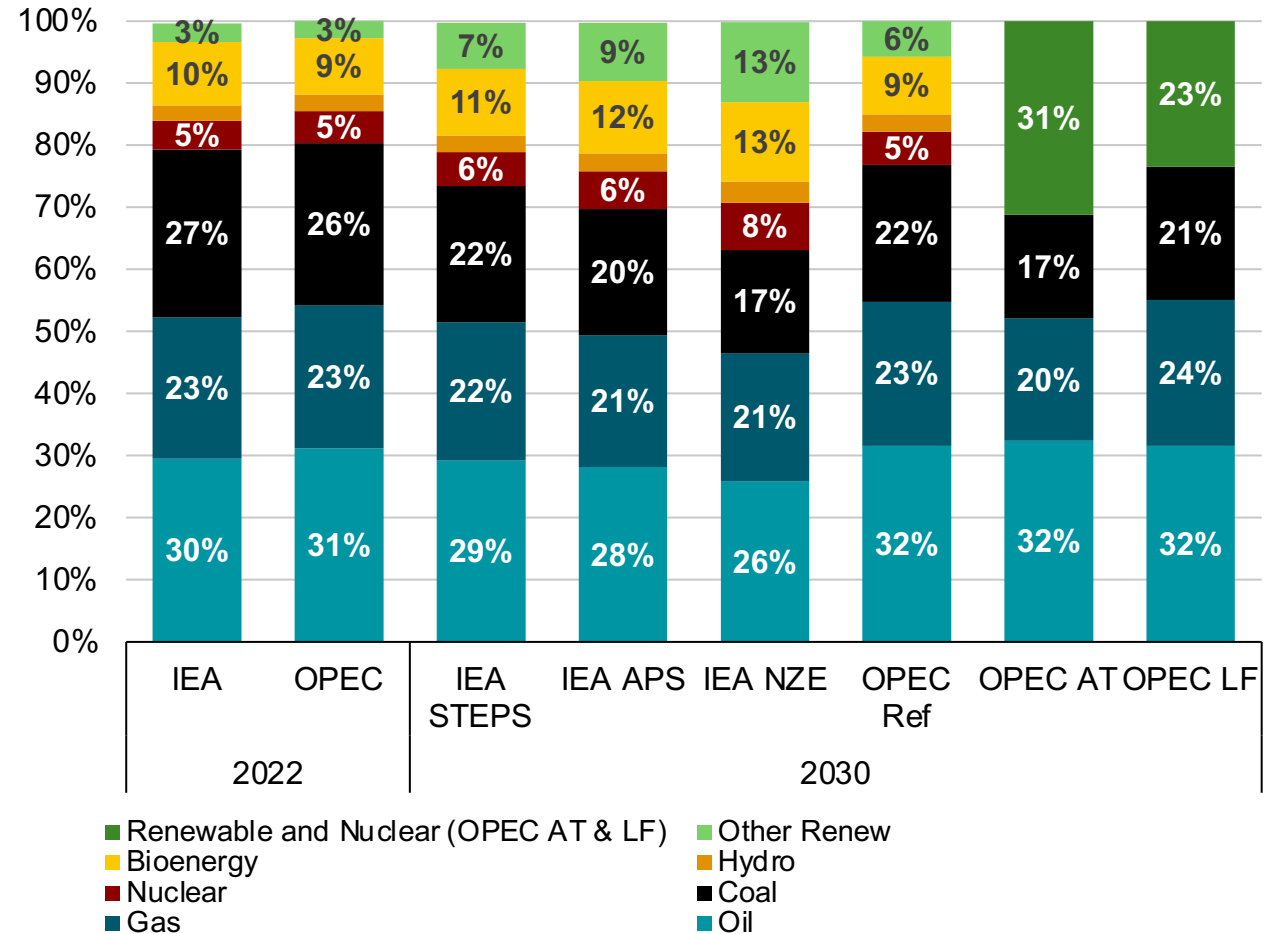
2030 IEA & OPEC Outlook Highlights:

- Paris-aligned scenarios (IEA NZE, APS and OPEC AT) show a one to nine percent drop in primary energy demand by 2030, with the largest decline occurring in coal demand. This is different from last year's assessments where IEA's APS scenario still showed a small *increase* in primary demand to 2030.

- **Oil demand** increases between 2022 and 2030 in four of the six scenarios led by growth in non-OECD countries.
- **Natural gas demand** grows to 2030 in three of the six scenarios and is driven by non-OECD countries.
- **Coal demand** is expected to fall in all scenarios. The size of the decline ranges from six percent (in OPEC Reference Case) to 44 percent in IEA's NZE scenario. Declines are expected in both OECD and non-OECD countries.
- **Renewable, hydro, biomass, and nuclear** are expected to grow by a total of 31 to 63 percent by 2030 in all six scenarios.

World Primary Energy Fuel Share Outlook to 2030

Percent of total primary energy



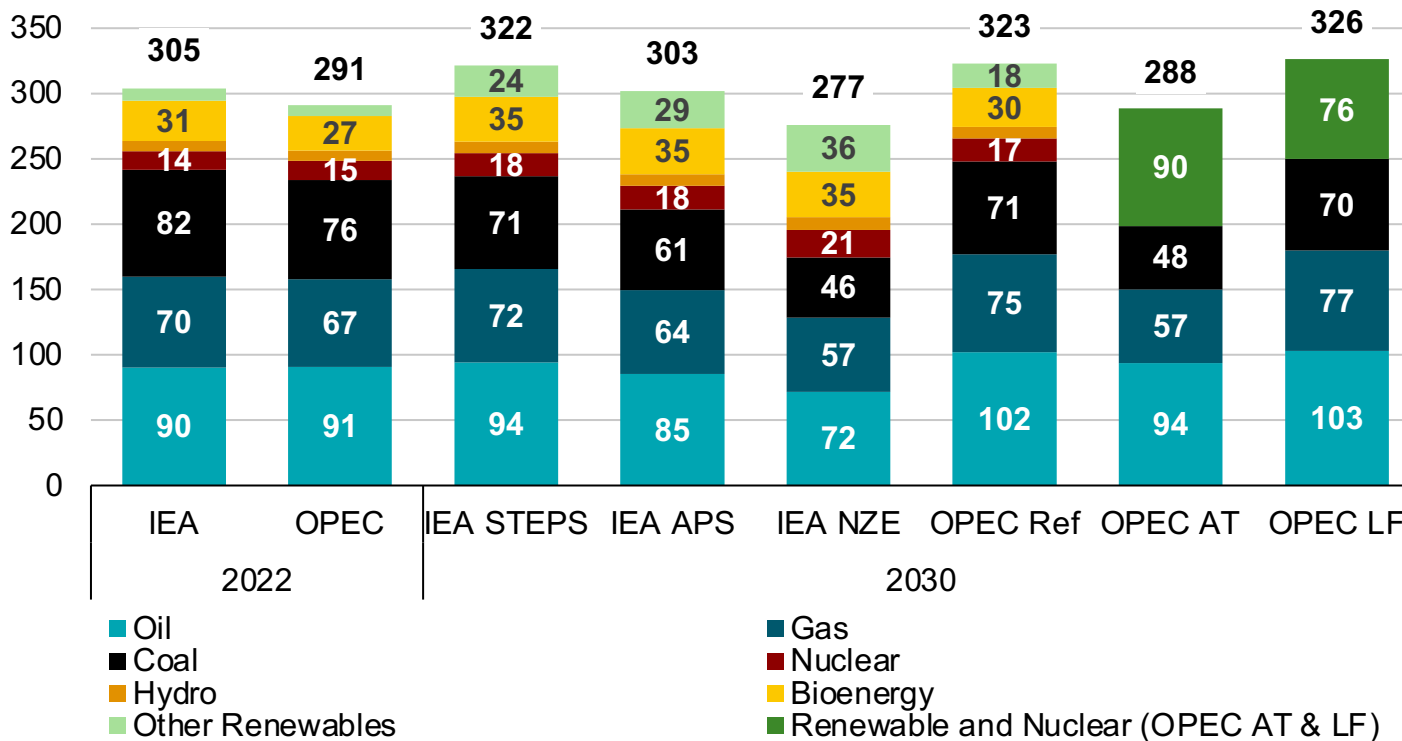
Source: IEF, IEA WEO 2023, OPEC WOO 2023

Reference scenarios show primary energy demand growing between 2022 and 2030

Renewable energy is set to more than double in most scenarios, but fossil fuels will still account for 63-77% of total primary demand in 2030

World Primary Energy Outlook to 2030

Million barrels of oil equivalent per day



- Oil demand is seen increasing in all scenarios except IEA NZE and APS.
- Only IEA's NZE sees a substantial (9%) fall in global primary energy between 2022 and 2030.
- OPEC AT and IEA APS show a slight increase in total primary energy.
- IEA STEPS is most similar to OPEC Reference Case and LF, although STEPS sees stronger renewable demand than both OPEC scenarios.
- Coal demand is expected to fall in all scenarios. The size of the decline ranges from 5% (in OPEC Reference and LF scenarios) to 46% in IEA's NZE.

Source: IEF, IEA WEO 2023, OPEC WOO 2023

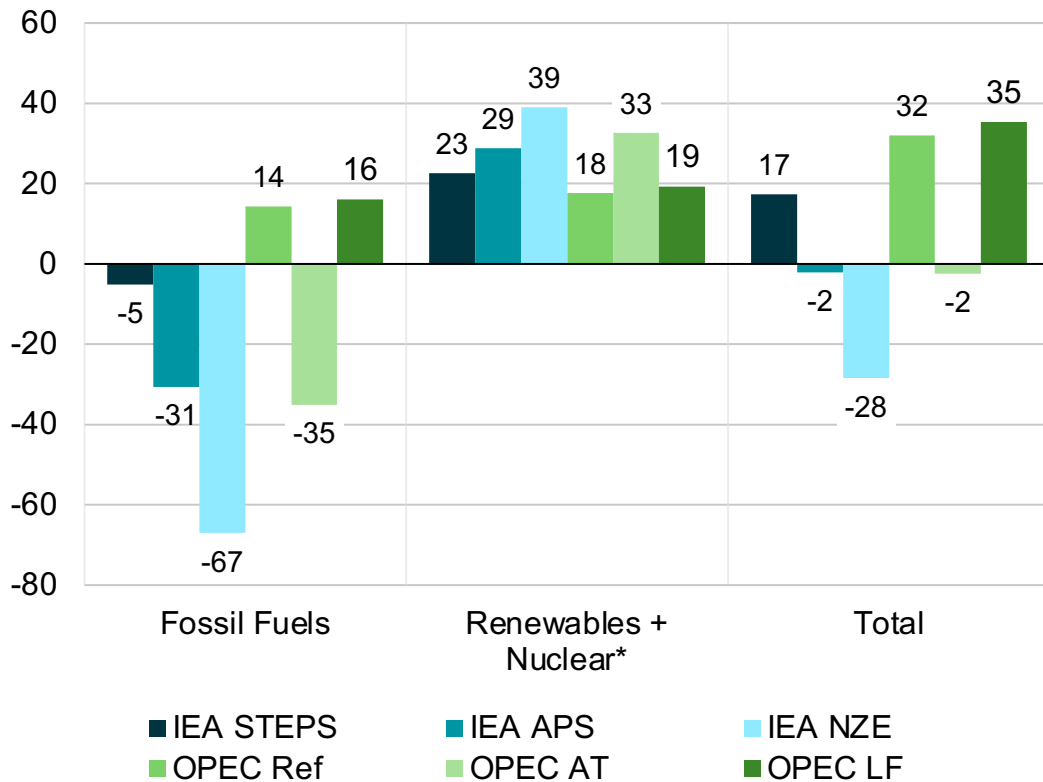
*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids

All scenarios see renewables + nuclear growing by >30% between 2022 and 2030

Only OPEC Reference Case and Laissez-Faire show fossil fuel demand growing between 2022 and 2030

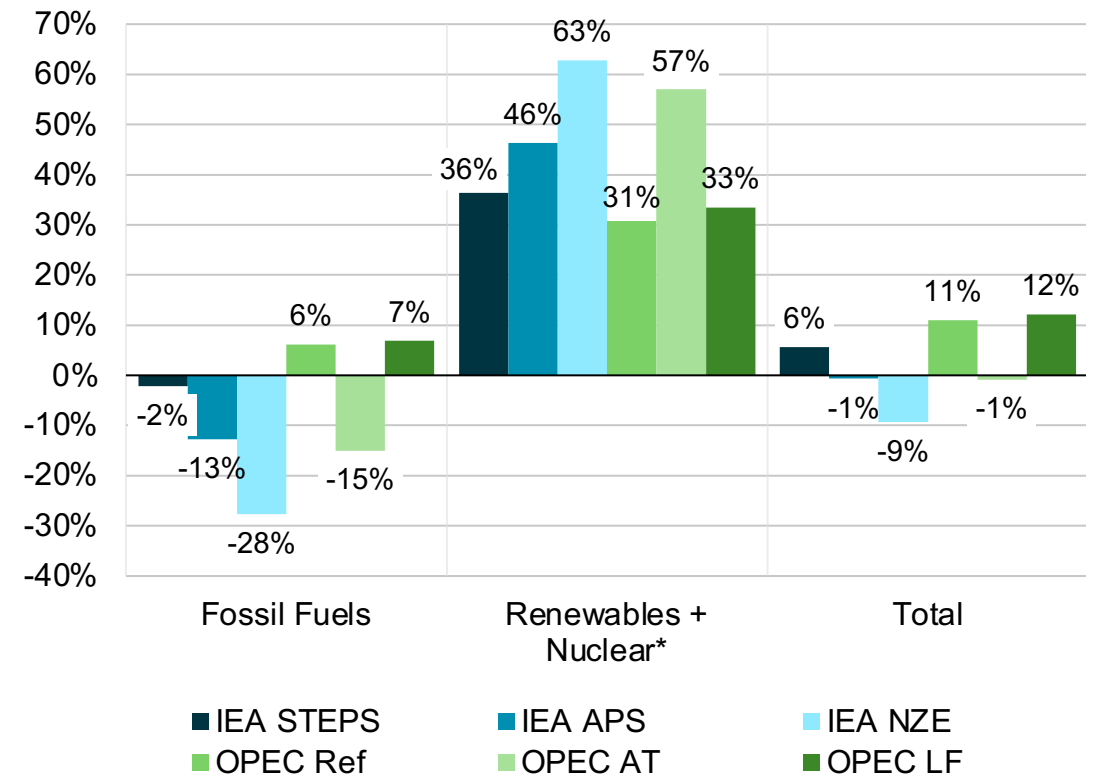
Change in World Primary Energy by Source: 2030 vs 2022

Million barrels of oil equivalent per day



World Primary Energy 2030 vs. 2022

% change from 2022



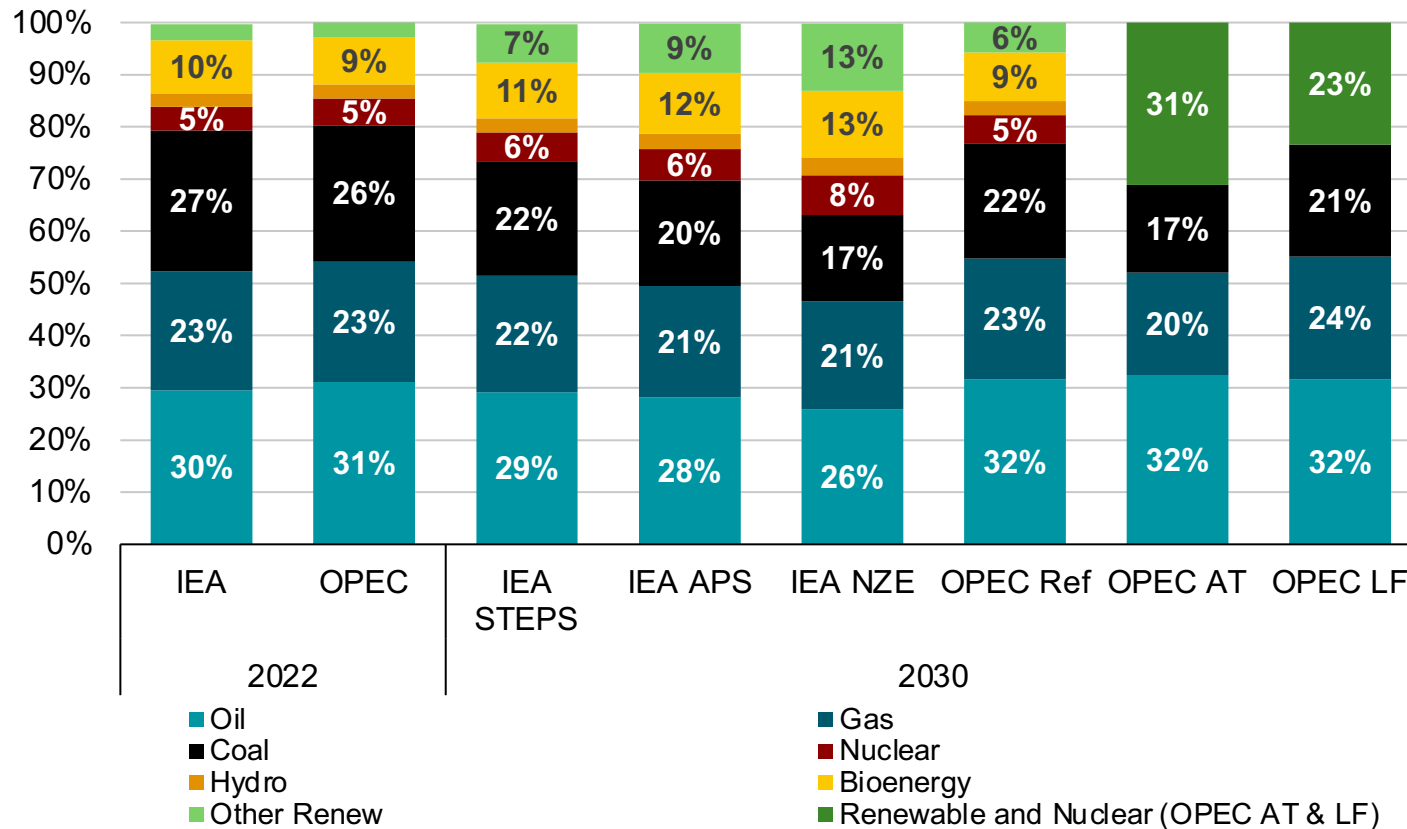
Source: IEF, IEA WEO 2023, OPEC WOO 2023

* Renewables + Nuclear includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios.

Fossil fuels will still account for 63-77% of total primary energy demand in 2030 (vs. ~80% in 2022)

World Primary Energy Fuel Share Outlook to 2030

Percent of total primary energy



- Oil's share of total primary energy demand is expected to grow in the three OPEC scenarios and shrink in the three IEA scenarios.
- Nuclear's share of primary energy demand is expected to grow in the three IEA scenarios and remain flat in the OPEC Reference Case (OPEC AT and LF scenarios only report nuclear demand aggregated with renewables).
- **Renewable demand (excluding hydro and bioenergy) is expected to more than double in all IEA scenarios and OPEC Reference Case.**

Source: IEF, IEA WEO 2023, OPEC WOO 2023

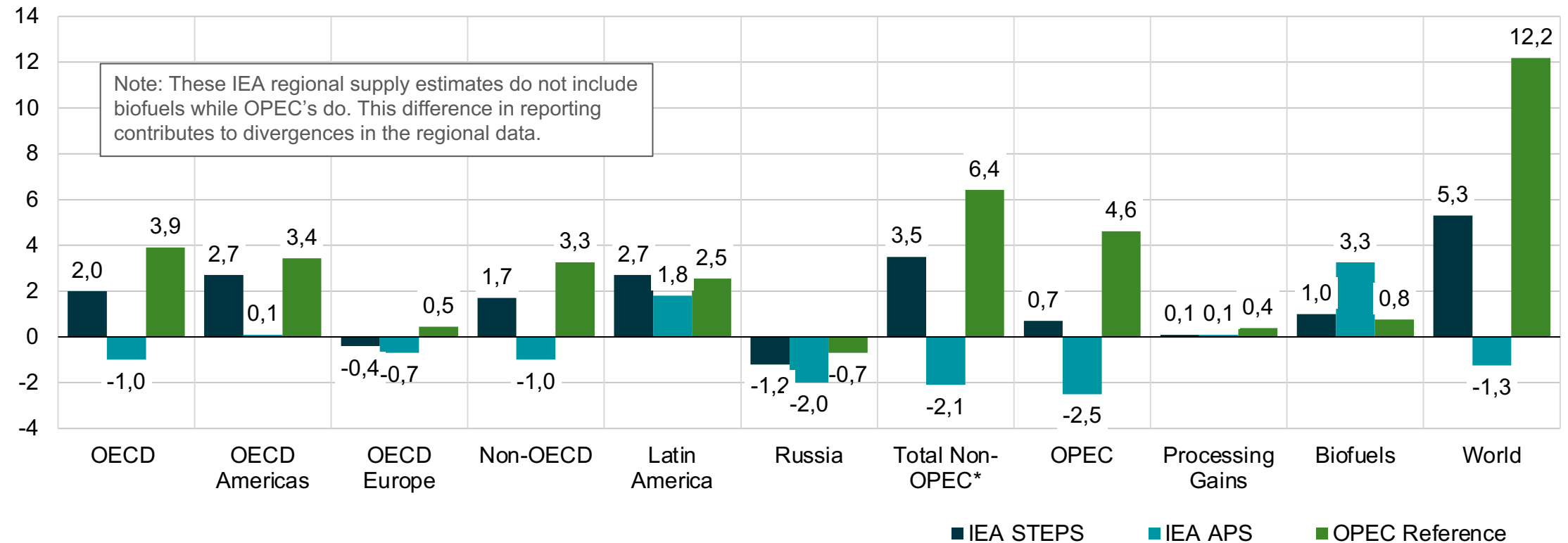
*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids

OPEC Reference Case sees >2x stronger non-OPEC supply growth and >6x stronger OPEC production than IEA STEPS

IEA APS sees strong biofuels growth but declines in non-OPEC and OPEC production

Liquids Supply by Source: 2030 vs. 2022

Million barrels per day



Source: IEF, IEA WEO 2023, OPEC WOO 2023

*Total non-OPEC excludes processing gains and biofuels

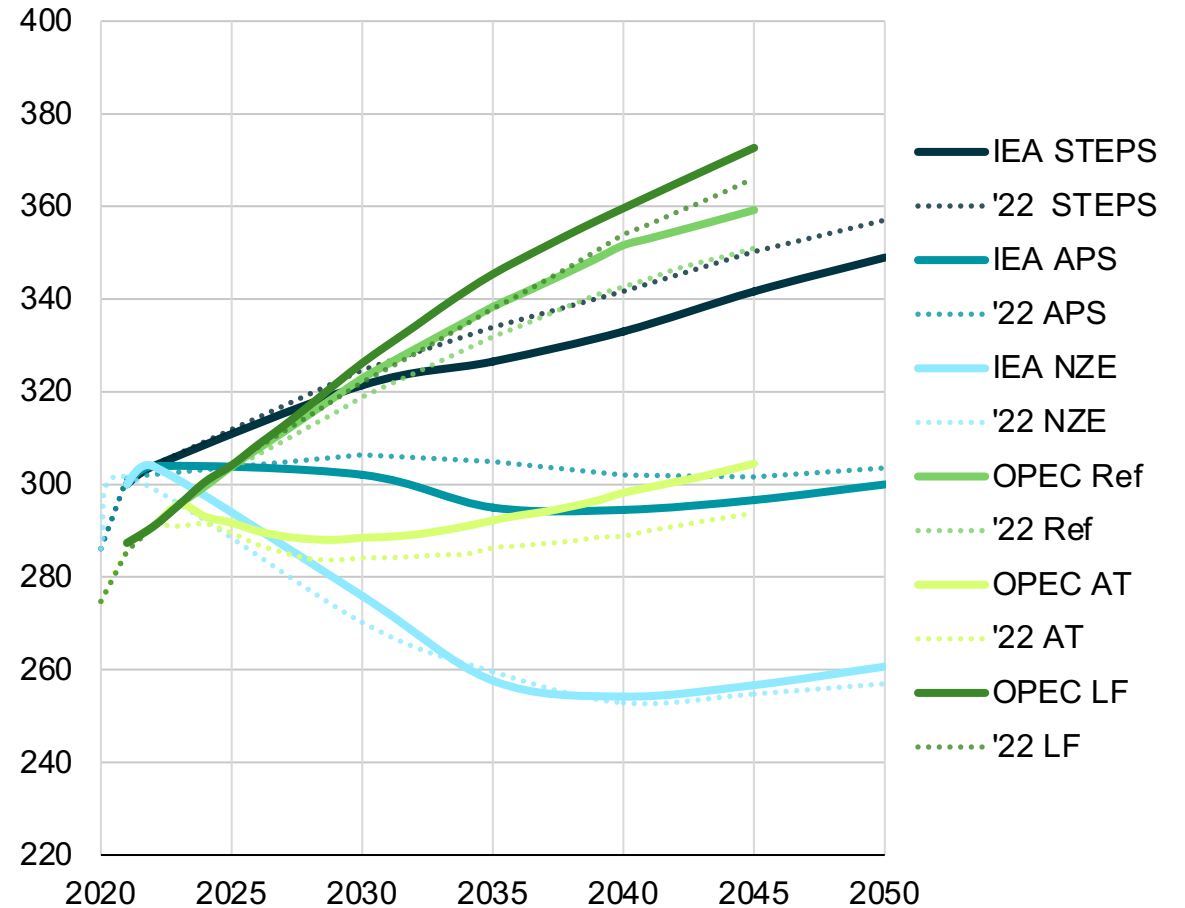
IEA and OPEC Outlooks to 2045

2045 IEA & OPEC Outlook Highlights:

- IEA and OPEC scenarios moved further apart this year as primary energy demand in OPEC scenarios were revised upward and IEA scenarios were generally revised downward.
- Renewable, hydro, biomass, and nuclear are expected to grow by a total of 95 to 224 percent by 2045 in all six scenarios.
- Liquids production rises by 16 mb/d between 2022 and 2045 in OPEC Reference Case and with 74 percent of the growth coming from OPEC countries as US liquid production falls below 2022 levels.

Global Primary Energy Demand Outlook

Million barrels of oil equivalent per day



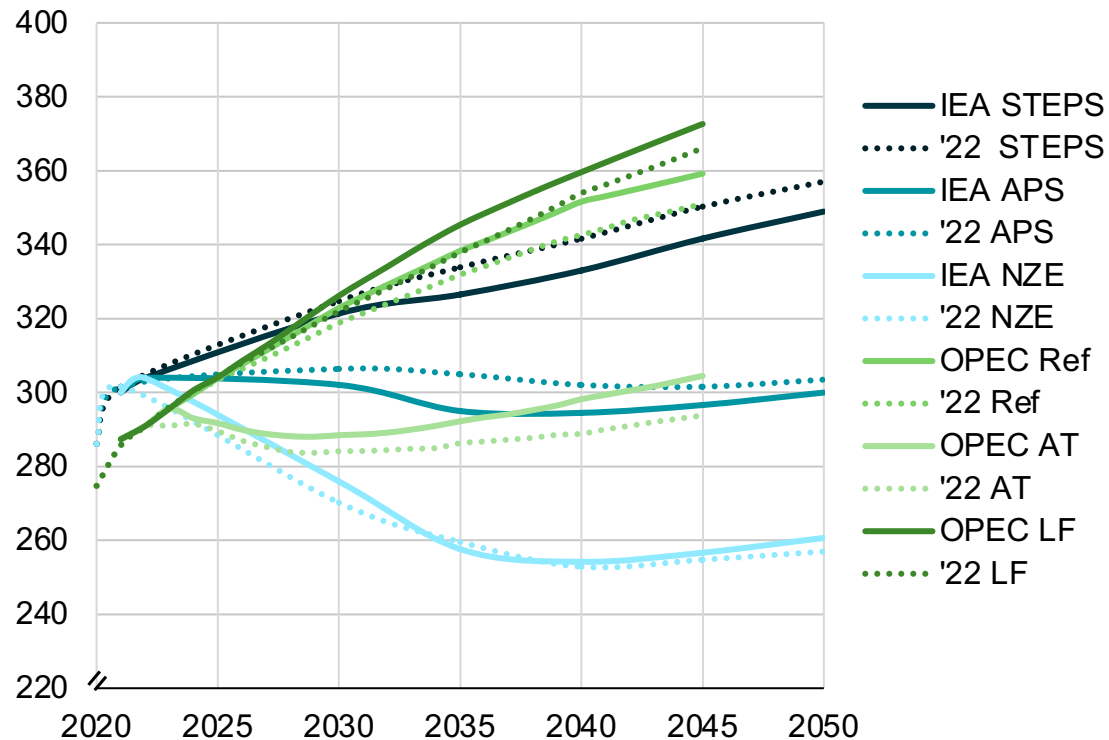
Source: IEF, IEA WEO 2023, OPEC WOO 2023

Half of the scenarios see robust growth (+12% to 28%) in primary energy between 2022 and 2045

OPEC scenarios for 2045 primary energy were revised higher by 7-11 mboe/d this year while IEA STEPS and APS were revised lower by 5-9 mboe/d

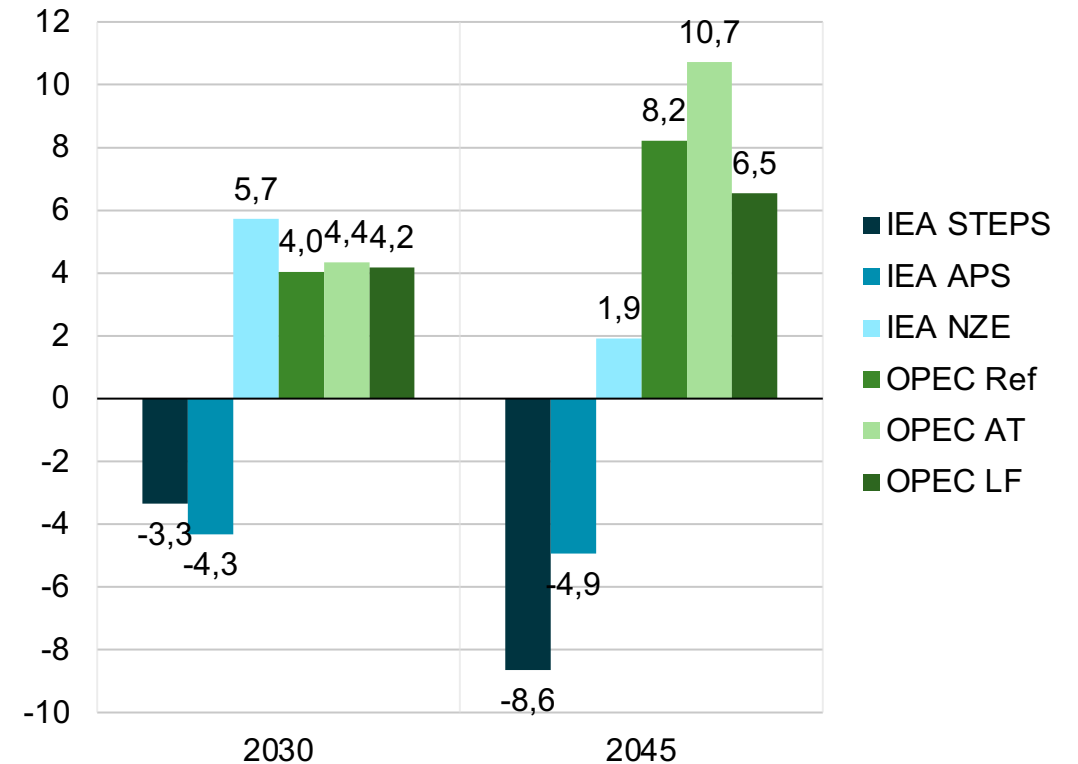
Global Primary Energy Outlook

Million barrels of oil equivalent per day



Global Primary Energy: Revisions to 2022 Scenarios

Million barrels of oil equivalent per day

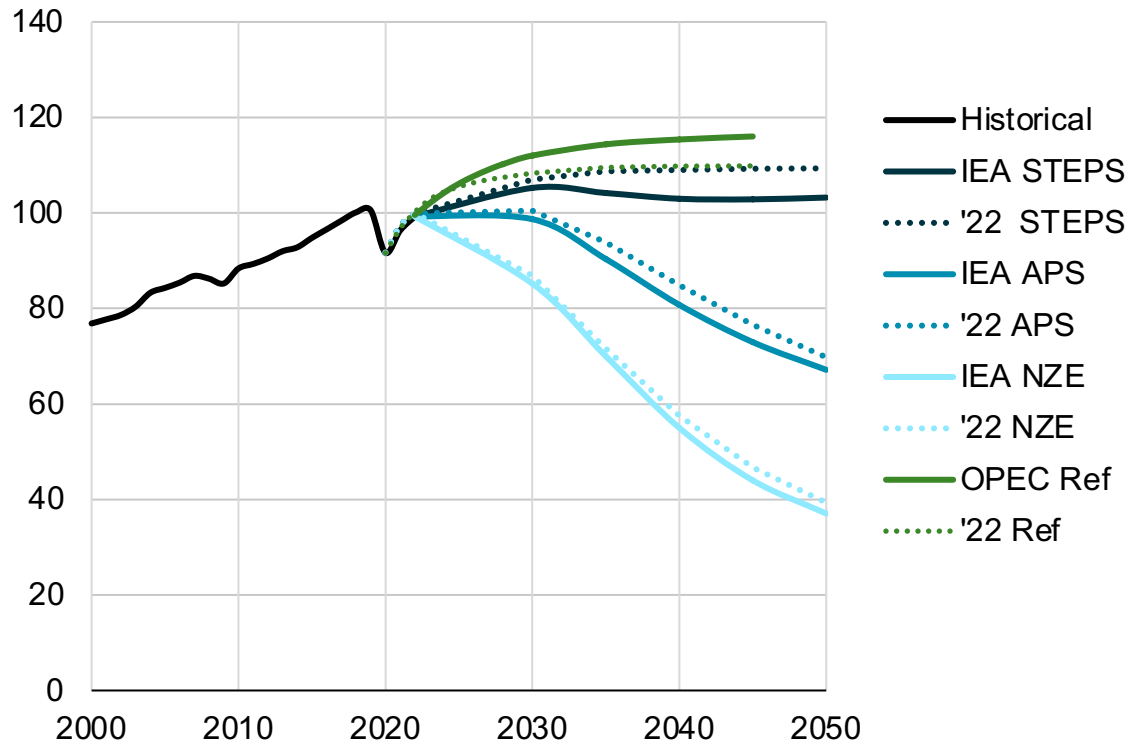


Source: IEF, IEA WEO 2023, OPEC WOO 2023

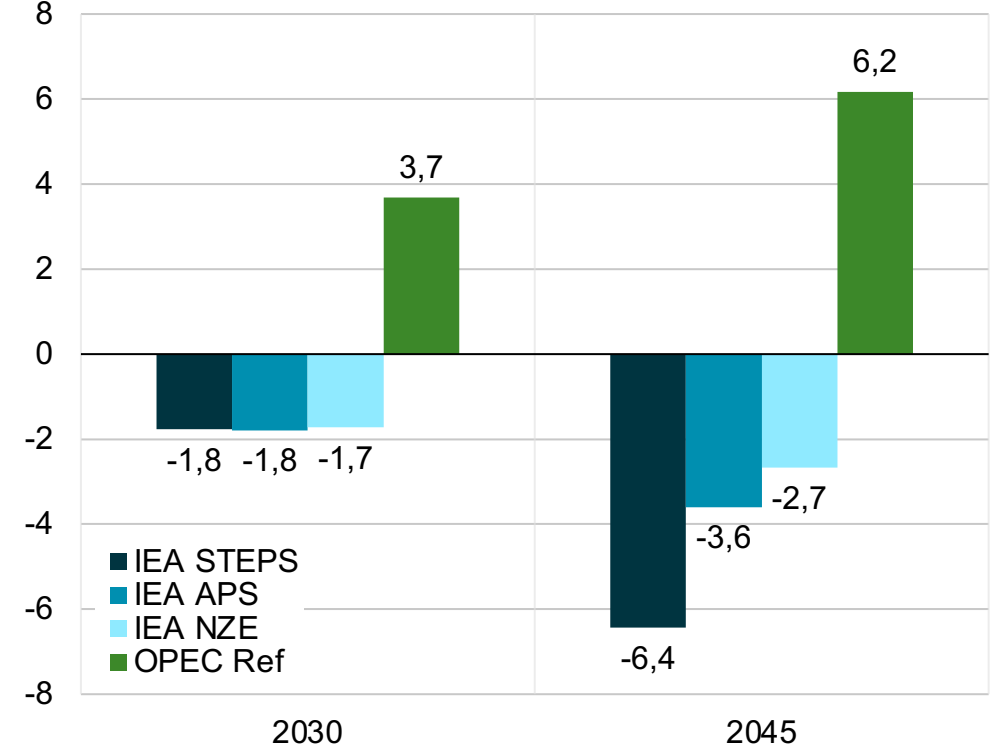
OPEC Reference Case and IEA STEPS show plateauing liquids demand in the 2030s and 2040s

The gap between IEA STEPS and OPEC Reference Case for 2045 liquids demand moved apart by >12 mb/d following upward revisions by OPEC and downward revisions by IEA

Global Liquids Demand
Million barrels of oil per day



Global Liquids Demand: Revisions to 2022 Scenarios
Million barrels of oil per day



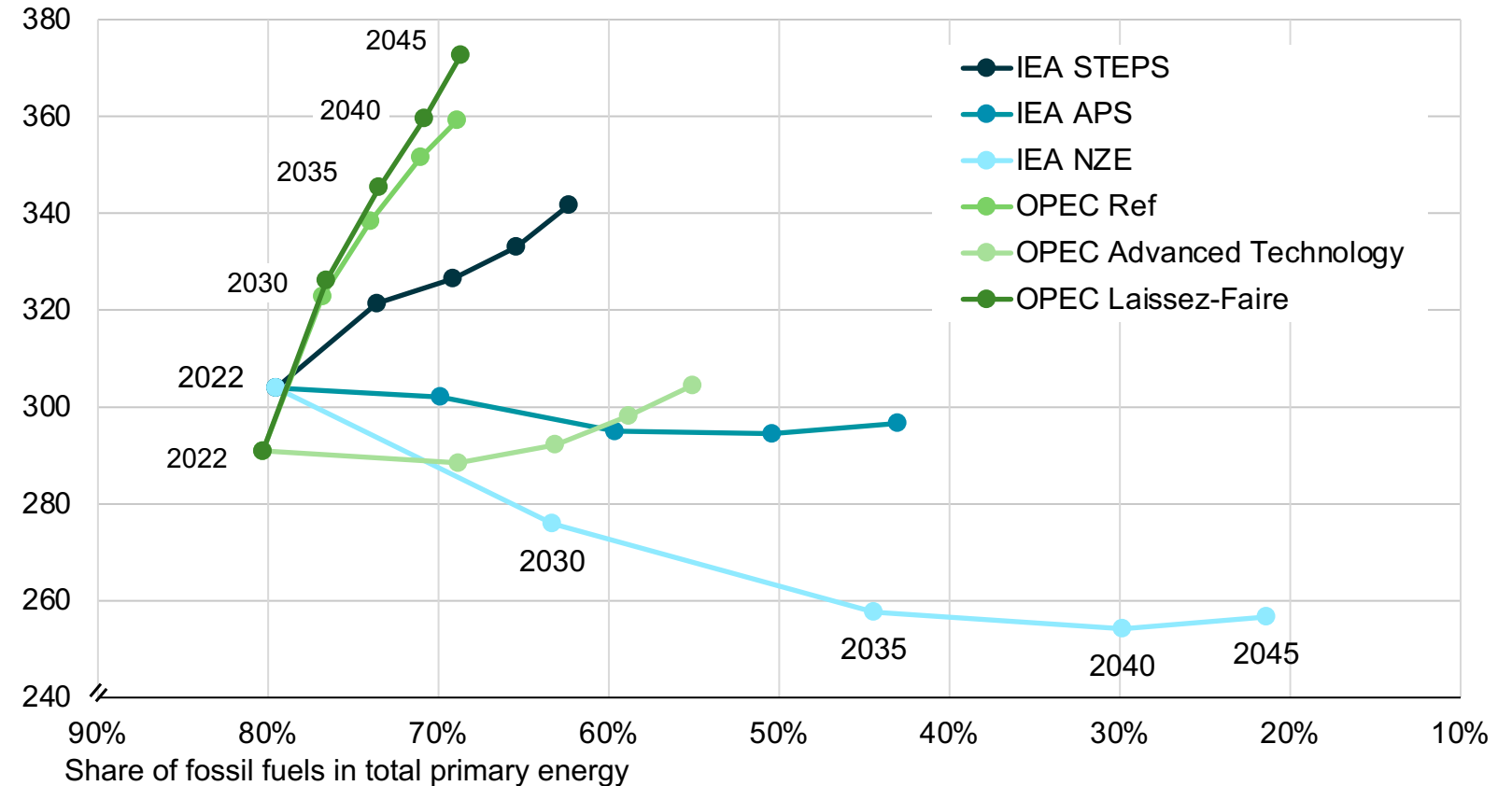
Source: IEF, IEA WEO 2023, OPEC WOO 2023 *IEA liquids figures are adjusted to account for volume of biofuels

Two-thirds of the scenarios show fossil fuels accounting for 55-70% of total primary energy in 2045

- Fossil fuel's share of total primary demand declines over time in all scenarios, albeit at different paces.
- Scenarios showing a substantial increase in total primary energy demand have the highest share of fossil fuels in 2045.

Share of Fossil Fuels in Total Primary Energy Demand

Total Primary Energy, Million barrels of oil equivalent per day



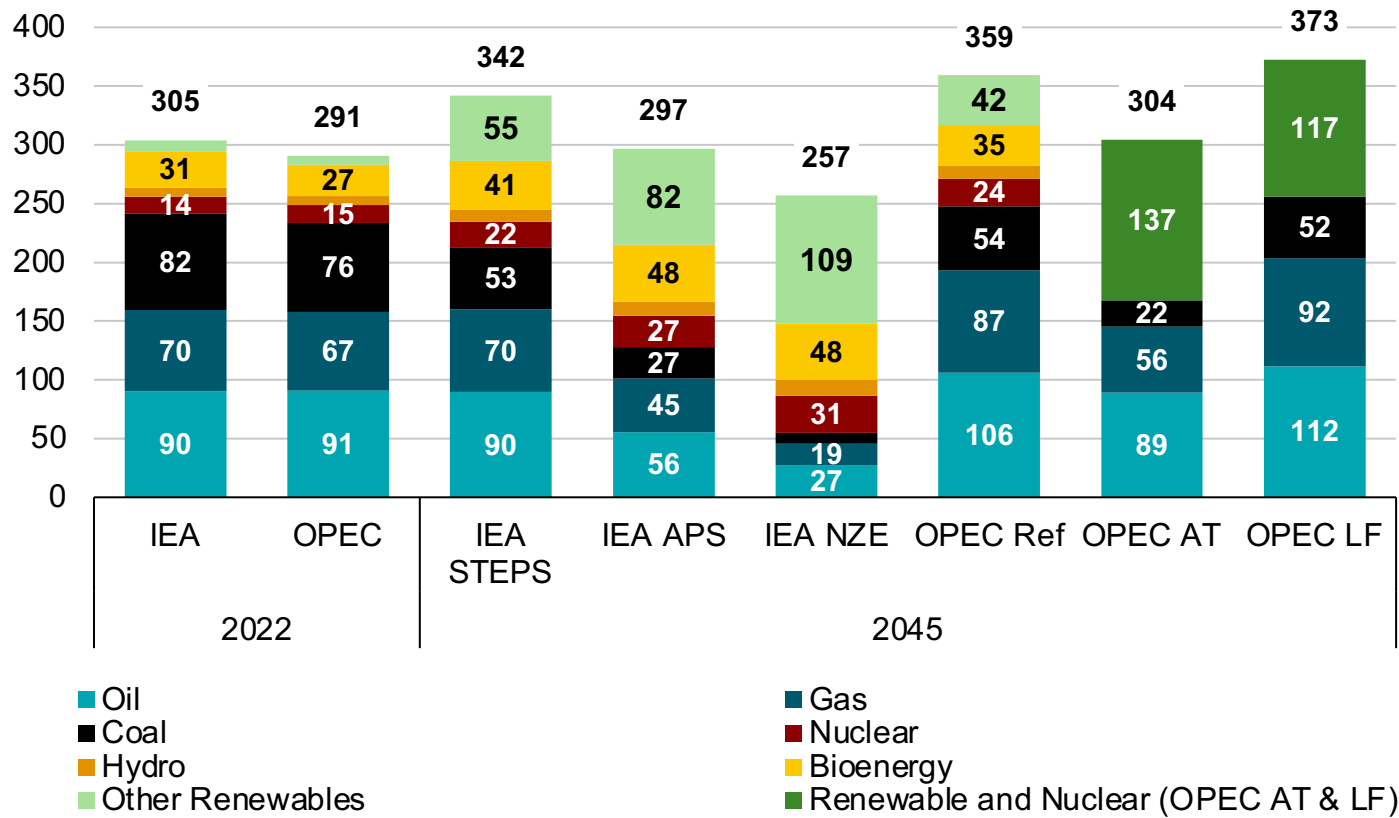
Source: IEF, IEA WEO 2023, OPEC WOO 2023

Primary energy demand grows between 2022 and 2045 in base case scenarios

“Other renewables” see the most significant growth across all scenarios to 2045

World Primary Energy Outlook to 2045

Million barrels of oil equivalent per day



- Scenarios consistent with the Paris Agreement show Primary Energy roughly at or below 2022 levels in 2045 – implying strong efficiency gains since GDP and global population continues to grow.
- IEA scenarios and OPEC Reference Case show “other renewables” at 5-12 times higher in 2045 compared to 2022 levels.

Source: IEF, IEA WEO 2023, OPEC WOO 2023

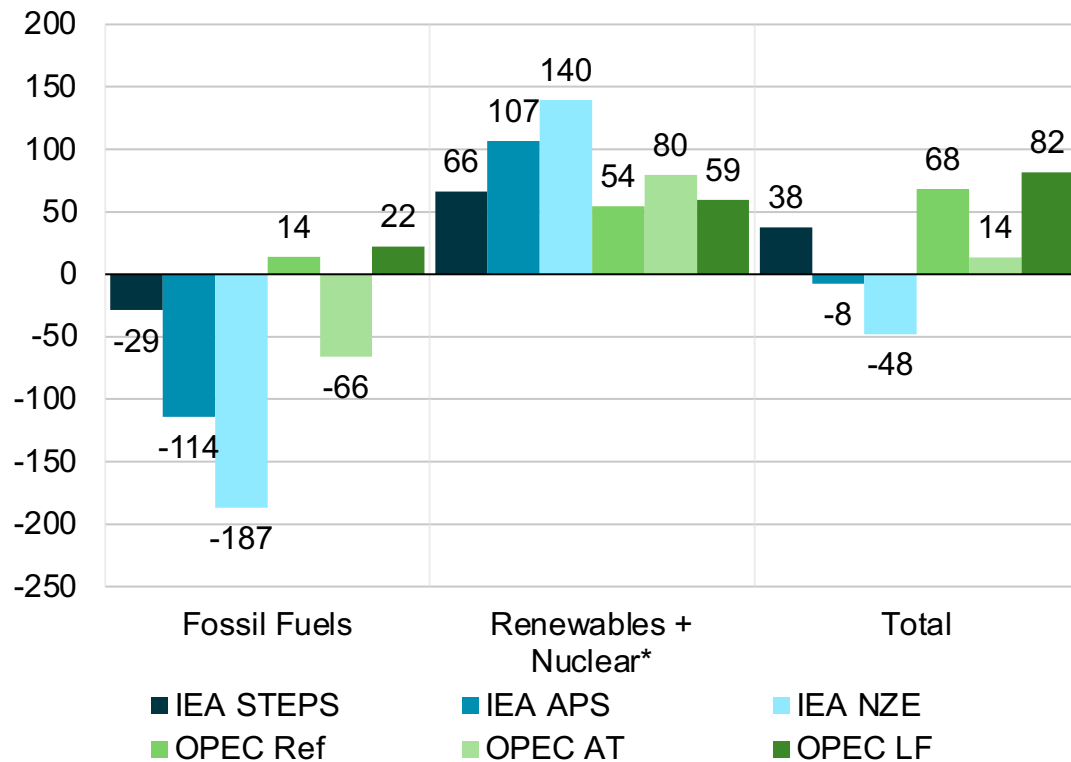
*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids

Renewables + nuclear primary energy sees 95%-224% increase in all scenarios between 2022 and 2045

Coal sees sharp decline in all scenarios driving fossil fuel demand lower

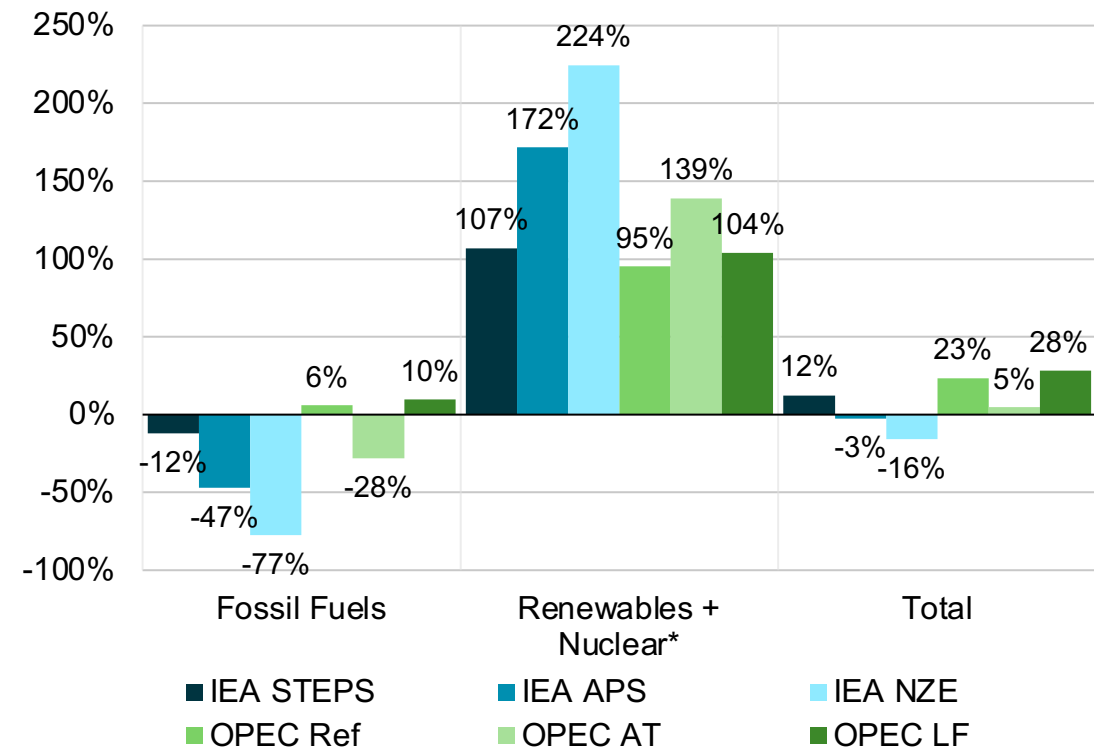
Change in World Primary Energy by Source: 2045 vs 2022

Million barrels of oil equivalent per day



World Primary 2045 vs. 2022

% change from 2022



* Renewables + Nuclear includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios.

Source: IEF, IEA WEO 2023, OPEC WOO 2023

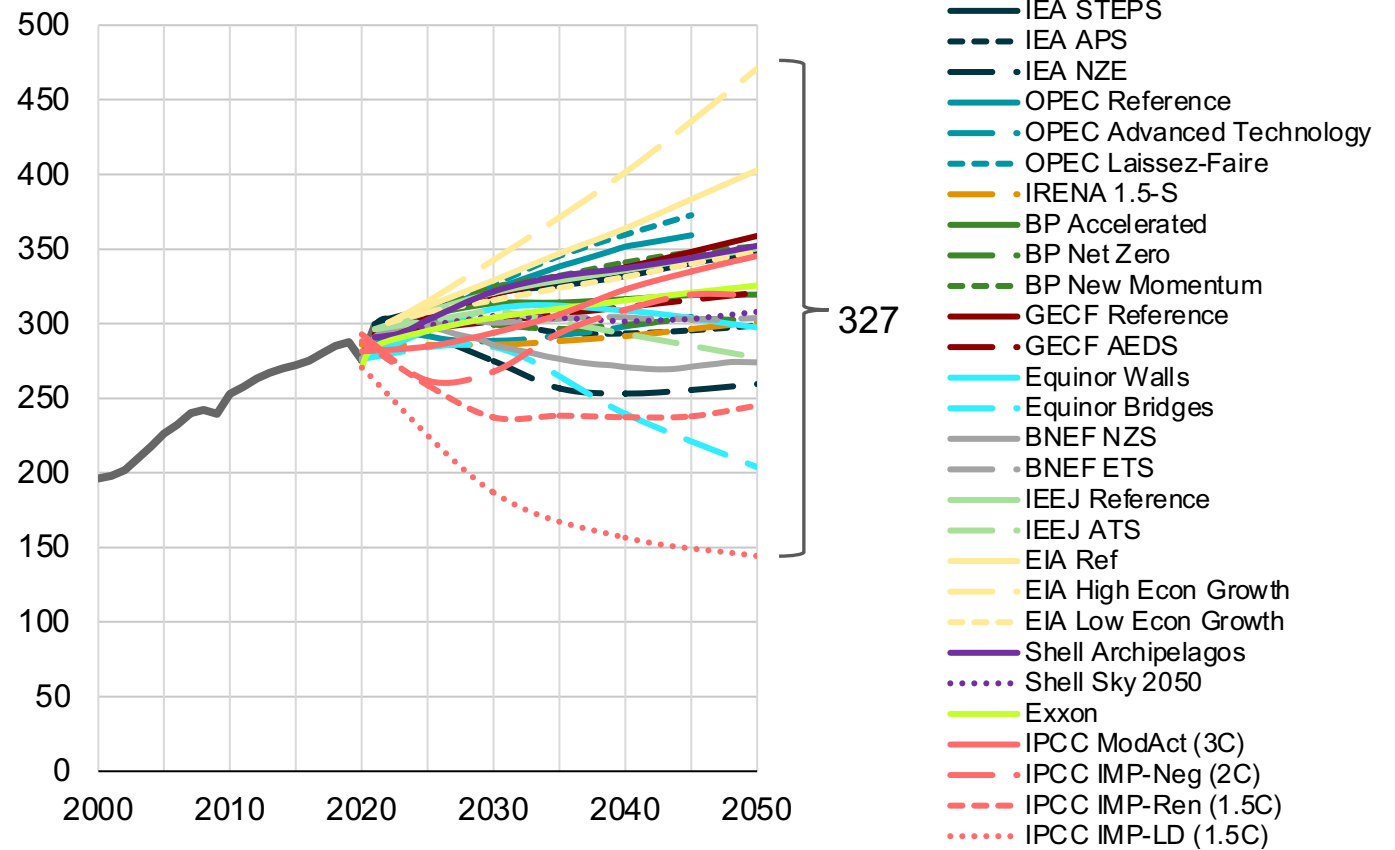
Additional Context: IEA and OPEC Scenarios Alongside Other Industry and Agency Outlooks

Comparing IEA & OPEC to Other Long-Term Energy Outlooks:

- 71 percent of all scenarios surveyed show end-period primary energy demand at higher levels than 2022.
- Several net zero scenarios show oil demand falling by >75 percent by 2050, while some reference case scenarios show 15 percent growth over the same period.
- More than half of all scenarios show Nuclear demand increasing by more than 50 percent by 2050

Primary Energy Demand Scenarios Through 2050

Million barrels of oil equivalent per day

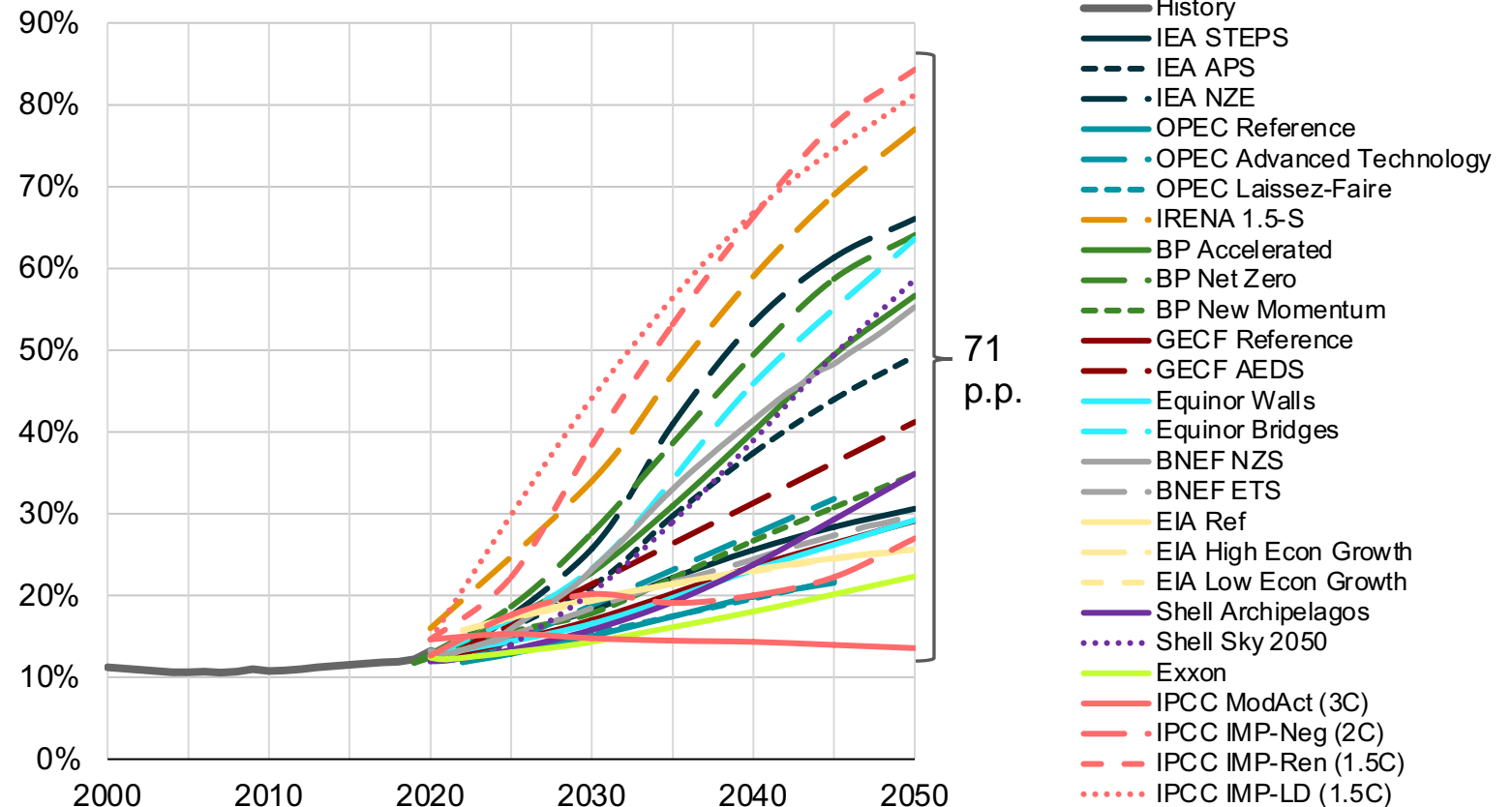


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios 2023, Exxon Global Outlook 2023, IPCC AR6

Comparing IEA & OPEC to Other Long-Term Energy Outlooks:

- Paris-aligned forecasts show a wide range of renewables penetration by 2050, ranging from 27 to 84 percent of primary energy demand.
- Most of the more ambitious climate scenarios show carbon capture expanding to six to eight Gt of CO₂/year by 2050.

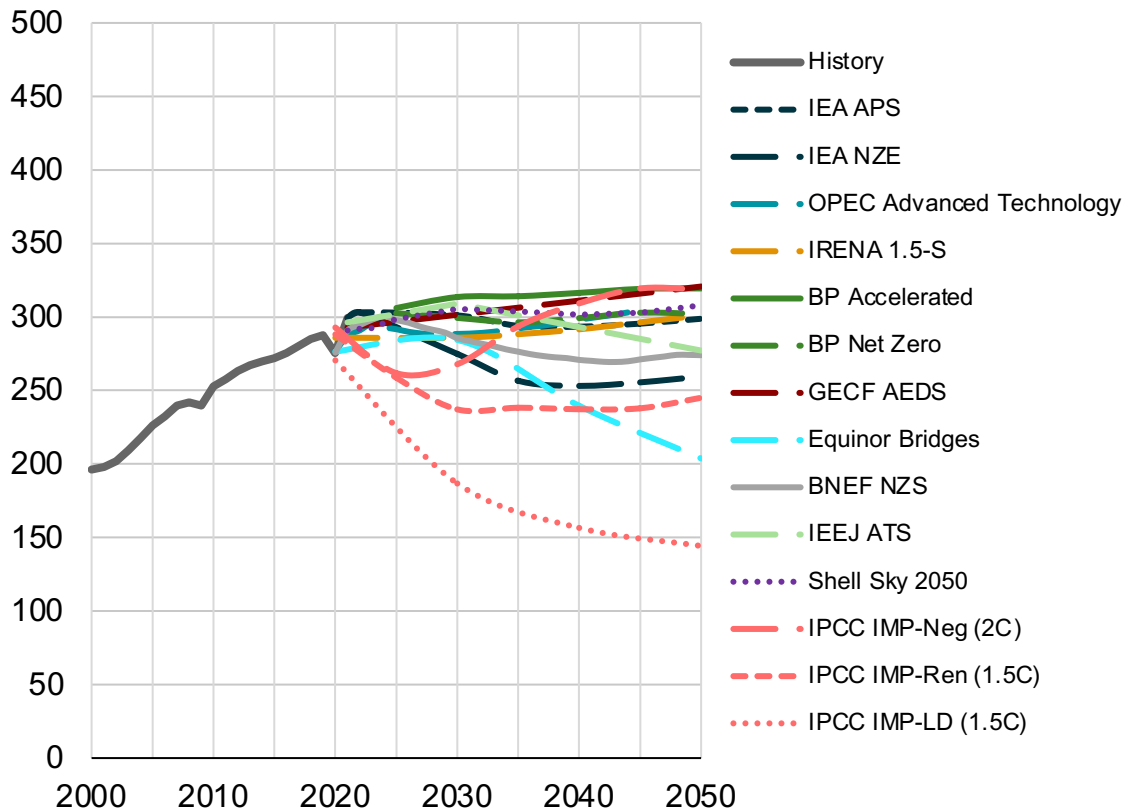
Renewables* Demand Share of Total Primary Energy Demand Scenarios to 2050
Share of Primary Energy Demand



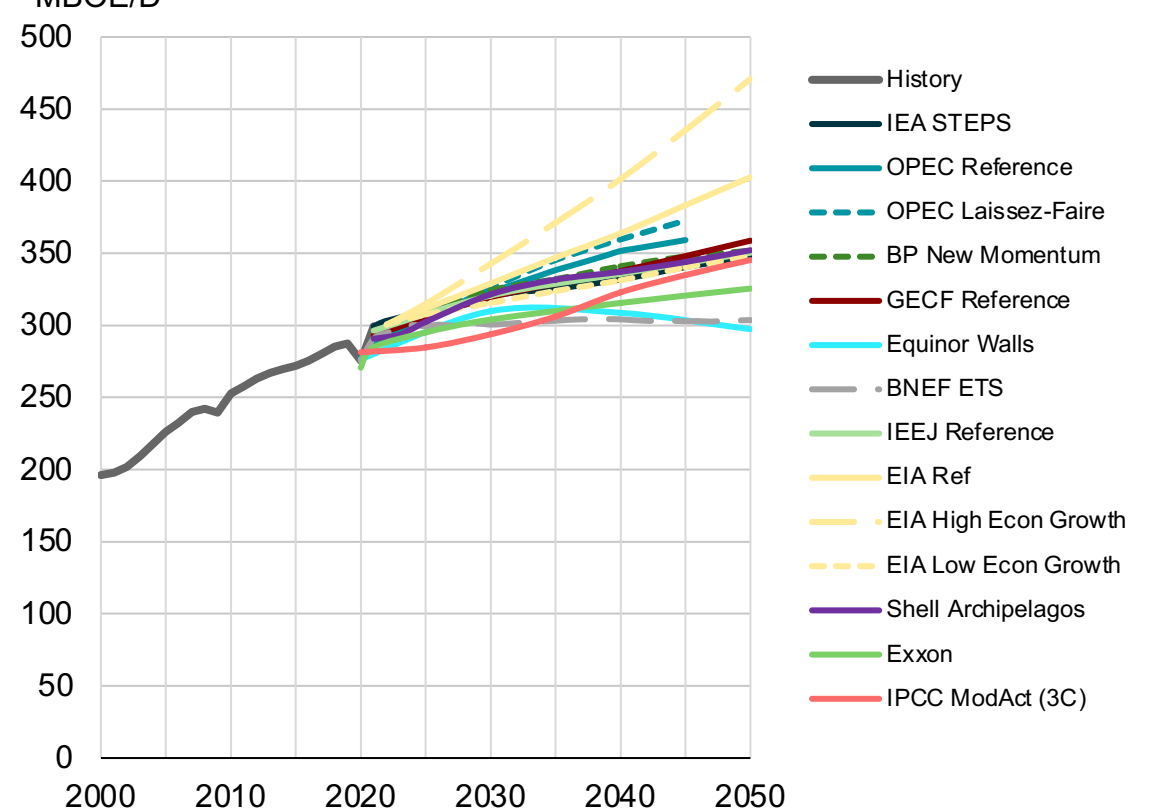
* Includes wind, solar, geothermal, biomass, biofuels, biomethane. EIA scenarios include hydro. Descriptions of the various scenarios are on page 58.
Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

Primary energy demand: Paris scenarios see demand plateau or decline, reference cases show demand grows by >15%

Total Primary Energy Demand: Ambitious Climate Scenarios
MBOE/D



Total Primary Energy Demand: Reference Cases & Evolving Policies
MBOE/D

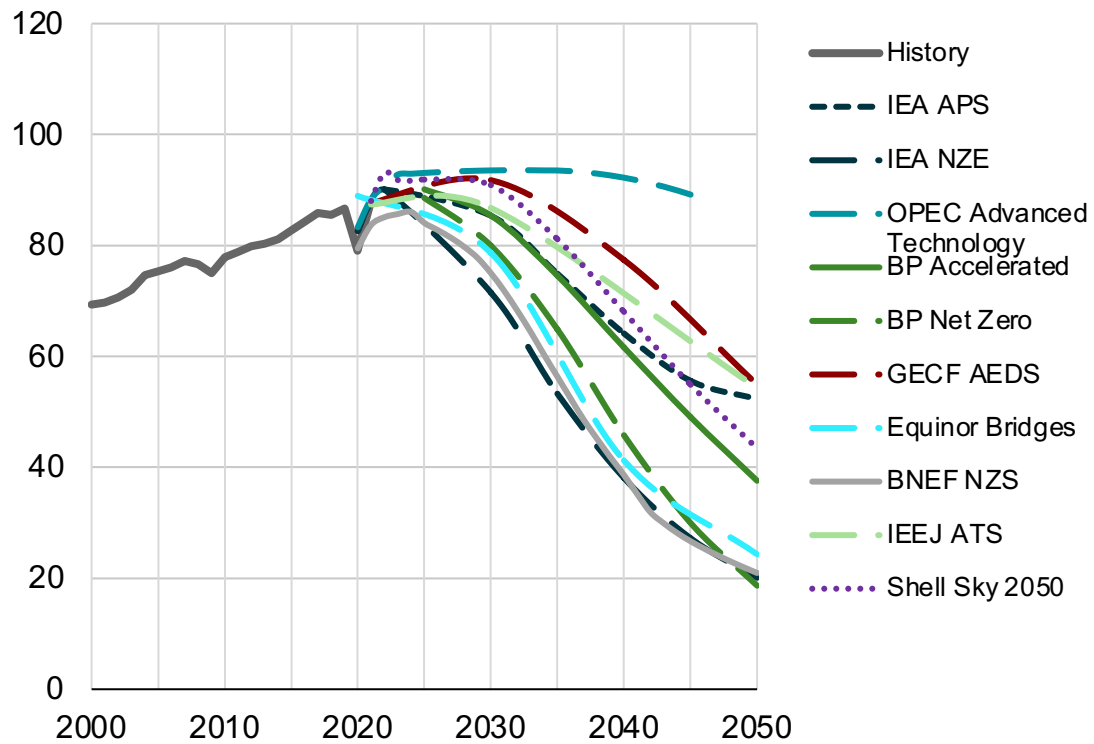


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

Oil demand: Several net zero scenarios show oil demand falling by >75% by 2050 some reference cases show 15% growth

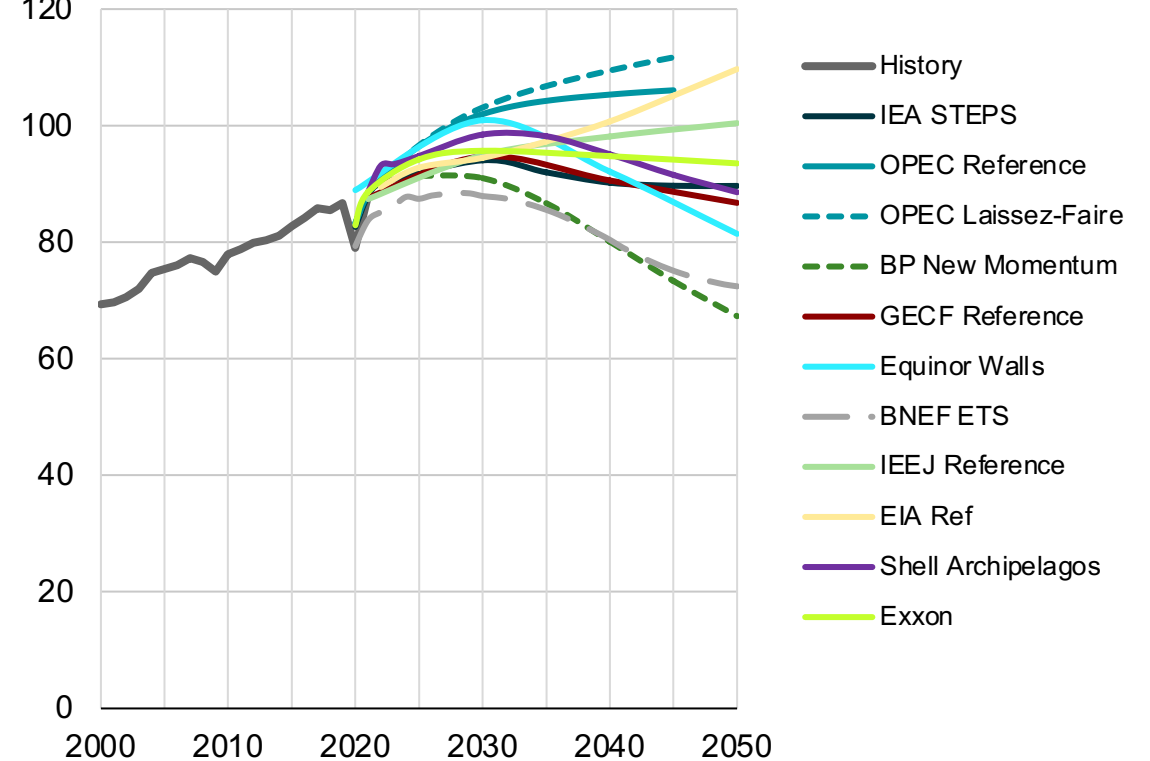
Oil Demand: Ambitious Climate Scenarios

MBOE/D



Oil Demand: Reference Cases and Evolving Policies

MBOE/D



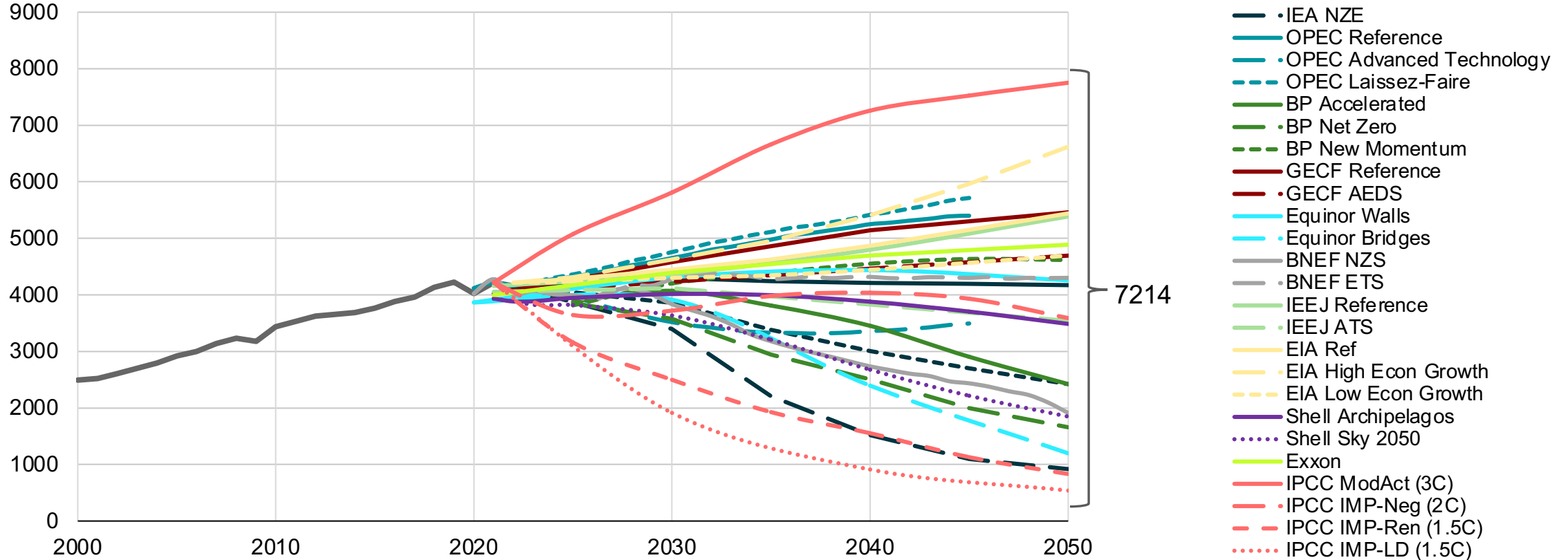
*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook

Natural gas demand: Range between the high and low forecast is more than 6,000 bcm ~45% larger than today's market

Natural Gas Demand Scenarios Through 2050

Billion cubic metres

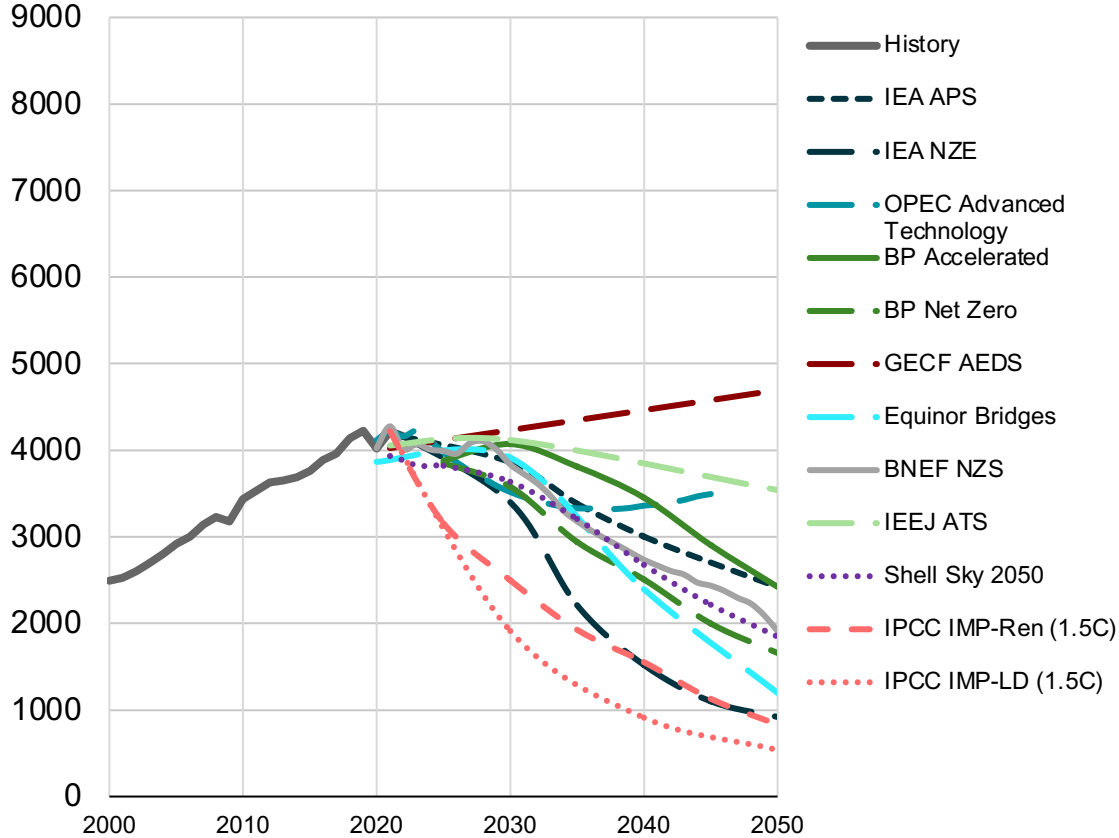


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

Natural gas demand: Paris scenarios show a peak and fall by 2030s, reference cases show a plateau or growth

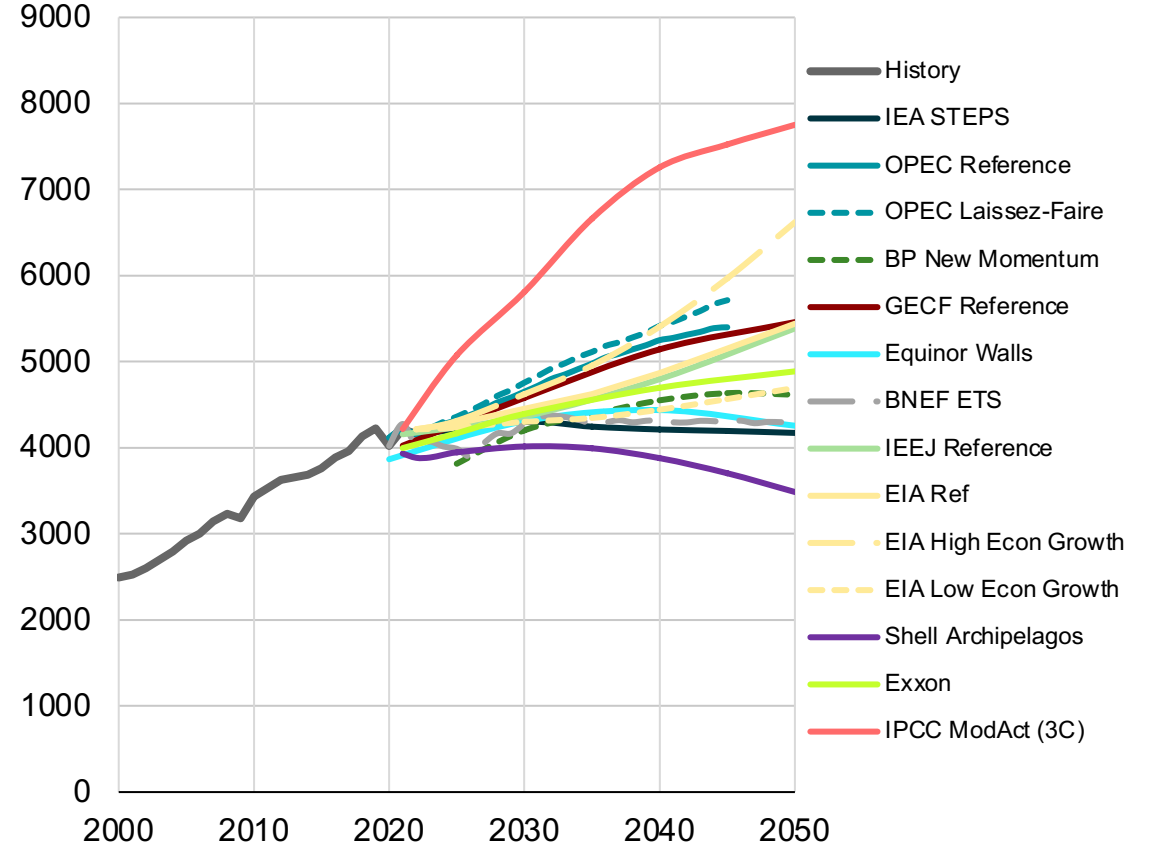
Natural Gas Demand: Ambitious Climate Scenarios

Billion cubic metres



Natural Gas Demand: Reference Cases and Evolving Policies

Billion cubic metres

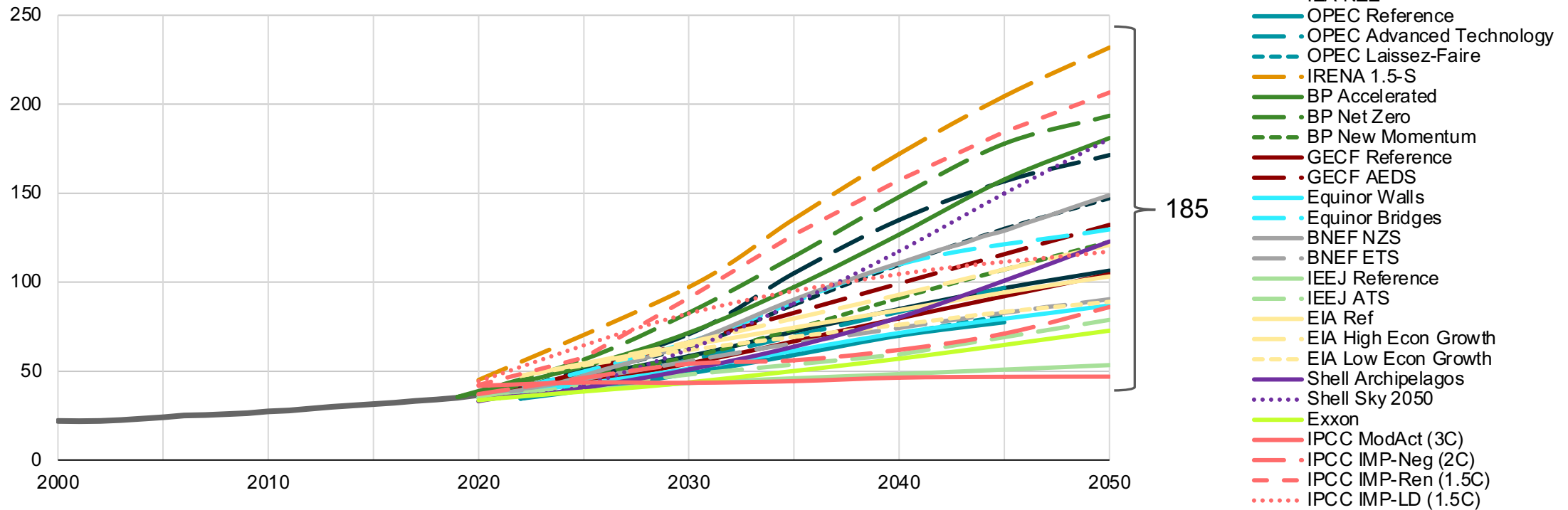


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

Renewables demand: Range of high and low forecasts for 2050 renewables demand ~5 times greater than current demand

Renewables Demand Scenarios Through 2050

MBOE/D

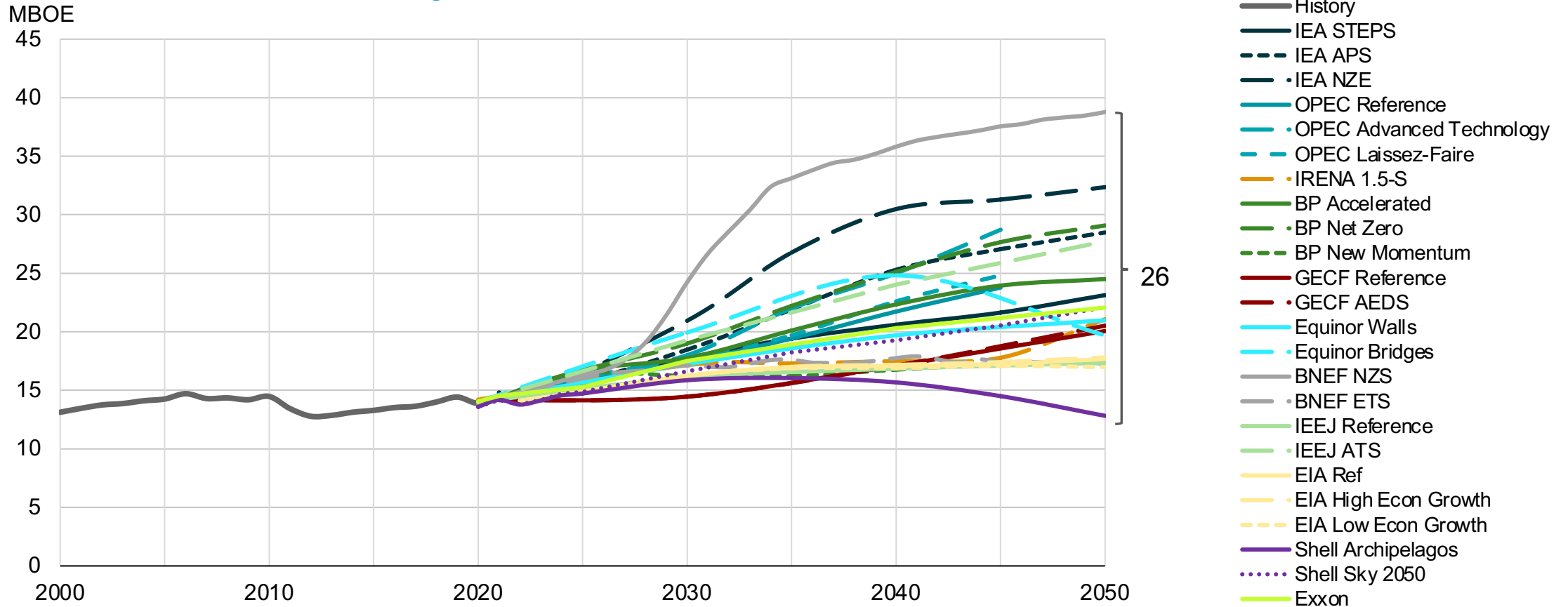


*Includes wind, solar, geothermal, modern and traditional bioenergy. EIA includes hydro.

Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

Nuclear demand: More than half of all scenarios show nuclear demand increasing by >50% in 2050 compared to 2022

Nuclear Demand Scenarios Through 2050

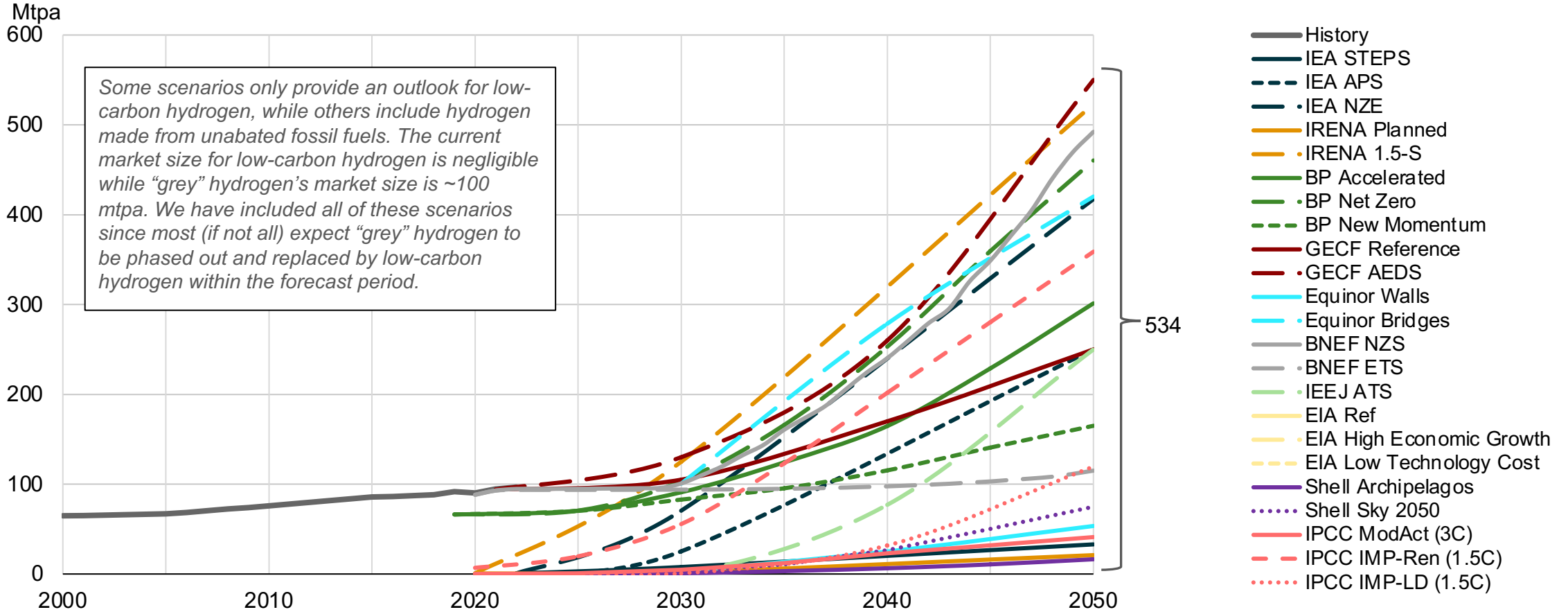


*Some calculations have been made to correct for different primary energy conversion efficiency assumptions.

Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook

Hydrogen demand: Some net zero scenarios see the low-carbon hydrogen market expanding by >400x by 2050

Hydrogen Demand Scenarios Through 2050

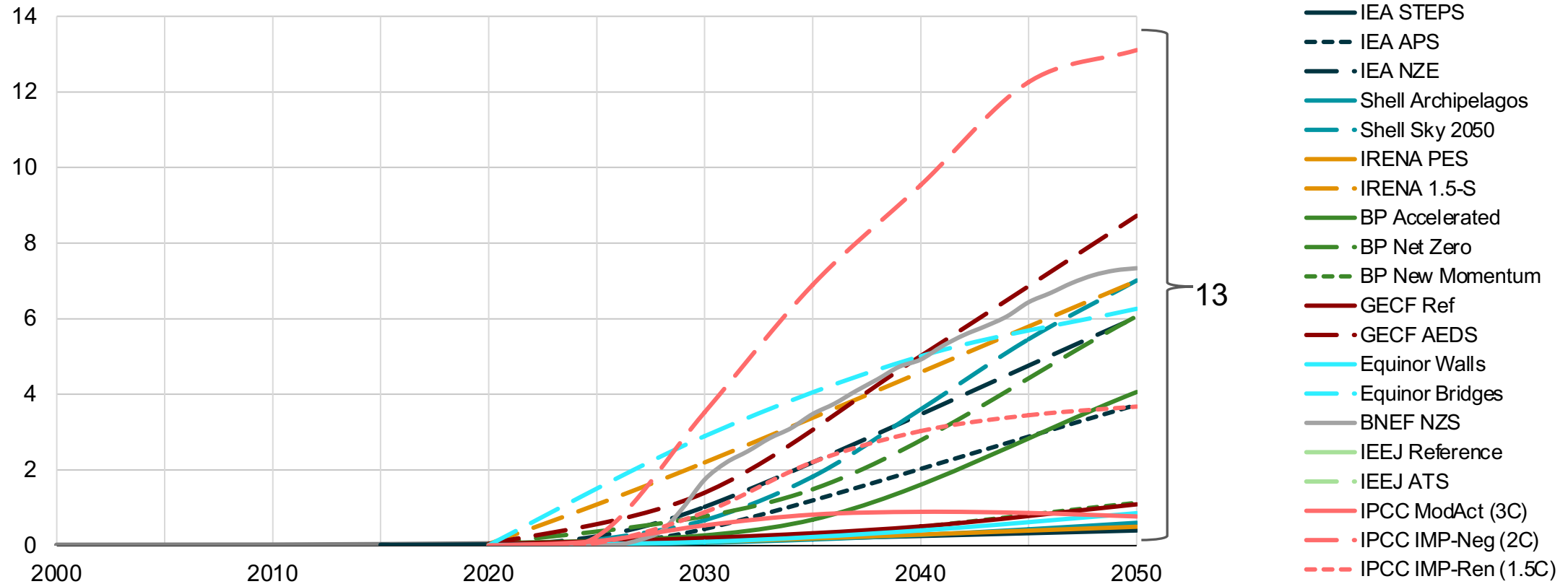


Source: IEF, IEA WEO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, IPCC AR6

Carbon capture: Carbon capture expands to at least ~6-8 Gt of CO₂/y in many of the ambitious net zero scenarios

Carbon Capture (CCUS, CCS, BECCS, Industrial)

Gt CO₂/year



Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6



Acknowledgements

This report was prepared by the IEF, in consultation with the International Energy Agency, and Organization of the Petroleum Exporting Countries.

The IEF thanks the IEA and OPEC for their constructive comments and insights into this document and the on-going dialogue that underpins the trilateral program of work.

Thank you