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OPEC

IEF RFF Outlooks Comparison Report Executive Summary

12

IEA IEF OPEC
Symposium on
Energy Outlooks

IEF



RESOURCES
for the FUTURE

16 February 2022

Comparability Beyond Compare

1. The impact of energy outlooks on policy and investment decisions and public views of energy trends and transitions continues to grow steadily since the UN Paris Agreement and Sustainable Development Goals were adopted in 2015 to achieve shared goals.
2. Increasingly diverse outlook findings enrich the energy dialogue but also warrant greater scrutiny and alignment of methods, categories, baseline data, and time frames to improve comparability and deepen understanding.
3. Though considerable advances have been made by both IEA and OPEC, IEF Ministers should ensure their Agencies accelerate work on aligning conventions and techniques that outlooks are based on and make all data public.
4. Peer review will bolster the global energy dialogue and the decisions that follow to address challenges regarding energy security, market stability and just and orderly transitions as called for by the G20 Leaders gathered under the Italian Presidency of Italy in Rome.

Scenario Findings

Constraints and Assumptions

As countries race forward to reach shared goals, energy outlook signpost merit closer scrutiny:

1. Many normative or “Paris Aligned” scenarios envision a world in which energy demand will be below 2020 levels in 2050, reflecting a major change in the historical relationship between economic and energy demand growth.
2. There is a growing “gap” between oil demand reference and “Paris Aligned” scenarios that reaches 84.6 mb/d in 2045 and 110 mb/d in 2050, reflecting growing uncertainty in respect of energy sector investment and security of demand.

Transparent data, and clarity on assumptions and underlying modelling constraints are central but not always available or properly understood. Working towards “Globally Acceptable Accounting Standards for Energy Outlooks” helps to improve scenario modelling, enables greater comparability, and increases confidence in the validity of both findings and assumptions.

This will help to maintain a predictable and transparent investment environment in an age of unprecedented change and uncertainty.

Overview

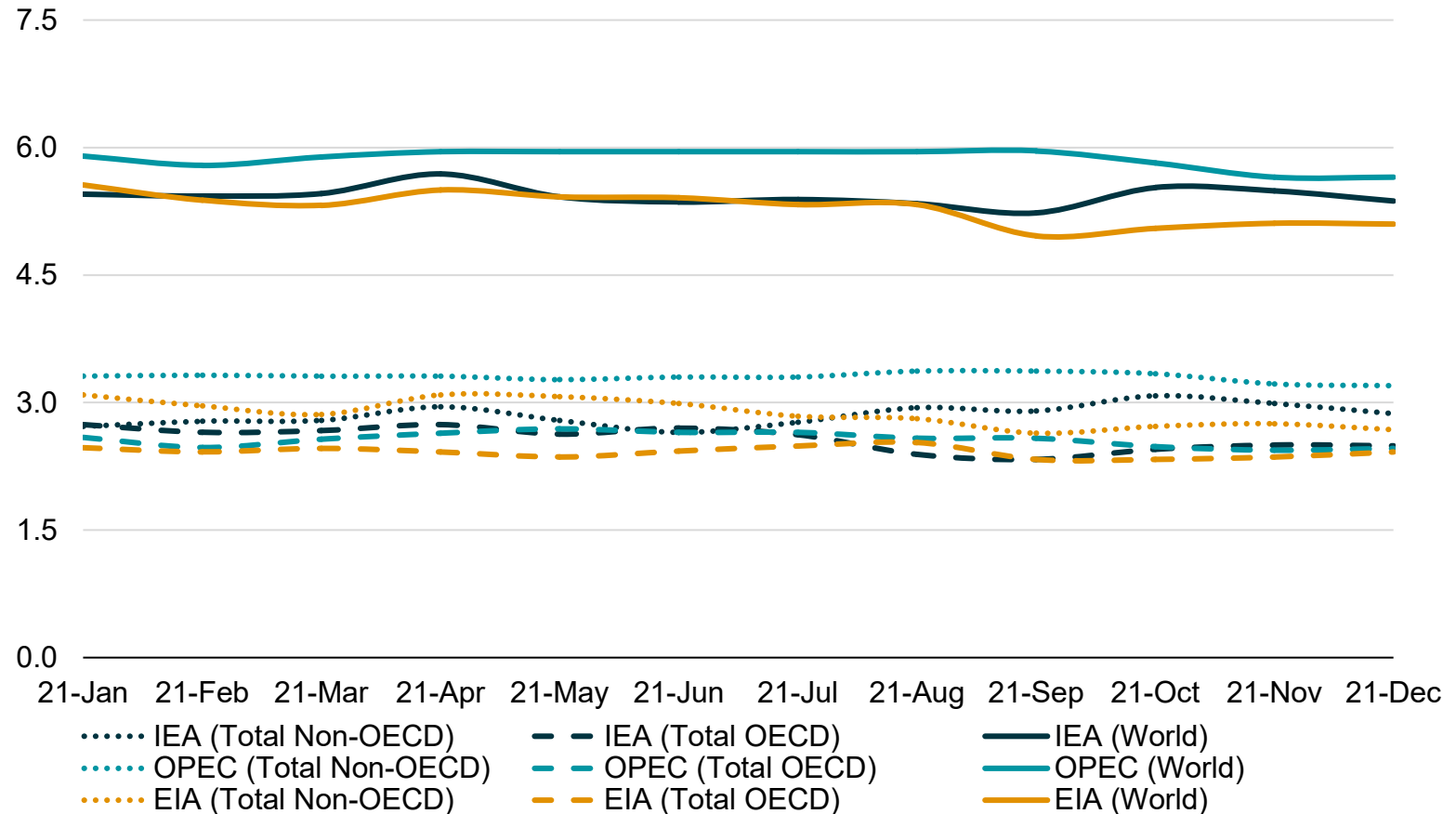
- IEA-OPEC Short-Term Outlooks
- IEA-OPEC Medium-Term Outlooks
- IEA-OPEC Long-Term Outlooks
- Long-Term Scenarios in Context

Short-Term Outlooks

Robust demand growth in 2021 held steady at 5-6 mb/d after the pandemic saw demand fall by 9-10 mb/d in 2020.

Monthly Revisions of 2021 Annual Estimates for Oil Demand Growth

Million barrels per day

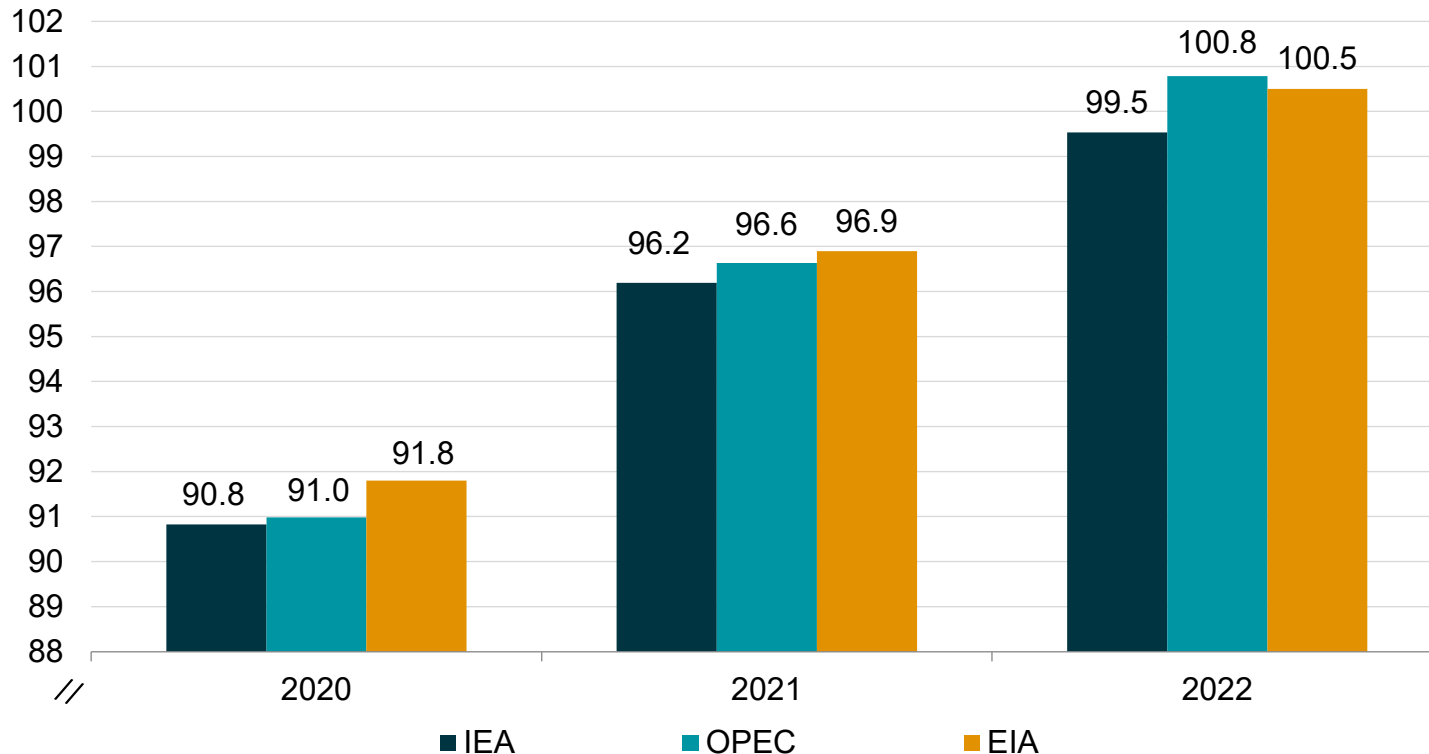


Source: IEF, IEA OMR Dec 2021, OPEC MOMR Dec 2021, and EIA STEO Dec 2021

The IEA, OPEC, and EIA are closely aligned on 2020-2022 liquids demand with IEA assessments consistently on the lower end.

Short-term World Liquids Annual Demand

Million barrels per day



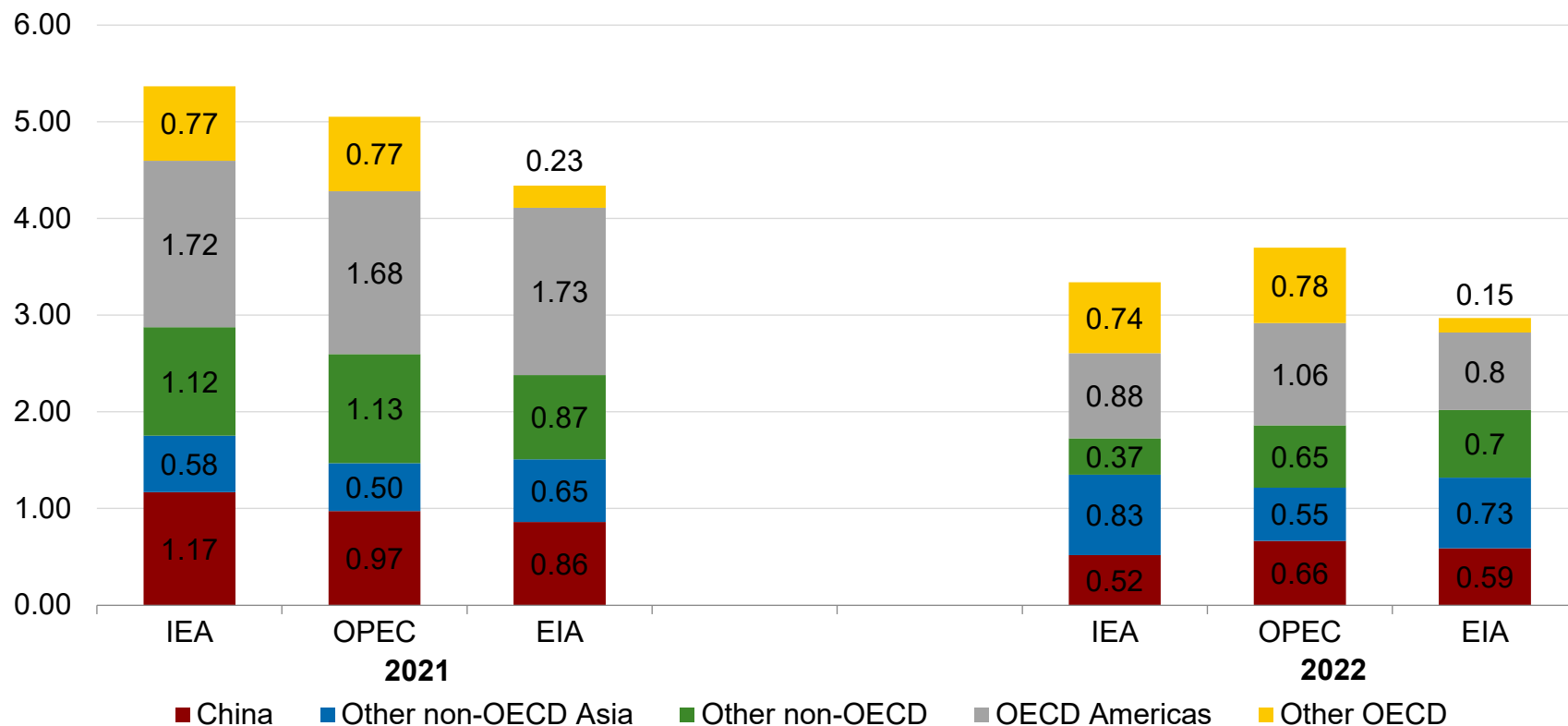
Source: IEF, IEA OMR Dec 2021, OPEC MOMR Dec 2021, and EIA STEO Dec 2021

Notes: 2020 are historical data and 2021/2022 are projections. Sums in data callouts may not total due to rounding.

Weaker demand growth is still driven by Non-OECD regions with the OECD not far behind, EIA OECD assessments are consistently lower.

Short-term World Liquids Annual Demand Growth

Million barrels per day

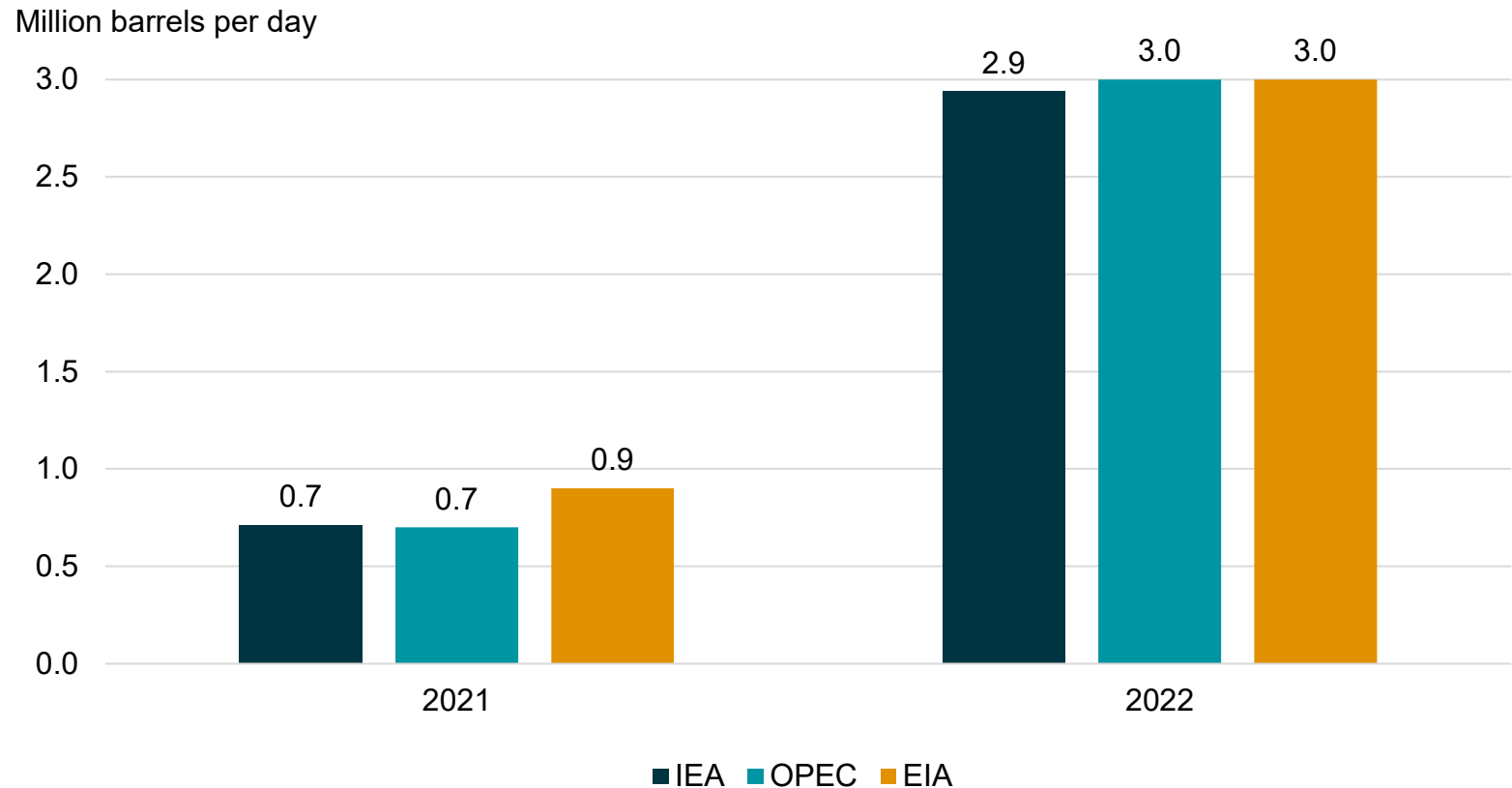


Source: IEF, IEA OMR Dec 2021, OPEC MOMR Dec 2021, and EIA STEO Dec 2021

Notes: 2020 are historical data and 2021/2022 are projections. Sums in data callouts may not total due to rounding.

Closely aligned assessments show Non-OPEC supply grow by 3 mb/d in 2022 according to the IEA, OPEC, and EIA.

Short-term World Liquids Annual Demand Growth



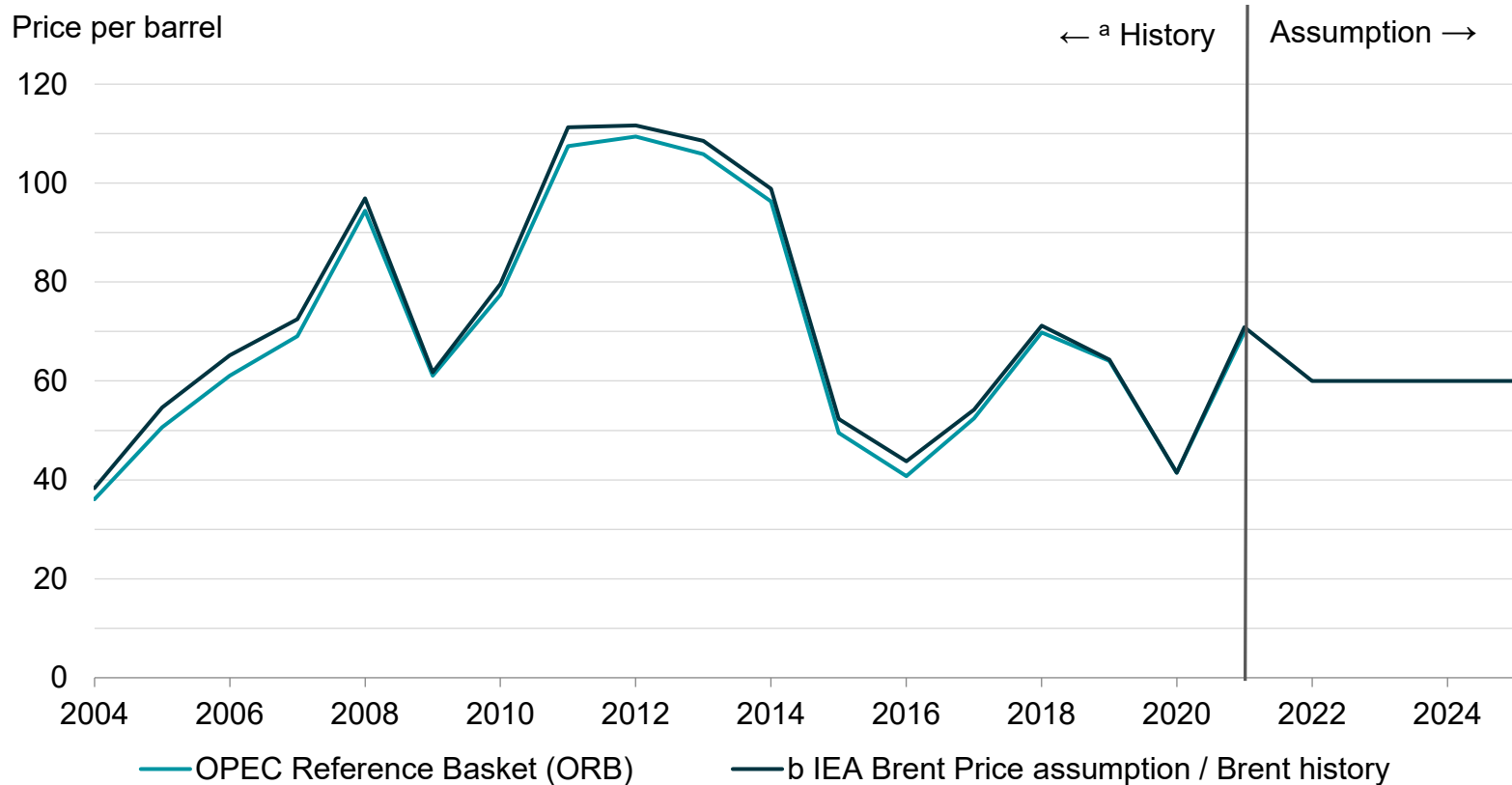
Source: IEF, IEA OMR Dec 2021, OPEC MOMR Dec 2021, and EIA STEO Dec 2021

Notes: 2020 are historical data and 2021/2022 are projections. Sums in data callouts may not total due to rounding.

Medium-Term Outlooks

Since 2017 OPEC does not publish its oil price assumptions preventing comparison with the IEA.

Oil Price History and Medium-Term IEA Assumptions (nominal USD)

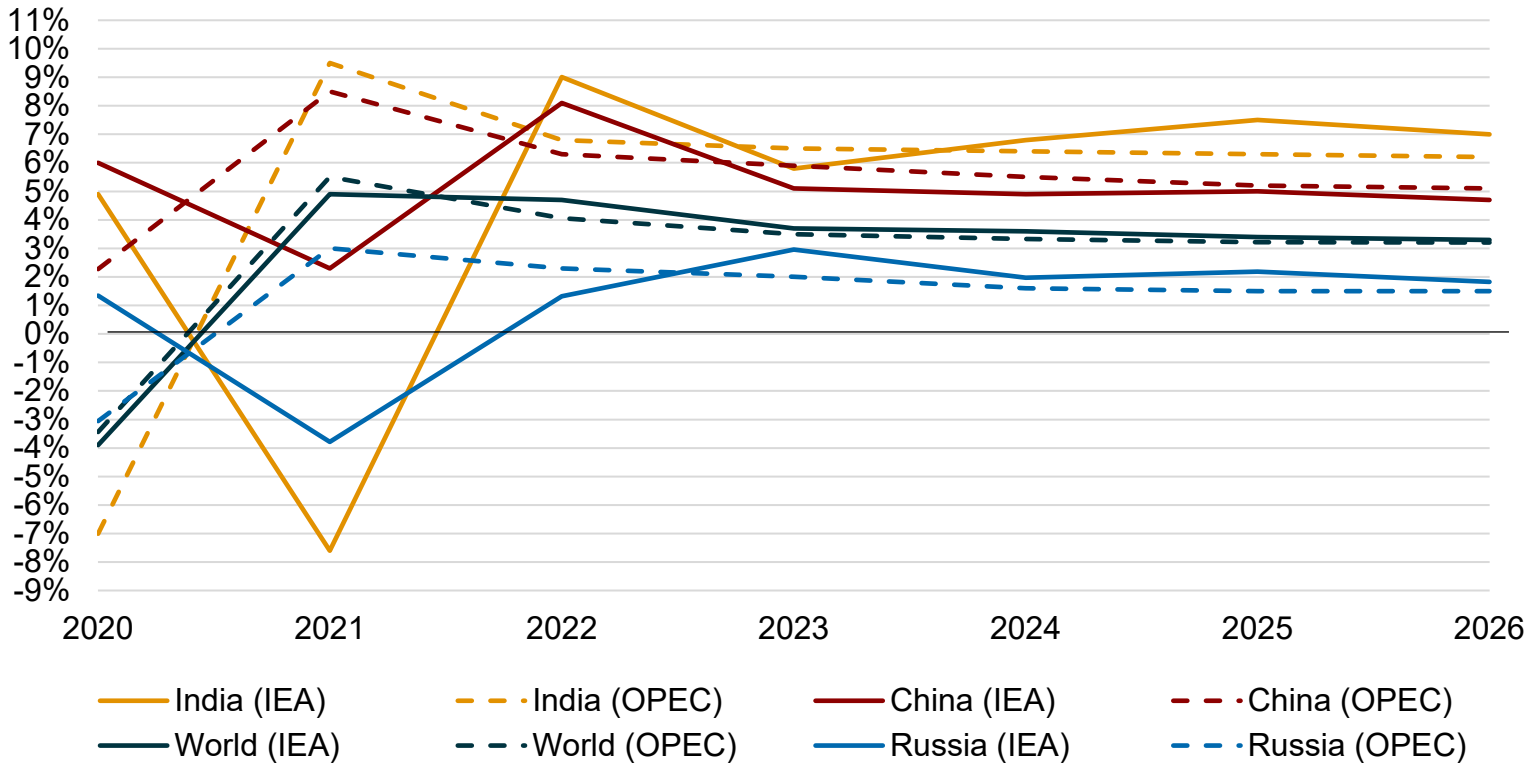


Source: IEF, IEA OMR Dec 2021, OPEC MOMR Dec 2021, and EIA STEO Dec 2021

Notes: 2020 are historical data and 2021/2022 are projections. Sums in data callouts may not total due to rounding.

OPEC and the IEA regional GDP growth estimates reflect different views on recovery but align towards the end of the medium term.

Regional GDP Growth Assumptions



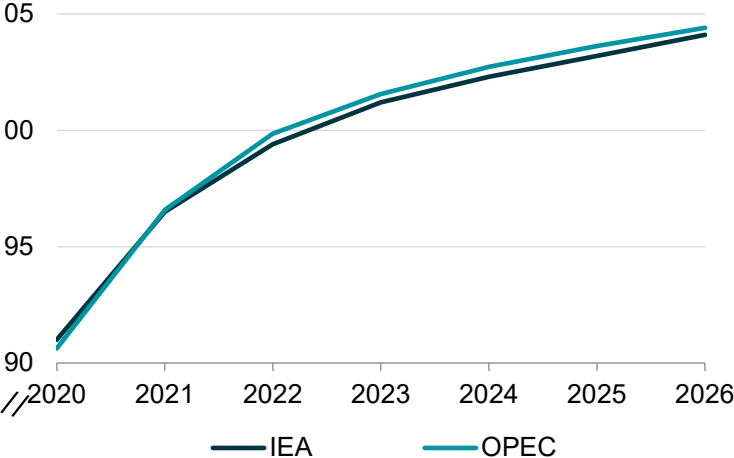
Source: IEF, IEA OMR Dec 2021, OPEC MOMR Dec 2021, and EIA STEO Dec 2021

Notes: 2020 are historical data and 2021/2022 are projections. Sums in data callouts may not total due to rounding.

OPEC and EIA show striking uniformity in medium- term liquids demand assessments.

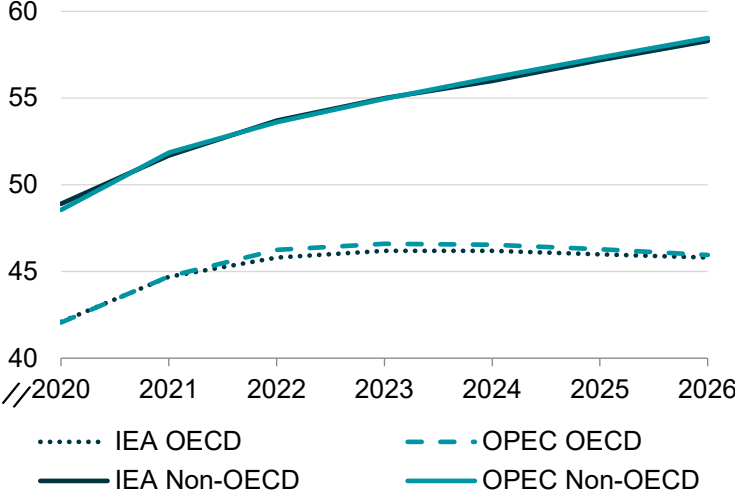
Medium-term World Liquids Demand

Million barrels per day



Medium-term OECD and Non-OECD Liquids Demand

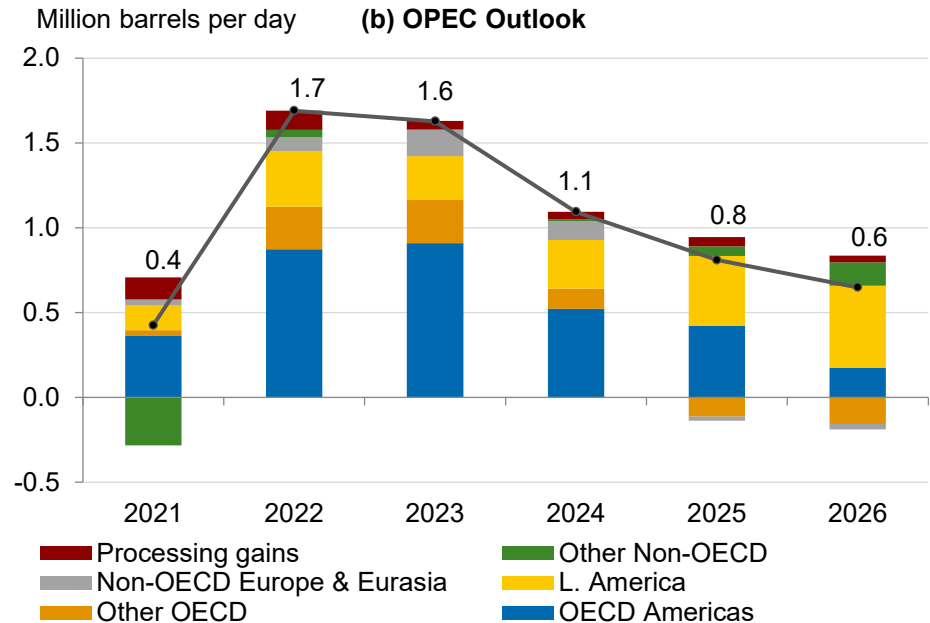
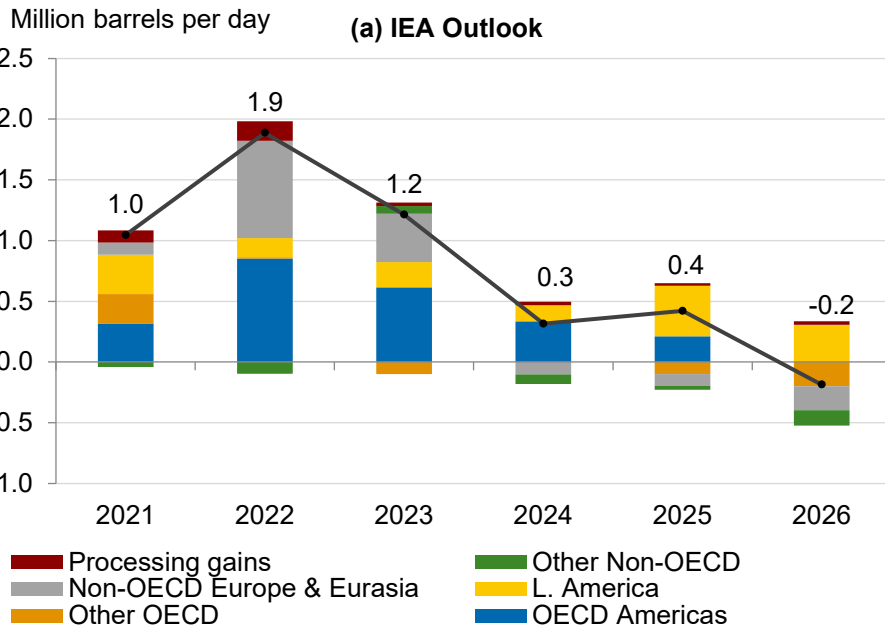
Million barrels per day



Source: IEA Oil 2021, Table 2; OPEC WOO 2021, Table 3.1

The IEA and OPEC forecast similar Non-OPEC supply growth for 2022 OPEC is more bullish on OECD Americas in the medium term.

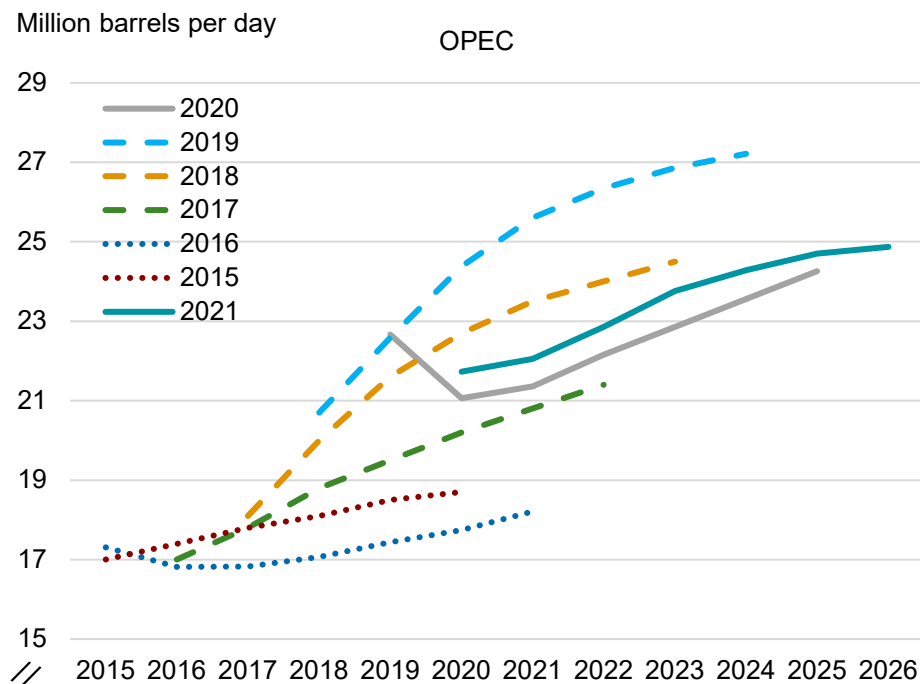
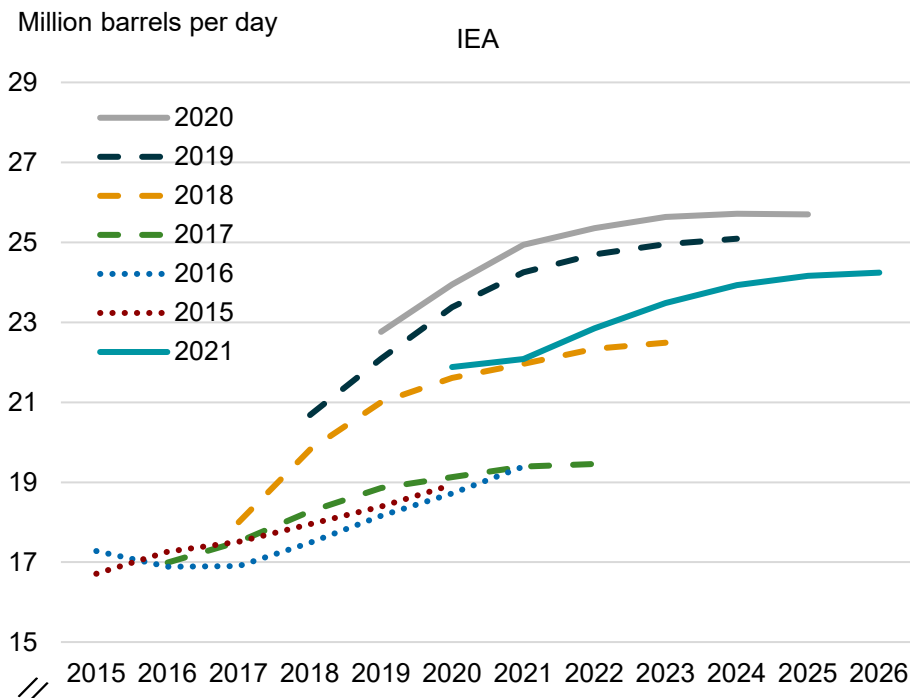
Medium-term Non-OPEC Liquids Supply Annual Growth



Source: IEA Oil 2021, Table 3, Table 5, Table 5a; OPEC WOO 2021, Table 4.1. Sums may differ due to rounding. Figure 10 notes: Other OECD is the sum of data from OECD Europe and Asia Oceania; Other Non-OECD is the sum of data from Middle East & Africa and Non-OECD Asia.

Differences in projected US and Canadian supply shrink to 0.6 mb/d in 2026. Most of this growth is driven by U.S. tight oil.

Medium-term US and Canadian Oil Supply (excluding biofuels)

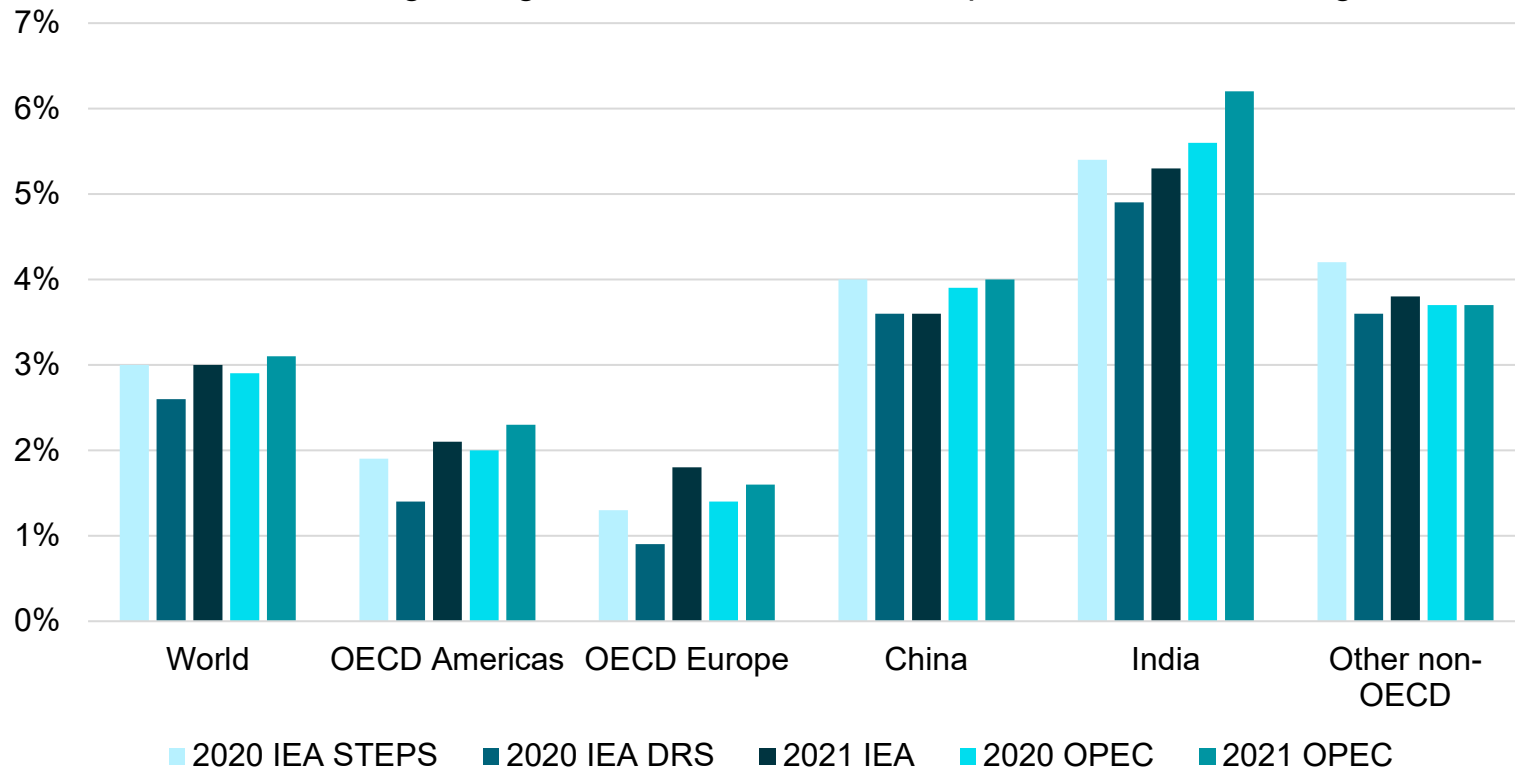


Source: IEA Oil 2021, Table 3, Table 5, Table 5a; OPEC WOO 2021, Table 4.1. Sums may differ due rounding. Figure 10 notes: Other OECD is the sum of data from OECD Europe and Asia Oceania; Other Non-OECD is the sum of data from Middle East & Africa and Non-OECD Asia.

Long-Term Outlooks

IEA and OPEC increased GDP growth assumptions for scenarios to 2045 and 2050, with OPEC more positive on growth and India's lead.

Annual Average Long-term GDP Growth Assumptions for Selected Regions



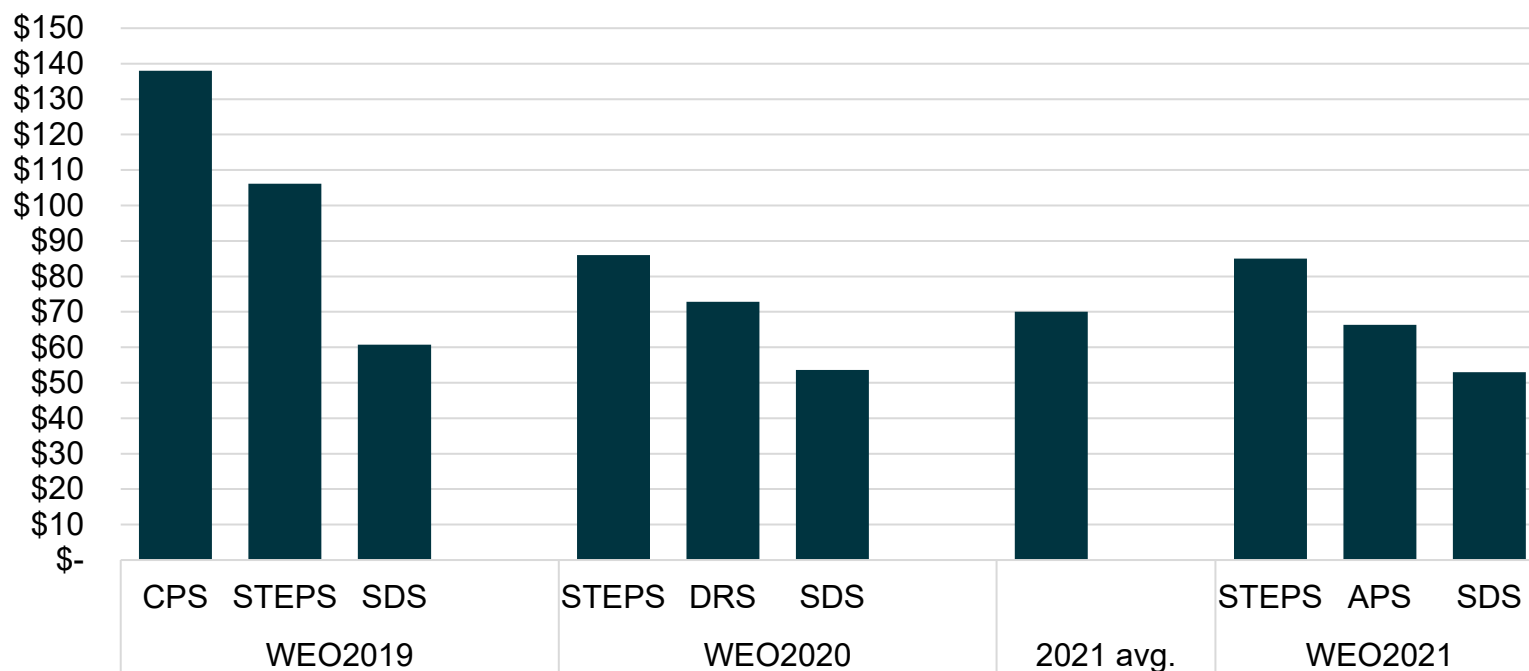
Source: IEA WEO 2021 Table 2.1; OPEC WOO2021 Table 1.5.

Notes: the IEA's 2021 assumptions extend from 2020 through 2050, while their 2020 assumptions are from 2020 to 2040. OPEC's assumptions extend from 2020 through 2045, which results in a higher annual average growth rate because growth is slower near the end of the projection period. Because the IEA and OPEC's regional classifications differ, we construct the following regional classifications to allow for intercomparison: OECD Americas is North America for IEA, and OECD Americas for OPEC; OECD Europe is the European Union for IEA, and OECD Europe for OPEC, Other non-OECD Asia is Southeast Asia for IEA, and Other non-OECD Asia for OPEC.

IEA price assumptions are lower for scenarios that are more aggressive on decarbonization, but decarbonization alone does not determine prices.

Long-term Oil Price Assumptions in 2040 and 2050

2020 US\$/bbl



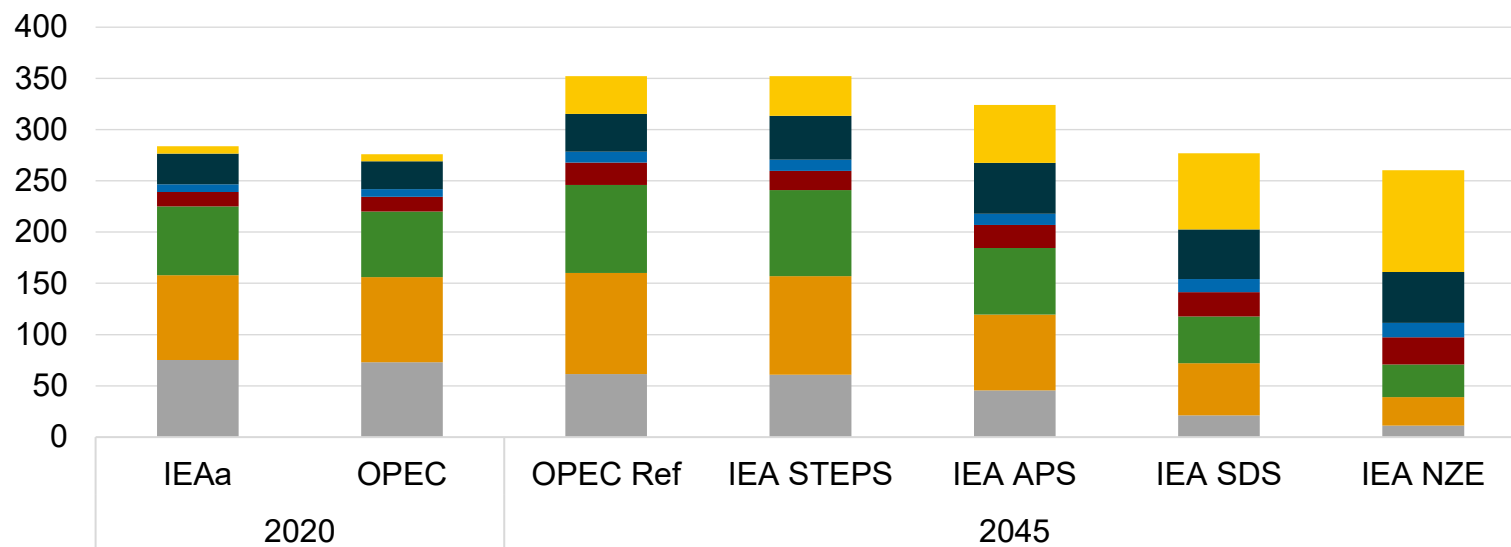
Source: IEA WEO 2019 and 2020 Table B.4, IEA WEO 2021 Annex Tables. US EIA for 2021 average Brent price.

Note: OPEC has not published medium- or long-term oil price assumptions since WOO2016.

Under all scenarios, nuclear, hydro, and other renewables grow to 2045, but differences on the role of fossil fuels reflect growing uncertainties.

World Primary Energy Demand for 2045

Million barrels per day of oil equivalent

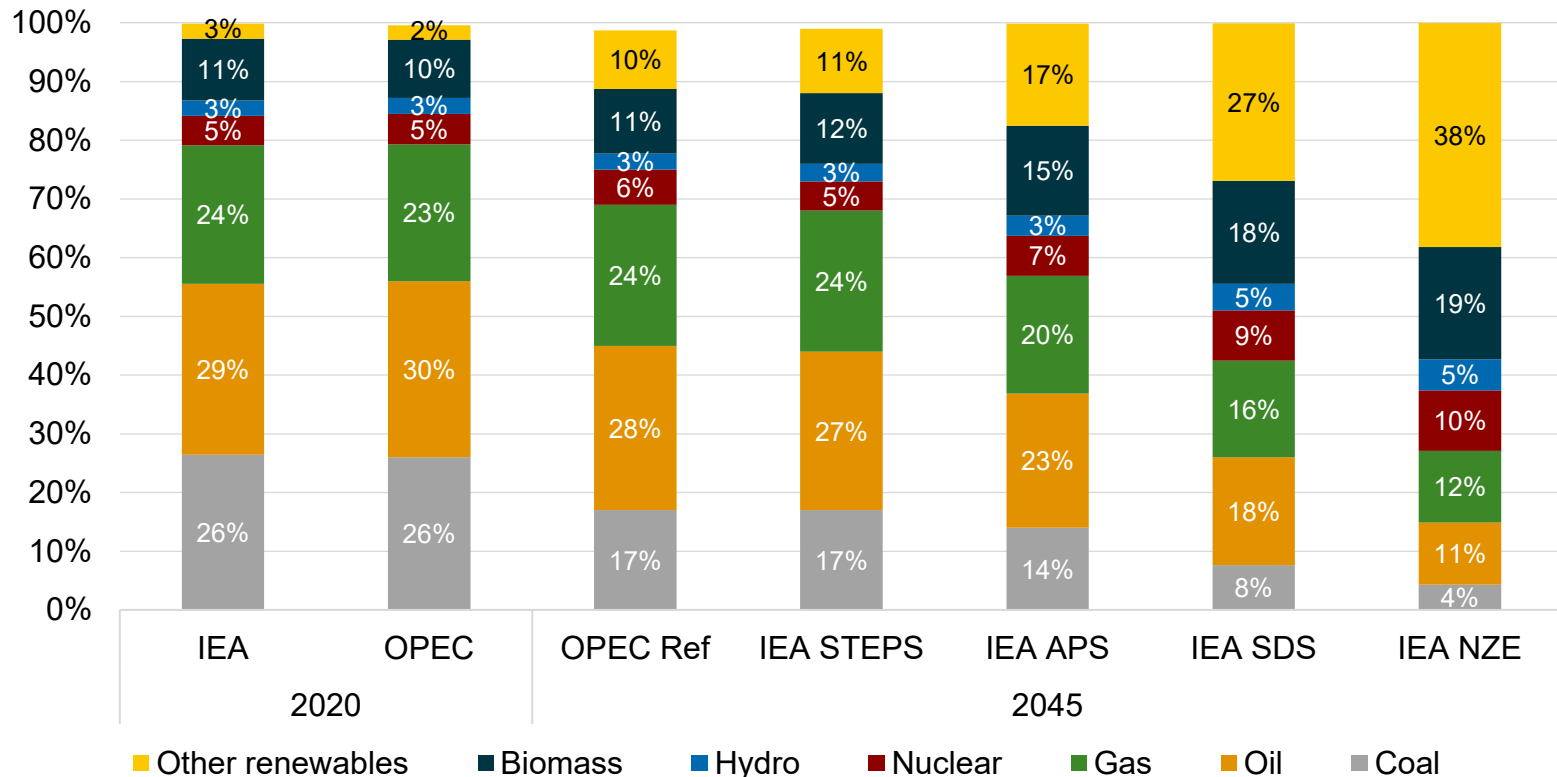


Source: IEA WEO 2021, Annex Tables; OPEC WOO2021, Table 2.1 for Reference Case.
 Note: a IEA primary energy is converted from EJ per year to mboe/d by multiplying by 0.4825 mboe/EJ.
 OPEC Sensitivity Scenarios do not provide fuel-specific data for non-fossil fuels.

■ Other renewables
 ■ Biomass
 ■ Hydro
 ■ Nuclear
 ■ Gas
 ■ Oil
 ■ Coal

Yet even under the most aggressive IEA net-zero scenario, fossil fuels still account for almost 30 percent of world primary energy demand.

World Primary Energy Demand Fuel Shares for 2025

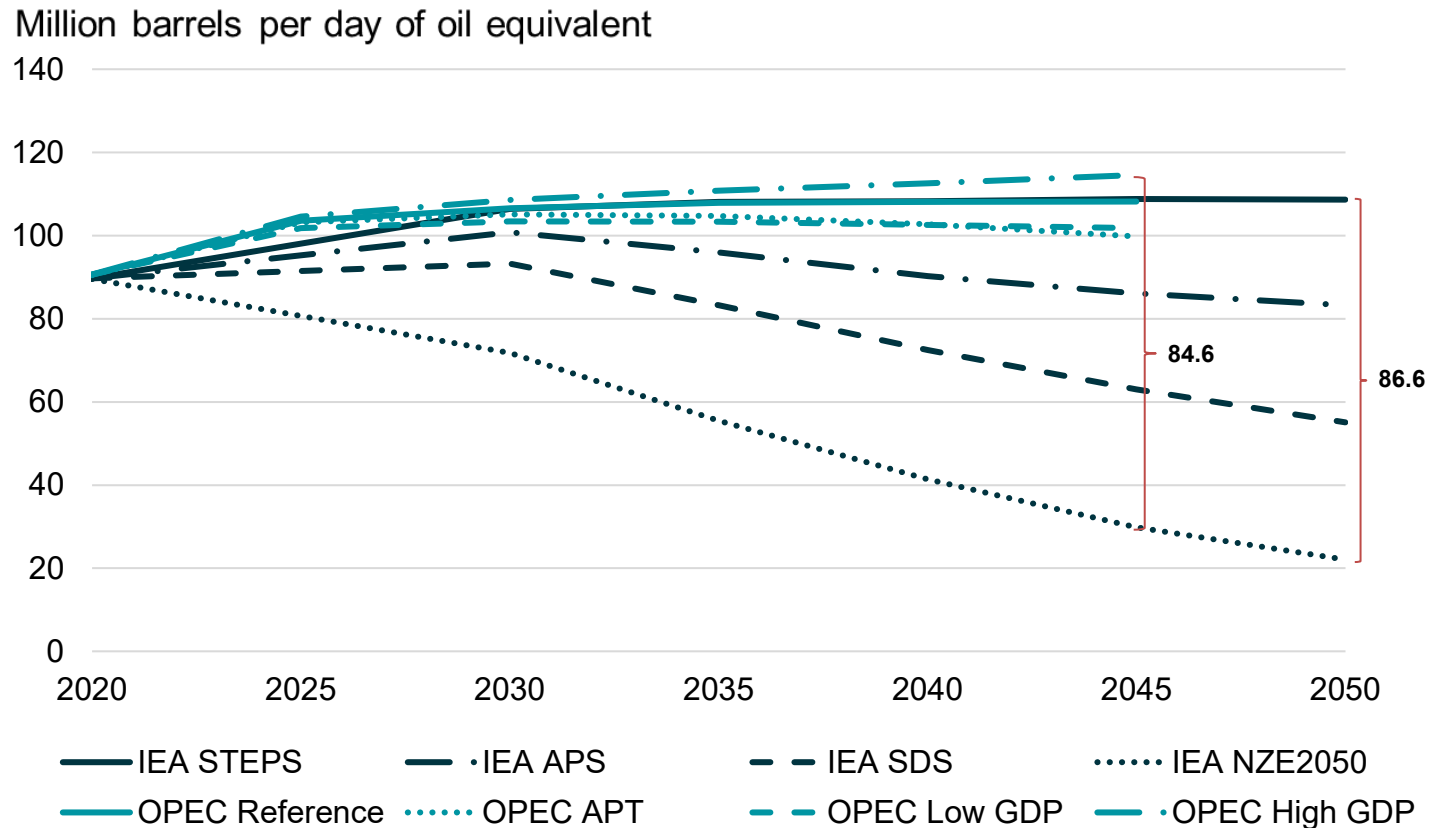


Source: See Figure 13 Sums in the data callouts may not total due to rounding

The gap between world liquids demand projections is 84.6 mb/d in 2045 up from a 35 mb/d projection gap in 2040 last year.

The gap between IEA Scenarios alone reaches 86.6 mb/d in 2050.

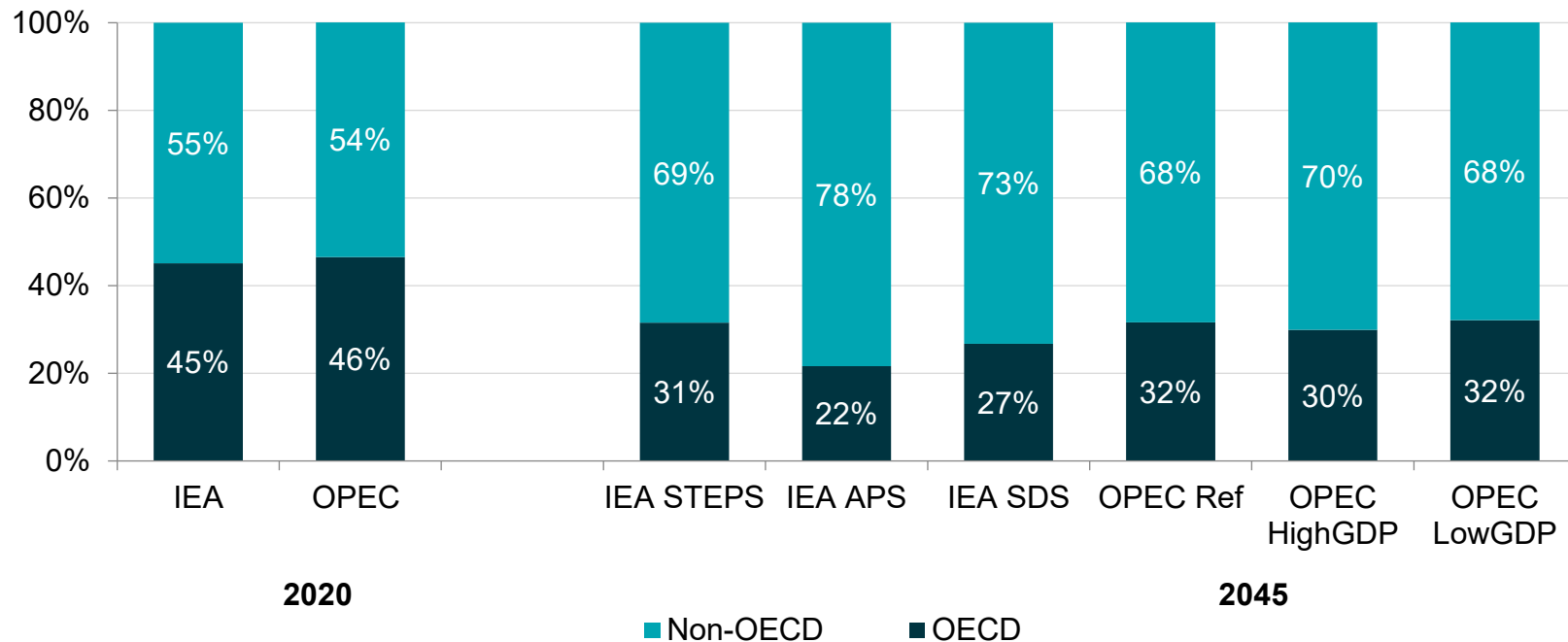
World Liquids Demand Projections in Various Scenarios



Source: IEA WEO 2021, Annex Tables; OPEC WOO 2021, Table 3.2 for Reference Case

The non-OECD share in world liquids demand grows by 15 percent in 2025 compared to 2020 averaging 71 percent across all scenarios.

World Liquids Demand Projections in Various Scenarios



Source: Figure 17 data sources: IEA WEO 2021, Annex Tables and internal communication; OPEC WOO 2021, Table 3.2.

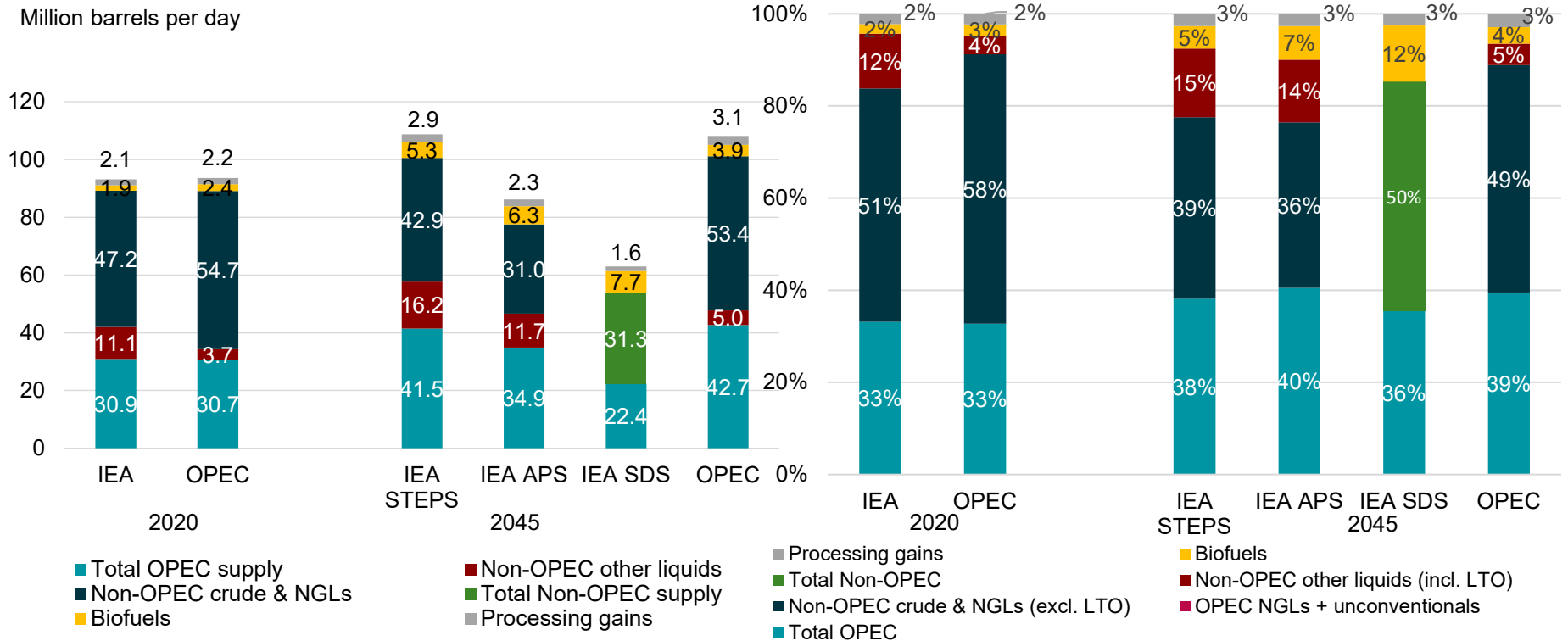
a The "bunkers" group in the IEA's WEO report is excluded from calculation for OECD and non-OECD oil demand shares.

b Biofuels from IEA WEO 2021 (provided via internal communication) are added to IEA regional oil demand data for comparability with OPEC estimates.

OPEC increases its share of liquids supply in 2045 under most scenarios compared to 2020 along with increases in other non-OPEC liquids.

Liquids Supply Sources in 2020 and Outlook for 2045

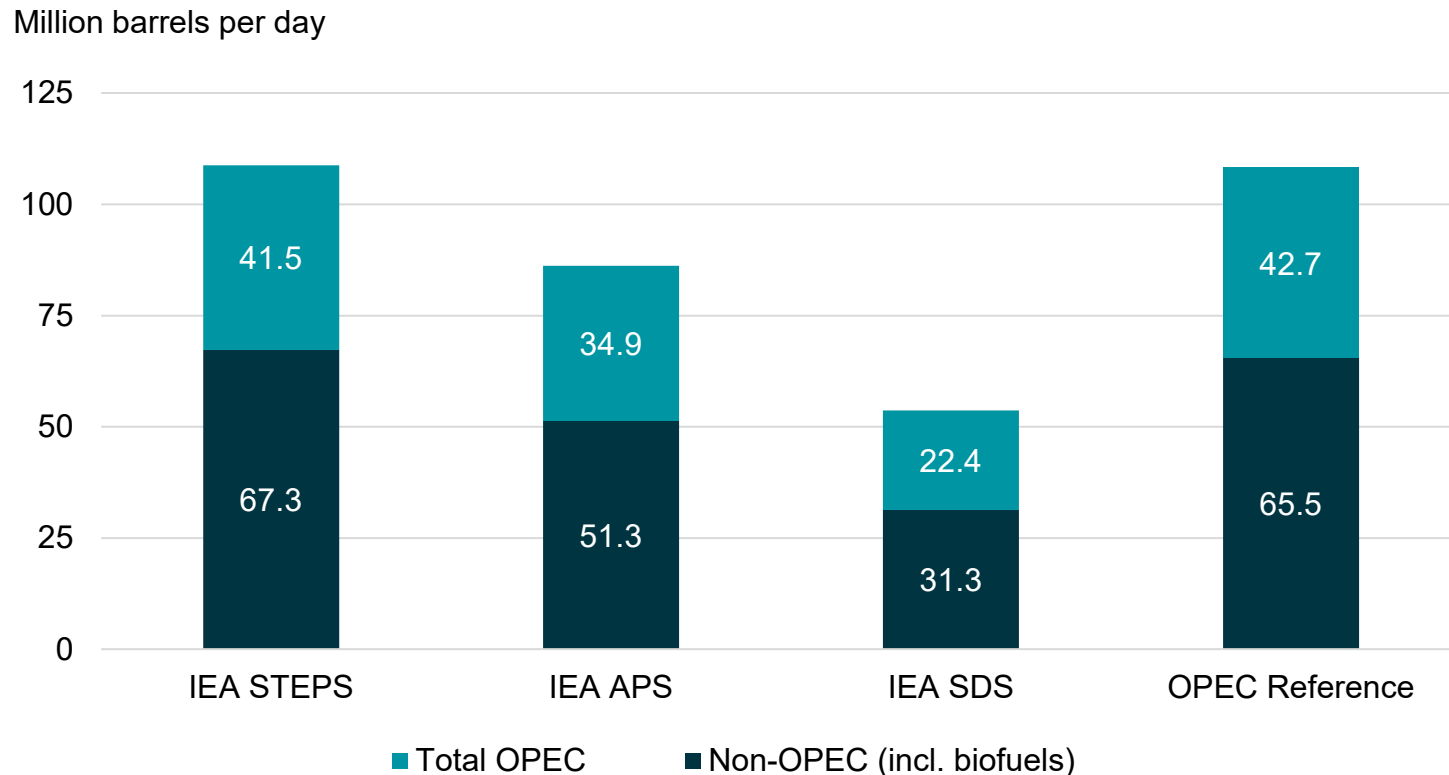
Shares of Liquids Supply Sources by types and Outlook for 2045



Source: IEA WEO2021 Annex Tables; OPEC WOO2021, Table 4.2 through 4.18

The IEA SDS scenario sees the greatest decrease in liquids supply in 2045.

2045 Liquids Supply Outlook in different Scenarios



Source: IEA WEO2021 Annex Tables. OPEC WOO2021 Table 4.3.

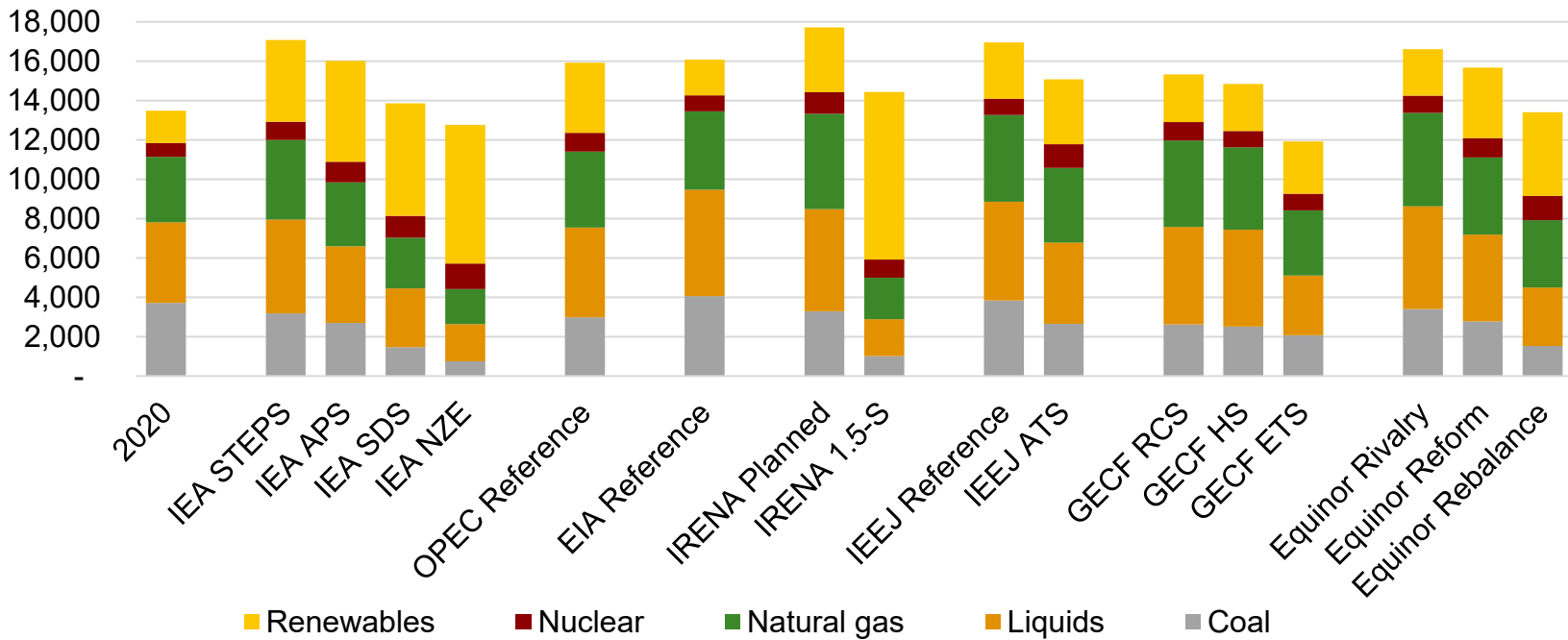
Figure 21 notes: OPEC did not publish details on the composition of OPEC supplies (e.g., NGLs and unconvensionals) in WOO2021. Processing gains are not included in this figure.

Long-Term Scenarios in Context

Long-term demand scenarios show a growing variety of fuel shares reflecting growing uncertainty that calls for more clarity on assumptions.

Primary Energy Demand in 2020 and 2050 Scenarios

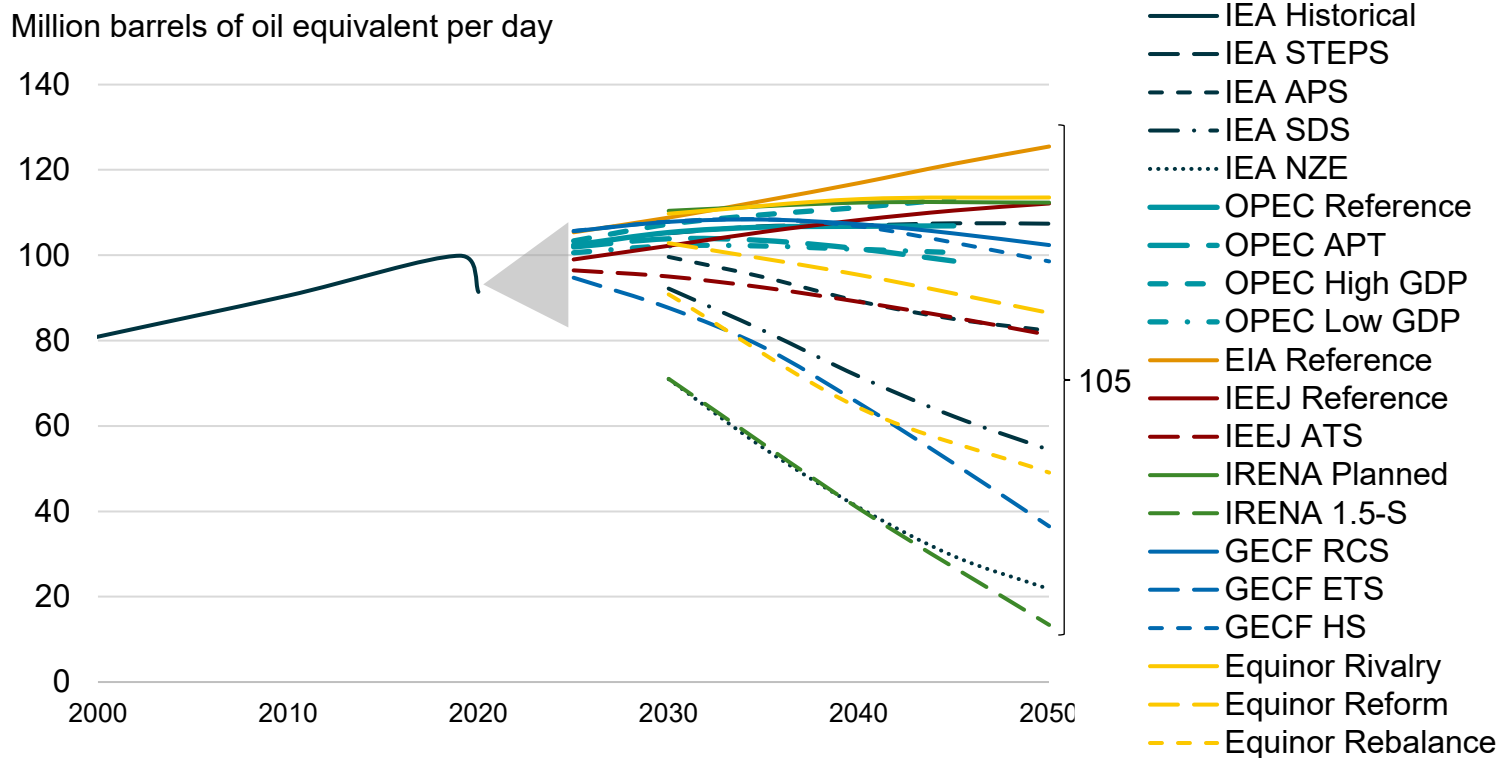
Million barrels per day



Source: IEA WEO2021 Annex Tables, OPEC WOO2021 Table 2.1, EIA International Energy Outlook 2021; IEEJ Outlook 2022, IRENA World Energy Transitions Outlook: 1.5°C Pathway and 2021 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2021 Data Appendix. Figure 22 notes: "Renewables" include hydro, biomass, and other renewables such as wind, solar, and geothermal.

The gap between liquids demand scenarios reaches 105 mb/d in 2050 — well exceeding today's market size of ~100 mb/d!

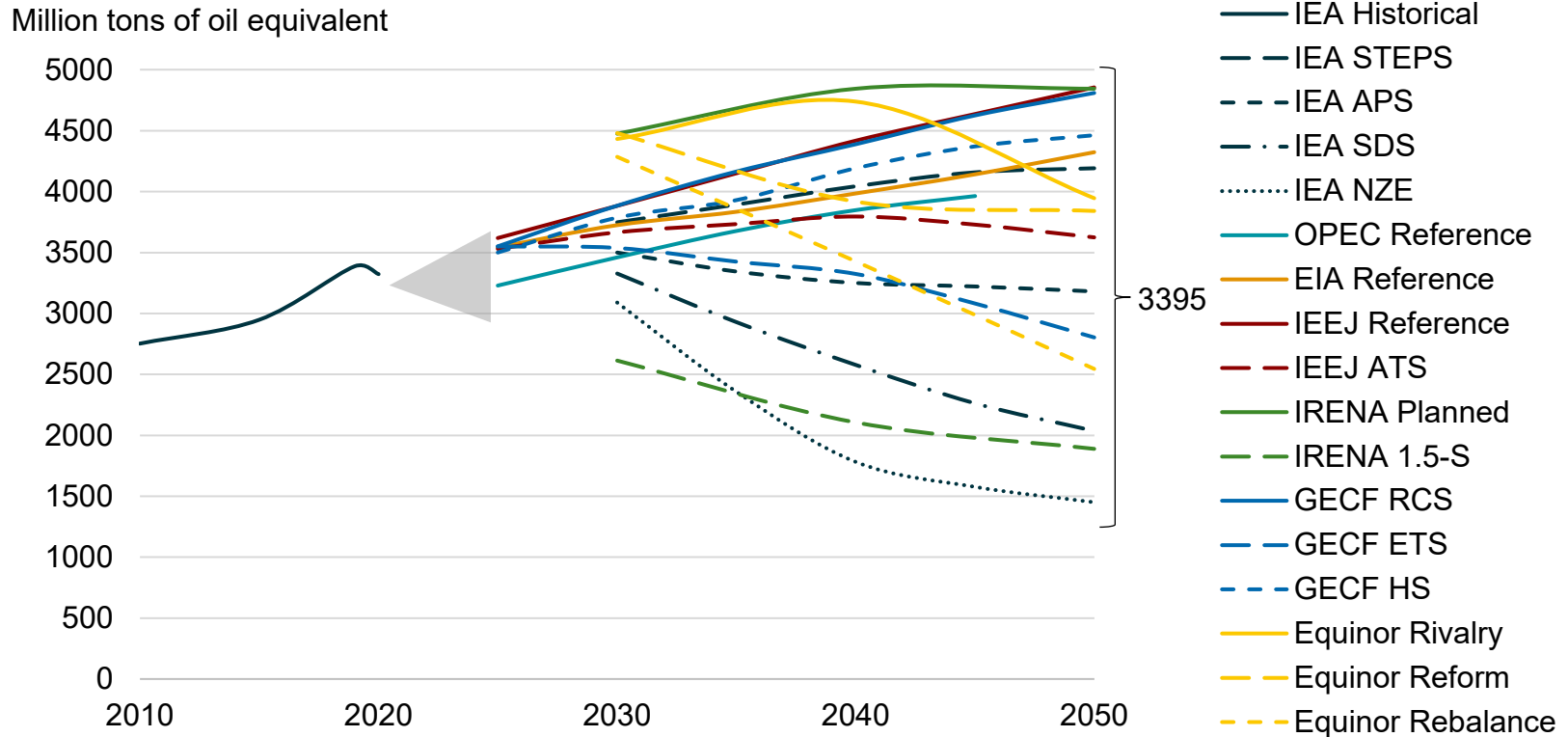
Liquids Demand Scenarios through 2050



Source: IEA WEO2021 Annex Tables, OPEC WOO2021 Table 3.2, EIA International Energy Outlook 2021; IEEJ Outlook 2022, IRENA World Energy Transitions Outlook: 1.5°C Pathway and 2021 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2021 Data Appendix. Because most outlooks do not provide projections from 2020 through 2025, the grey shaded area represents the range of implied natural gas demand during this period.

Long-term natural gas demand scenarios differ by 3395 mtoe with IRENA's Planned scenario forecasting the highest and IEA Net-Zero lowest demand.

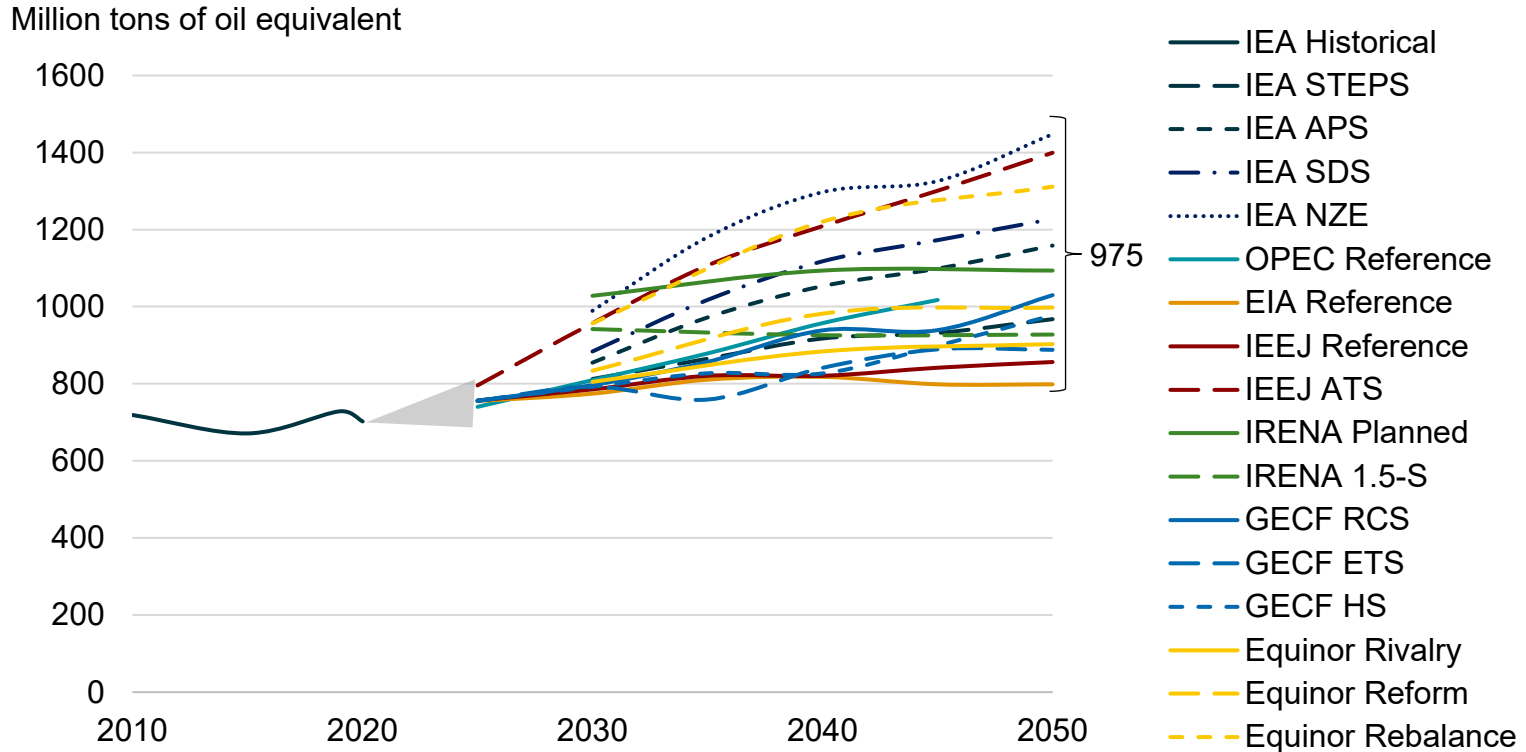
Natural Gas Demand Scenarios through 2050



Source: IEA WEO2021 Annex Tables, OPEC WOO2021 Table 2.1, EIA International Energy Outlook 2021; IEEJ Outlook 2022, IRENA World Energy Transitions Outlook: 1.5°C Pathway and 2021 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2021 Data Appendix. Because most outlooks do not provide projections from 2020 through 2025, the grey shaded area represents the range of implied liquids demand during this period.

Long-term nuclear demand scenarios diverge by 975 mtoe in 2050. IEA Net-Zero scenario forecasts the highest and Equinor Rivalry lowest demand.

Nuclear Demand Scenarios through 2050

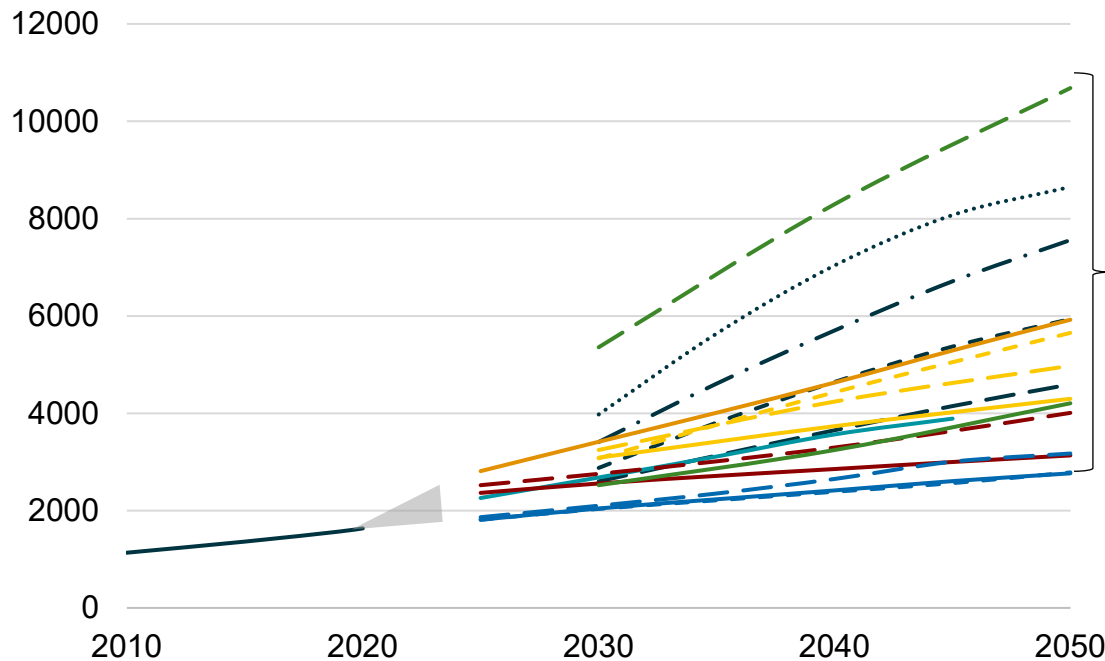


Source: IEA WEO2021 Annex Tables, OPEC WOO2021 Table 2.1, EIA International Energy Outlook 2021; IEEJ Outlook 2022, IRENA World Energy Transitions Outlook: 1.5°C Pathway and 2021 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2021 Data Appendix. Because most outlooks do not provide projections from 2020 through 2025, the grey shaded area represents the range of implied liquids demand during this period.

Long-term renewable demand scenarios diverge by 7899 mtoe in 2050. IRENA 1.5C scenario forecasts highest and GECF HS reports the lowest

Renewable Demand Scenarios through 2050

Million tons of oil equivalent



- IEA Historical
- - IEA STEPS
- - - IEA APS
- · - IEA SDS
- IEA NZE
- OPEC Reference
- EIA Reference
- IEEJ Reference
- - IEEJ ATS
- IRENA Planned
- - IRENA 1.5C
- GECF RCS
- - GECF ETS
- - GECF HS
- Equinor Rivalry
- - Equinor Reform
- - Equinor Rebalance

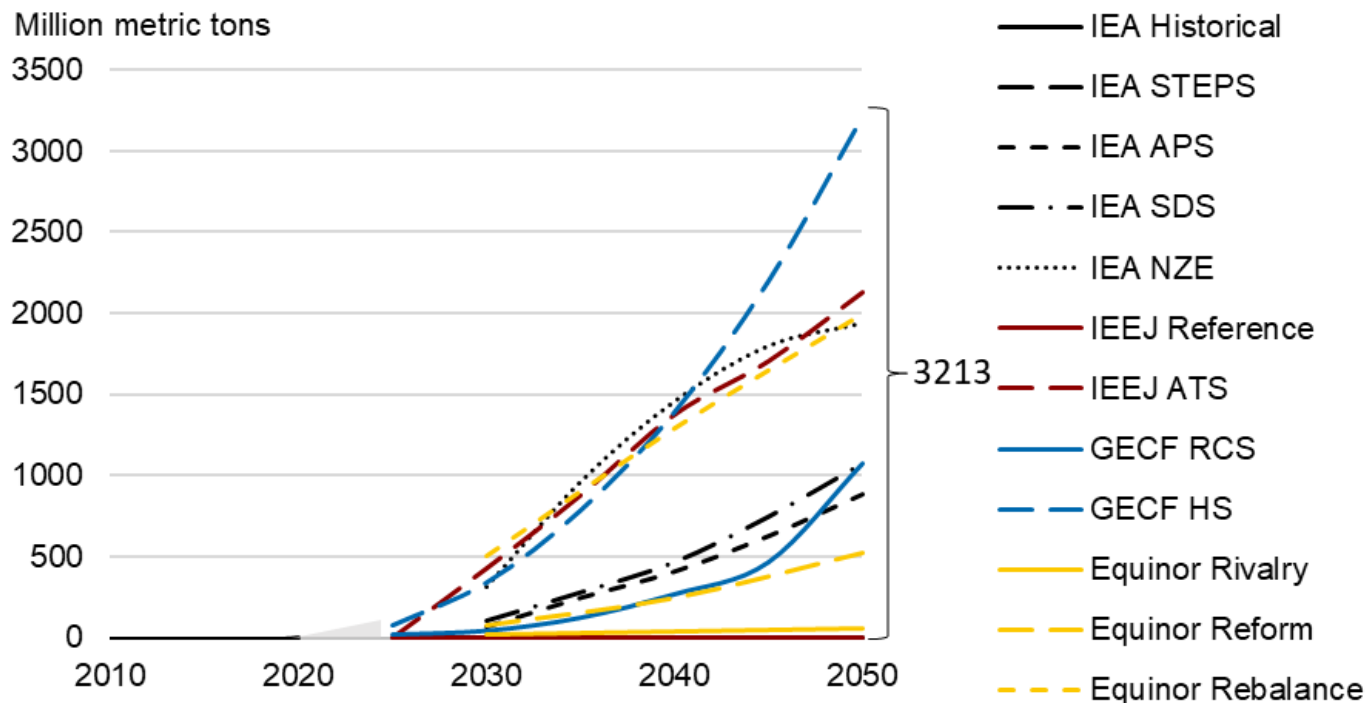
7899

Source: IEA WEO2021 Annex Tables, OPEC WOO2021 Table 2.1, EIA International Energy Outlook 2021; IEEJ Outlook 2022, IRENA World Energy Transitions Outlook: 1.5°C Pathway and 2021 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2021 Data Appendix. Because most outlooks do not provide projections from 2020 through 2025, the grey shaded area represents the range of implied liquids demand during this period.

Long-term CCUS deployment diverges by 3213 mmt in 2050. The GECF HS scenario forecasts highest and Equinor Rivalry reports the lowest demand.

All scenarios fall short of the CCUS 5600 mmt required to reduce GHG emissions by 20 percent in 2050.

CCUS Deployment Scenarios through 2050



Source: IEA WEO2021 Annex Tables, EIA International Energy Outlook 2021; IEEJ Outlook 2022, IRENA World Energy Transitions Outlook: 1.5°C Pathway and 2021 edition GECF Global Gas Outlook 2050 data provided via internal communication, Equinor Energy Perspectives 2021 Data Appendix. Because most outlooks do not provide projections from 2020 through 2025, the grey shaded area represents the range of implied liquids demand during this period.



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