



# 14 IEA IEF OPEC Symposium on Energy Outlooks



## IEF Outlooks Comparison Report

February 2024

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# Introduction: IEA-IEF-OPEC trilateral program of work bolsters energy data transparency and market stability

- IEA and OPEC energy outlooks shape consensus views and influence policy and investment decisions worldwide. Given their influence, it is vital to understand these outlooks and the assumptions underlying the various scenarios.
- The Cancun IEF Ministerial Declaration (2010) called for the IEA, IEF, and OPEC to organize an annual symposium on energy outlooks. This mission has only become more important considering the recent global pandemic, geopolitical upheaval, and progress toward energy transitions.
- This report will inform the 14<sup>th</sup> IEA-IEF-OPEC Symposium by comparing the key scenarios and underlying methodologies of IEA and OPEC's most recent outlooks and placing them in the broader context of outlooks produced by other key industry organizations and market players.
- Promoting greater transparency of energy outlook methodologies, assumptions, and data comparability can help bring stability to the market by enabling informed policies and investment decisions.

# Energy outlooks highlight the need for a “multidimensional” approach to the energy transition along with increased inter-government cooperation, investment, and technology innovation

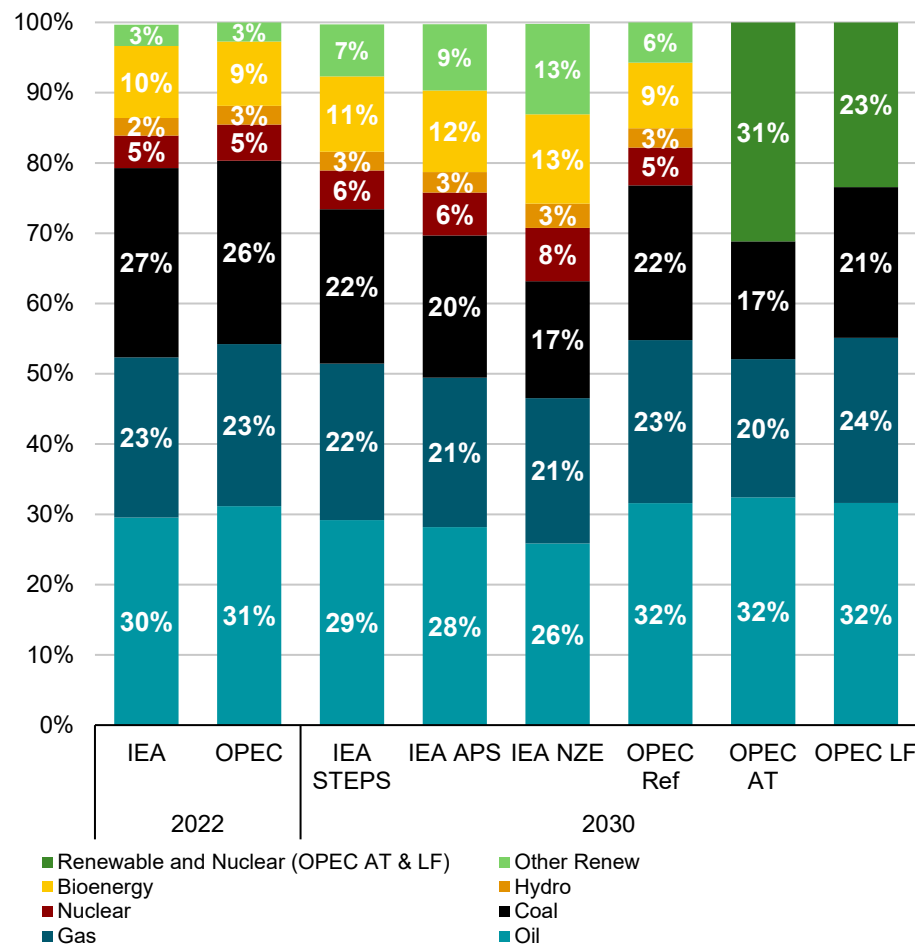
- This report compares the short and long-term energy outlooks from IEA and OPEC and then examines a wider-range of scenarios published by leading industry and intergovernmental organizations.
- Similar to previous years, the divergences in energy forecasts are growing, underscoring the vast uncertainties relating to policy, technology, energy costs, and energy efficiency. The range between the high and low scenarios for 2050 total primary energy demand is more than eight percent greater than today’s global energy market. Similarly wide ranges are found in the long-term demand outlooks for oil, natural gas, coal, nuclear, and renewables.
- Different approaches to modeling and the complexity of energy systems help explain the large range in projections. Some models use backcasting and start from a desired end-goal, such as achieving net zero emissions by a specific date, and then model a path to reach specific targets. Other models take a bottom-up approach with different assumptions on whether and how policies will evolve, how geopolitics will impact energy security and resource availability, and how technology costs will develop.
- While there is significant uncertainty in the short-, medium-, and long-term, one thing is clear, there is no single, linear path for the energy transition. All energy sources and technologies will be needed to meet the world’s growing energy needs while reducing greenhouse gas emissions. Additionally, different countries will progress at different paces according to domestic circumstances, priorities, and financial and technological capabilities.
- Many of the scenarios examined show global population growing by more than 20 percent by 2050 and the global economy doubling compared to 2022. Unprecedented levels of investment and cooperation across governments and in the energy and technology sectors will be needed to achieve climate goals and ensure accessible and affordable energy for all.
- The range of energy scenarios also underscores the importance for policymakers to provide clear, predictable, and achievable policies/regulations and highlights the challenges ahead for achieving a just and orderly transition. Aspirational energy outlook scenarios are essential for tracking global progress towards climate goals, but it is equally important to provide outlooks that reflect likely policy developments and consumer trends. Clear model assumption descriptions and an assessment on the probability of scenario outcomes based on recent trends could enhance the usefulness of outlooks for investors and policymakers.

# 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.
- While four of the six IEA and OPEC scenarios see total fossil fuel demand falling between 2022 and 2030, fossil fuel's share of total primary demand will remain a robust 63 to 77 percent in 2030 (vs. 80 percent in 2022).
  - 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.
- Liquids supply is expected to rise by 6 mb/d in IEA's STEPS and 12 mb/d in OPEC Reference Case. IEA's APS sees a slight 1 mb/d decline. The drivers of liquids supply growth include OPEC countries, Latin America and OECD Americas.
  - OPEC Reference Case sees more than six times stronger OPEC production growth and more than two times stronger non-OPEC supply growth to 2030 compared to IEA STEPS.

## World Primary Energy Fuel Share Outlook to 2030

Percent of total primary energy



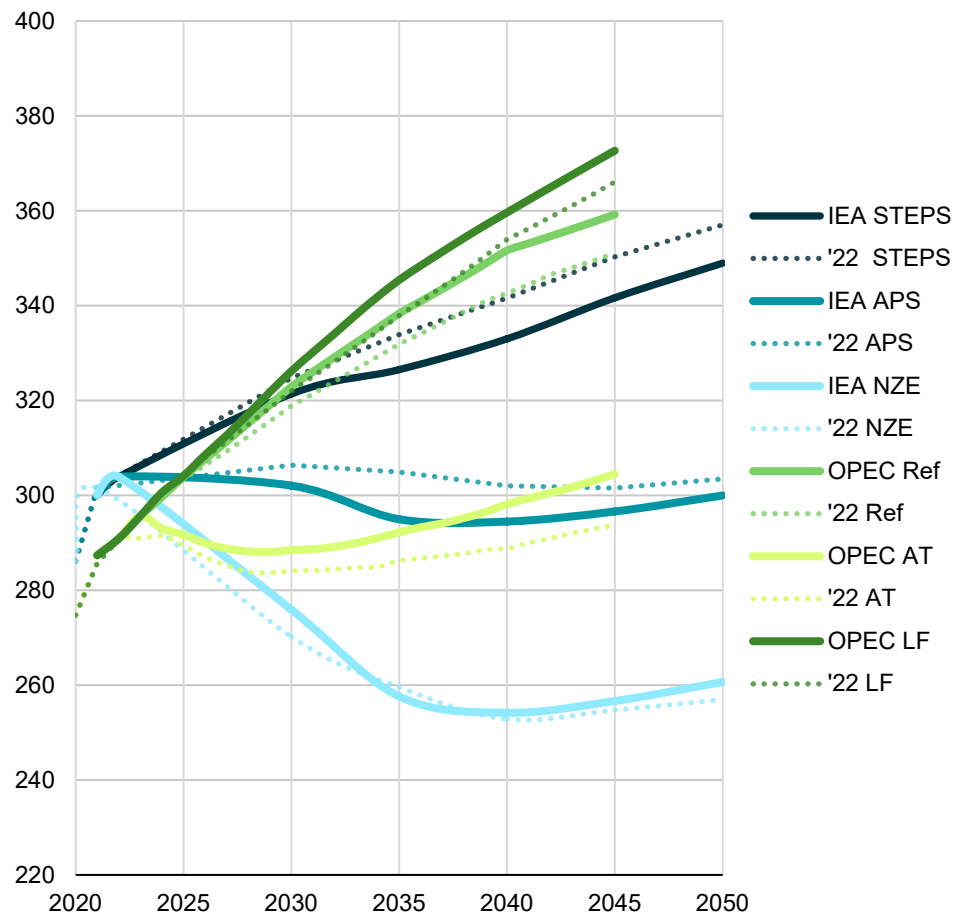
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# 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.
- Three of the six scenarios see robust growth in primary energy demand to 2045. However, IEA's NZE scenario shows primary energy demand will need to plummet by 15 percent by 2045 vs. 2022.
- Renewable, hydro, biomass, and nuclear are expected to grow by a total of 95 to 224 percent by 2045 in all six scenarios.
- IEA's NZE scenario has the highest non-fossil fuel energy forecast for 2050 at 218 mboe/d, but this is still slightly below IEA's estimate of 2022's fossil fuel demand of 242 mboe/d. However, IEA's NZE shows fossil fuel demand will have fallen well below the current market size for non-fossil fuels by 2045.
- Four of the six scenarios show fossil fuels accounting for more than 50 percent of primary energy in 2045 (vs. 80 percent in 2022).
- Liquid demand grows into the 2030s and plateaus in IEA STEPS and OPEC Reference Case, while it peaks and collapses in IEA's APS and NZE. This is largely mirrored in the forecast for oil use in the transportation sector.
- IEA STEPS and OPEC Reference Case see oil demand in the petrochemical sector rising by nearly 30 percent in the forecast period. APS also shows a net increase, albeit to a lesser extent.
- Liquids production rises by 16 mb/d between 2022 and 2045 in OPEC Reference Case with 74 percent of the growth coming from OPEC countries and US liquid production falling below 2022 levels.

## Global Primary Energy Demand Outlook

Million barrels of oil equivalent per day



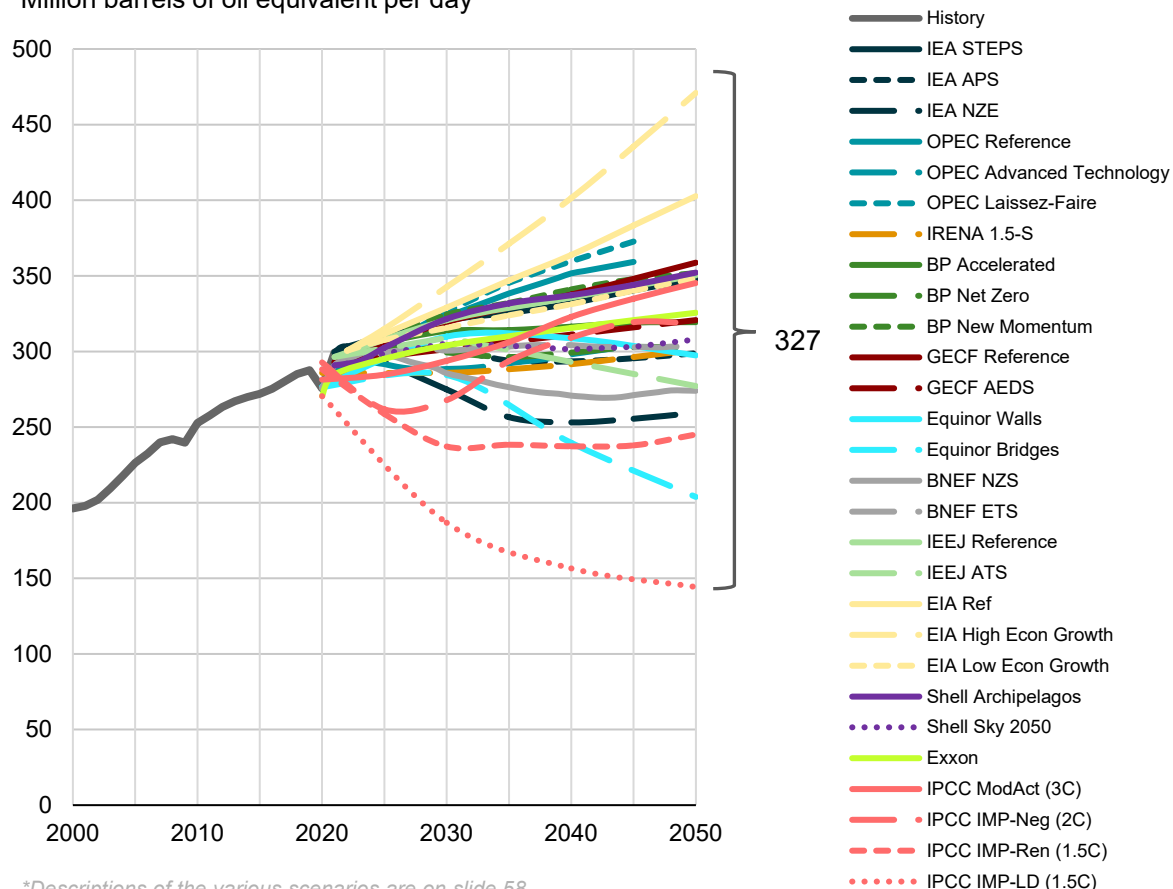
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Comparing IEA and OPEC to Other Long-Term Energy Outlooks:

- To gain a better sense of how IEA and OPEC projections compare against other industry-leading energy outlooks, we gathered data on 23 additional scenarios from 10 sources.
- 71 percent of all scenarios surveyed show end-period primary energy demand at higher levels than 2022. Scenarios modeling more ambitious climate policies, particularly models that backcast, show a decline or plateau in energy demand.
- The range between the high and low forecast for 2050 is 327 mboe/d, eight percent larger than 2022 demand levels.
- 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:
  - Coal demand falling by more than 50 percent by 2050
  - Fossil fuels accounting for more than 50 percent of total primary energy demand in 2050
  - Nuclear demand increasing by more than 50 percent by 2050

## Total Primary Energy Demand Scenarios Through 2050

Million barrels of oil equivalent per day



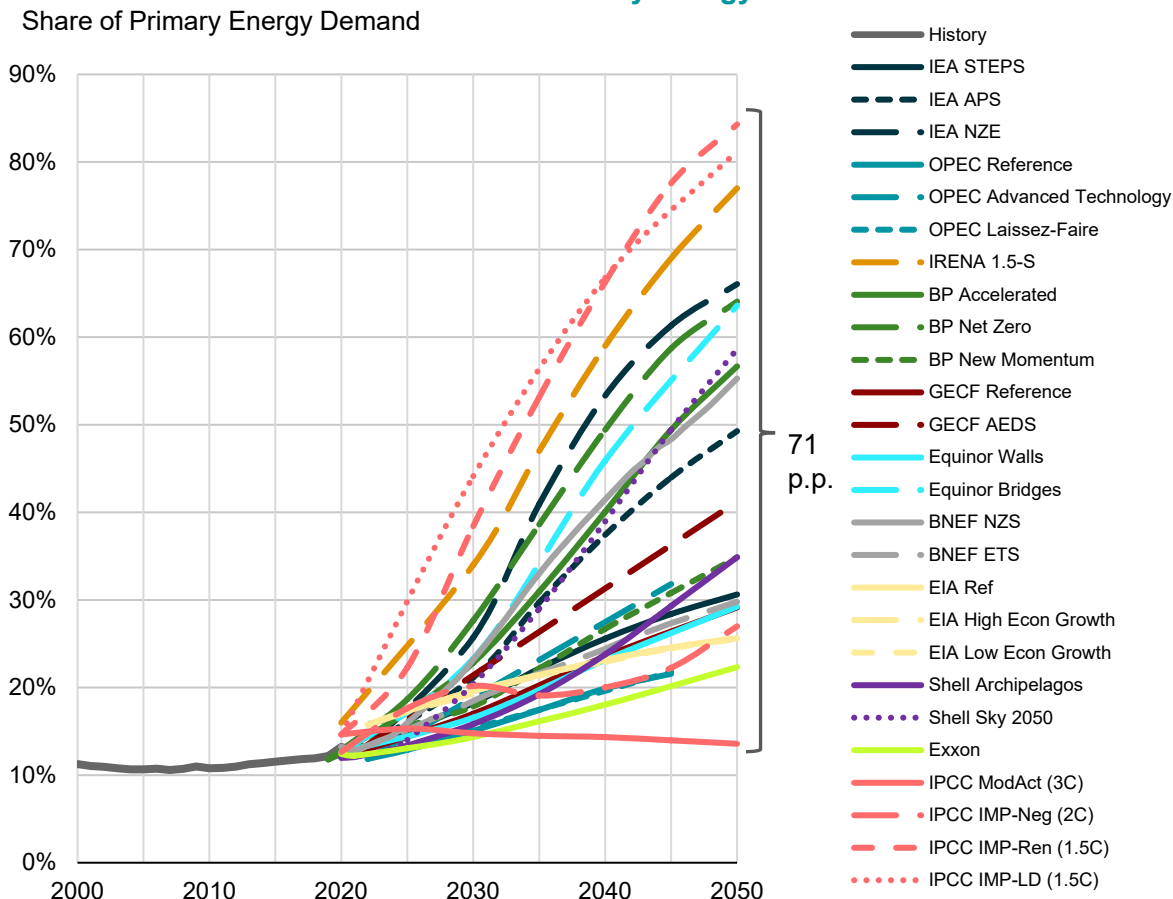
\*Descriptions of the various scenarios are on slide 58

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, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios 2023, Exxon Global Outlook 2023, IPCC AR6

# Comparing IEA and 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.
- The median 2050 renewables demand forecast for the more ambitious climate scenarios is 40 percent higher than the median forecast for reference and evolving policies scenarios.
- Excluding a high outlier, scenarios for natural gas demand in 2050 diverge by more than 6,000 bcm – an amount that is still 45 percent larger than today's global gas market.
- The median 2050 electricity generation forecast for more ambitious climate scenarios is nearly 20 percent above the median for reference and evolving policies scenarios.
- Most of the more ambitious climate scenarios show carbon capture expanding to six to eight Gt of CO<sub>2</sub>/year by 2050.
- The more ambitious climate scenarios show the per capita energy use falling by ~10 to 25 percent by 2050, reversing the historical trend.
- The Paris-aligned scenarios show the energy intensity of GDP falling to a median 1.6 MJ/USD by 2050 vs. 2.3 MJ/USD median for reference and evolving policies scenarios.

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



\* 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



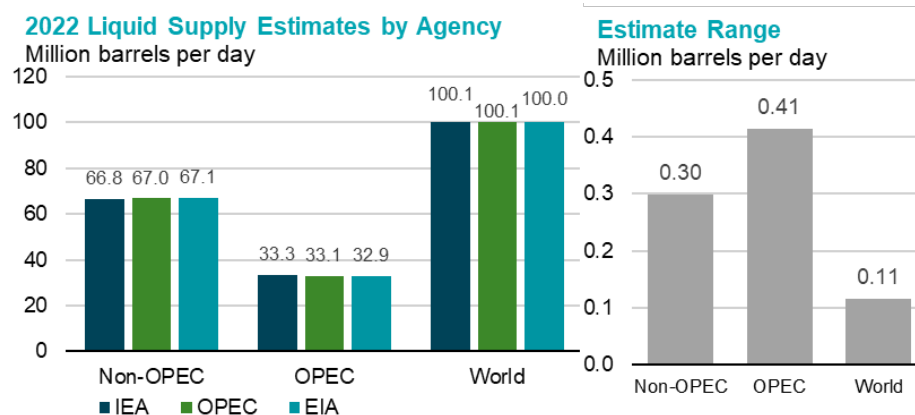
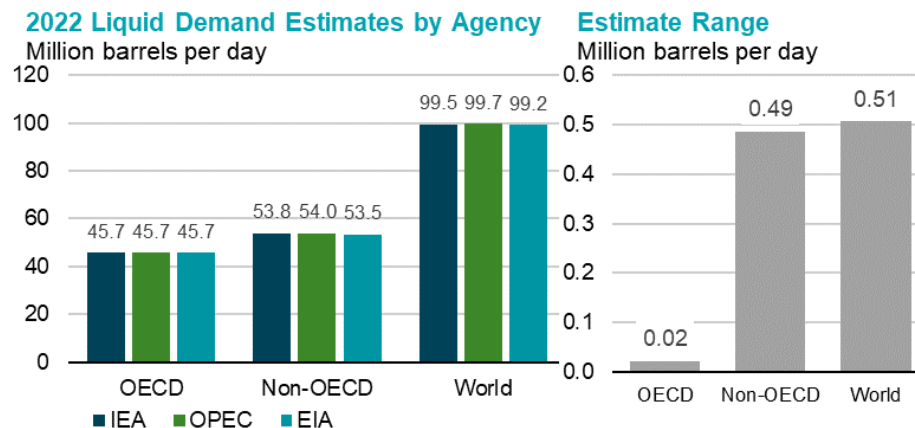
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# IEA OMR, OPEC MOMR, and EIA STEO Baseline 2022 Liquids Data (as of January 2024)

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# 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.
- The largest divergences in current liquids baseline data exist in non-OECD demand – similar to previous years.
- 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. Unless otherwise stated, this report adds IEA regional biofuels data – both historical and forecast data – to IEA’s regional liquids supply data.
- EIA supply includes refinery processing gains in country-level supply and does not separate them out as in IEA and OPEC data. This report subtracts estimated regional processing gains in historical and forecasted EIA data to make it more comparable to IEA and OPEC.



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

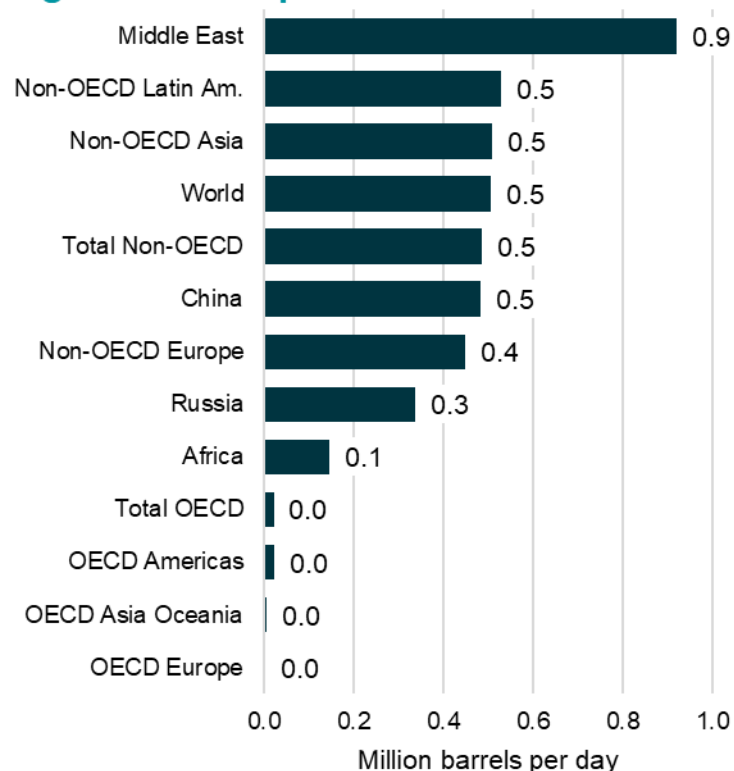
# Largest baseline demand divergences stem from the Middle East, Latin America, and non-OECD Asia

Non-OECD demand estimates range 0.5 mb/d vs. OECD demand's 0.0 mb/d

2022 Total Liquid Demand Estimates by Agency

million barrels per day	IEA	OPEC	EIA	Range (high-low)
<b>Total OECD</b>	<b>45.7</b>	<b>45.7</b>	<b>45.7</b>	<b>0.0</b>
Americas	24.8	24.8	24.8	0.0
Europe	13.5	13.5	13.5	0.0
Asia Oceania	7.4	7.4	7.4	0.0
<b>Total Non-OECD</b>	<b>53.8</b>	<b>54.0</b>	<b>53.5</b>	<b>0.5</b>
Asia	28.7	29.2	28.7	0.5
China	14.7	15.0	15.1	0.5
Middle East*	8.8	8.3	9.2	0.9
Latin America	6.2	6.4	5.9	0.5
Europe and Eurasia	5.7	5.7	5.3	0.4
Russia	3.8	3.8	3.4	0.3
Africa	4.3	4.4	4.4	0.1
<b>World</b>	<b>99.5</b>	<b>99.7</b>	<b>99.2</b>	<b>0.5</b>

Range in 2022 Liquid Demand Estimates



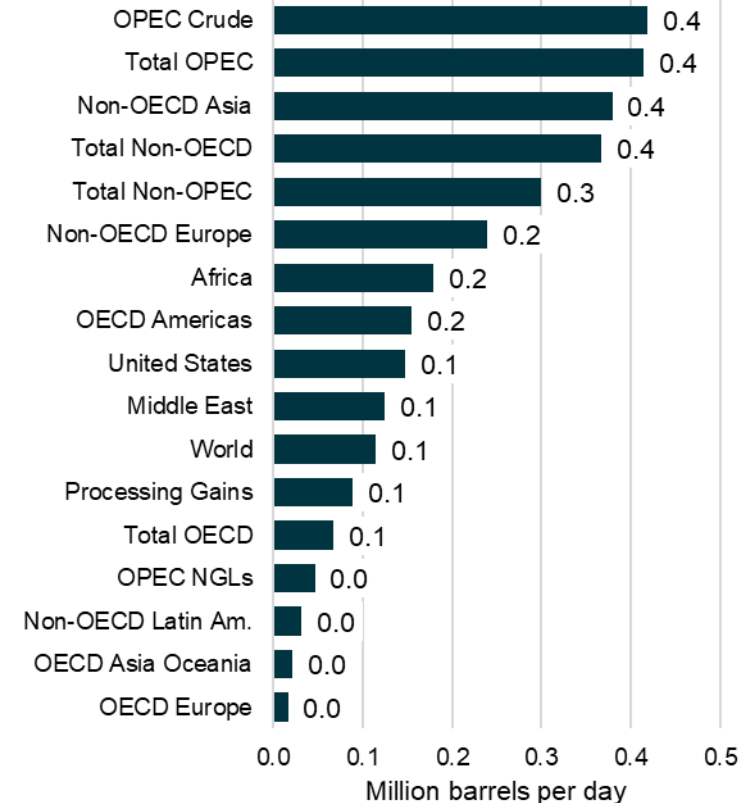
Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

\*The differences between the IEA and OPEC Middle East baselines relate to data sources. OPEC Secretariat's figures stem from the OPEC Annual Questionnaire a review of Member Countries' technical bodies.

# Largest divergences on the supply-side stem from OPEC crude, non-OECD Asia, and non-OECD Europe

2022 Total Liquid Supply Estimates by Agency				
million barrels per day	IEA*	OPEC	EIA**	Range (high-low)
<b>Total OECD</b>	<b>31.0</b>	<b>31.0</b>	<b>30.9</b>	<b>0.1</b>
Americas	26.9	26.9	26.8	0.2
<i>United States</i>	19.1	19.3	19.3	0.1
Europe	3.6	3.6	3.6	0.0
Asia Oceania	0.5	0.5	0.5	0.0
<b>Total Non-OECD</b>	<b>33.4</b>	<b>33.6</b>	<b>33.8</b>	<b>0.4</b>
Asia	7.4	7.6	7.8	0.4
Middle East	3.2	3.3	3.2	0.1
Latin America	6.4	6.3	6.3	0.0
Europe and Eurasia	14.0	14.0	13.8	0.2
Africa	2.5	2.5	2.6	0.2
<b>Processing Gains</b>	<b>2.3</b>	<b>2.4</b>	<b>2.3</b>	<b>0.1</b>
<b>Total Non-OPEC</b>	<b>66.8</b>	<b>67.0</b>	<b>67.1</b>	<b>0.3</b>
<b>Total OPEC</b>	<b>33.3</b>	<b>33.1</b>	<b>32.9</b>	<b>0.4</b>
OPEC Crude***	27.9	27.7	27.5	0.4
OPEC NGLs	5.4	5.4	5.4	0.0
<b>World</b>	<b>100.1</b>	<b>100.1</b>	<b>100.0</b>	<b>0.1</b>

## Range in 2022 Liquid Supply Estimates



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

\* Regional biofuels were added to IEA total liquids supply using IEA's OMR Table 17 World's Biofuels Production estimates

\*\* Regional refinery processing gains were estimated using EIA and IEF data and subtracted from EIA regional total liquids supply

\*\*\* OPEC Secretariat's estimate of OPEC crude production is based on assessments from secondary sources.

# Agencies largely agree on OECD commercial stock change, but the estimates for net global stock change and miscellaneous to balance differ by >0.4 mb/d

- The net global stock change and miscellaneous items equal the difference between annual global supply and global demand estimates.
- IEA estimated the net global stock change and miscellaneous items for 2022 was at +0.63 mb/d compared to OPEC's +0.41 mb/d and EIA's +0.84. This difference is primarily driven by demand uncertainty.

2022 Stock Change and Miscellaneous Items				
million barrels per day	IEA	OPEC	EIA	Range (high-low)
<b>Total OECD</b>	<b>-0.38</b>	<b>-0.39</b>	<b>-0.26</b>	<b>0.13</b>
Commercial	0.35	0.35	0.35	0.01
Government/SPR	-0.74	-0.74	-0.61	0.13
<b>Oil-on-water</b>	<b>0.28</b>	<b>0.54</b>		<b>0.26</b>
<b>Miscellaneous to balance</b>	<b>0.74</b>	<b>0.26*</b>	<b>1.10**</b>	<b>0.48</b>
<b>Net Global Stock Change and Miscellaneous Items</b>	<b>0.63</b>	<b>0.41</b>	<b>0.84</b>	<b>0.42</b>

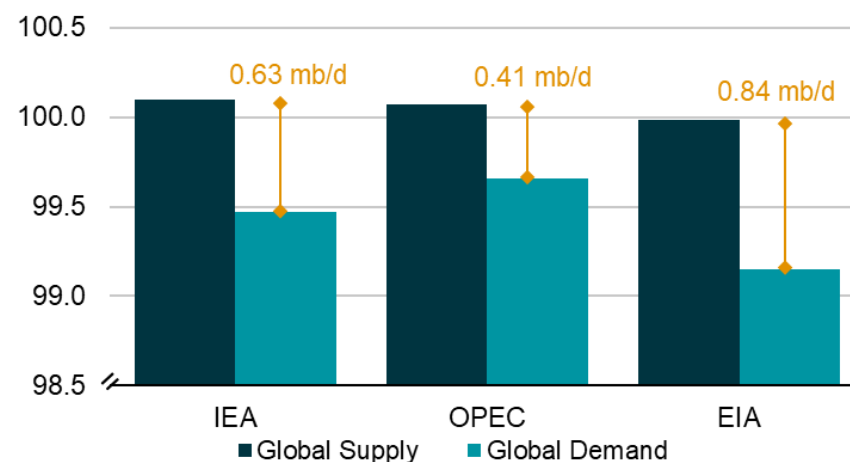
Some differences may exist due to rounding

\* OPEC does not report misc. to balance, it is calculated from the reported components.

\*\* EIA does not provide a breakdown of oil-on-water and miscellaneous to balance

## 2022 Global Oil Balances

million barrels per day



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

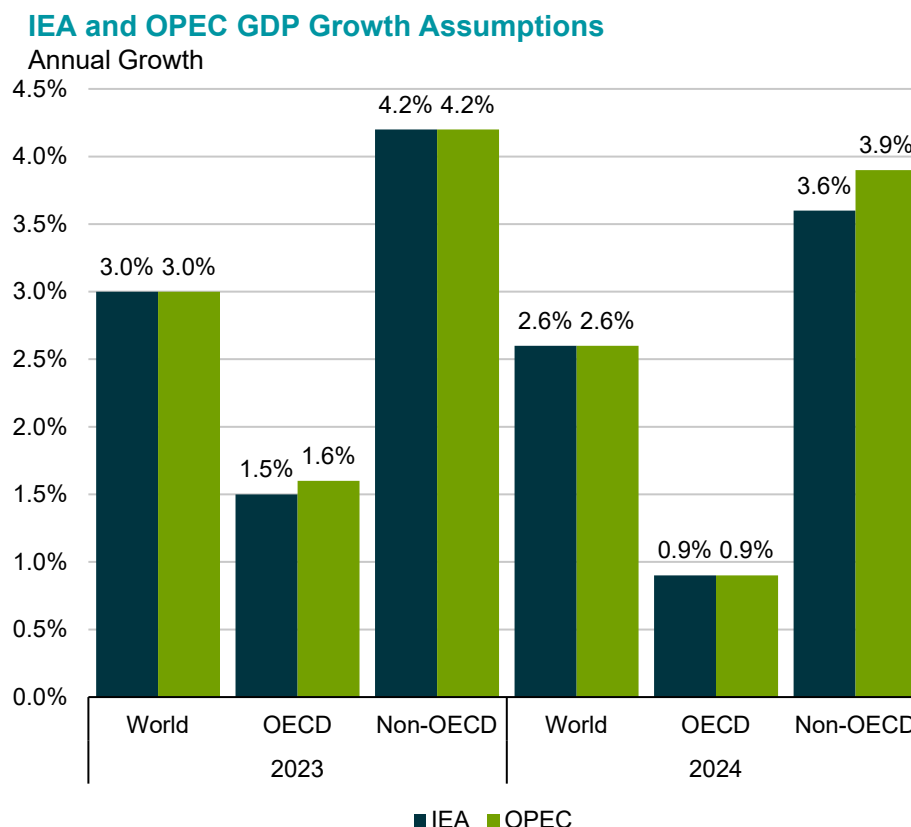
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# IEA OMR, OPEC MOMR and EIA STEO 2023-2024 Liquids Outlook (as of January 2024)

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# Both IEA and OPEC see global economic growth slowing from 3.0% in 2023 to 2.6% in 2024

Short-term GDP Growth Assumptions						
	2023			2024		
	IEA	OPEC	Range (p.p.)	IEA	OPEC	Range (p.p.)
<b>World</b>	<b>3.0%</b>	<b>3.0%</b>	<b>0.0</b>	<b>2.6%</b>	<b>2.6%</b>	<b>0.0</b>
<b>OECD</b>	<b>1.5%</b>	<b>1.6%</b>	<b>0.1</b>	<b>0.9%</b>	<b>0.9%</b>	<b>0.0</b>
US	2.4%	2.4%	0.0	1.2%	1.0%	0.2
EU*	0.5%	0.5%	0.0	0.5%	0.5%	0.0
Japan	1.5%	1.9%	0.4	0.7%	0.9%	0.2
<b>Non-OECD</b>	<b>4.2%</b>	<b>4.2%</b>	<b>0.1</b>	<b>3.6%</b>	<b>3.9%</b>	<b>0.3</b>
China	5.2%	5.2%	0.0	4.4%	4.8%	0.4
India	7.0%	6.8%	0.2	6.9%	5.9%	2.0
Brazil	3.0%	2.9%	0.1	1.5%	1.4%	0.1
Russia	3.1%	2.8%	0.3	1.1%	1.4%	0.3



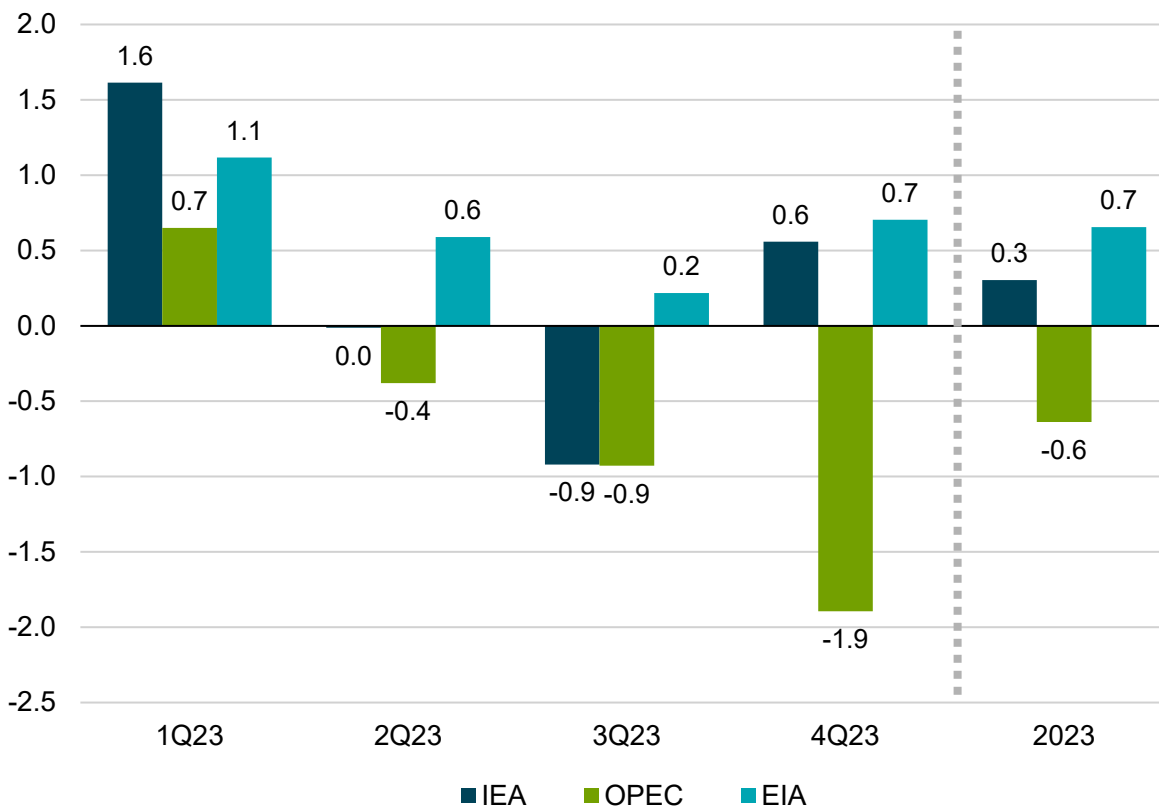
Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR

Note: IEA GDP assumptions are based on analysis from Oxford Economics  
 \* IEA provides estimates for the EU while OPEC uses Euro Zone grouping

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

- Data, particularly for demand, is revised routinely for years to come, but this large of a divergence at the end of the year is uncommon.
- The 2023 annual balances from IEA, OPEC, and EIA imply global oil inventories either *grew* by 0.3-0.7 mb/d or *drew* by 0.6 mb/d.
- This is 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).
- 4Q23 data is still considered a forecast and the current estimates of the global supply-demand balance diverge by 2.6 mb/d.
- All three forecasters are fairly aligned on non-OPEC production estimates for the year, but estimates on global demand levels differ by 1 mb/d and on OPEC crude supply differ by 0.6 mb/d.
- Current estimates by IEA and OPEC show OECD inventories fell by 15-20 mb in 2023.

**2023 Global Liquids Stock Change**  
million barrels per day



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

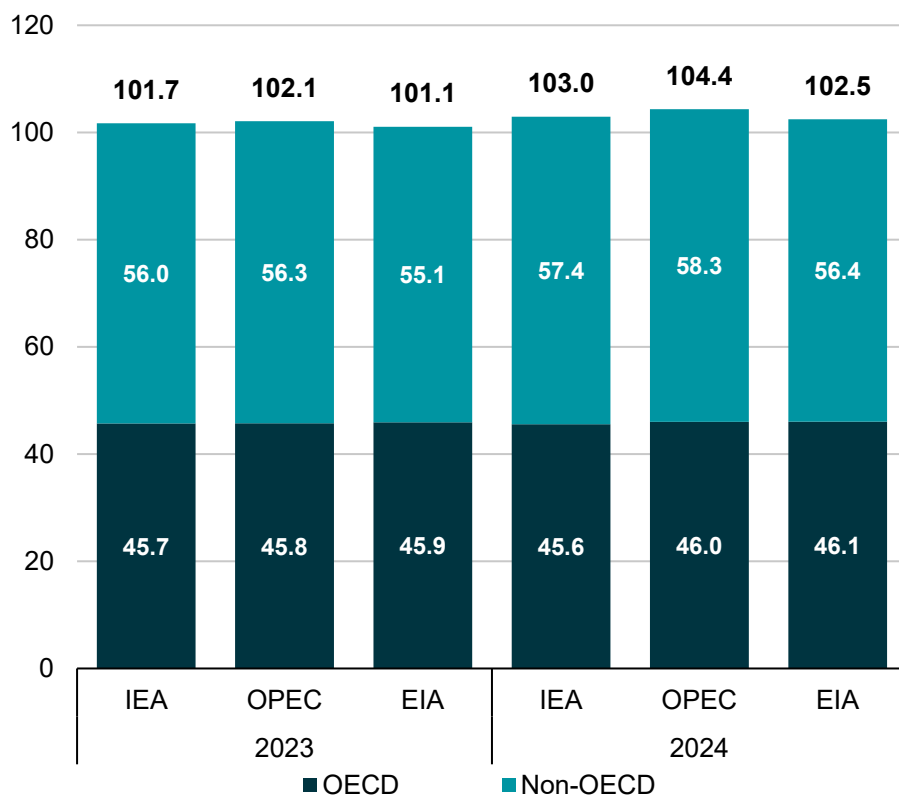


# Demand forecast divergences continue into 2024 where growth forecasts diverge by 1.0 mb/d and demand levels diverge by 1.4 mb/d

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

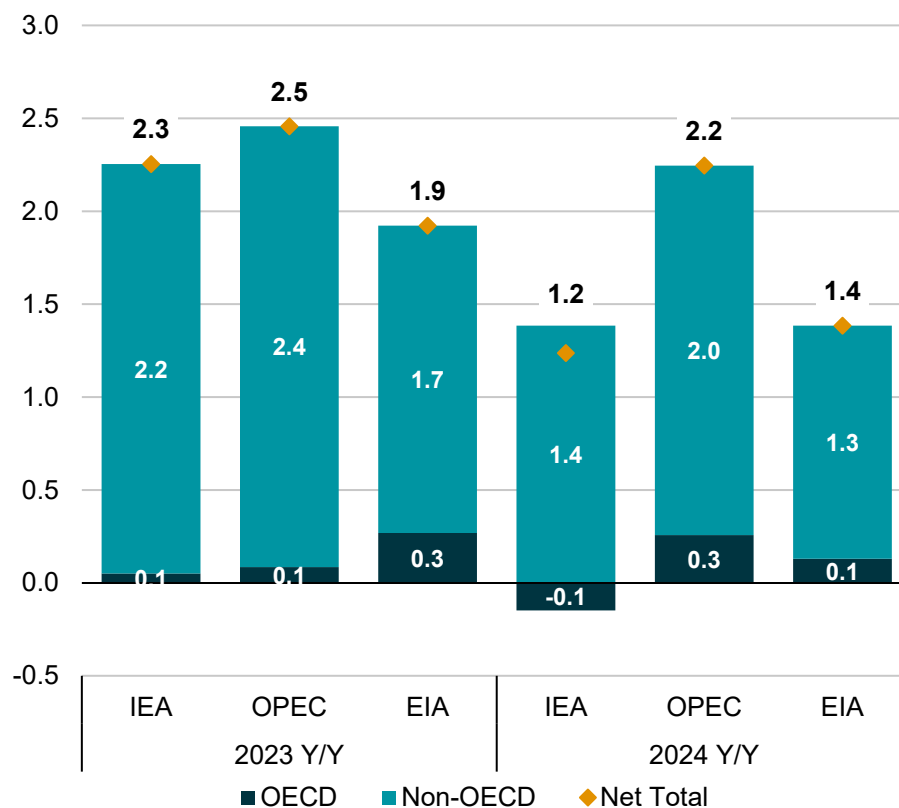
### 2023 & 2024 Liquid Demand Forecasts By Agency

Million barrels per day



### 2023 & 2024 Y/Y Demand Growth By Agency

Million barrels per day

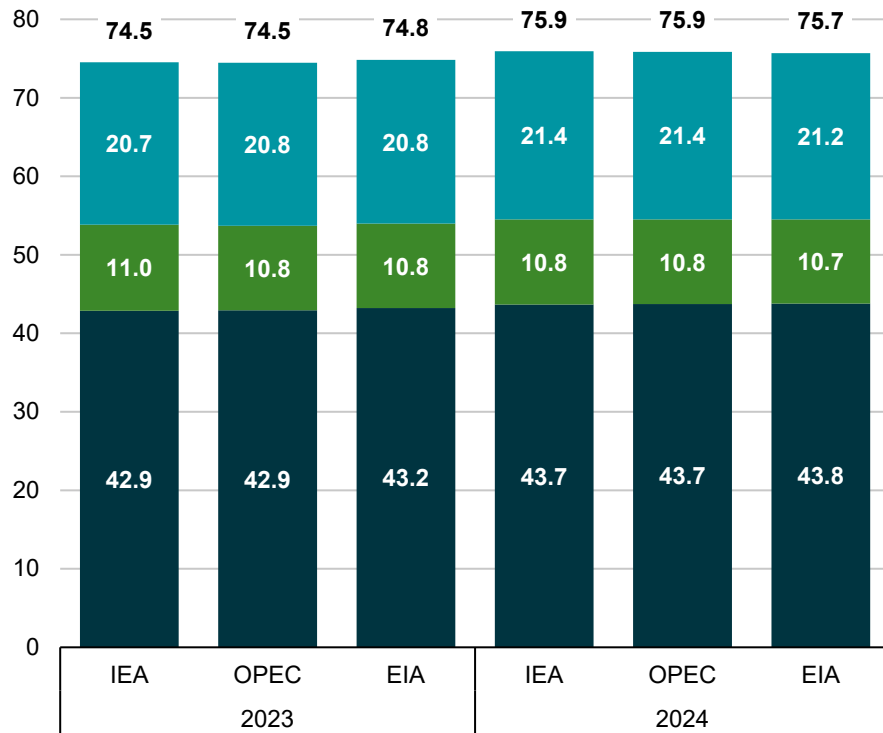


Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

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

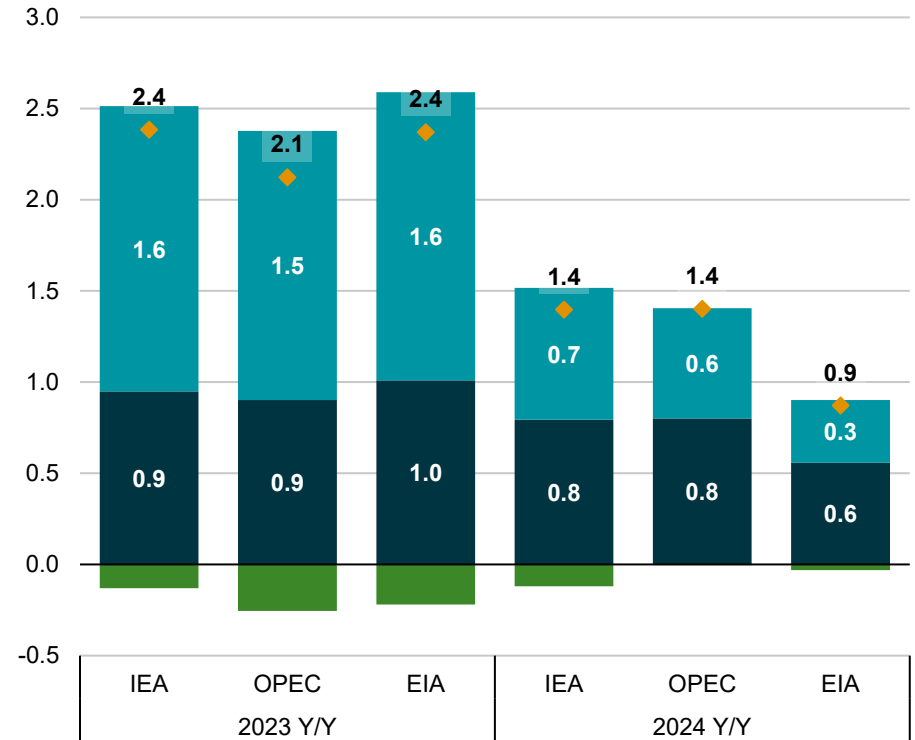
2023 & 2024 Non-OPEC and OPEC NGLs Supply Forecasts

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

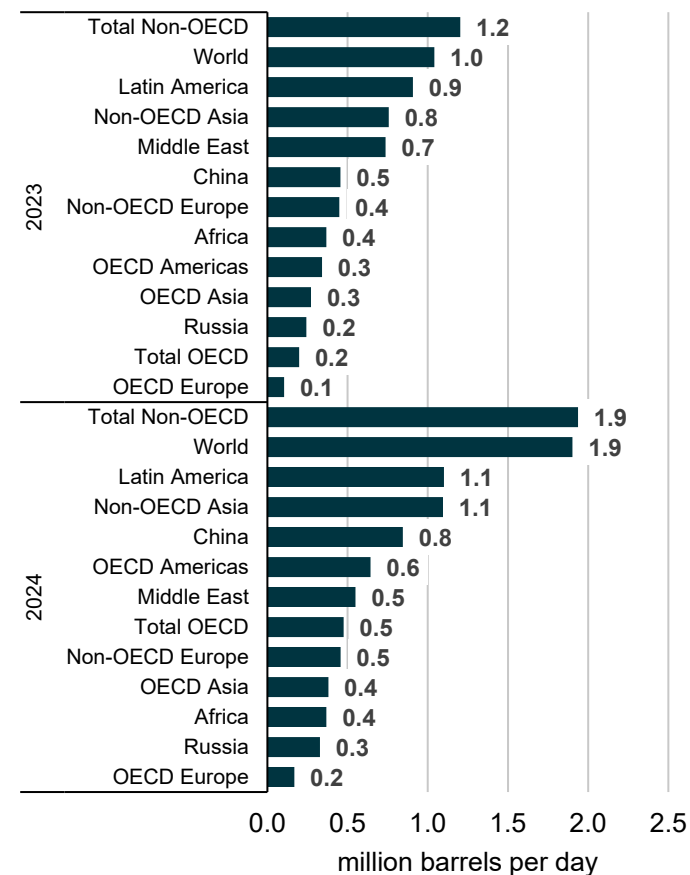
Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

# Largest 2023-24 demand divergences stem from Latin America and non-OECD Asia

2023-2024 Liquid Demand Forecast by Agency

million barrels per day	2023				2024			
	IEA	OPEC	EIA	Range (high-low)	IEA	OPEC	EIA	Range (high-low)
<b>Total OECD</b>	<b>45.7</b>	<b>45.8</b>	<b>45.9</b>	<b>0.2</b>	<b>45.6</b>	<b>46.0</b>	<b>46.1</b>	<b>0.5</b>
Americas	25.0	25.0	25.3	0.3	24.9	25.2	25.6	0.6
Europe	13.4	13.4	13.5	0.1	13.3	13.5	13.5	0.2
Asia Oceania	7.3	7.4	7.1	0.3	7.3	7.4	7.0	0.4
<b>Total Non-OECD</b>	<b>56.0</b>	<b>56.3</b>	<b>55.1</b>	<b>1.2</b>	<b>57.4</b>	<b>58.3</b>	<b>56.4</b>	<b>1.9</b>
Asia	30.8	30.8	30.0	0.8	31.8	31.9	30.8	1.1
China	16.4	16.2	15.9	0.5	17.1	16.8	16.3	0.8
Middle East	8.9	8.6	9.4	0.7	9.0	9.0	9.6	0.5
Latin America	6.3	6.7	5.8	0.9	6.4	6.9	5.8	1.1
Europe and Eurasia	5.7	5.8	5.4	0.4	5.7	6.0	5.5	0.5
Russia	3.8	3.8	3.6	0.2	3.7	3.9	3.6	0.3
Africa	4.2	4.5	4.6	0.4	4.4	4.6	4.7	0.4
<b>World</b>	<b>101.7</b>	<b>102.1</b>	<b>101.1</b>	<b>1.0</b>	<b>103.0</b>	<b>104.4</b>	<b>102.5</b>	<b>1.9</b>

Range in Agencies' 2023-2024 Demand



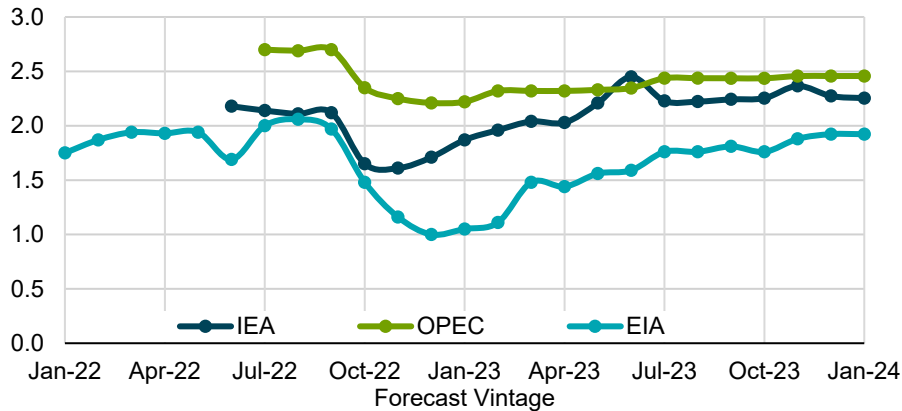
Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

# Agencies raised 2023 global demand growth forecasts through the year on stronger non-OECD demand

IEA estimates 0.5-0.9 mb/d stronger Chinese demand growth for 2023

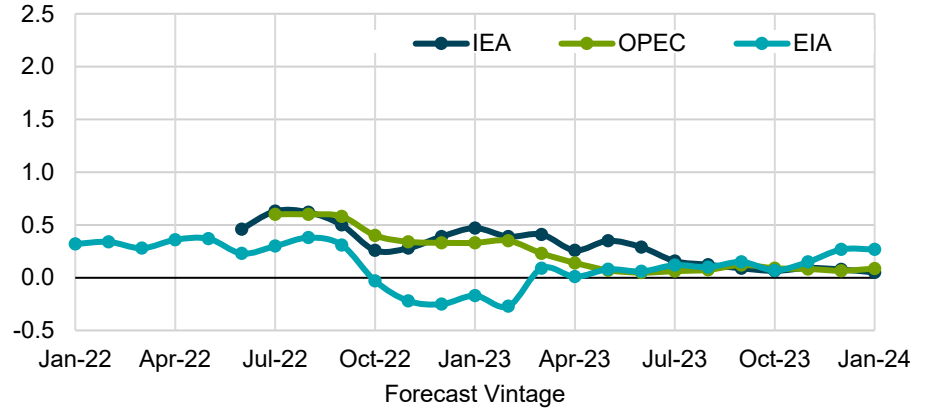
**Annual Global Demand Growth: Evolution of 2023 Forecasts**

y/y growth in million barrels per day



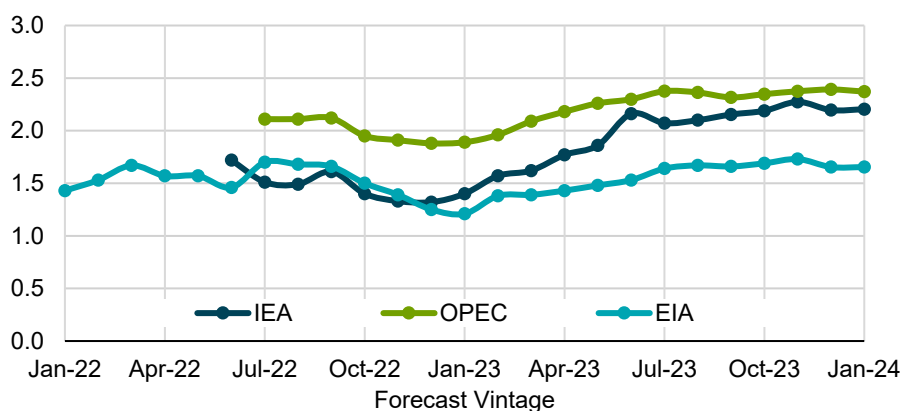
**Annual OECD Demand Growth: Evolution of 2023 Forecasts**

y/y growth in million barrels per day



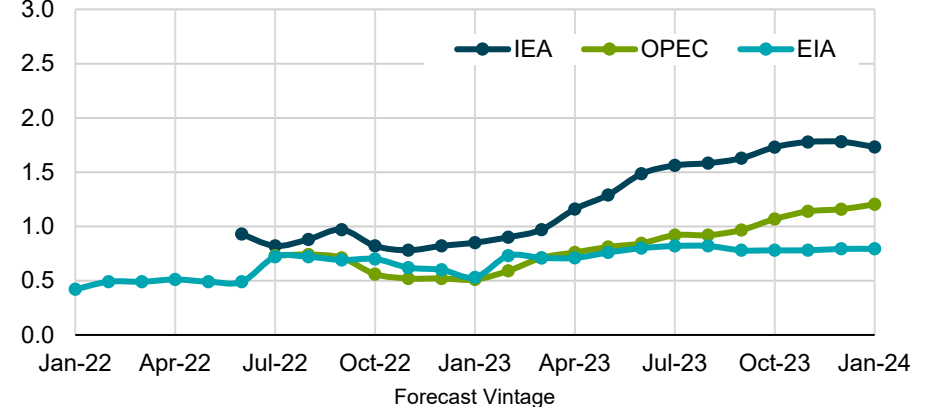
**Annual Non-OECD Demand Growth: Evolution of 2023 Forecasts**

y/y growth in million barrels per day



**Annual Chinese Demand Growth: Evolution of 2023 Forecasts**

y/y growth in million barrels per day



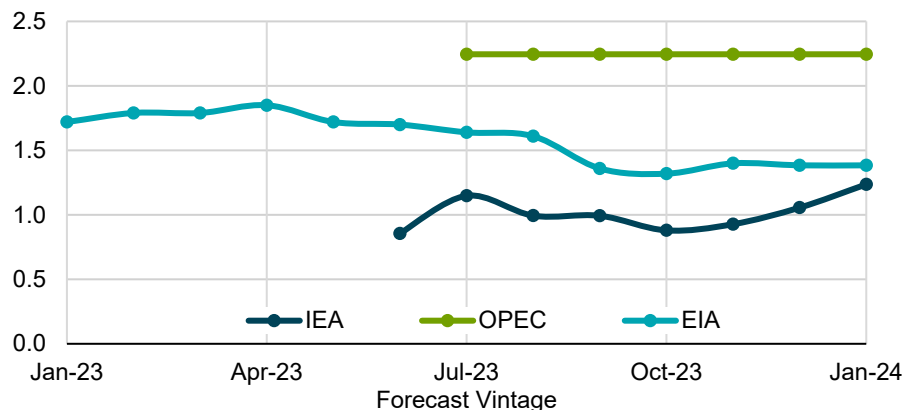
Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

# Demand growth forecasts for 2024 diverge by 1 mb/d with largest differences in non-OECD outlooks

IEA sees declining OECD demand while EIA and OPEC see slight growth

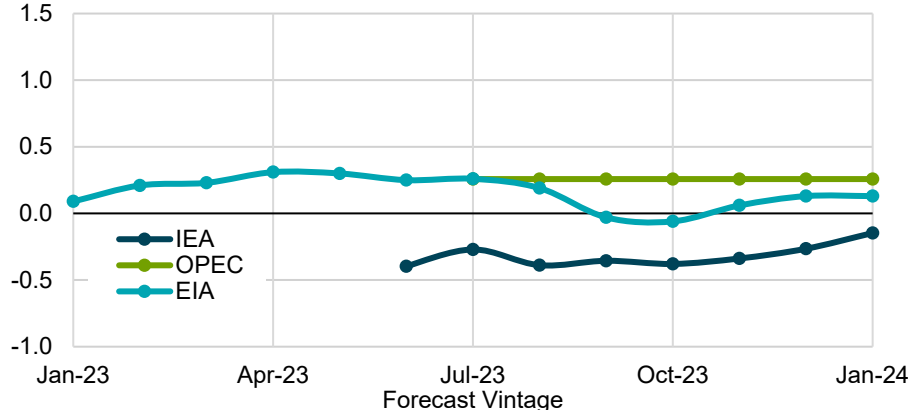
**Annual Global Demand Growth: Evolution of 2024 Forecasts**

y/y growth in million barrels per day



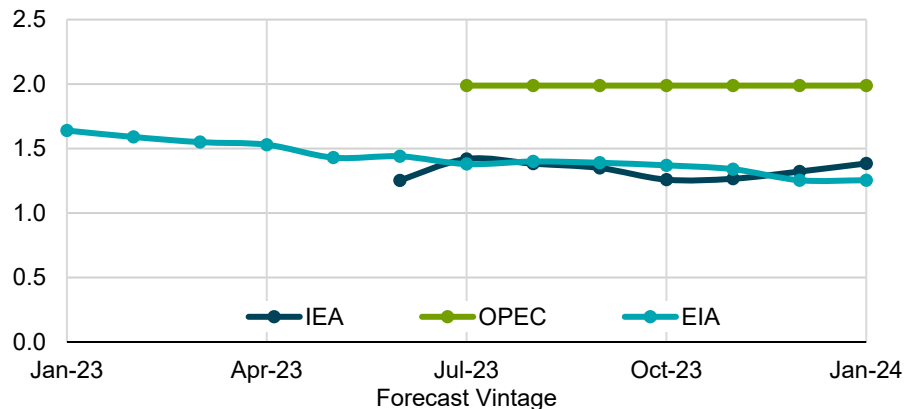
**Annual OECD Demand Growth: Evolution of 2024 Forecasts**

y/y growth in million barrels per day



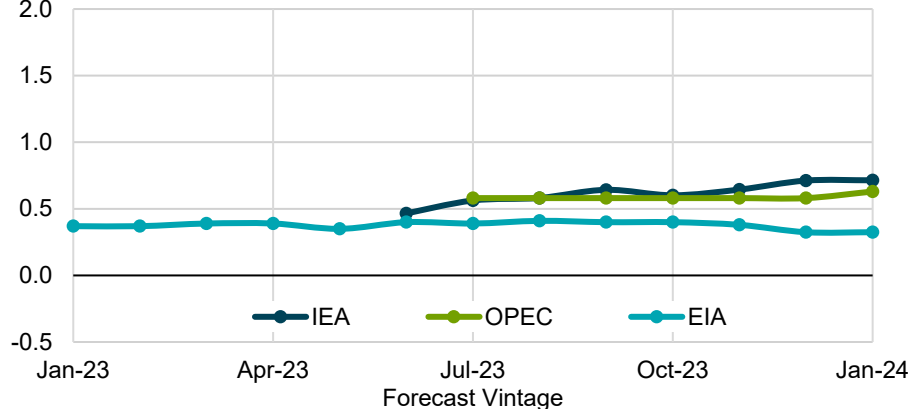
**Annual Non-OECD Demand Growth: Evolution of 2024 Forecasts**

y/y growth in million barrels per day



**Annual China Demand Growth: Evolution of 2024 Forecasts**

y/y growth in million barrels per day



\* EIA first published a 2024 forecast in Jan 2023; IEA in June 2023; and OPEC in July 2023

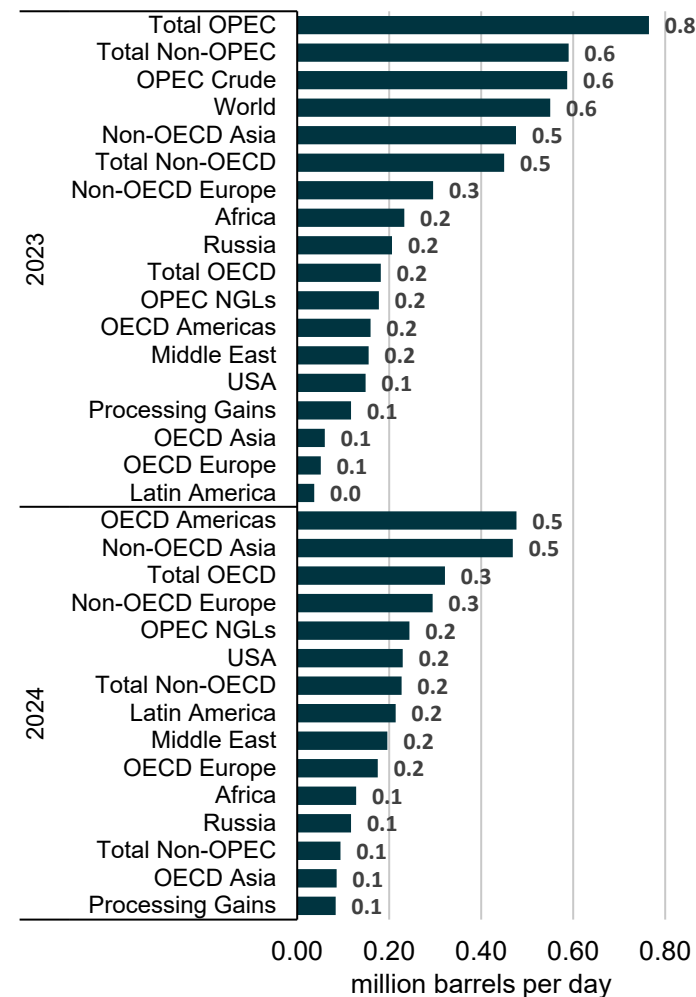
Source: IEF, IEA OMR, OPEC MOMR, EIA STEO

# Largest supply divergence in 2023 was for OPEC crude

## 2023-2024 Liquid Supply Forecasts by Agency

million barrels per day	2023				2024			
	IEA*	OPEC	EIA**	Range (high-low)	IEA*	OPEC	EIA**	Range (high-low)
<b>Total OECD</b>	<b>32.7</b>	<b>32.6</b>	<b>32.8</b>	<b>0.2</b>	<b>33.6</b>	<b>33.5</b>	<b>33.3</b>	<b>0.3</b>
Americas	28.7	28.5	28.7	0.2	29.5	29.3	29.1	0.5
USA	20.7	20.8	20.8	0.1	21.4	21.4	21.2	0.2
Europe	3.6	3.6	3.6	0.1	3.6	3.8	3.8	0.2
Asia Oceania	0.5	0.4	0.5	0.1	0.5	0.4	0.5	0.1
<b>Total Non-OECD</b>	<b>34.0</b>	<b>34.0</b>	<b>34.4</b>	<b>0.4</b>	<b>34.3</b>	<b>34.4</b>	<b>34.6</b>	<b>0.2</b>
Asia	7.5	7.6	8.0	0.5	7.5	7.6	8.0	0.5
Middle East	3.1	3.3	3.2	0.2	3.1	3.3	3.1	0.2
Latin America	7.0	6.9	7.0	0.0	7.5	7.2	7.3	0.2
Europe and Eurasia	14.0	13.8	13.7	0.3	13.8	13.9	13.6	0.3
Russia	11.0	10.8	10.8	0.2	10.8	10.8	10.7	0.1
Africa	2.4	2.4	2.6	0.2	2.4	2.4	2.5	0.1
<b>Processing Gains</b>	<b>2.4</b>	<b>2.5</b>	<b>2.4</b>	<b>0.1</b>	<b>2.4</b>	<b>2.5</b>	<b>2.4</b>	<b>0.1</b>
<b>Total Non-OPEC***</b>	<b>69.1</b>	<b>69.1</b>	<b>69.5</b>	<b>0.5</b>	<b>70.4</b>	<b>70.4</b>	<b>70.3</b>	<b>0.1</b>
<b>Total OPEC</b>	<b>33.0</b>	<b>32.4</b>	<b>32.2</b>	<b>0.8</b>			<b>32.0</b>	
OPEC Crude	27.5	27.0	26.9	0.6			26.6	
OPEC NGLs	5.5	5.4	5.3	0.2	5.6	5.5	5.3	0.2
<b>World</b>	<b>102.0</b>	<b>101.5</b>	<b>101.7</b>	<b>0.6</b>			<b>102.3</b>	

## Range in Agencies' 2023-2024 Supply Forecasts



\* Regional biofuels were added to IEA total liquids supply using IEA's OMR Table 17

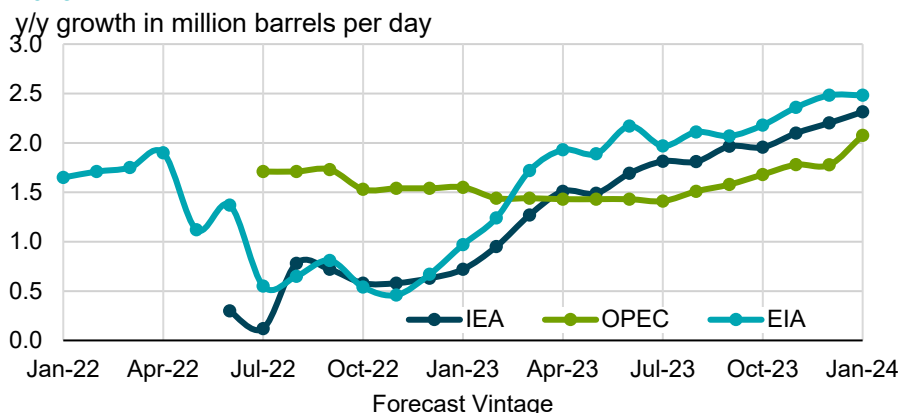
\*\* Regional refinery processing gains were estimated using EIA and IEF data and subtracted from EIA regional total liquids supply

\*\*\* Includes processing gains

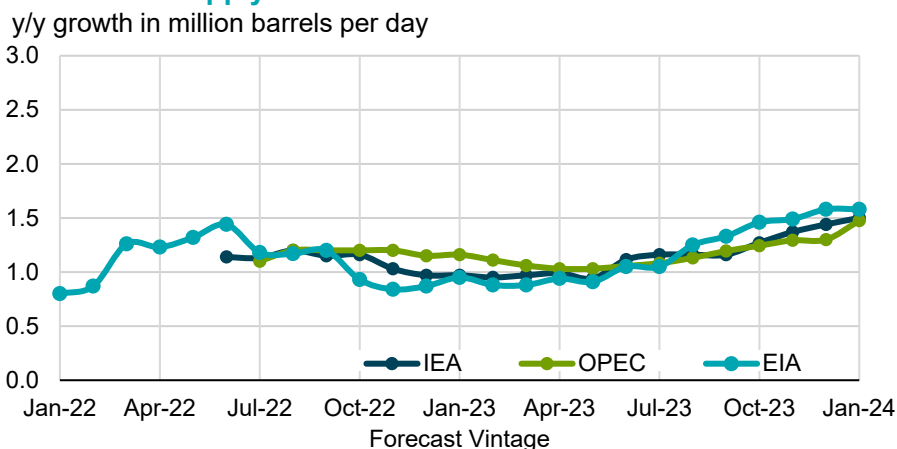
# Non-OPEC supply growth estimates for 2023 have been steadily revised higher on stronger US and resilient Russian production

- US production is estimated to have increased by ~1.5 mb/d in 2023, accounting for 65-75% of total net non-OPEC production growth.
- Russian production declined by 0.1-0.3 mb/d y/y, far less than the 0.7-1.5 mb/d decline expected a year ago.

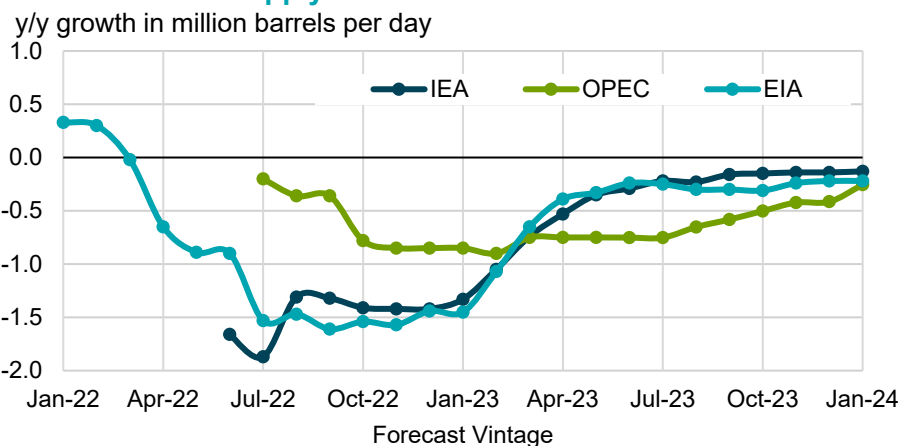
**Annual Non-OPEC & OPEC NGLs Supply Growth: Evolution of 2023 Forecasts**



**Annual US Supply Growth: Evolution of 2023 Forecasts**



**Annual Russia Supply Growth: Evolution of 2023 Forecasts**

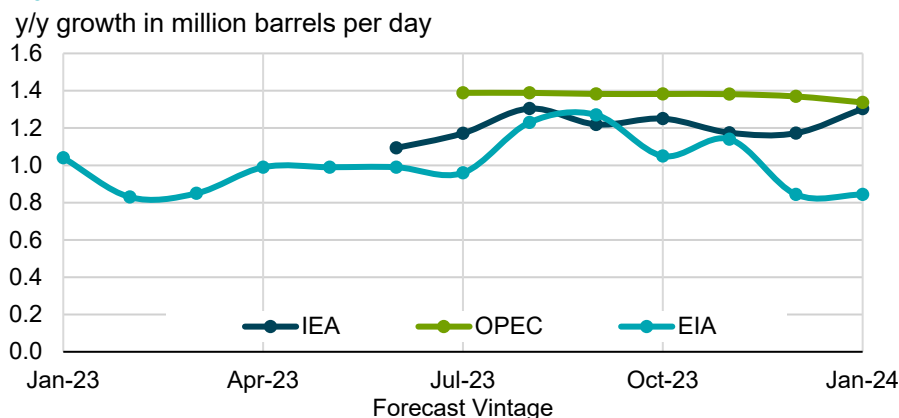


Source: IEF, IEA Jan 2024 OMR, OPEC Jan 2024 MOMR, EIA Jan 2024 STEO

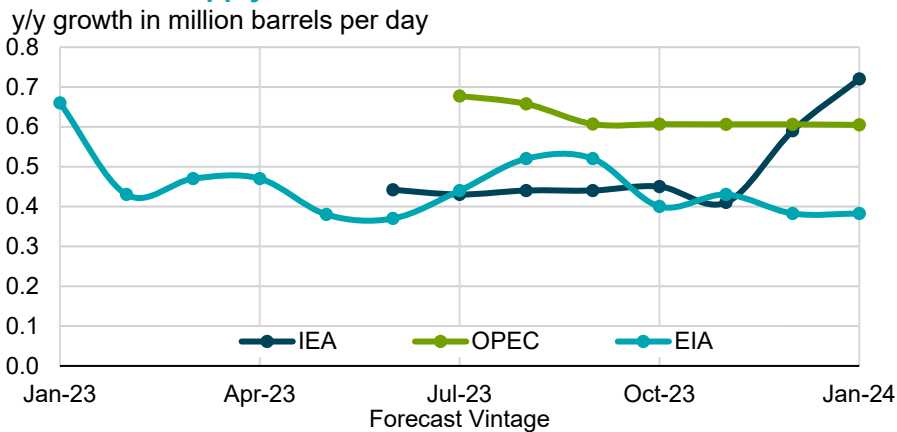
# 2024 Non-OPEC supply growth forecasts range from 0.8 mb/d to 1.4 mb/d with diverging views on the US and Latin America

- OPEC and IEA are fairly aligned on total non-OPEC and OPEC NGL supply growth, although there are some differences on a country-level.
- OPEC and IEA see more robust US supply growth this year vs. EIA.
- OPEC sees flat Russian production this year while EIA and IEA see slight declines.

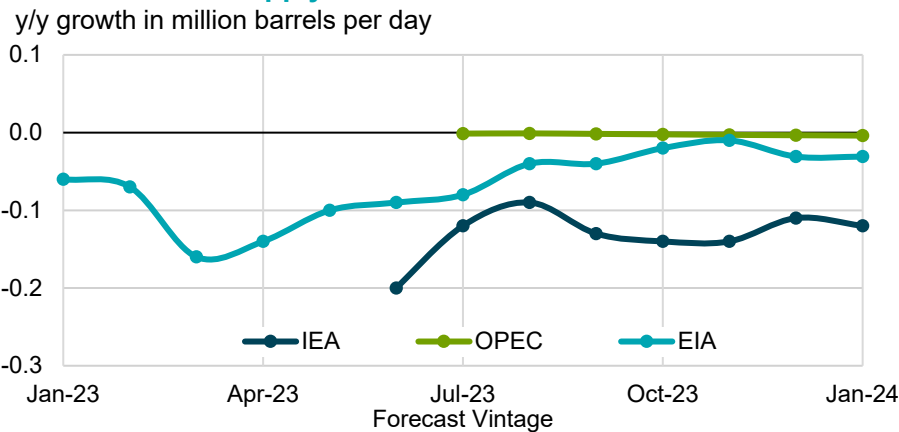
**Annual Non-OPEC & OPEC NGLs Supply Growth: Evolution of 2024 Forecasts**



**Annual US Supply Growth: Evolution of 2024 Forecasts**



**Annual Russia Supply Growth: Evolution of 2024 Forecasts**



\* EIA first published a 2024 forecast in Jan 2023; IEA in June 2023; and OPEC in July 2023

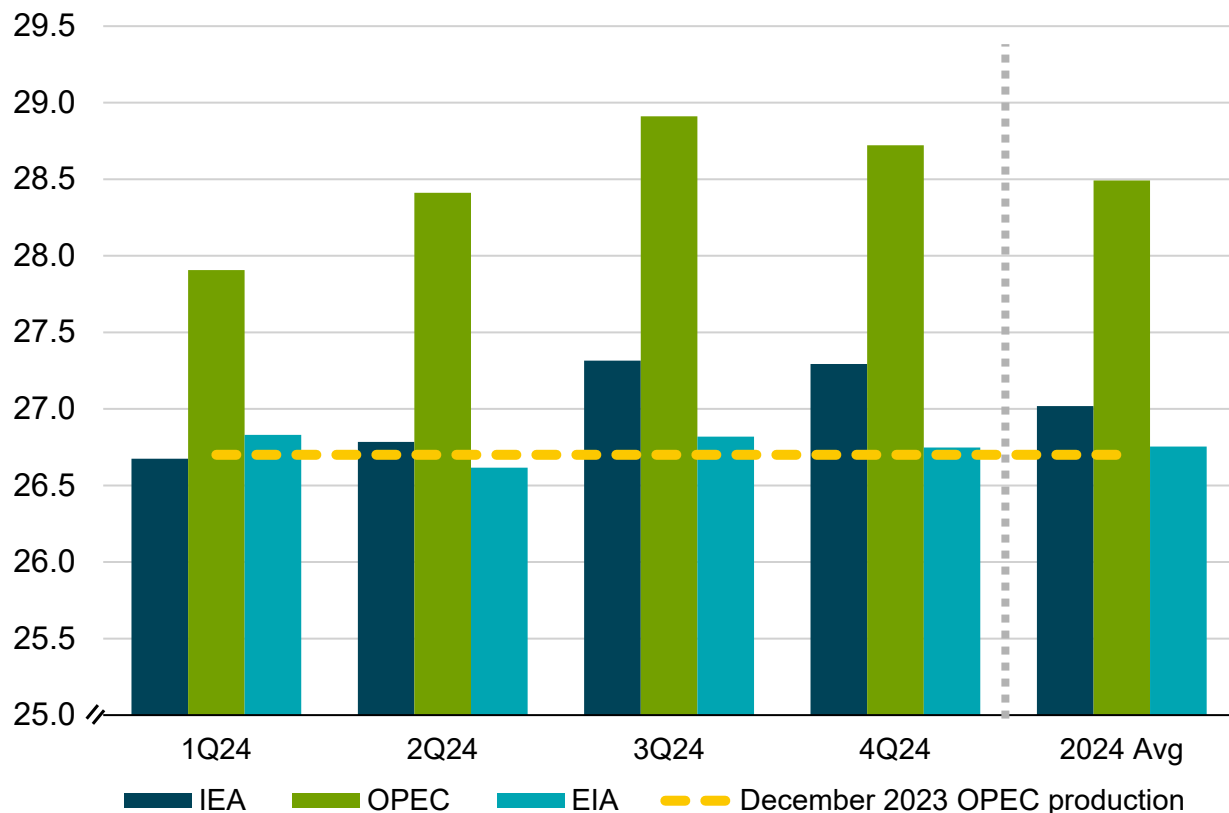
Source: IEF, IEA OMR, OPEC MOMR, EIA STEO



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

## 2024 Call on OPEC and Recent OPEC Production Levels

million barrels per day



- The “call on OPEC crude” is a calculation and not a forecast of actual OPEC production.
- The “call on OPEC” estimates what OPEC would need to produce to balance global supply and demand.
- It is estimated by subtracting a forecast for non-OPEC production and OPEC NGLs from global demand.
- 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

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# IEA WEO and OPEC WOO Baseline Energy Data

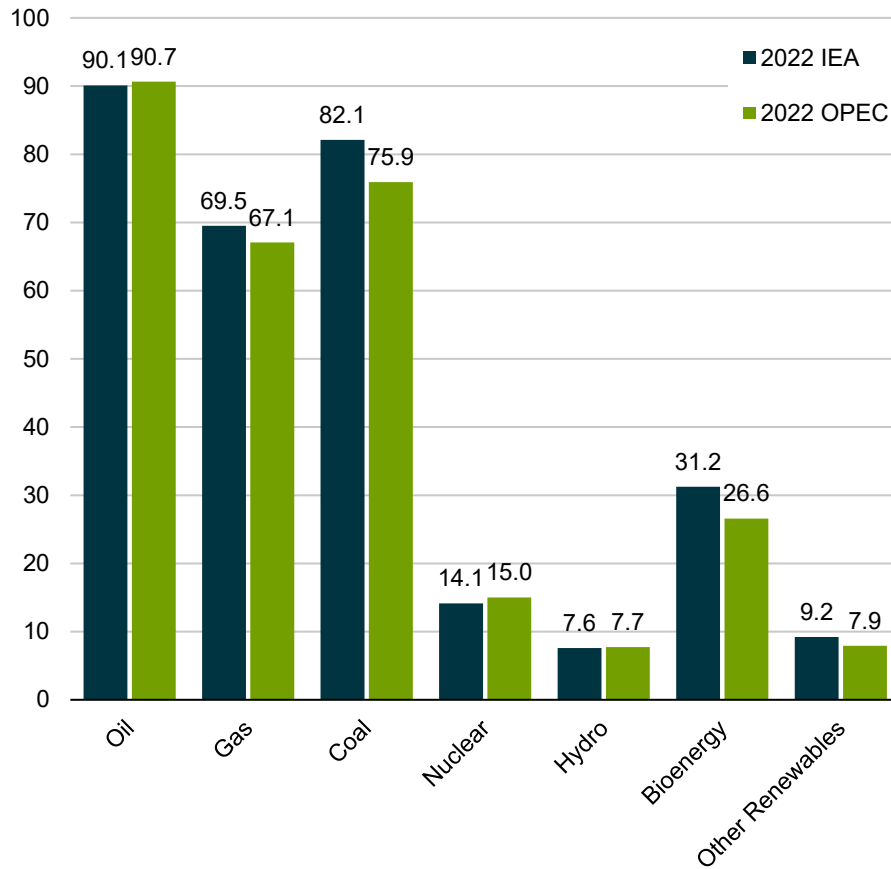
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# Largest baseline divergences for the long-term outlooks stem from coal, bioenergy and gas

Different conversion efficiency assumptions could contribute to the gaps in historical data

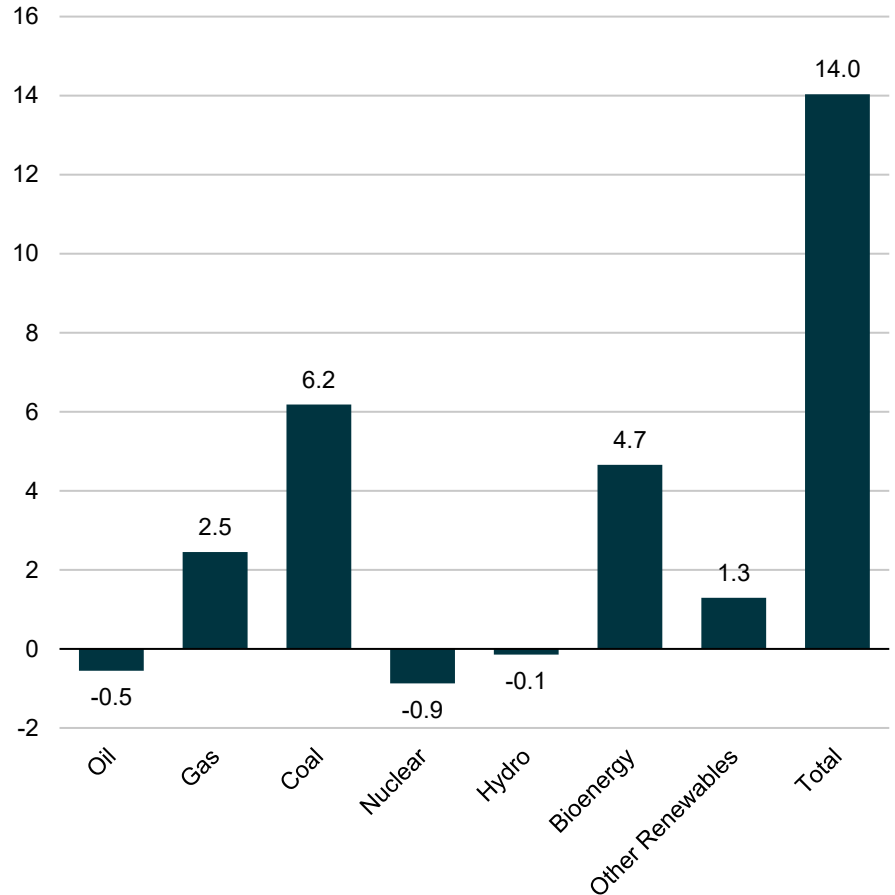
## 2022 World Primary Energy

Million barrels of oil equivalent per day



## IEA vs. OPEC: 2022 World Primary Energy

Million barrels of oil equivalent per day



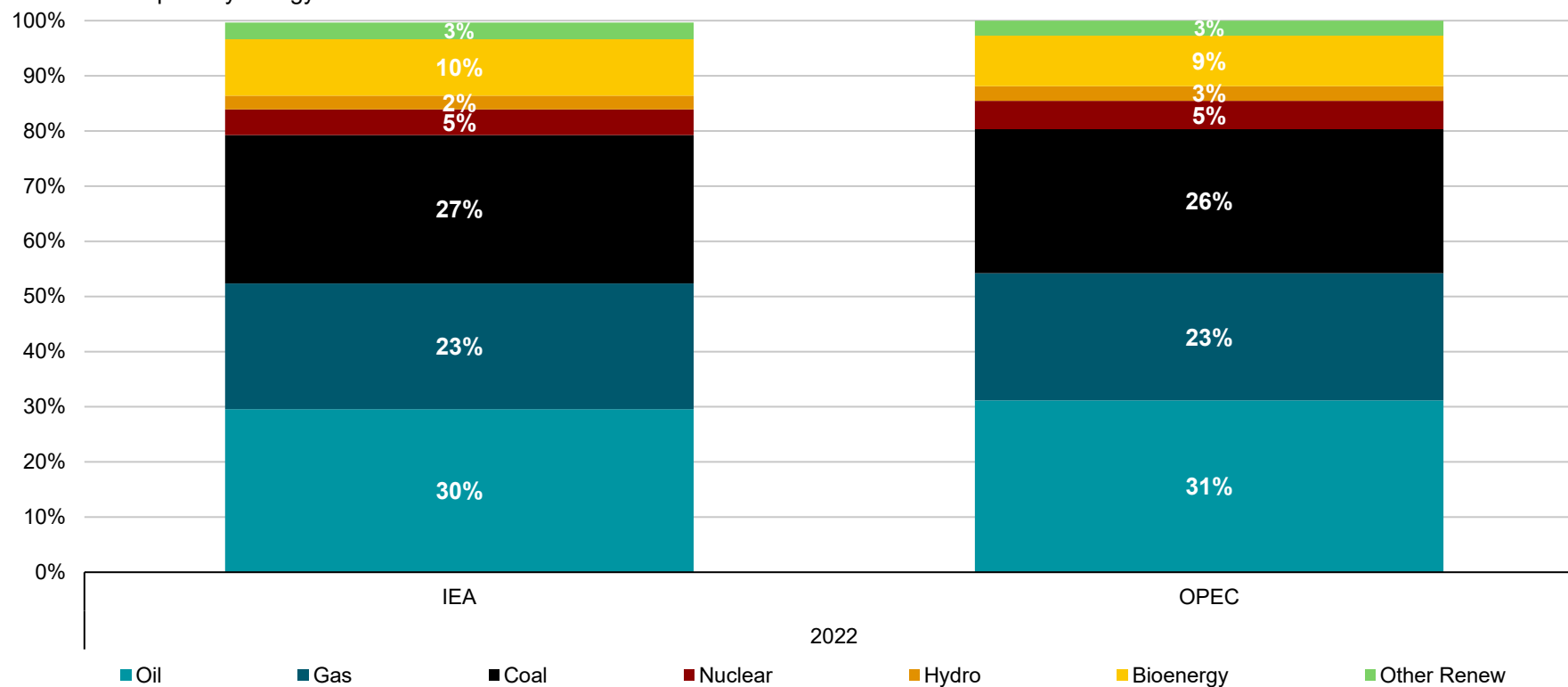
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Largest differences in IEA and OPEC estimates of 2022 total primary energy's fuel shares are in oil, coal, and bioenergy

IEA's 2022 total primary energy demand estimate is 14 mboe/d higher than OPEC's

## 2022 World Primary Energy Fuel Share

Percent of total primary energy



Source: IEF, IEA WEO 2023, OPEC WOO 2023

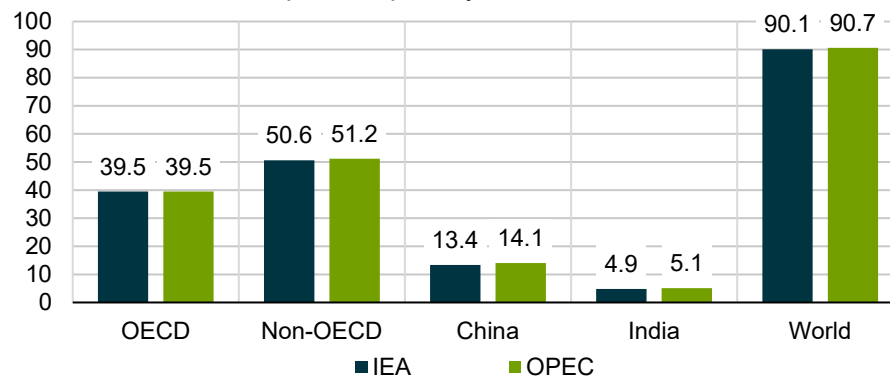
# Baselines for natural gas and coal diverge more than oil

Non-OECD coal demand estimates for 2022 diverge by >5 mboe/d

- The lack of baseline data harmonization can make it difficult to compare historical and projected data.
- Enhancing transparency on conversion assumptions can help enable data harmonization.
- Additionally, harmonizing treatment of bunkering fuels can improve comparability.
- IEA's WEO includes bunkering fuels in the global energy estimates but not in regional estimates, whereas OPEC includes bunkering in the regional estimates.

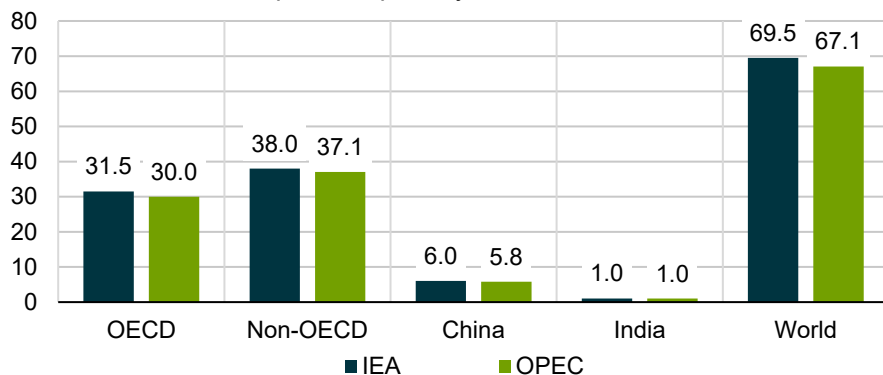
## 2022 Oil\* Demand

Million barrels of oil equivalent per day



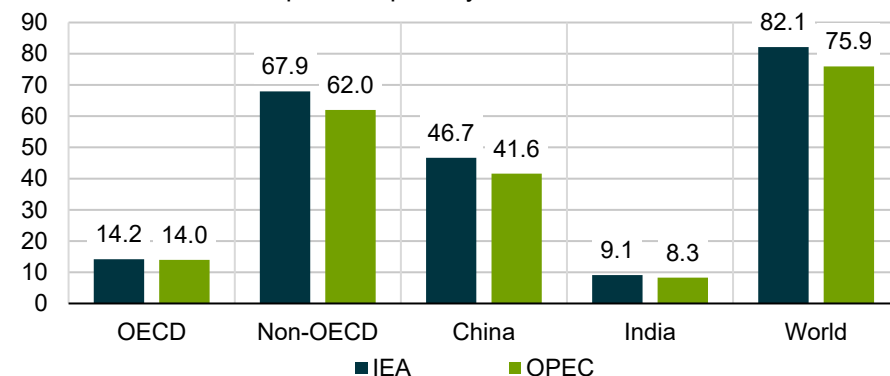
## 2022 Natural Gas Demand

Million barrels of oil equivalent per day



## 2022 Coal Demand

Million barrels of oil equivalent per day



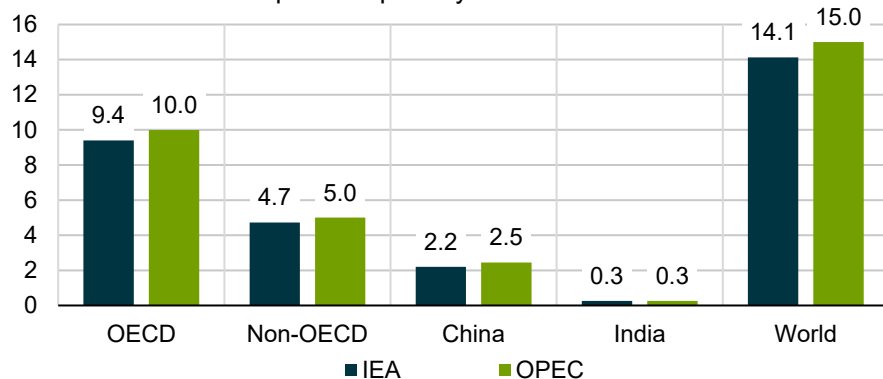
\*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Biomass baseline data differ by 4.6 mboe/d with significant differences in both OECD and non-OECD regional data

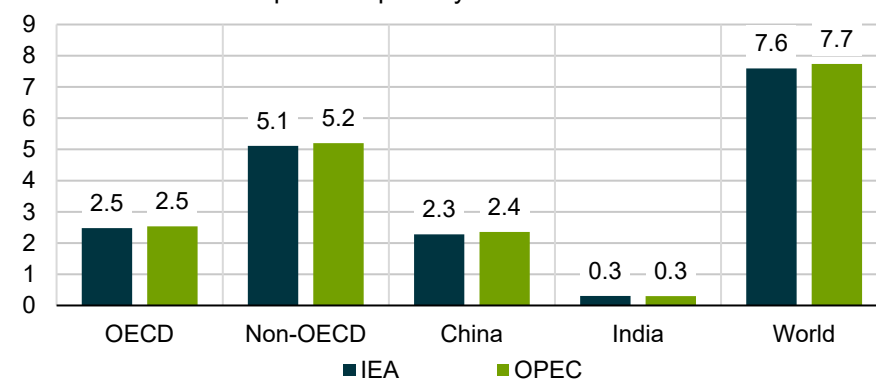
## 2022 Nuclear Demand

Million barrels of oil equivalent per day



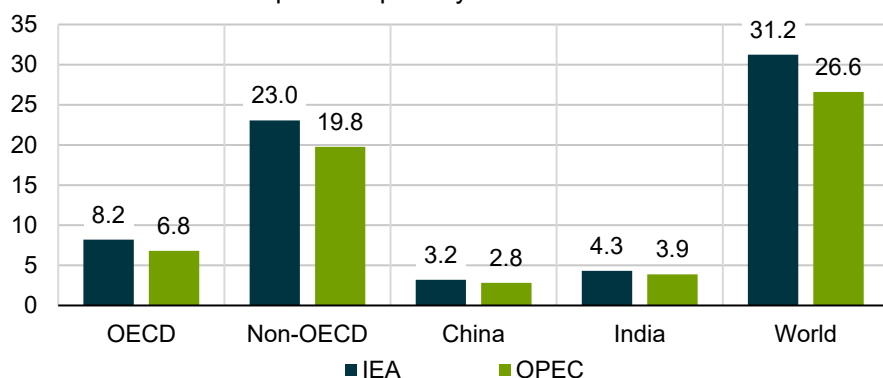
## 2022 Hydro Demand

Million barrels of oil equivalent per day



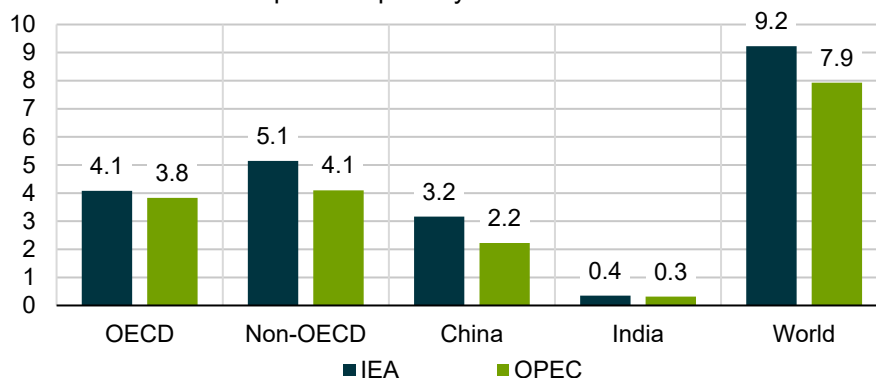
## 2022 Biomass Demand

Million barrels of oil equivalent per day



## 2022 Other Renewables Demand

Million barrels of oil equivalent per day



Source: IEF, IEA WEO 2023, OPEC WOO 2023

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# IEA and OPEC Outlooks to 2030

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## IEA and OPEC Scenario Descriptions and Assumptions

### IEA WEO 2023 Scenarios

#### **Stated Policies Scenario (STEPS):**

This scenario is a bottom-up assessment based on the prevailing direction of energy system progression and current policy landscape.

#### **Announced Pledges Scenario (APS):**

This scenario assumes that governments will meet in full and on time, all of the climate-related commitments that have been announced, including net zero emissions targets and pledges in NDCs.

This pathway is associated with a temperature increase of 1.7 °C by 2100 (with a 50% probability).

#### **Net Zero Emissions by 2050 (NZE):**

This scenario works backwards from the defined outcome of achieving net zero emissions by mid-century and stabilizing temperatures at 1.5°C above pre-industrial levels.

### OPEC WOO 2023 Scenarios

#### **Reference Case:**

This scenario assumes continued progress in energy policies that have been announced and enacted to the extent they are technically and financially viable.

#### **Advanced Technology Scenario (AT):**

This scenario provides an alternative emissions reduction pathway consistent with limiting the global temperature increase to below 2°C. It focuses on greater deployment of CCUS, hydrogen, and increased adoption of the circular carbon economy (CCE).

#### **Laissez-Faire Scenario (LF):**

This scenario assumes improved energy access in least developed countries and a quicker transition to modern energy sources. It assumes policies will be tightened in the future but in a more isolated manner.

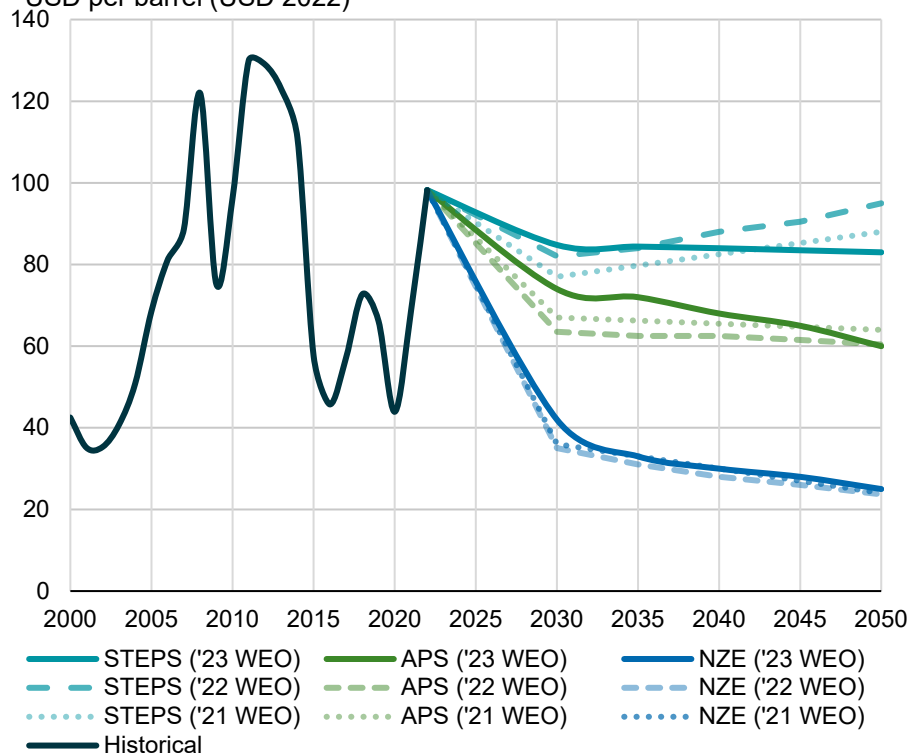


# IEA and OPEC both assume 3.0% annual global growth this decade, with some differences at the regional-level

IEA's oil price assumptions are slightly higher in the near-term but broadly inline with previous years; OPEC does not provide price assumption data

## IEA Crude Oil Price Assumptions by Scenario

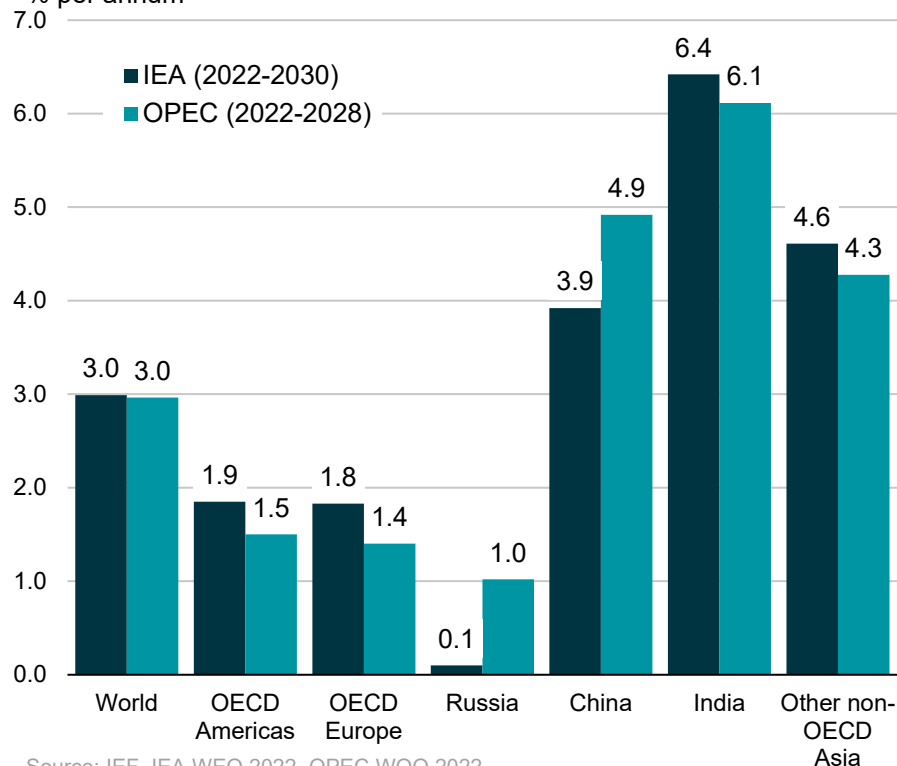
USD per barrel (USD 2022)



Source: IEF, IEA WEO

## Compound Average Annual Real GDP Growth Rate\*

% per annum



Source: IEF, IEA WEO 2022, OPEC WOO 2022

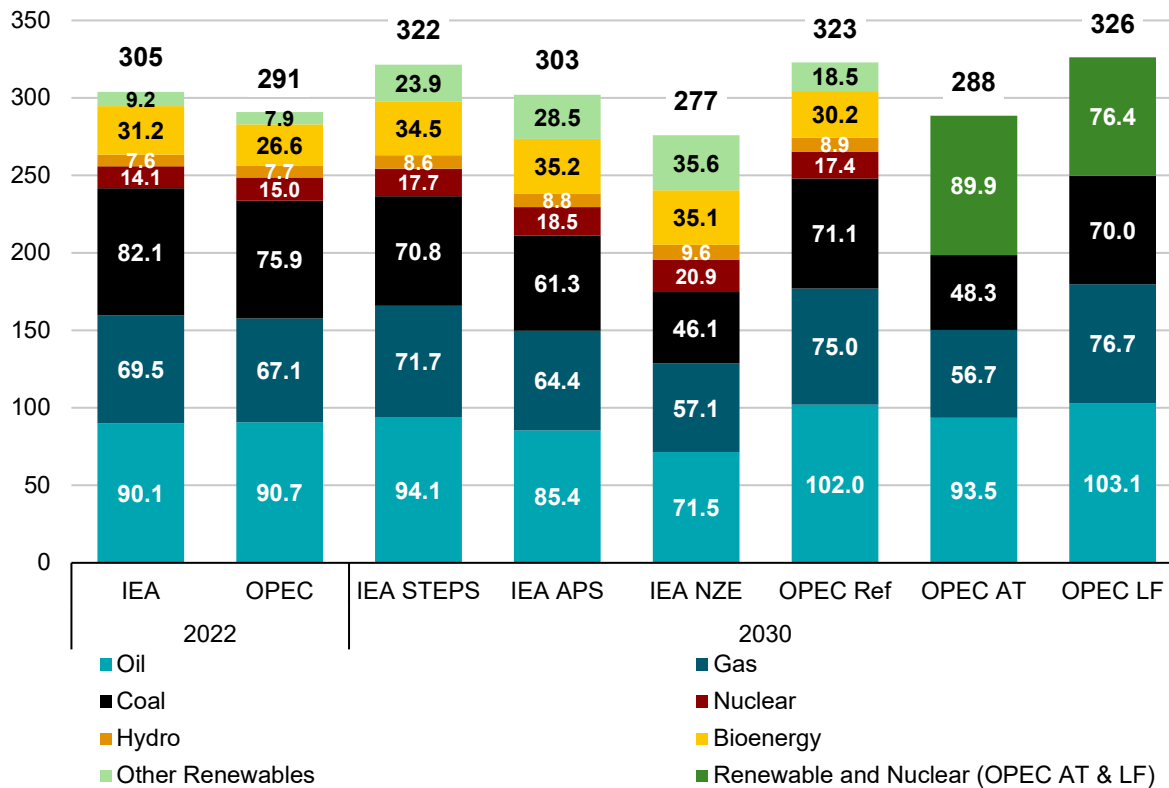
\* IEA and OPEC's regional classifications differ, so we construct the following regional classifications to allow for intercomparison: OECD Americas is North America for IEA, and OECD Americas for OPEC; OECD Europe is the European Union for IEA, and OECD Europe for OPEC, Other non-OECD Asia is Southeast Asia for IEA, and Other non-OECD Asia for OPEC.

# 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



- 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.
- Oil demand is seen increasing in all scenarios except IEA NZE and APS.
- 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.

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

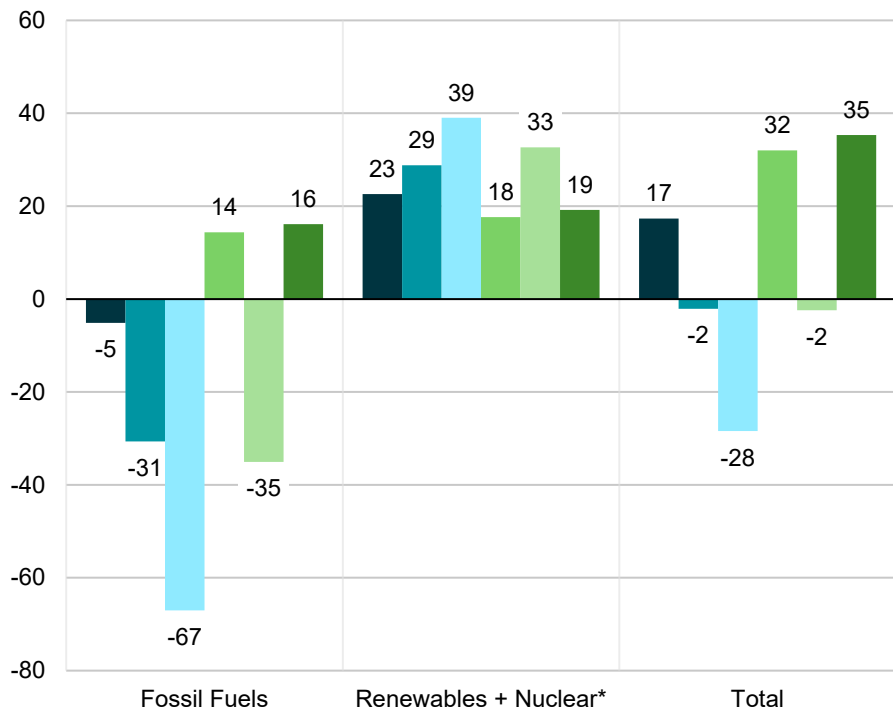
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# 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

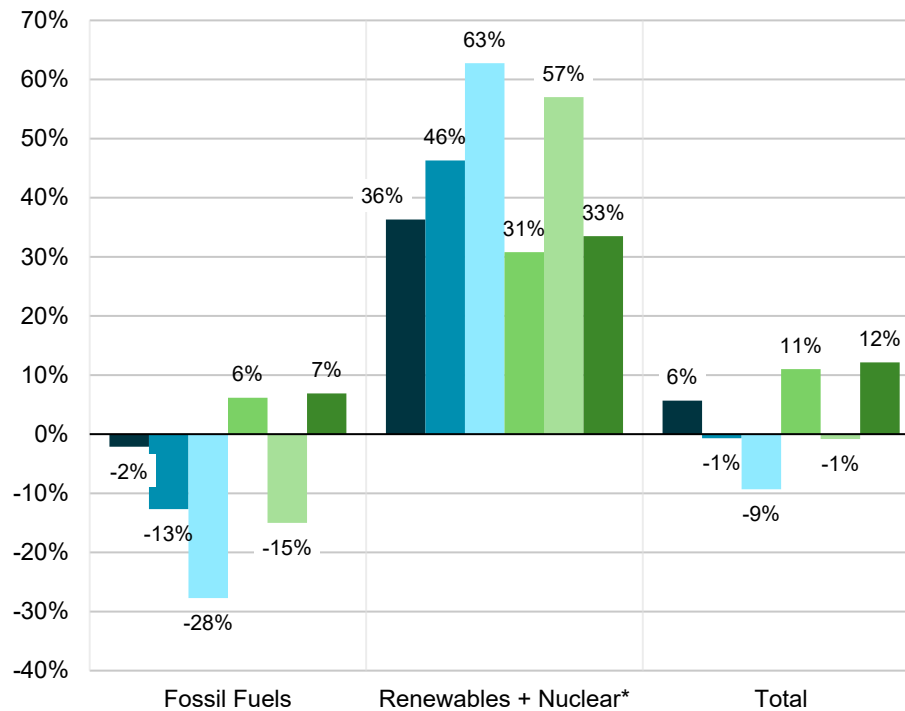
Change in World Primary Energy by Source: 2030 vs 2022

Million barrels of oil equivalent per day



World Primary 2030 vs. 2022

% change from 2022



■ IEA STEPS ■ IEA APS ■ IEA NZE ■ OPEC Ref ■ OPEC AT ■ OPEC LF

■ IEA STEPS ■ IEA APS ■ IEA NZE ■ OPEC Ref ■ OPEC AT ■ OPEC LF

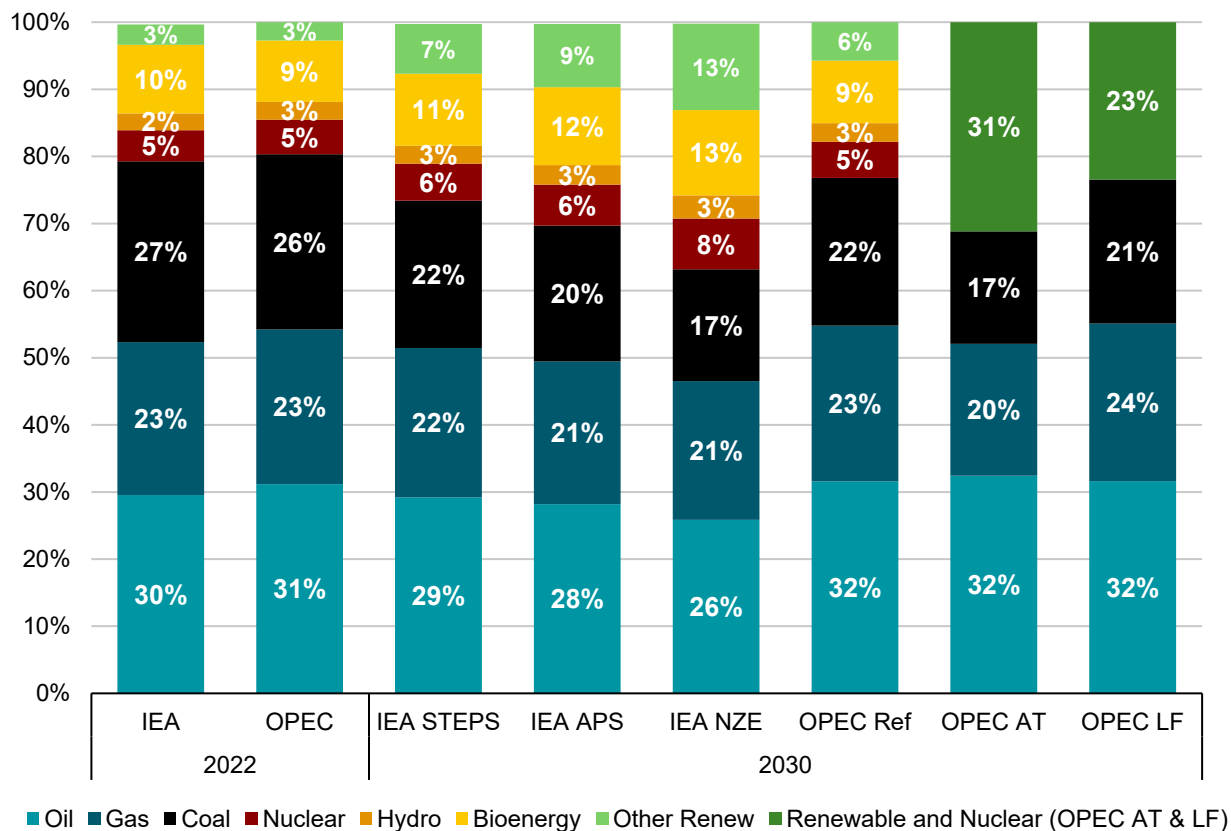
\* Renewables + Nuclear includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios. OPEC's LF and AT only report the aggregate and not components for renewables and nuclear.

Source: IEF, IEA WEO 2023, OPEC WOO 2023

# 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.

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

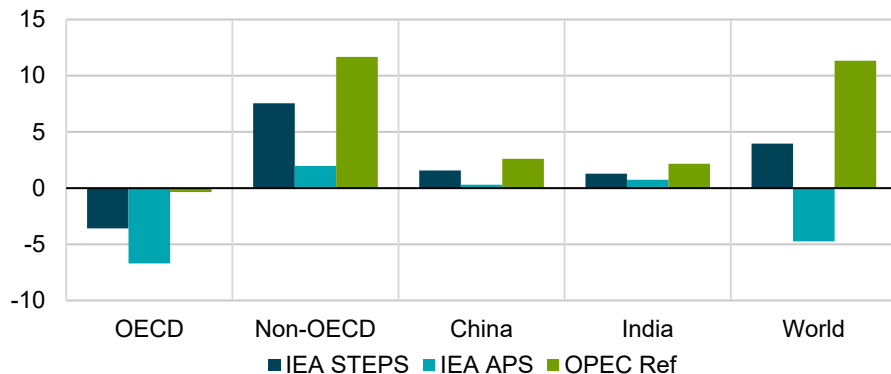
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Oil & natural gas demand is expected to grow in non-OECD countries in IEA STEPS, APS and OPEC Reference Case

All scenarios show declining OECD demand for oil, gas, and coal by 2030

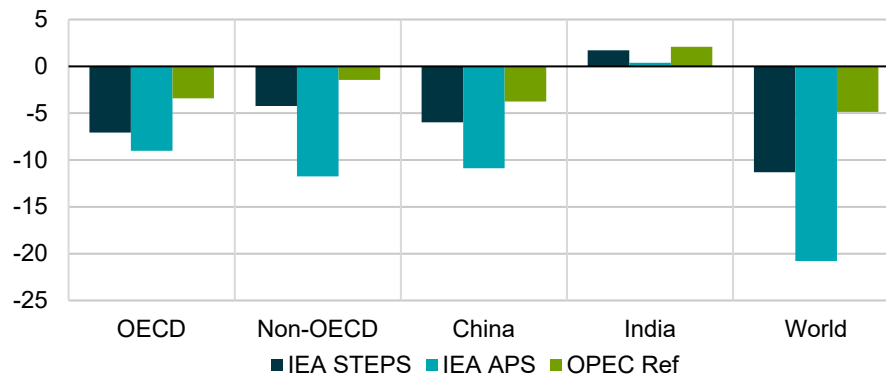
## Change in Oil Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



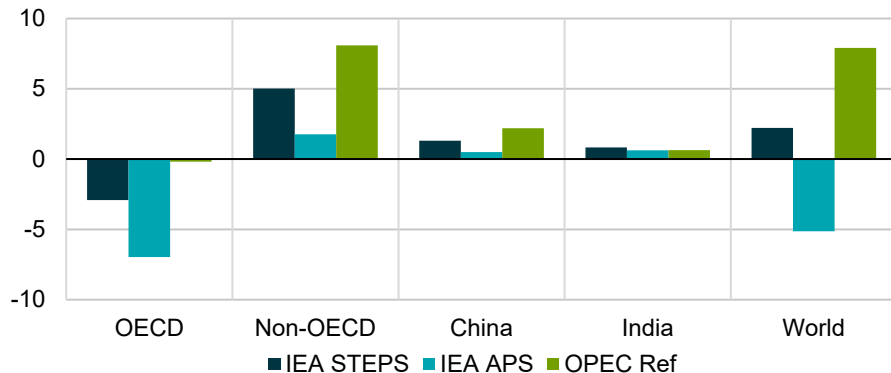
## Change in Coal Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



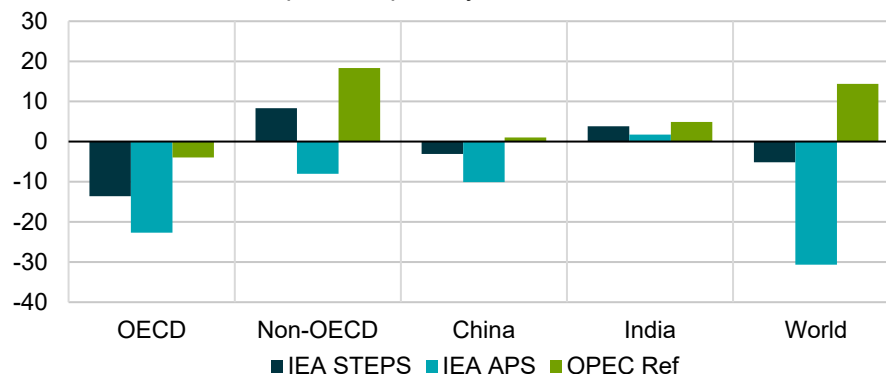
## Change in Natural Gas Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



## Change in Fossil Fuel Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



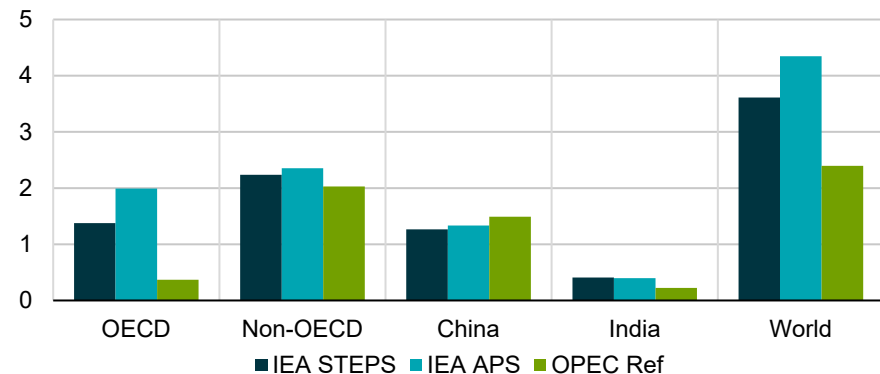
\*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Non-OECD countries lead growth in nuclear, hydro, and other renewables demand to 2030 in all scenarios

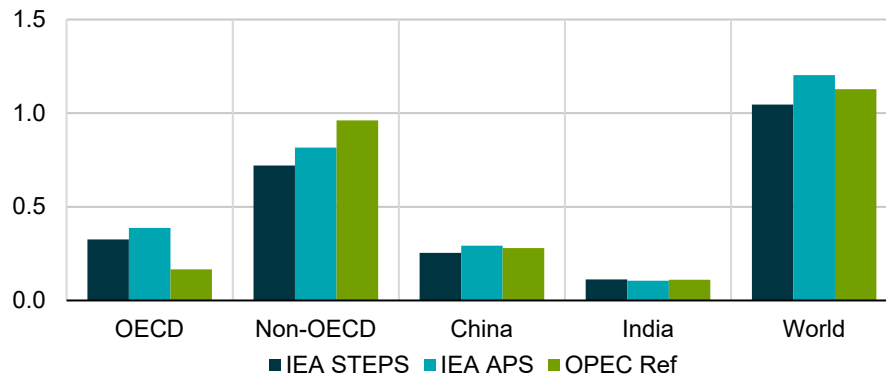
## Change in Nuclear Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



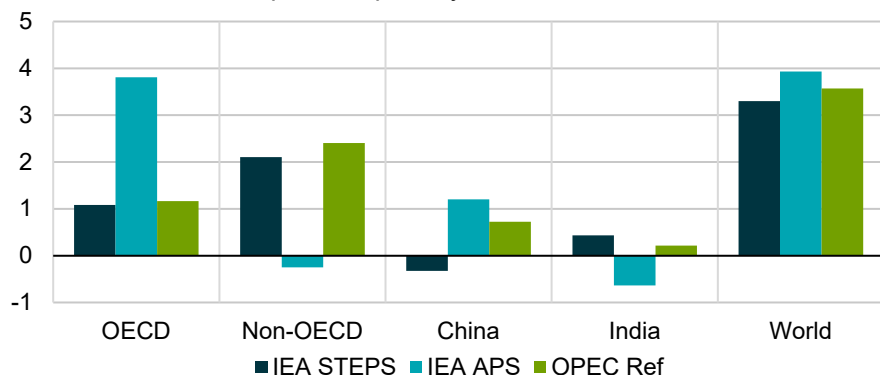
## Change in Hydro Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



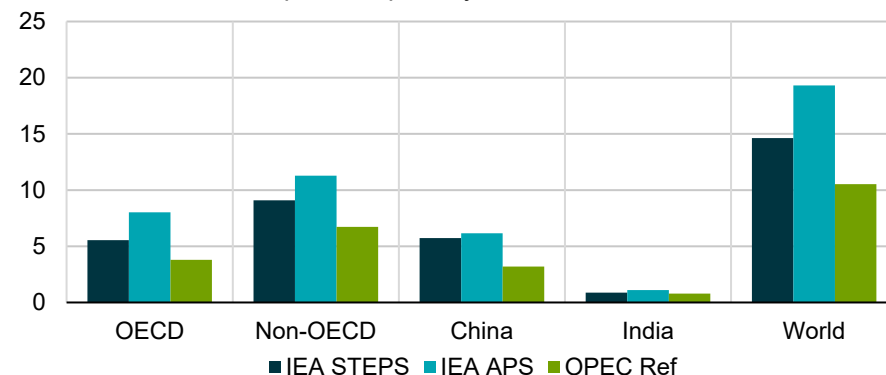
## Change in Biomass Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



## Change in Other Renewables Demand: 2030 vs. 2022

Million barrels of oil equivalent per day



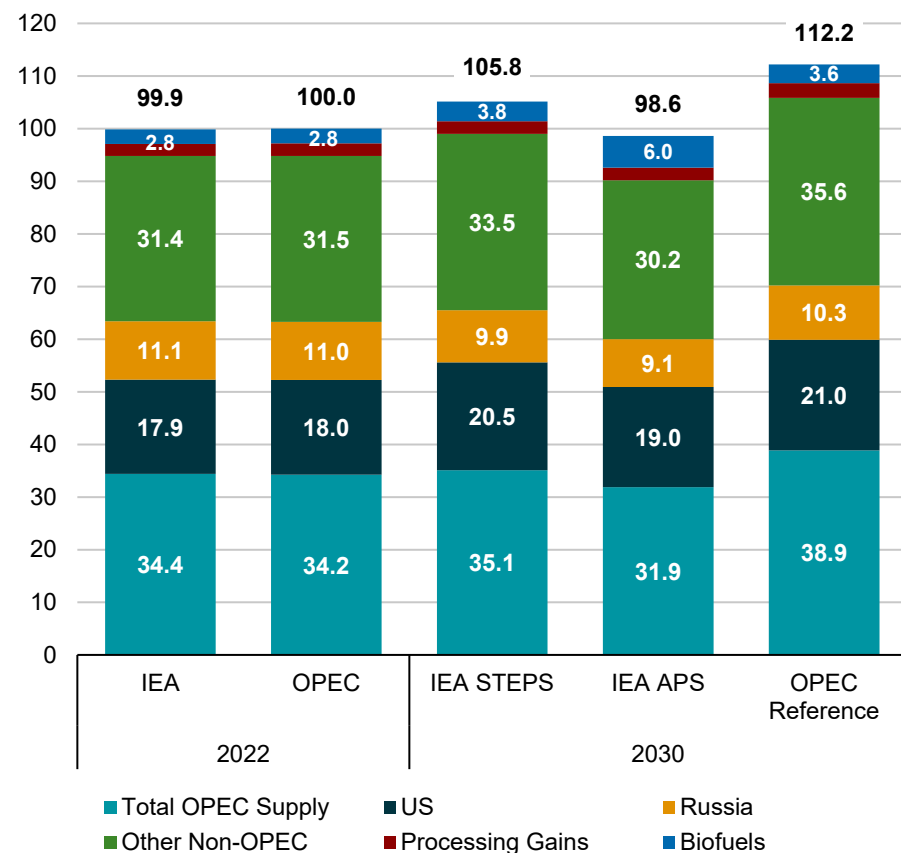
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Biofuels play a bigger role in IEA APS scenario – accounting for 6% of total liquids supply by 2030

OPEC’s reference case shows ~6.4 mb/d higher liquids supply vs. IEA STEPS in 2030

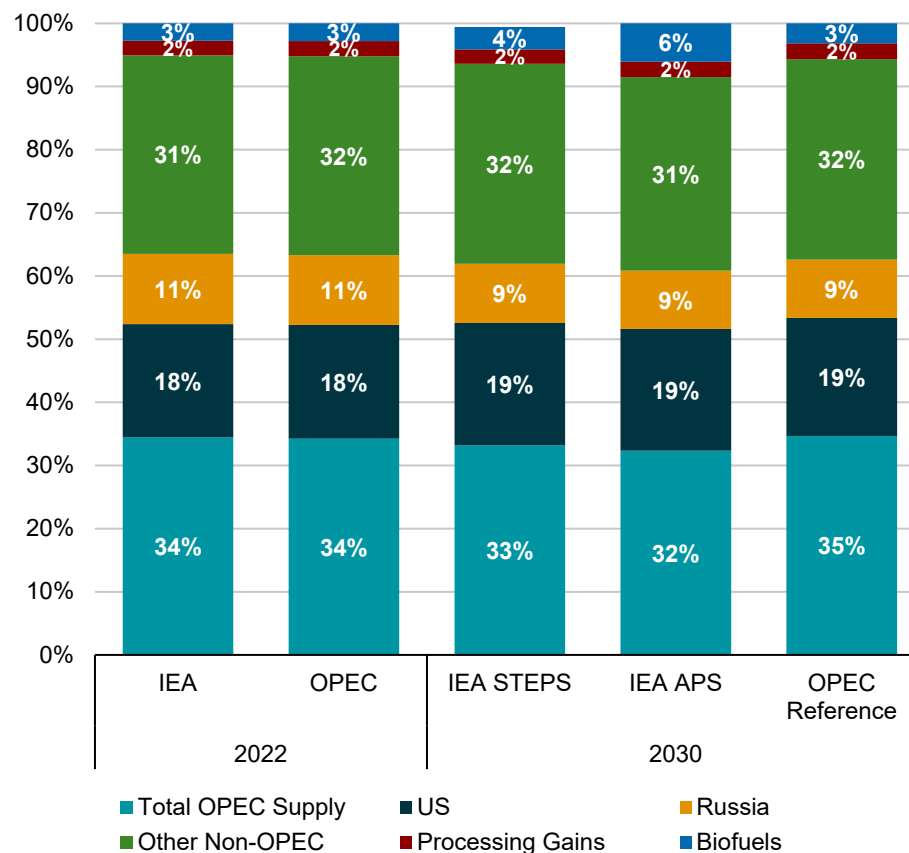
### Liquids Supply Sources by Scenario

Million barrels per day



### Liquids Supply Sources by Scenario

Share of global liquids production



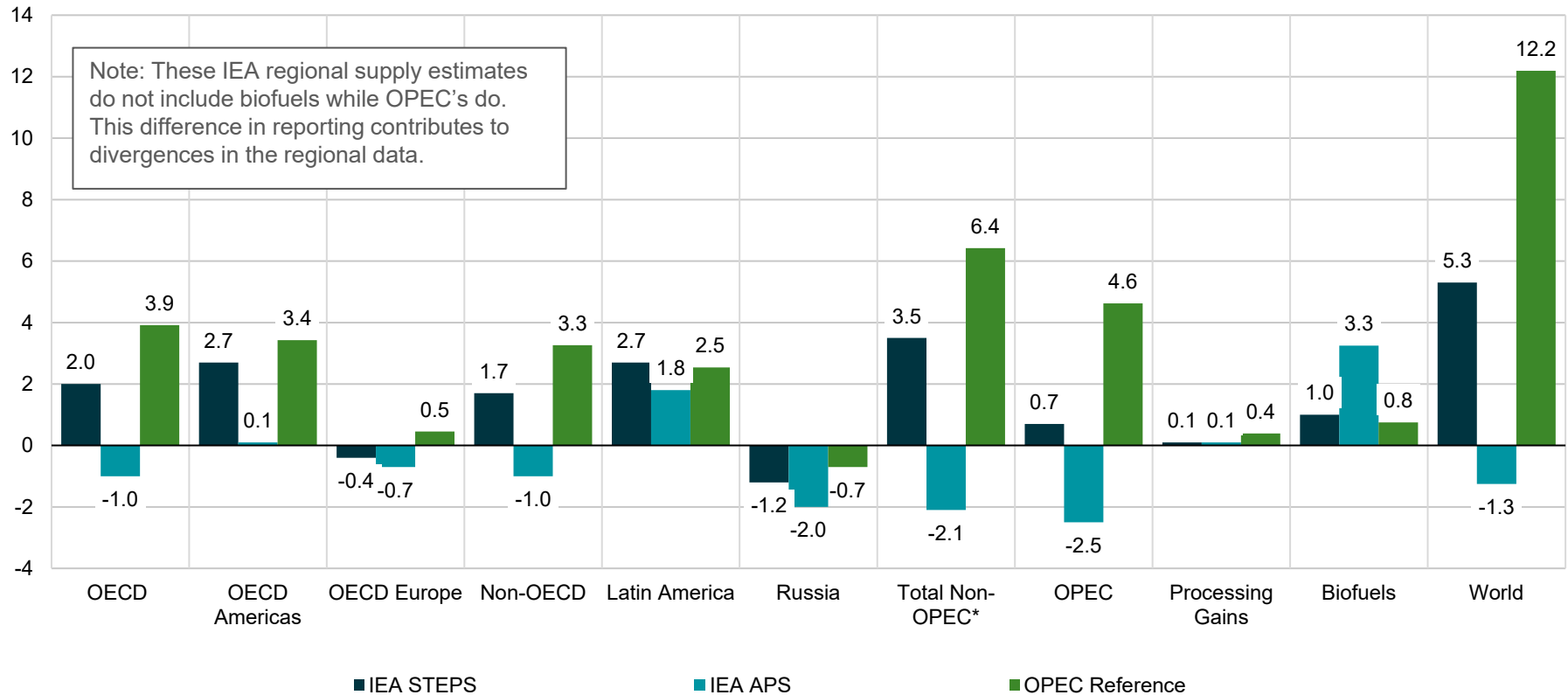
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# 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



\*Excludes processing gains and biofuels

Source: IEF, IEA WEO 2023, OPEC WOO 2023



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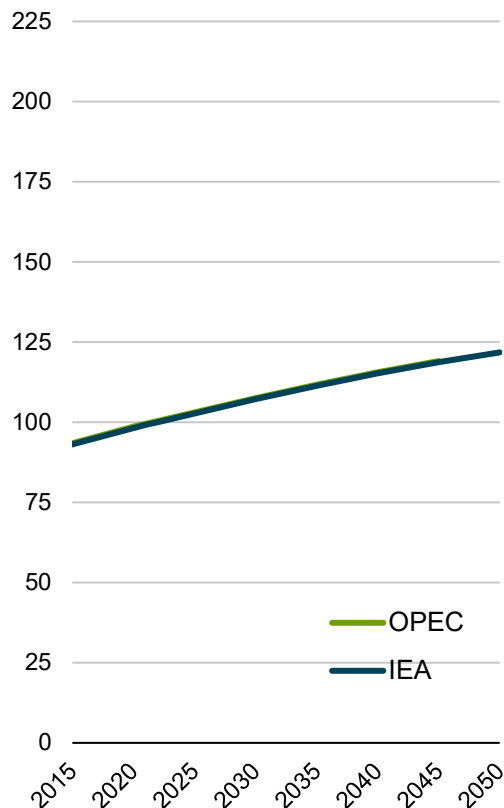
# IEA and OPEC Outlooks to 2045

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# Global GDP is expected to double by 2050 and global population is expected to grow by more than 20%

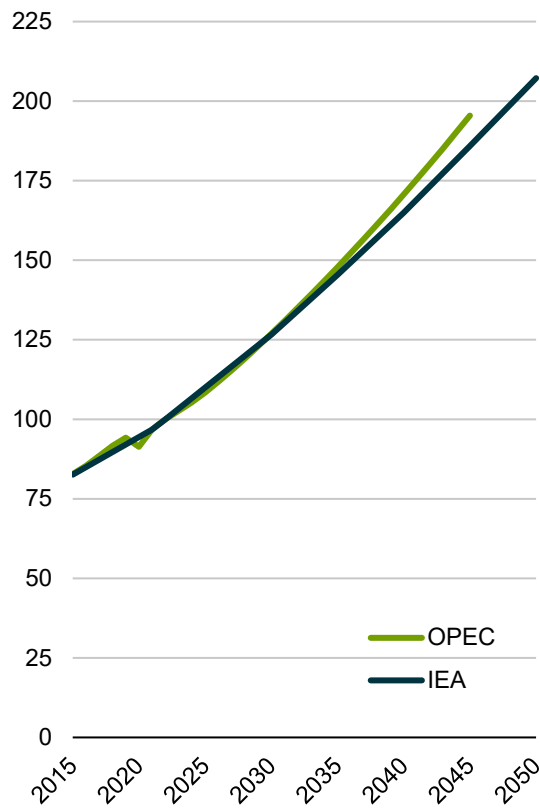
## Global Population

Index 2022=100



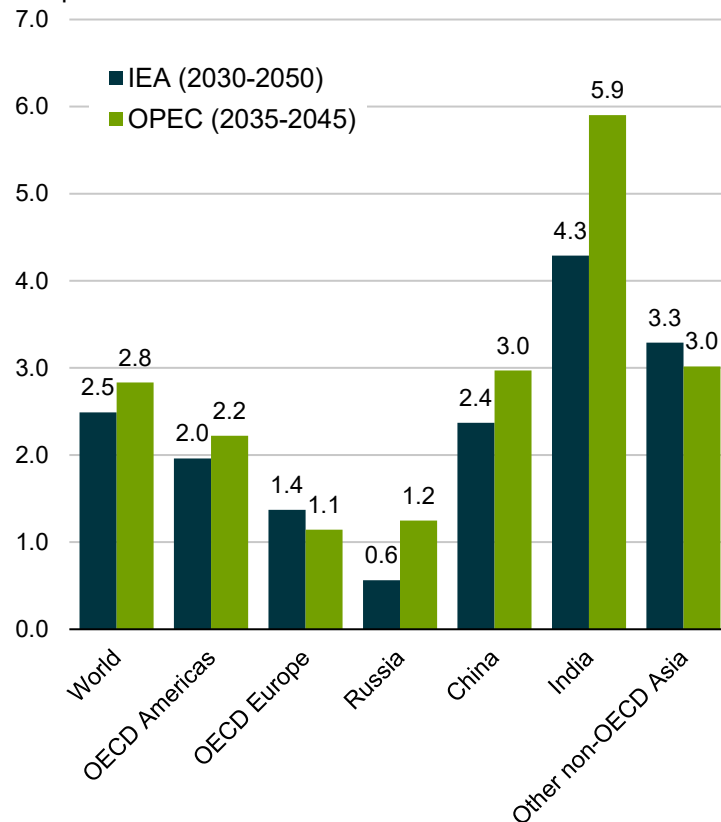
## Global GDP

Index 2022=100



## Compound Avg Annual Real GDP Growth Rate

% per annum



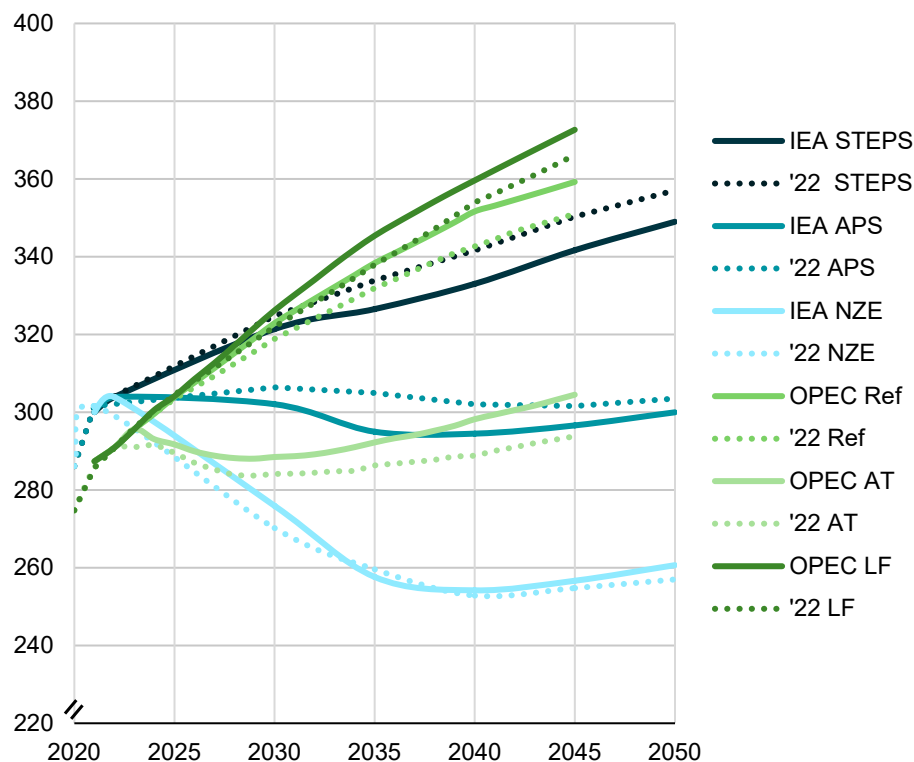
\* Because the IEA and OPEC's regional classifications differ, we construct the following regional classifications to allow for intercomparison: OECD Americas is North America for IEA, and OECD Americas for OPEC; OECD Europe is the European Union for IEA, and OECD Europe for OPEC, Other non-OECD Asia is Southeast Asia for IEA, and Other non-OECD Asia for OPEC.

# 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

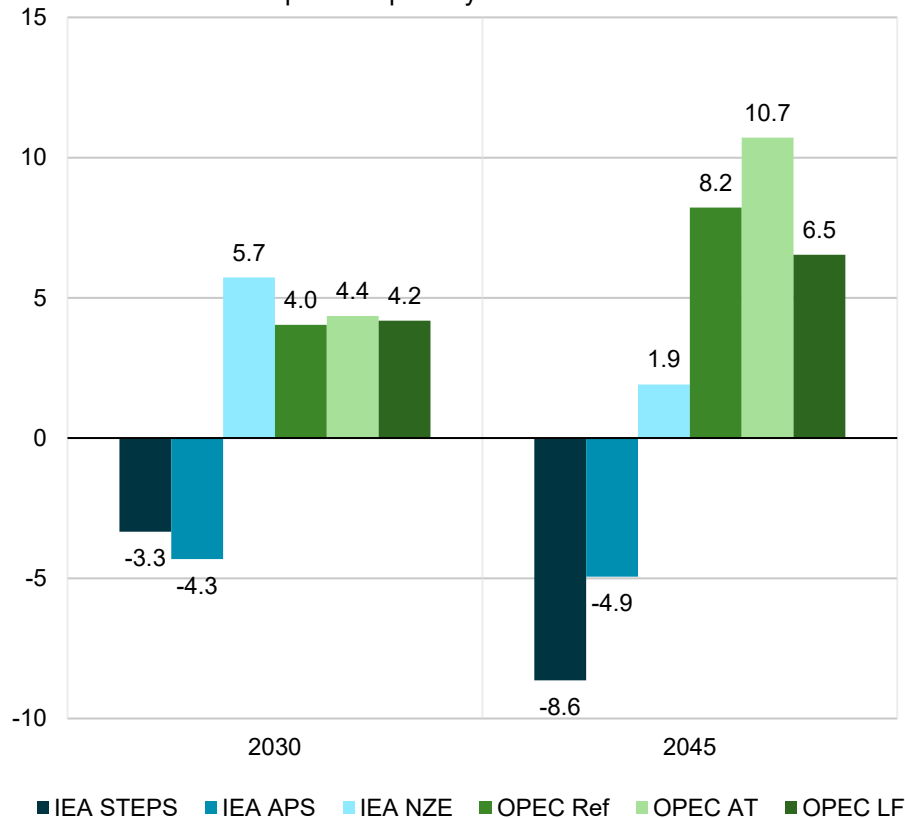
Million barrels of oil equivalent per day



Source: IEF, IEA WEO 2023, OPEC WOO 2023

## Global Primary Energy Outlook: Revisions to 2022 Scenarios

Million barrels of oil equivalent per day

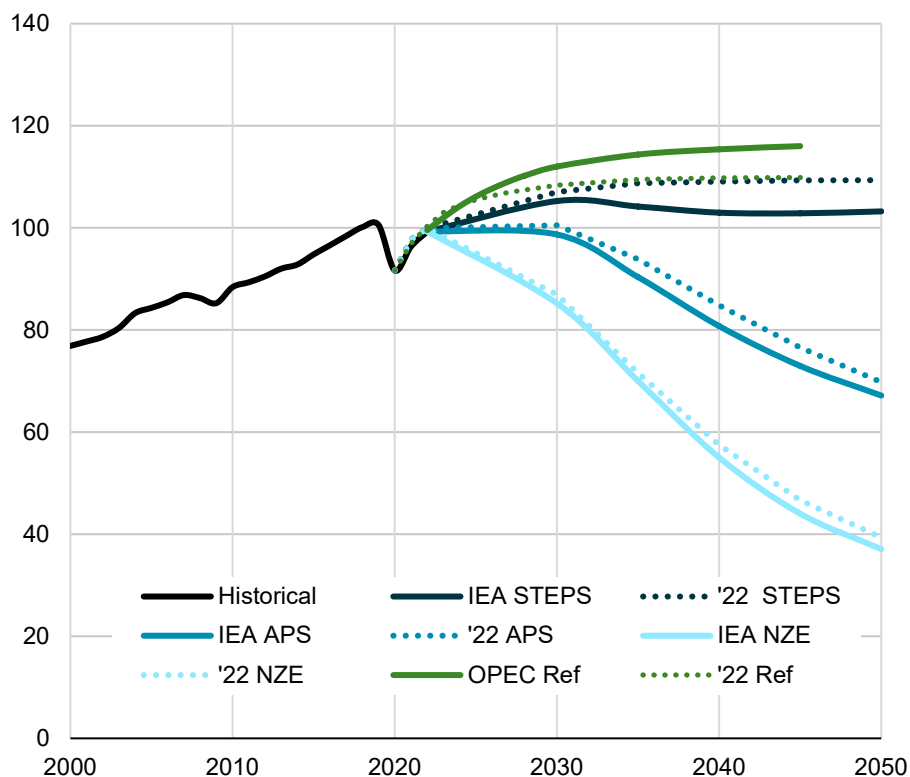


# OPEC Reference Case and IEA STEPS show plateauing liquids demand in the 2030s and 2040s

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

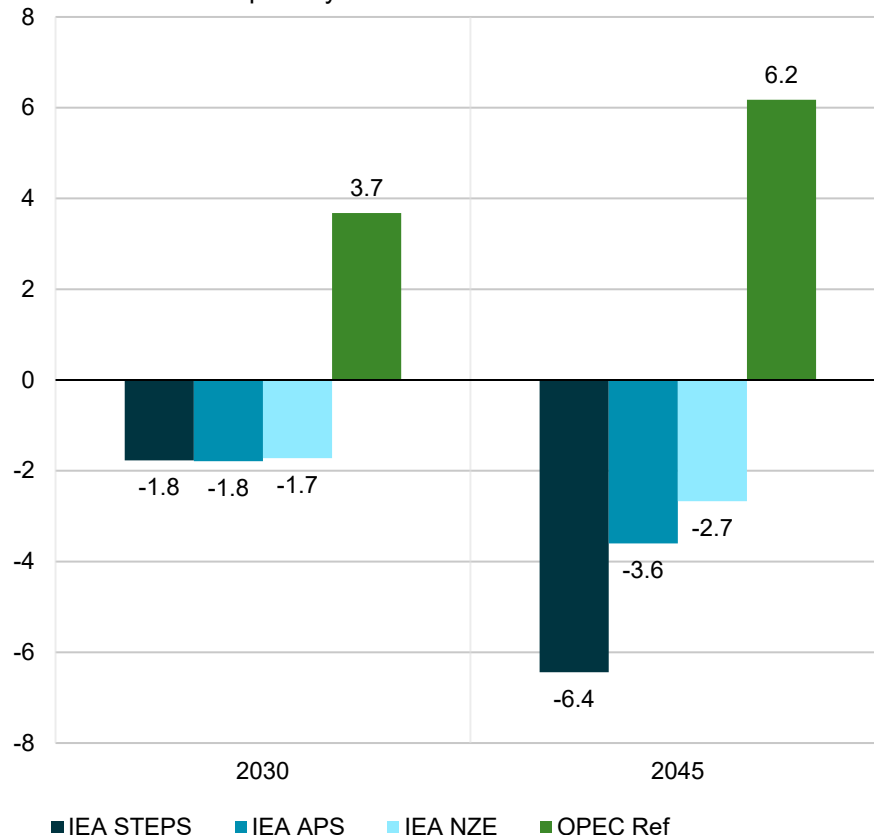


\*IEA liquids figures are adjusted to account for volume of biofuels (see appendix)

Source: IEF, IEA WEO 2023, OPEC WOO 2023

## Global Liquids Demand: Revisions to 2022 Scenarios

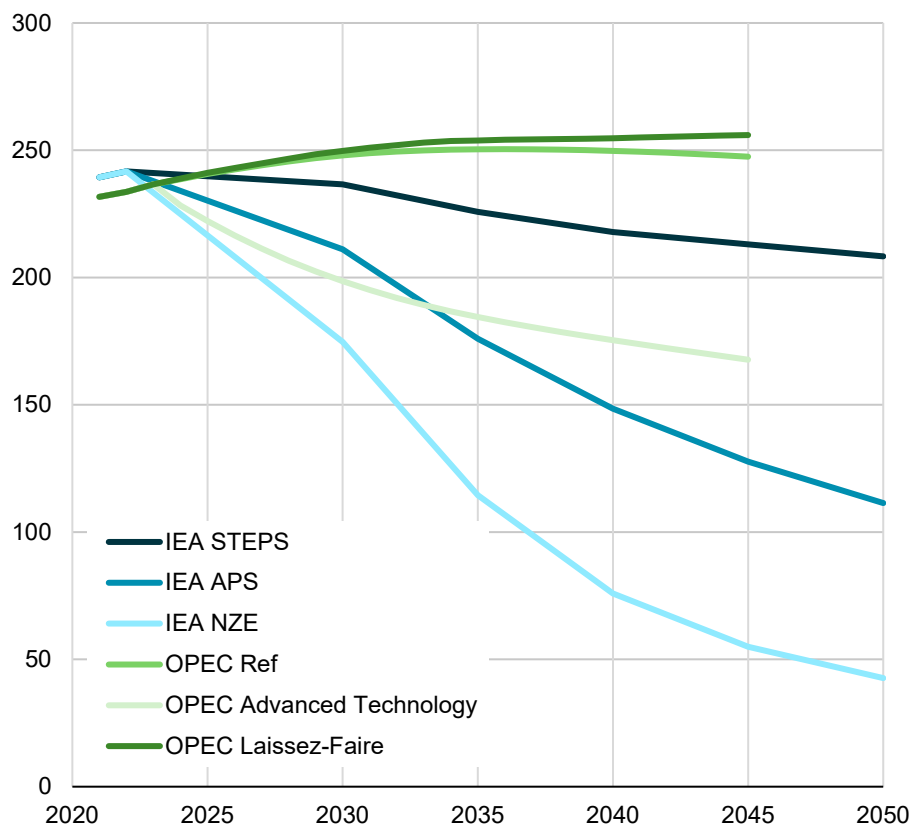
Million barrels of oil per day



# Despite robust growth, demand for non-fossil fuels will not surpass 2022's demand level for fossil fuels in the forecast period

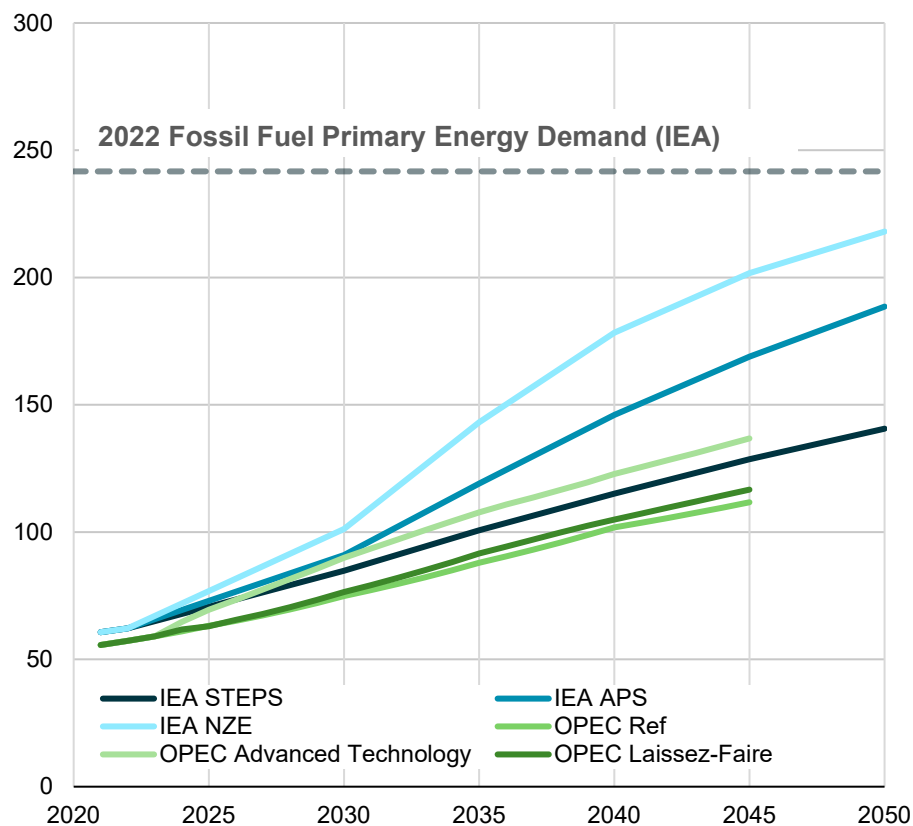
## Fossil Fuel Primary Energy Outlook

Million barrels of oil equivalent per day



## Non-Fossil Fuel Primary Energy Outlook

Million barrels of oil equivalent per day



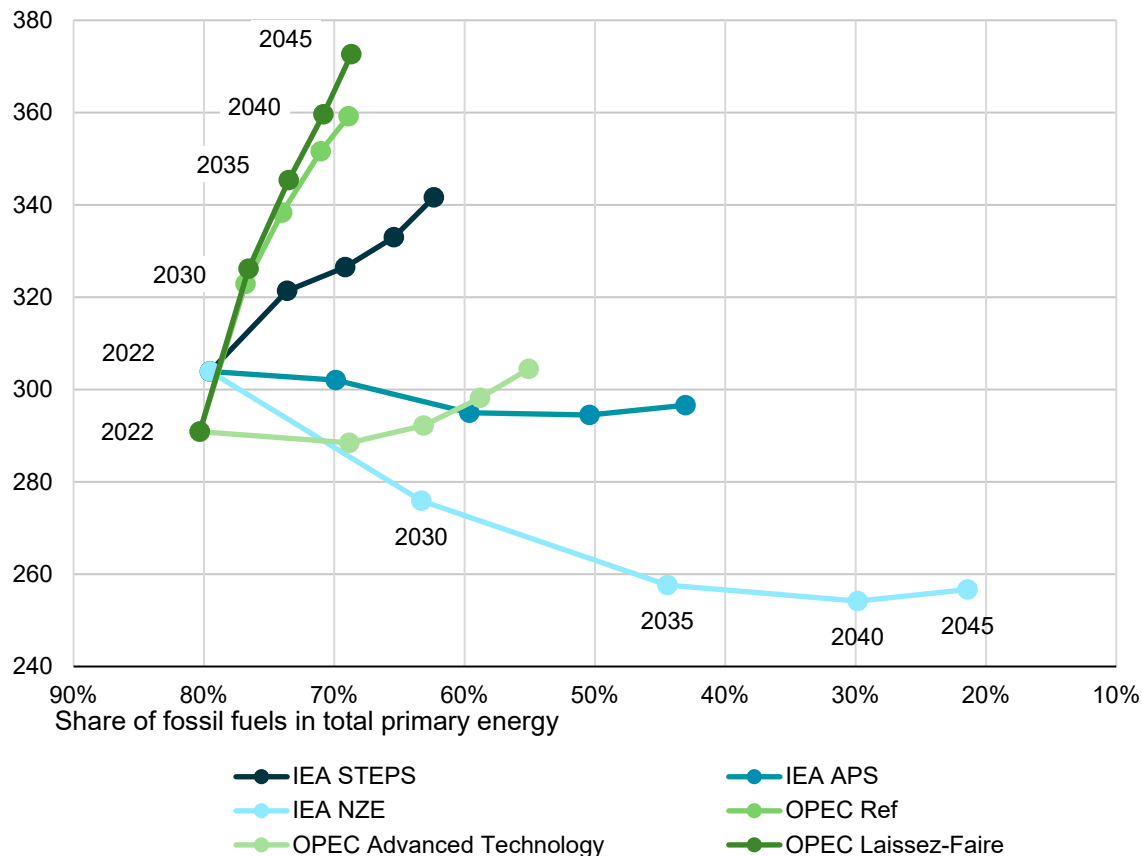
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# 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.
- IEA's NZE shows the most aggressive phase-out of fossil fuels and is accompanied by a 16% decline in total primary energy by 2045.

**Share of Fossil Fuels in Total Primary Energy Demand**

Total Primary Energy, Million barrels of oil equivalent per day



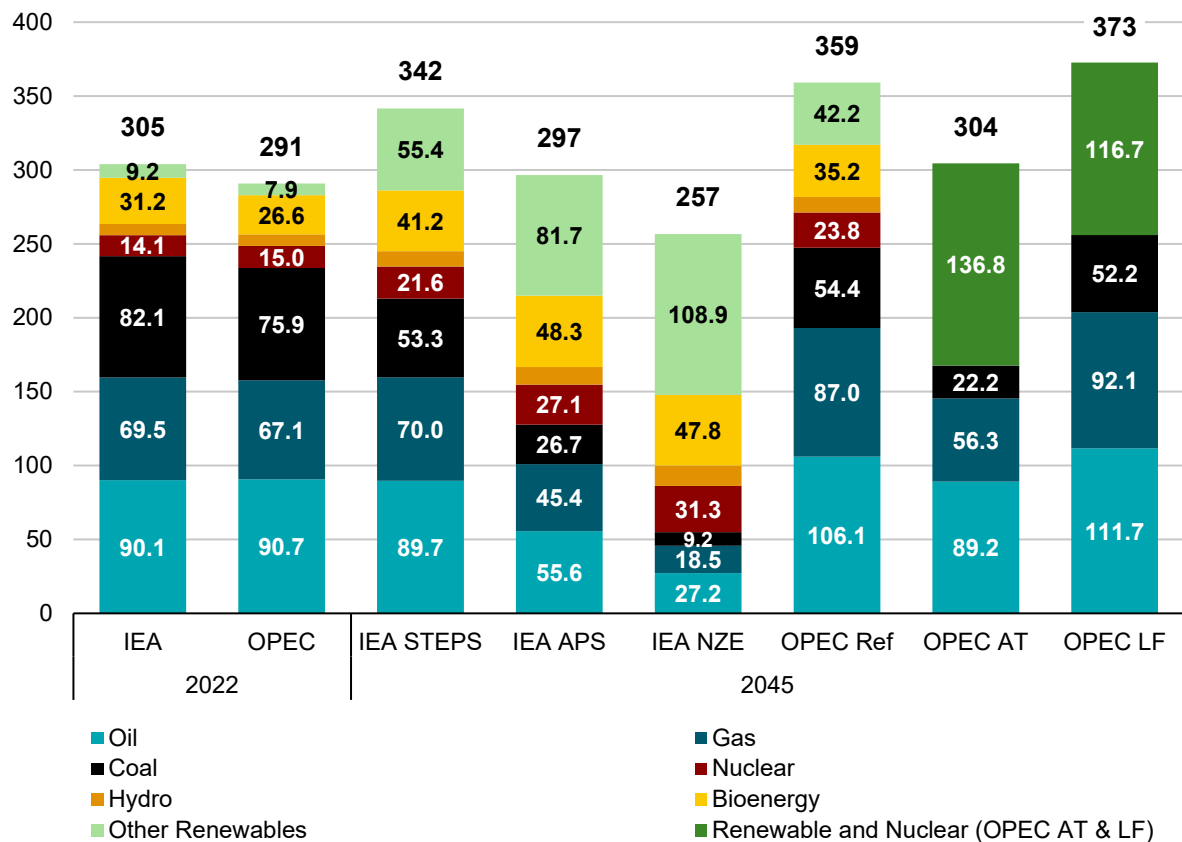
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# 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



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

Source: IEF, IEA WEO 2023, OPEC WOO 2023

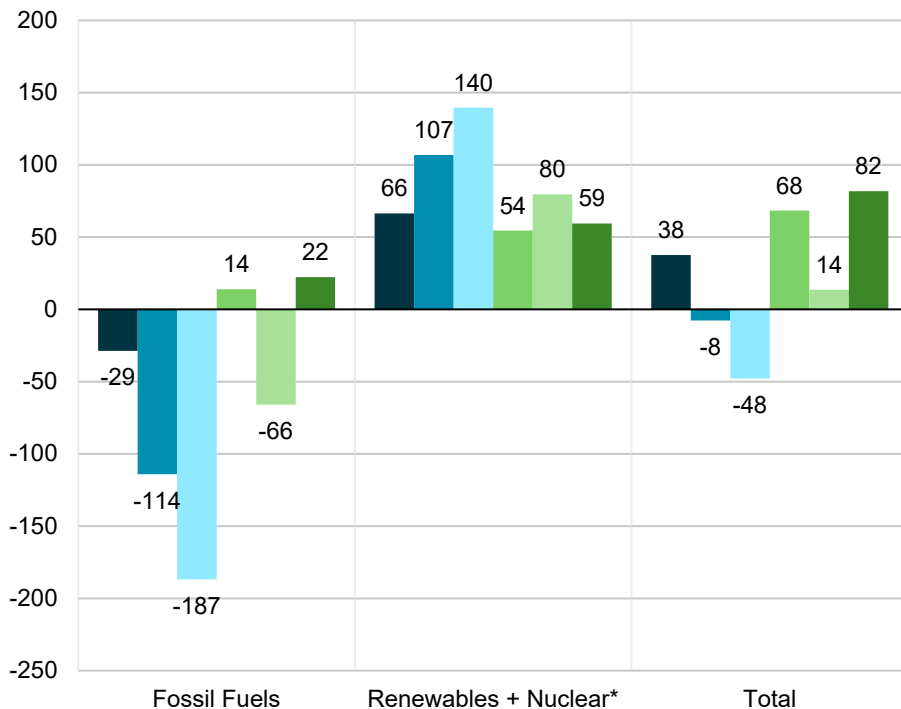
- Scenarios consistent with the Paris Agreement show Primary Energy roughly at or below 2022 levels in 2045 – implying strong efficiency gains since GDP and global population continues to grow.
- IEA scenarios and OPEC Reference Case show “other renewables” at 5-12 times higher in 2045 compared to 2022 levels.
- Natural gas demand is higher in 2045 in IEA STEPS and OPEC Reference and Laissez-Faire scenarios.
- IEA STEPS and OPEC Reference Case see similar total primary energy demand in 2045 – although OPEC sees a higher share of fossil fuel demand.

# 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

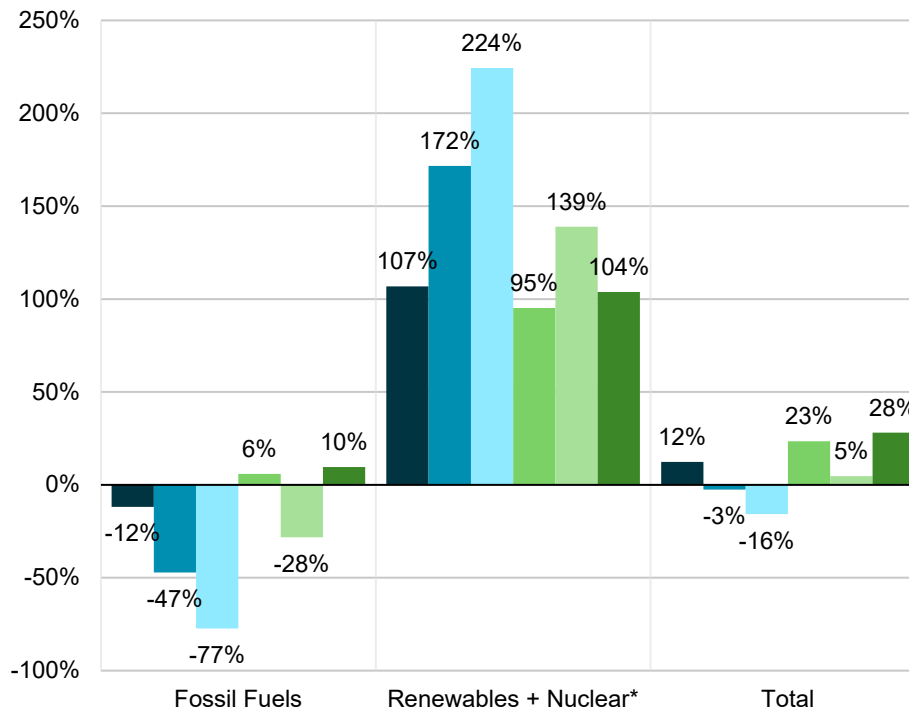
**Change in World Primary Energy by Source: 2045 vs 2022**

Million barrels of oil equivalent per day



**World Primary 2045 vs. 2022**

% change from 2022



■ IEA STEPS ■ IEA APS ■ IEA NZE ■ OPEC Ref ■ OPEC AT ■ OPEC LF ■ IEA STEPS ■ IEA APS ■ IEA NZE ■ OPEC Ref ■ OPEC AT ■ OPEC LF

\* Renewables + Nuclear includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios. OPEC's LF and AT only report the aggregate and not components for renewables and nuclear.

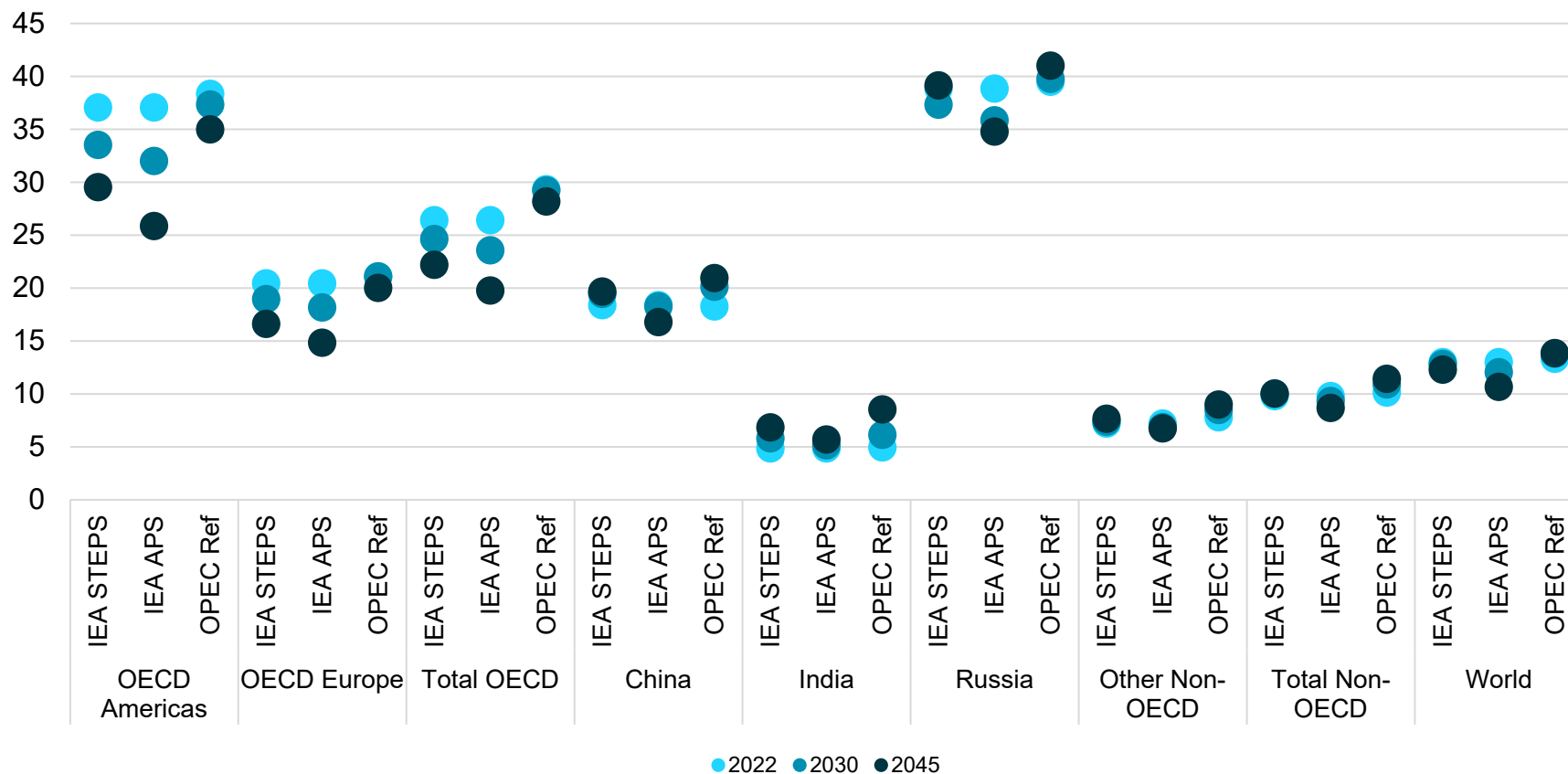
Source: IEF, IEA WEO 2023, OPEC WOO 2023



# Non-OECD energy use per capita in 2045 remains at ~60-70% below the OECD rate seen in 2022

## Primary Energy Per Capita

Barrels of oil equivalent

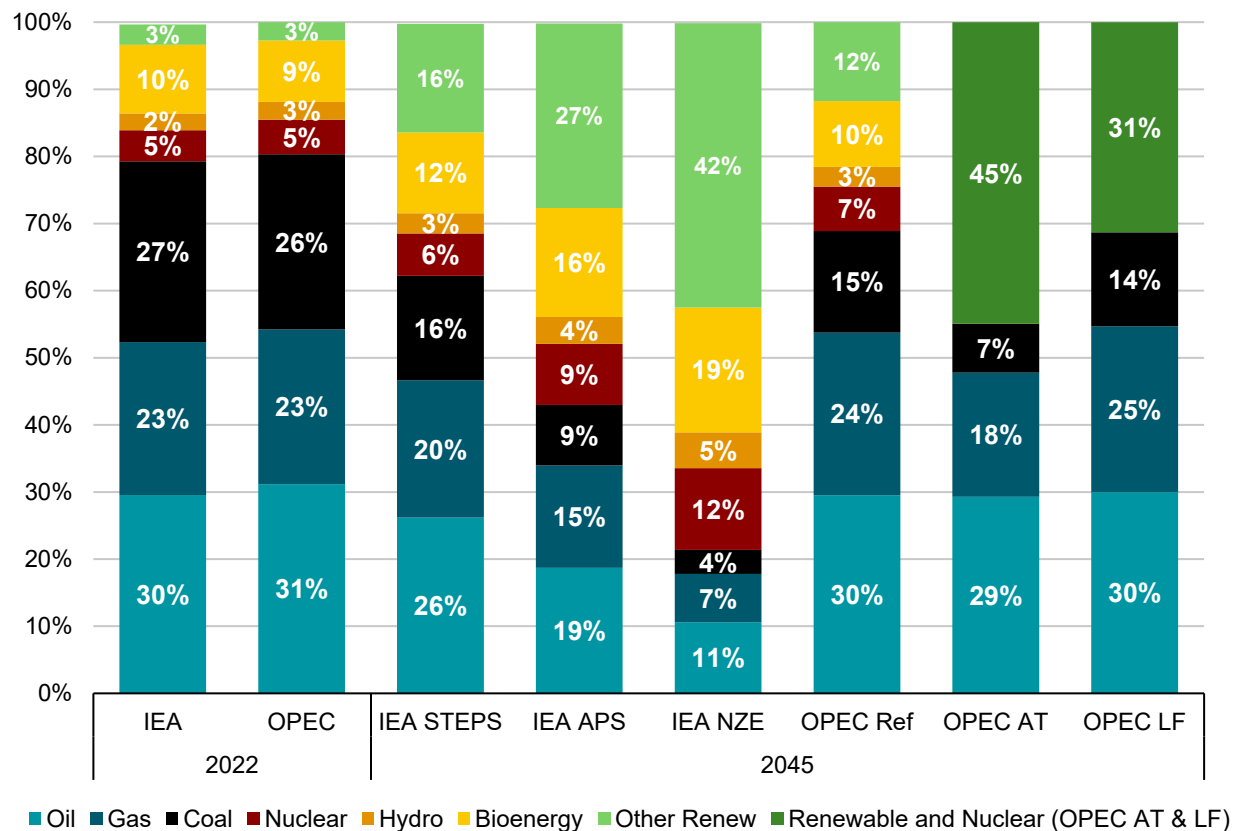


Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Renewables + nuclear share of primary demand increases from ~20% in 2022 to 32%-78% in 2045

## World Primary Energy Fuel Share Outlook to 2045

Percent of total primary energy



- IEA's NZE scenario shows "other renewables" share of primary demand increasing from 3% in 2022 to 42% in 2045 with solar increasing from 1% to 23% and wind increasing from 1% to 14%.
- OPEC scenarios all see only a 1 to 2 percentage point decrease in oil's share of primary energy between 2022 and 2045.
- Natural gas' share of primary energy demand declines in all scenarios except OPEC's reference and LF scenarios.
- Coal sees the sharpest decrease in share of primary energy between 2022 and 2045. Coal shrinks from 26-27% of total primary energy in 2022 to as little as 4% in IEA's NZE or as much as 16% in IEA's STEPS and 15% in OPEC's reference case.

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

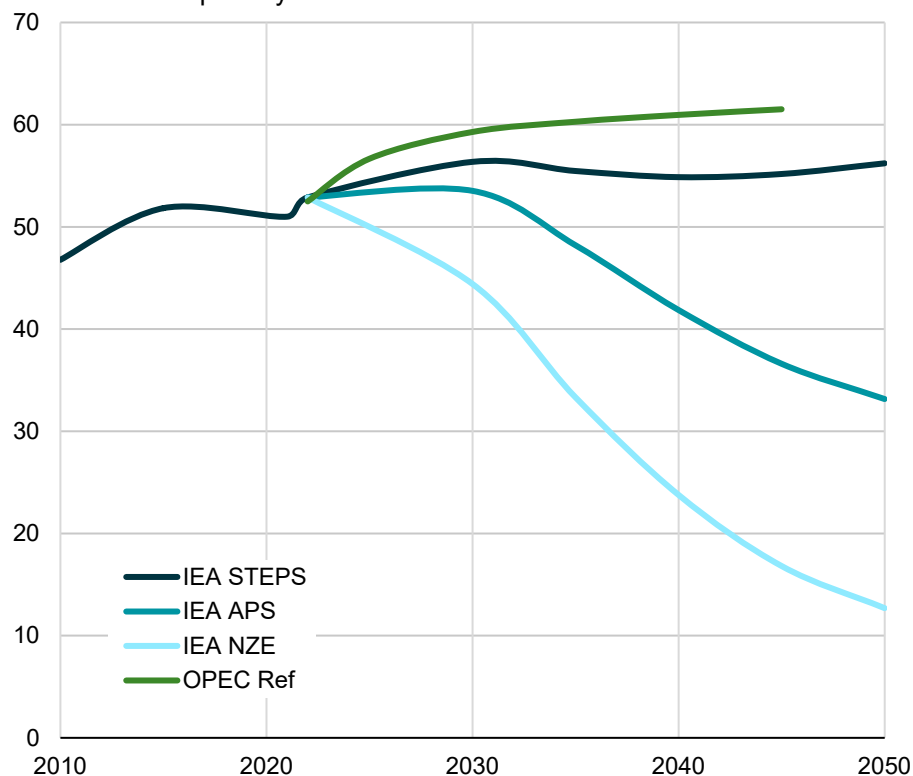
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Liquids demand in the transportation sector grows or plateaus for the next 20 years in IEA STEPS and OPEC Reference Cases, but it peaks in the 2020s and then declines sharply in IEA APS and NZE cases

- The transportation sector accounts for more than 50% of current oil demand.
- The pace of EV penetration into the global vehicle fleet will greatly impact future oil demand. In recent years, EV's share of new car sales has soared from just 1% in 2015 to more than 13% in 2022. Despite the increase of sales, EVs currently make up less than 2% of the global fleet.
- OPEC's reference case assumes ~16% of the global fleet will be EVs by 2035 (up from 11% expected in last year's report) and 23% by 2045.
- IEA does not provide comparable data on the evolution of the global fleet but notes that STEPS assumes by 2030, 38% of all new car sales are electric and APS assumes 45%. NZE assumes 60% of all car sales in 2030 are electric and no new ICE car sales occur after 2035.

Liquids Demand in the Transportation Sector (road, aviation, and shipping)

Million barrels per day



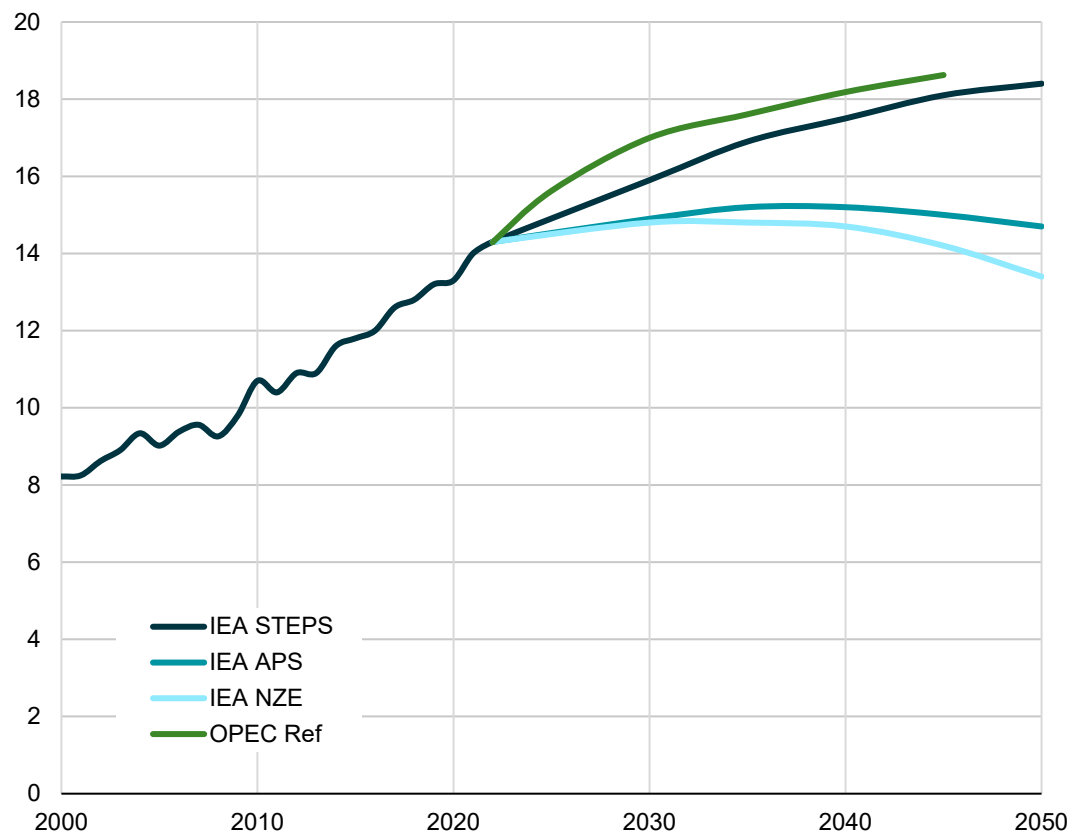
Note: Includes biofuels and excludes bunkers  
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# IEA STEPS and OPEC Reference Case see oil demand in the petrochemical sector rising by nearly 30% in the forecast period

- Petrochemicals are used for plastics, fertilizers, clothing, tires, and many other things used in modern society.
- Petrochemical demand is set to continue to be a significant portion of future oil demand and demand growth. However, there are still significant uncertainties related to how increased regulations around plastic pollution and bans on single use plastic may impact petrochemical demand.
- OPEC notes that the largest incremental demand is expected in non-OECD countries, particularly in Asia and the Middle East.
- IEA highlighted that China's feedstock demand has increased by 50% since 2019 and is responsible for 80% of China's oil demand growth between 2019 and 2023.

Oil Demand in Petrochemical Sector

Million barrels per day



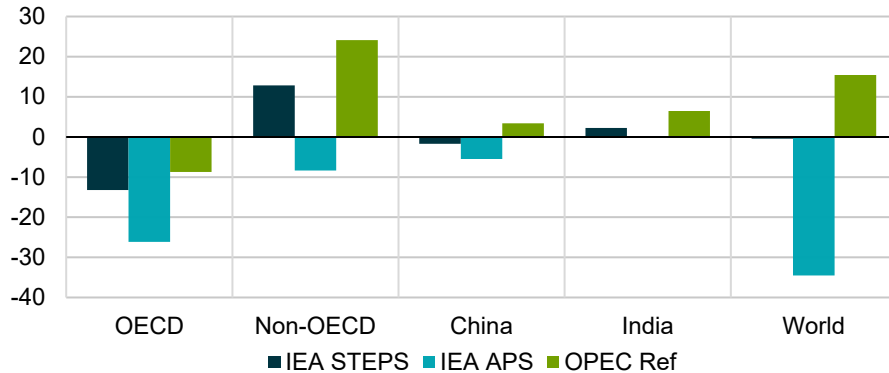
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# All three scenarios see a sharp decline in coal demand

OPEC Reference Case sees global growth in oil and gas demand through 2045 but STEPS sees OECD declines offsetting non-OECD growth

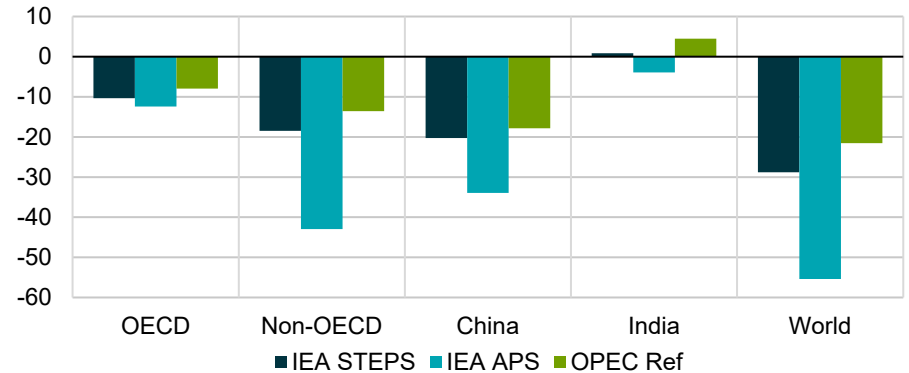
## Change in Oil Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



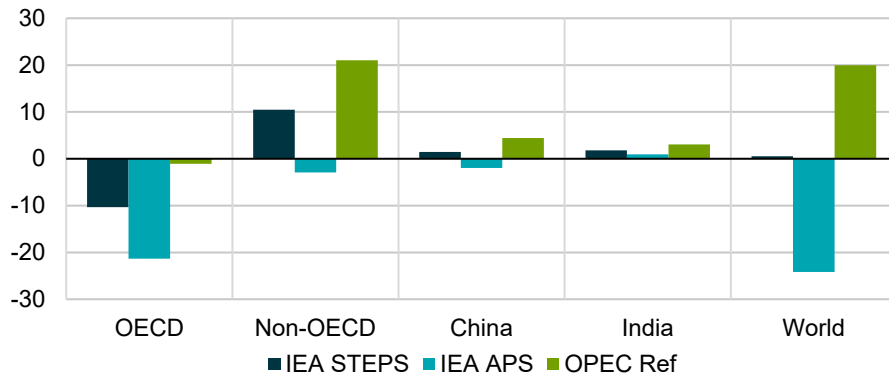
## Change in Coal Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



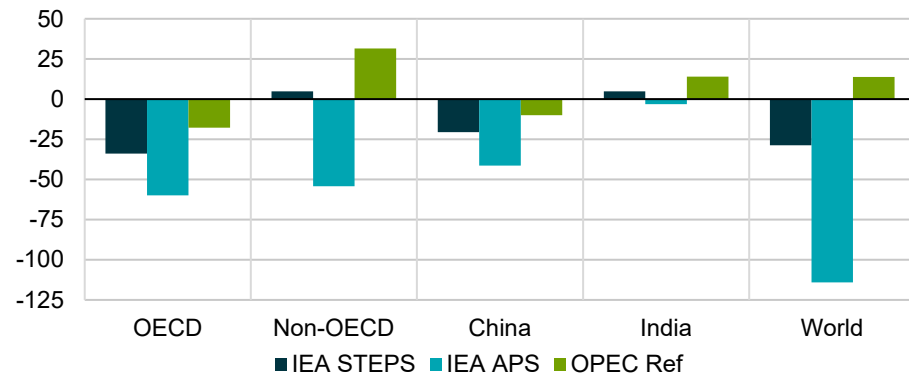
## Change in Natural Gas Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



## Change in Fossil Fuel Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



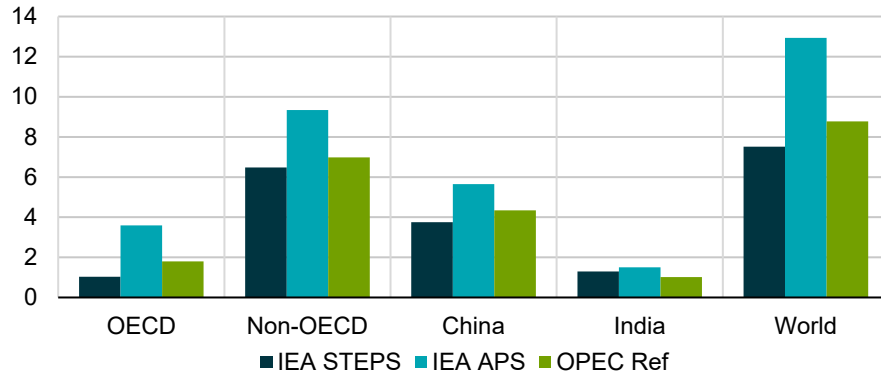
\*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Nuclear, hydro, biomass, and other renewables see substantial growth across the board between 2022 and 2045

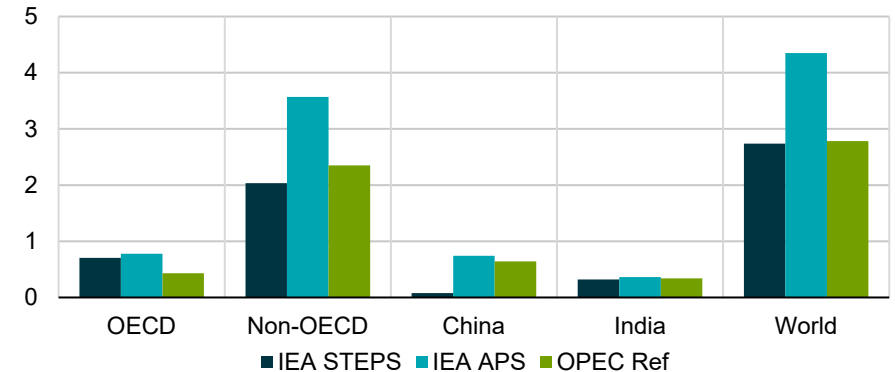
## Change in Nuclear Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



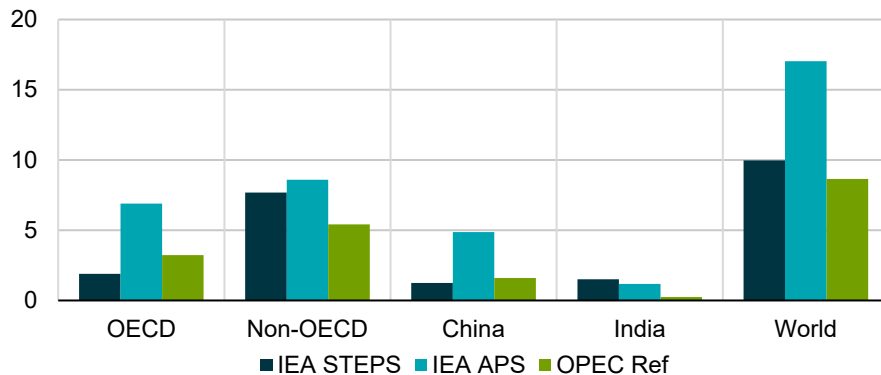
## Change in Hydro Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



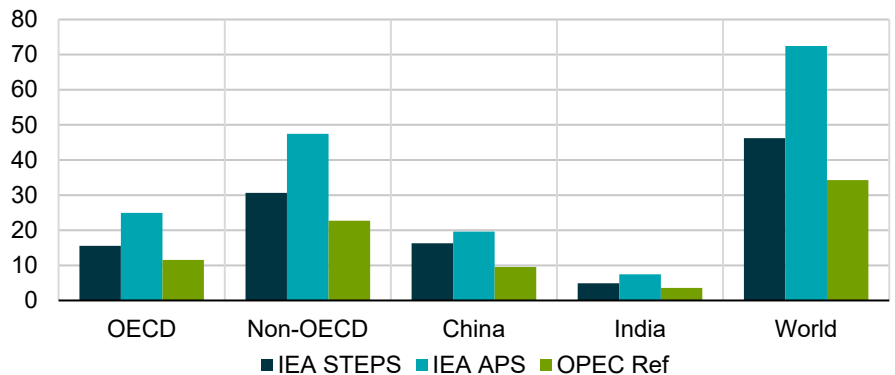
## Change in Biomass Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



## Change in Other Renewables Demand: 2045 vs. 2022

Million barrels of oil equivalent per day



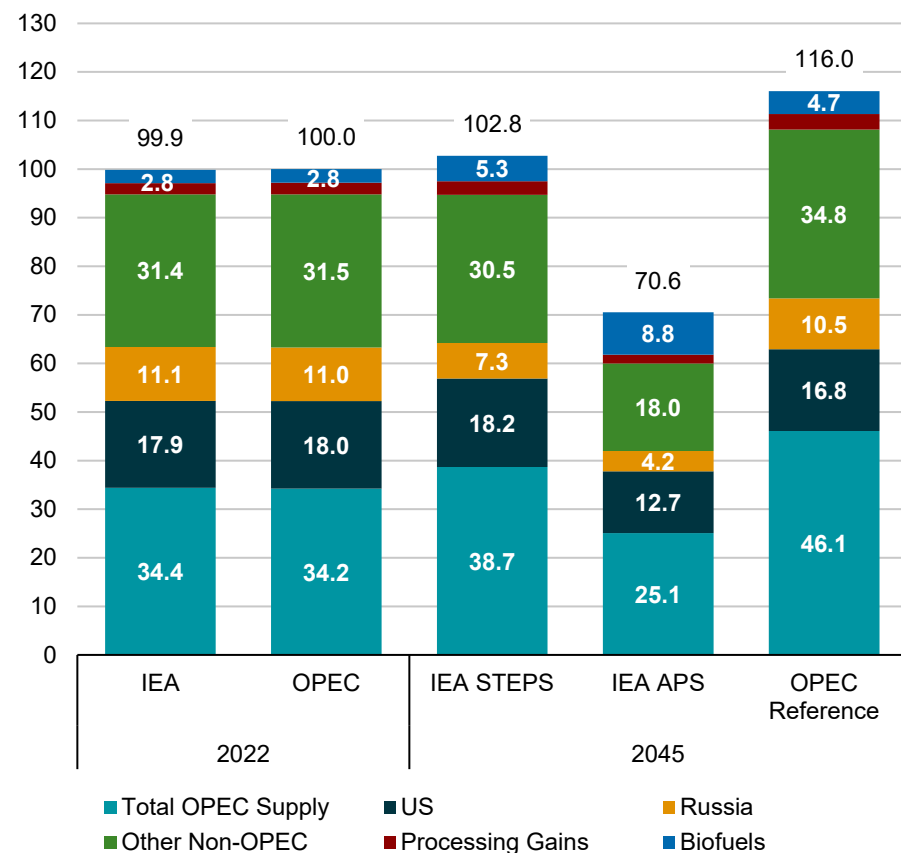
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# Biofuels and OPEC members see rising share of total liquids supply by 2045 in all scenarios

US production is seen rising only in IEA STEPS

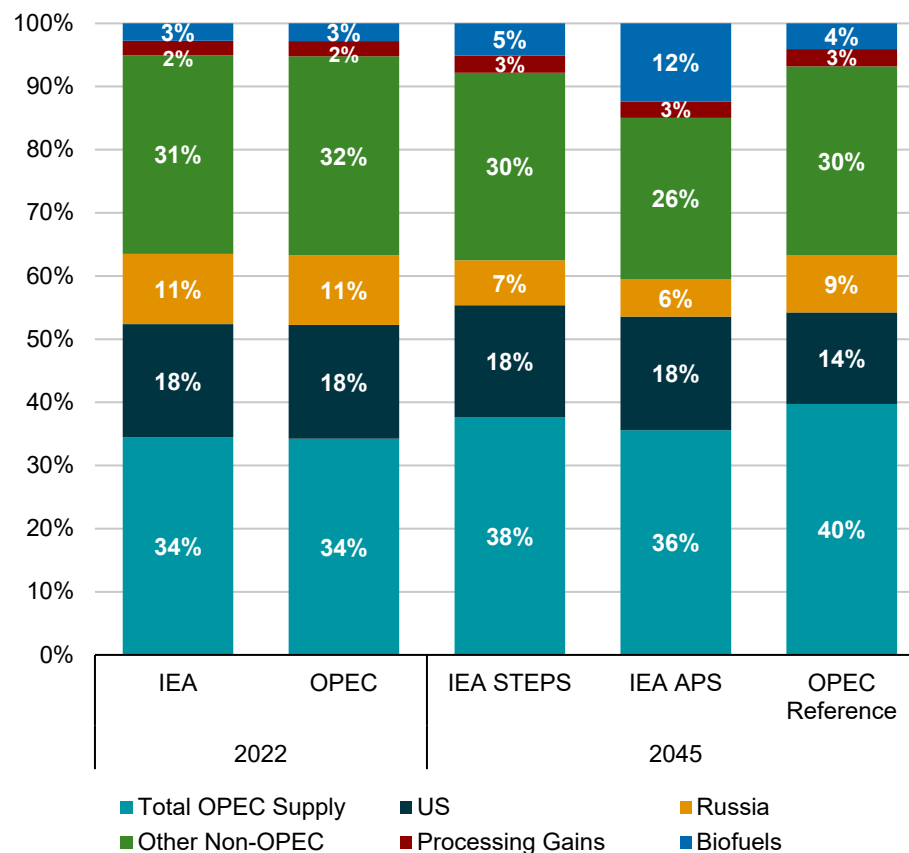
### Liquids Supply Sources by Scenario

Million barrels per day



### Liquids Supply Sources by Scenario

Percent of global liquid supply



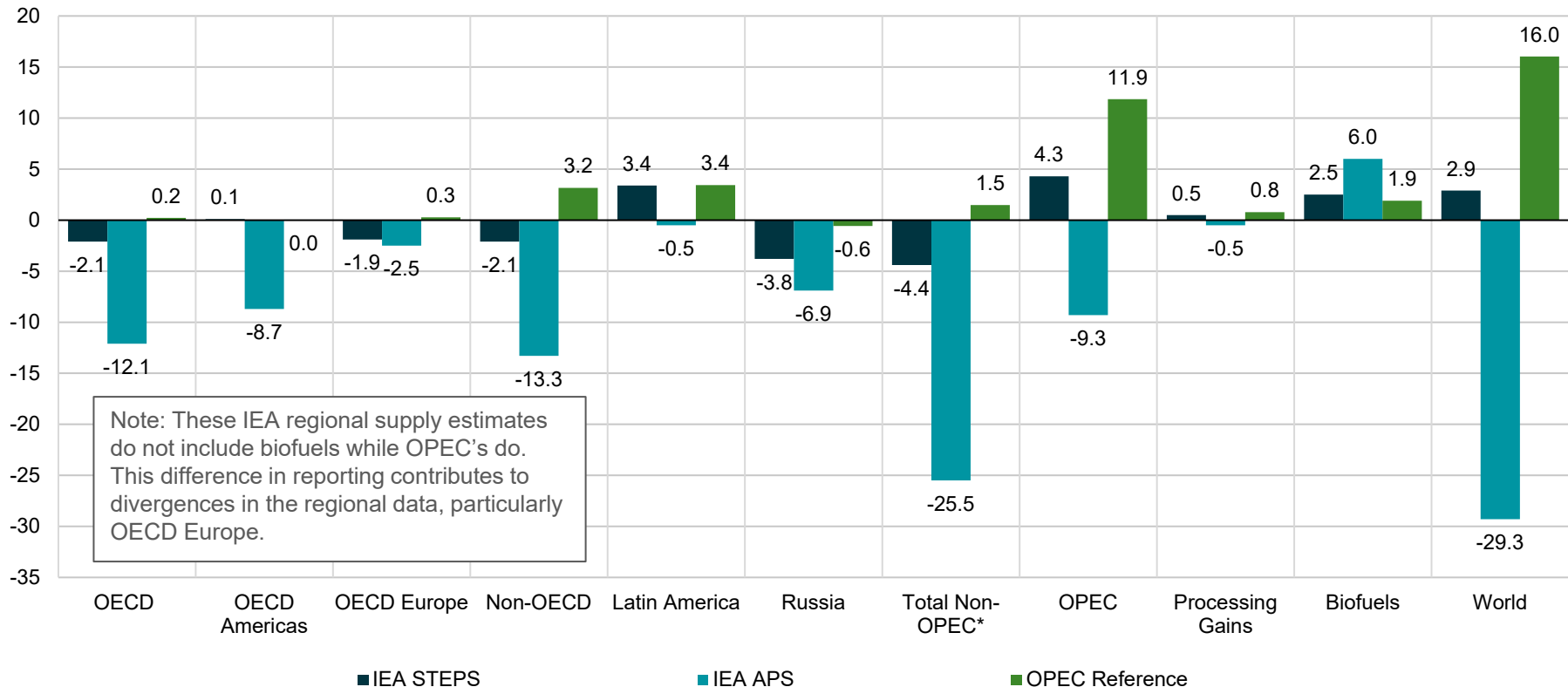
Source: IEF, IEA WEO 2023, OPEC WOO 2023

# IEA APS sees a steep drop in liquids supply by 2045 led by declines in non-OPEC production

OPEC countries account for 74% of liquids supply growth in the OPEC Reference Case

## Liquids Supply by Source: 2045 vs. 2022

Million barrels per day



\*Excludes processing gains and biofuels

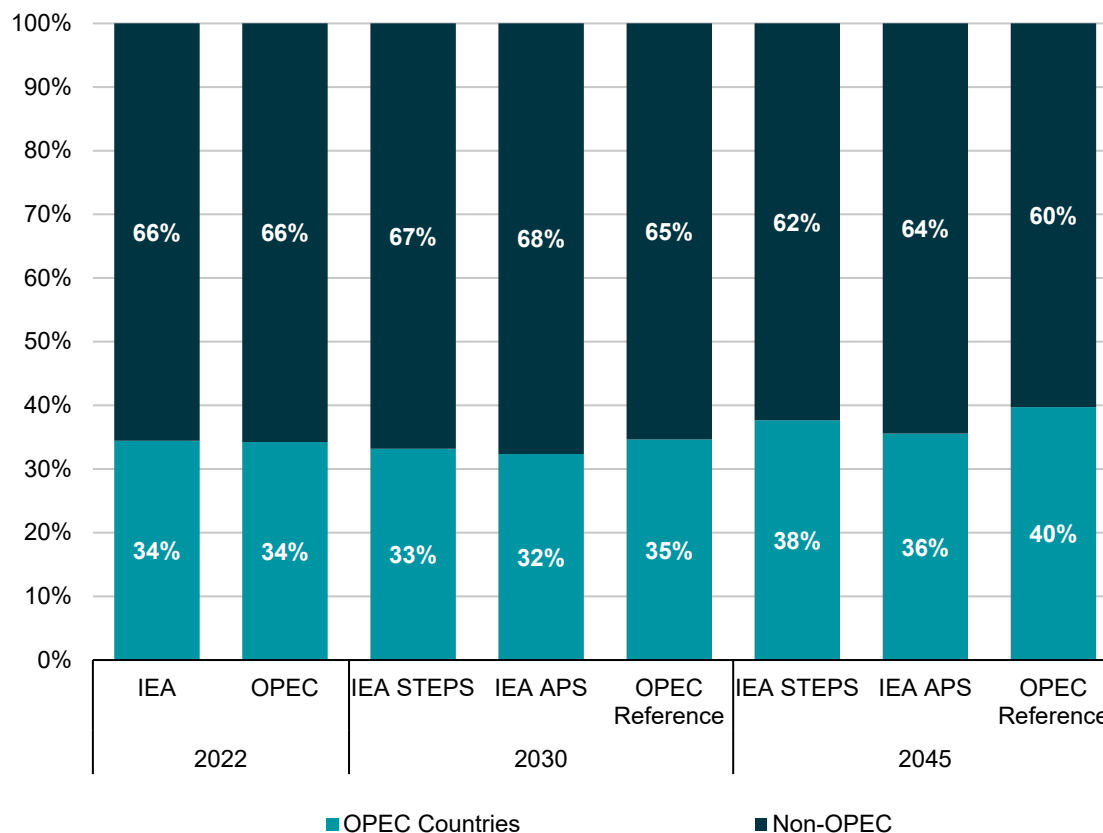
Source: IEF, IEA WEO 2023, OPEC WOO 2023



# OPEC market share of total liquids supply rises from 34% in 2022 to 38-40% in 2045 in IEA STEPS and OPEC Reference Case

- IEA STEPS and APS show OPEC market share of total liquids supply falling between 2022 and 2030 before rising between 2030 and 2045.
- OPEC Reference Case show OPEC member production rising by nearly 12 mb/d between 2022 and 2045.
- While OPEC does not provide country-level forecasts for OPEC members, IEA does provide some data.
- IEA STEPS forecast for 2045 shows OPEC production at 4.3 mb/d higher than 2022 levels as increases from the Middle East more than offset declines in Africa. STEPS shows increased output from:
  - Saudi Arabia (+1.8 mb/d);
  - Iraq (+1.2 mb/d);
  - Iran (+1.2 mb/d); and
  - UAE (+1.1 mb/d)

**OPEC and Non-OPEC Market Share of Total Liquid Supply**  
% of global liquids supply



Source: IEF, IEA WEO 2023, OPEC WOO 2023

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

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# Additional Scenario Descriptions and Assumptions

<b>BNEF</b>	NZS*	Scenario consistent with achieving global net-zero emissions by 2050 and meeting the goals of the Paris Agreement.	<b>GECF</b>	Reference (RCS)**	Current and likely policies. Energy demand will rise by 22% by 2050.
	Economic Transition Scenario (ETS)**	A baseline assessment. Assumes no further major climate policy intervention.		Accelerated Energy Decarbonization Scenario (AEDS)*	Considers a faster energy system decarbonization that, above all, considers how natural gas and clean technologies can be used.
<b>BP</b>	Accelerated*	Broadly in line with IPCC 2°C. Total final consumption peaks in late 2020s.	<b>IEEJ</b>	Reference**	Reflects past trends with technology progress and current energy policies without aggressive policies for low-carbon measures.
	Net Zero*	Broadly in line with IPCC 1.5°C. Total final consumption peaks in the mid-2020s.		Advanced Technology (ATS)*	Energy and environmental technologies are introduced to the maximum extent possible.
	New Momentum**	Follows the current trajectory of energy policies. Total final consumption peaks around 2040.			
<b>EIA</b>	Reference**	Reflects current energy trends and existing laws and regulations. Assumes global GDP growth averages 2.6% from 2022-2050.	<b>IPCC AR6 WGIII</b>	ModAct**	NDCs are implemented. Current trajectory leads to >2°C warming.
	High and Low Economic Growth**	The High Economic case assumes global GDP growth from 2022-2050 averages 3.4% while the low case assumes 1.8%.		IMP-Neg (2C)*	Limits warming to 2C with a higher reliance on net negative emissions.
				IMP-Ren (1.5)*	Limits warming to 1.5C with greater emphasis on renewables.
IMP-LD (1.5)*				Limits warming to 1.5C with greater emphasis on demand reduction.	
<b>Equinor</b>	Walls**	Current trends in market, technology and policies. Energy transition accelerates slowly but does not reach climate goals.	<b>IRENA</b>	Planned**	Reference case based on planned targets and government policies.
	Bridges*	Broadly consistent with IPCC 1.5°C.		1.5-S*	Describes an energy transition pathway aligned with a 1.5C climate goals. It prioritizes readily available technology solutions that can be scaled up.
<b>Exxon</b>	Reference**	Current trends in market, technology and policies.	<b>Shell</b>	Archipelagos**	Global sentiment shifts away from managing emissions and towards energy security. Emissions fall throughout the century, but net zero is not achieved by 2100.
				Sky 2050*	Achieves net zero emissions by 2050 and limits global warming to 1.5C by 2100.

\*Included in "Ambitious Climate Scenarios" group in the following slides;

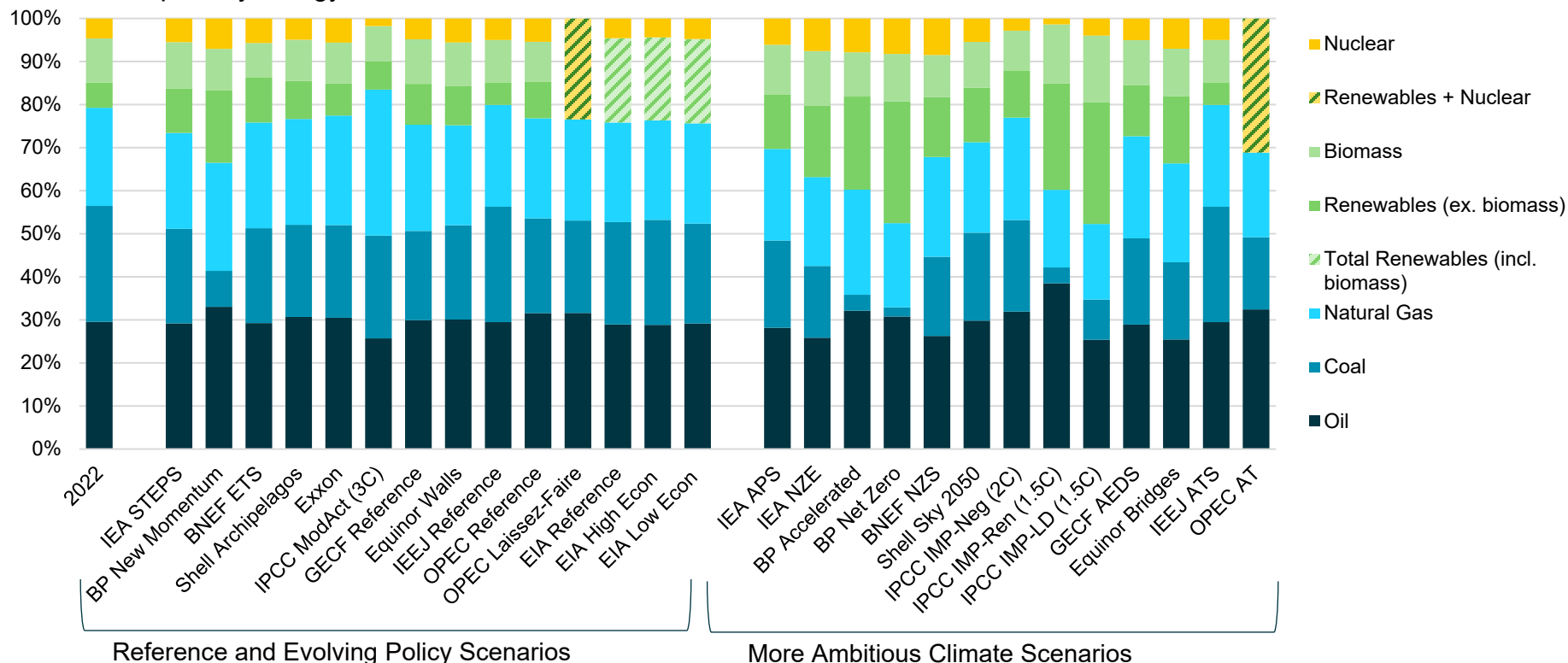
\*\*Included in the "Reference Cases and Evolving Policies" group in the following slides;

See descriptions of IEA and OPEC scenarios on page 32

# Fossil fuels account for more than 50% of primary energy demand in 2030 in all scenarios surveyed

## Primary Energy Mix in 2030

% of total primary energy

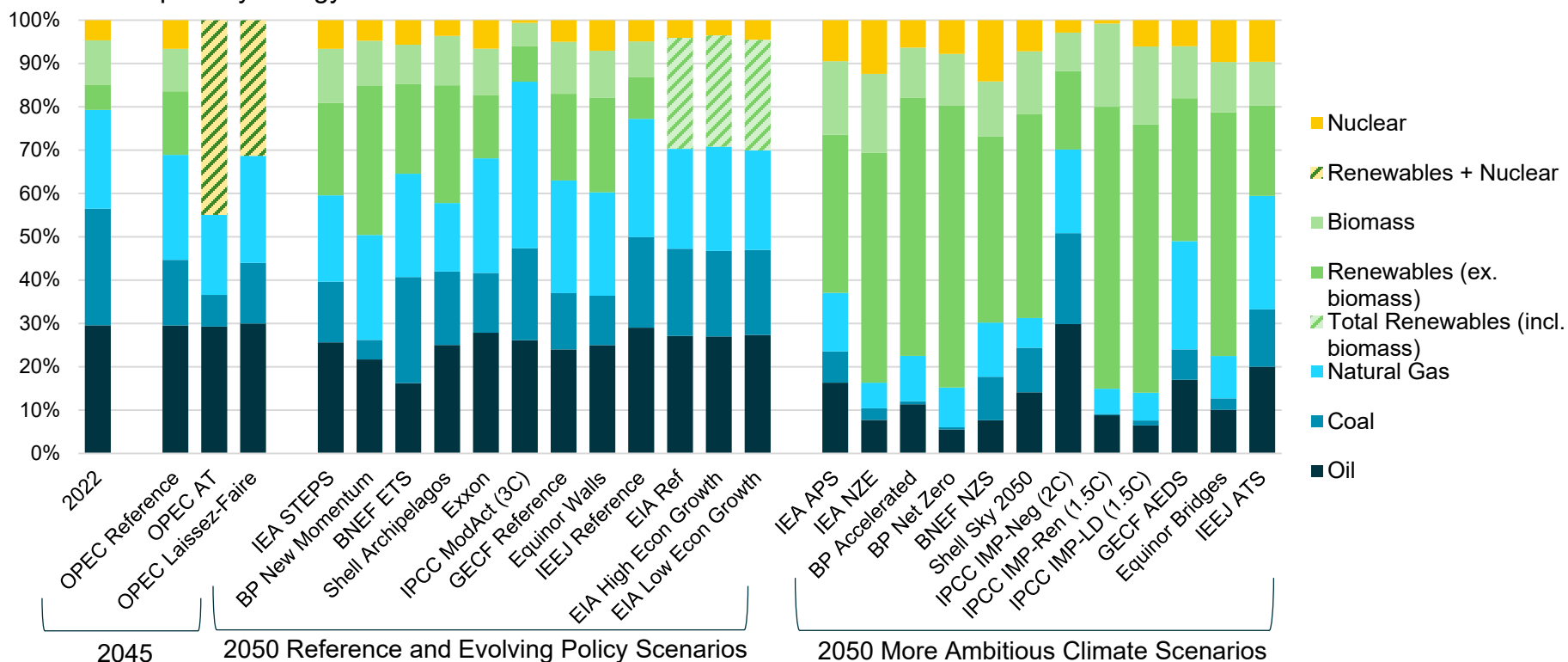


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# Renewables and nuclear account for 30-40% of primary energy in 2050 in most reference scenarios and 50-85% in most of the more ambitious climate scenarios

## Primary Energy Mix in 2050

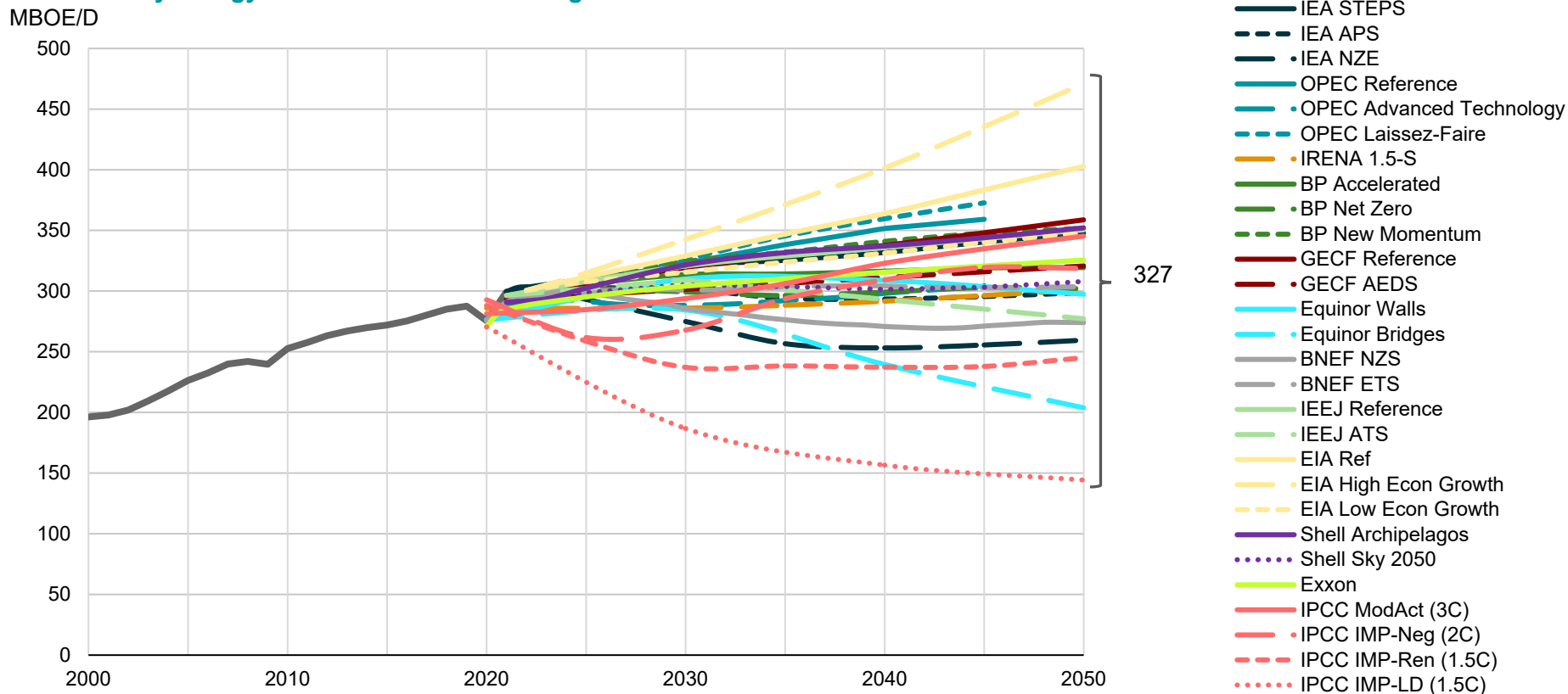
% of total primary energy



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

# Primary energy demand: The range between the high and low forecasts for 2050 exceeds 2022 demand levels by 8%

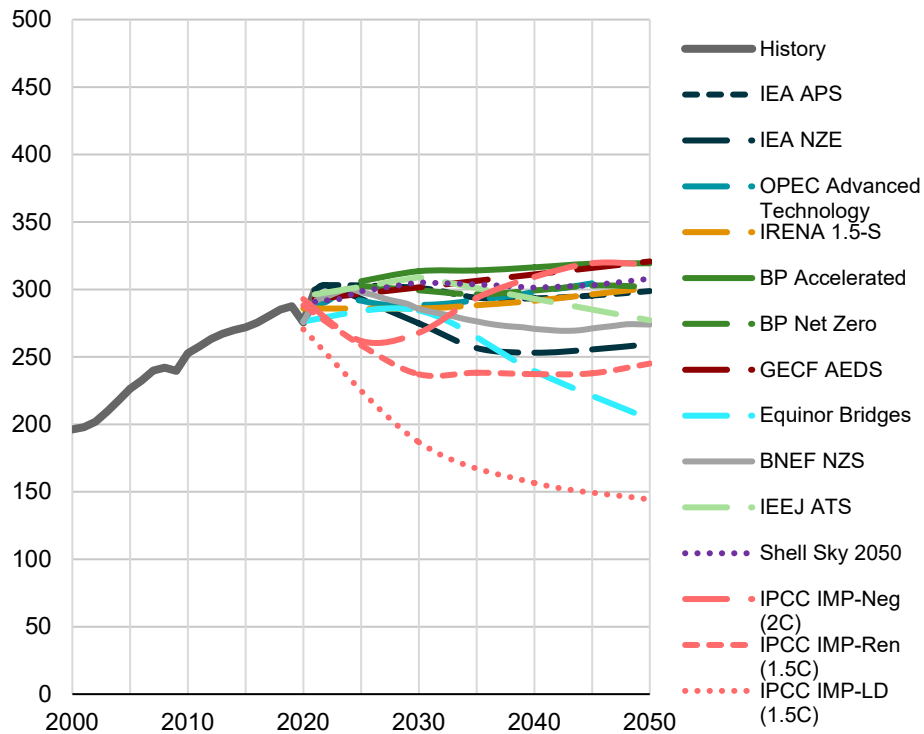
Total Primary Energy Demand Scenarios Through 2050



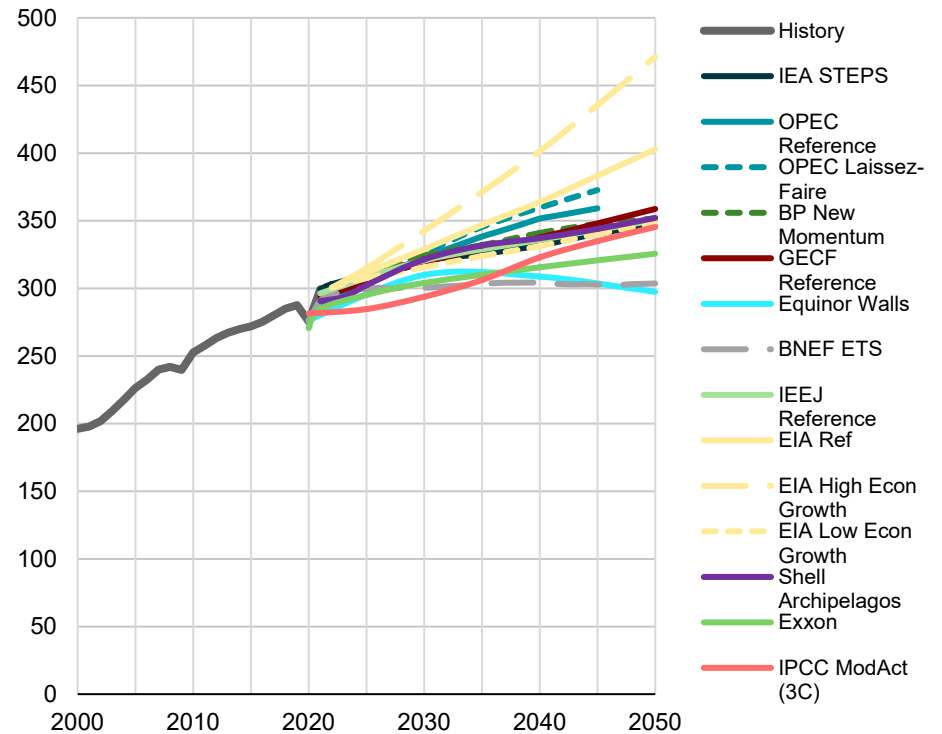
Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# Primary energy demand: Paris-compliant scenarios show demand plateauing or declining from current levels while most reference cases show demand growing by >15% by 2050

**Total Primary Energy Demand: Ambitious Climate Scenarios**  
MBOE/D



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

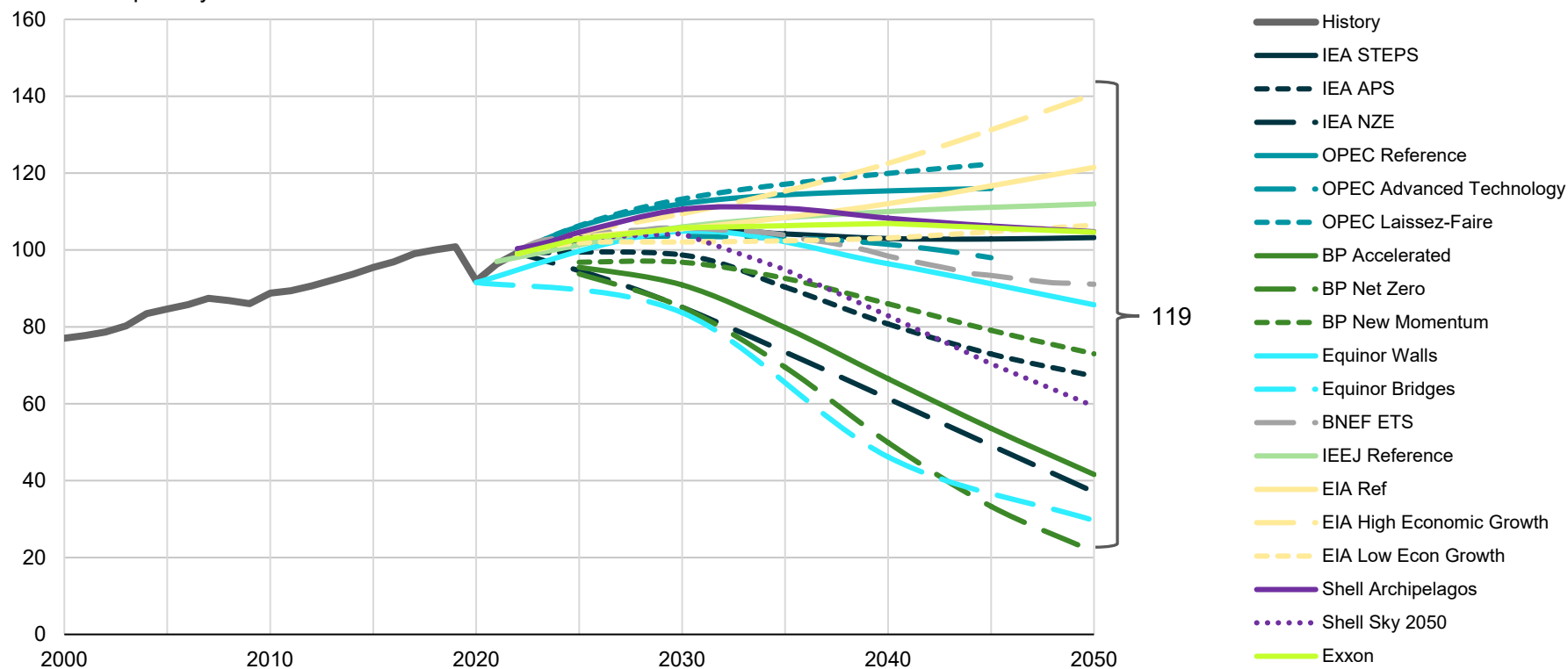


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# Total liquids demand: The range between the high and low forecasts for 2050 is 119 mboe/d – up from 92 mboe/d assessed in last year’s report

## Total Liquids Demand Scenarios Through 2050

Million barrels per day



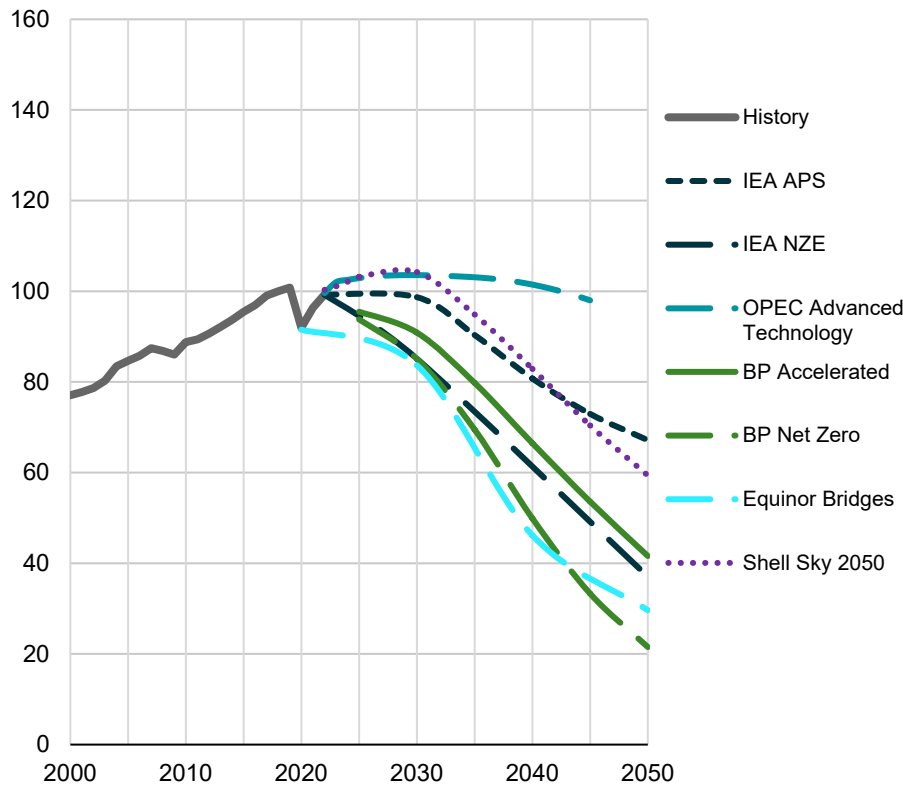
Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook



# Total liquids demand: Many Paris-compliant scenarios show an imminent peak and collapse in liquids demand while many reference cases show a plateau or growth

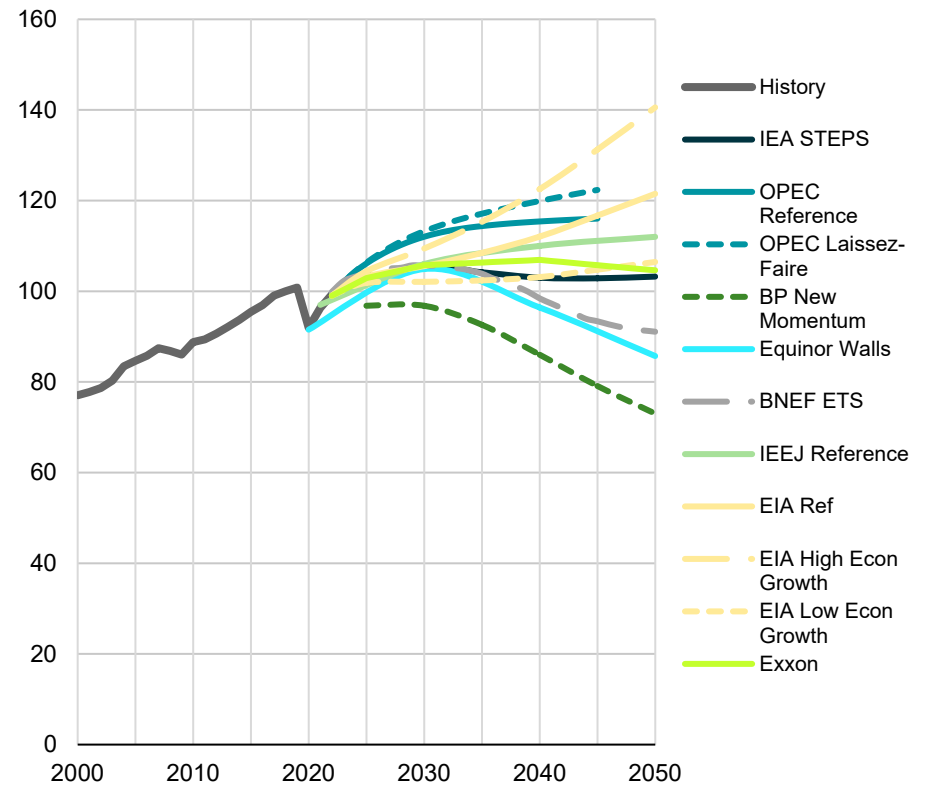
**Total Liquids Demand: Ambitious Climate Scenarios**

Million barrels per day



**Total Liquids Demand: Reference Cases and Evolving Policies**

Million barrels per day

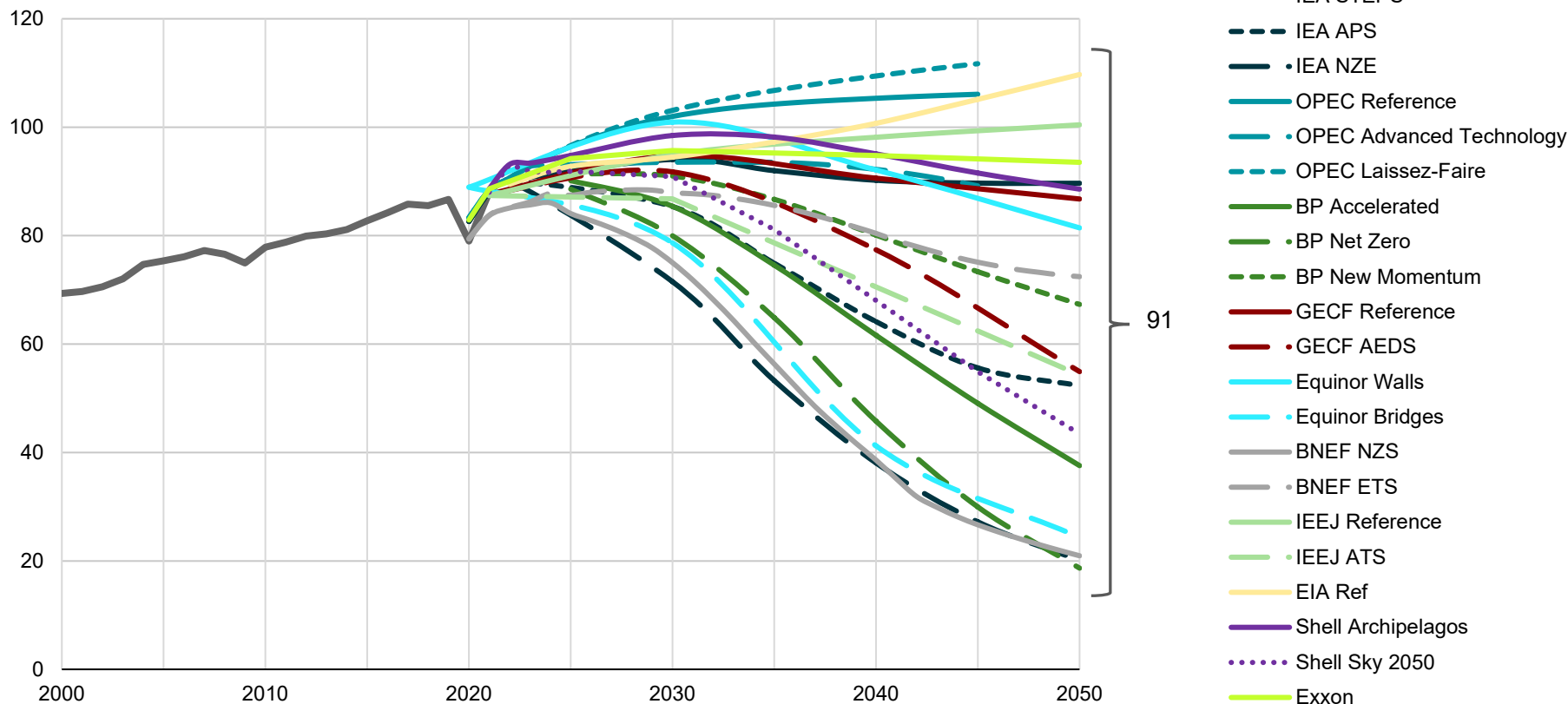


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook

# Oil demand: Most scenarios show a peak and decline or plateau in oil demand in the 2030s

Oil Demand Scenarios Through 2050

MBOE/D



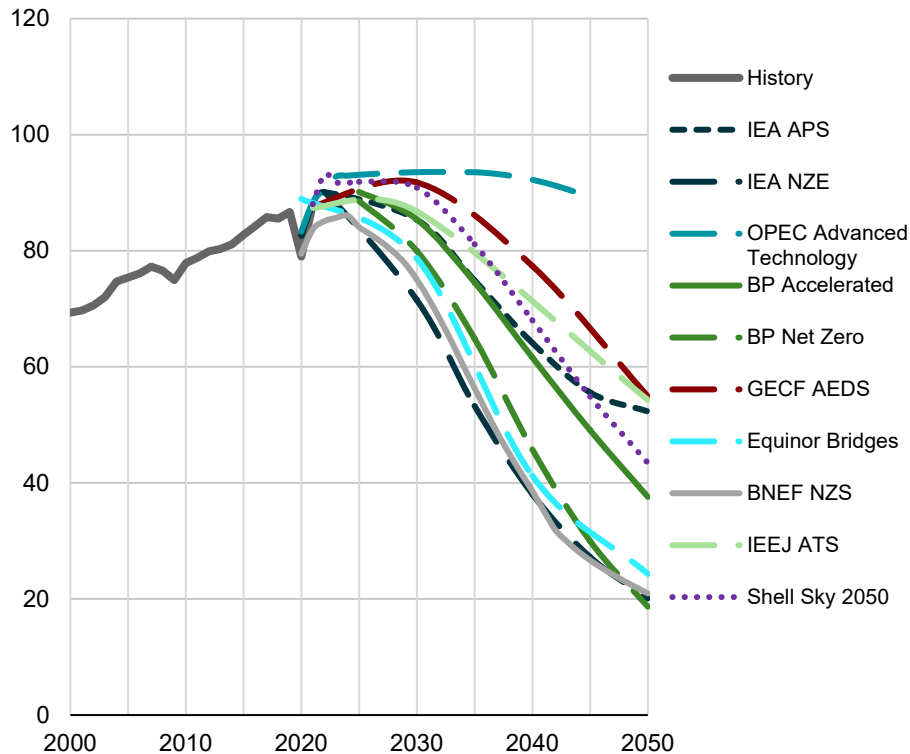
\*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

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

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

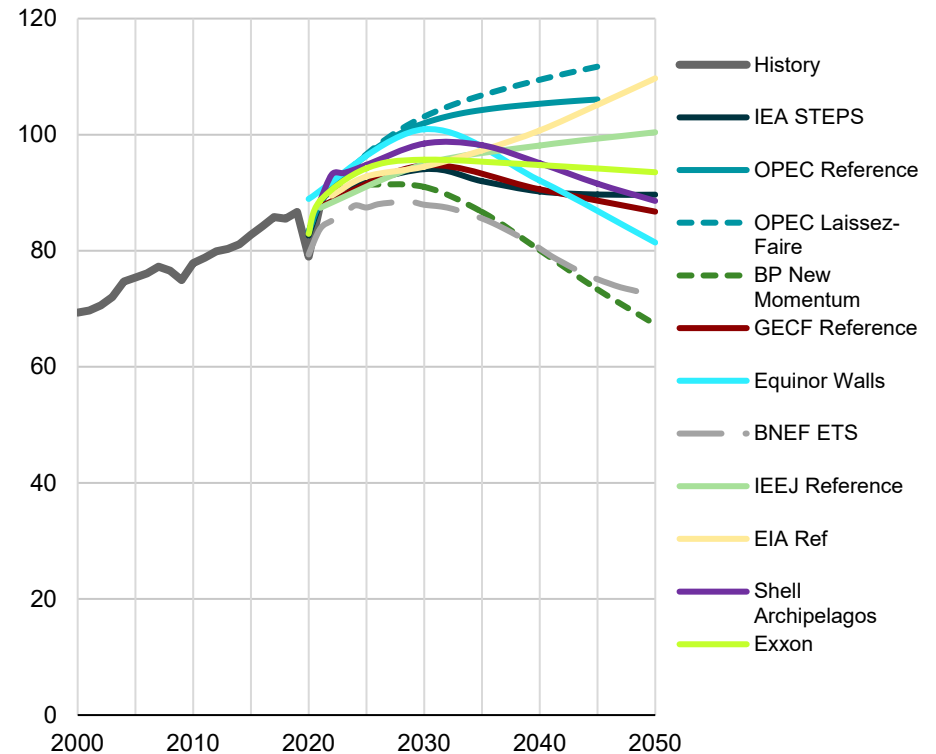
## Oil Demand: Ambitious Climate Scenarios

MBOE/D



## Oil Demand: Reference Cases and Evolving Policies

MBOE/D



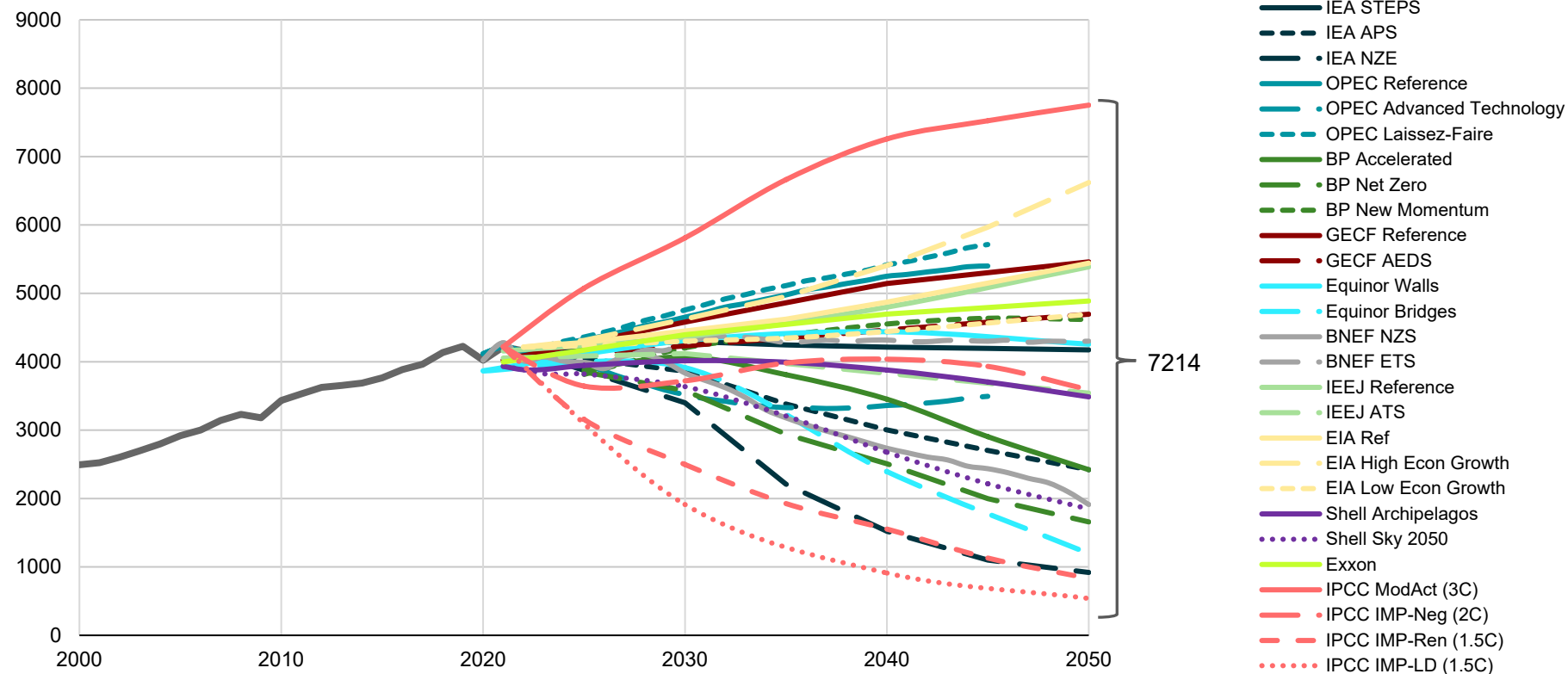
\*Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

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: Excluding the high outlier, the range between the high and low forecast is more than 6,000 bcm or ~45% larger than today's global gas market

## Natural Gas Demand Scenarios Through 2050

Billion cubic metres

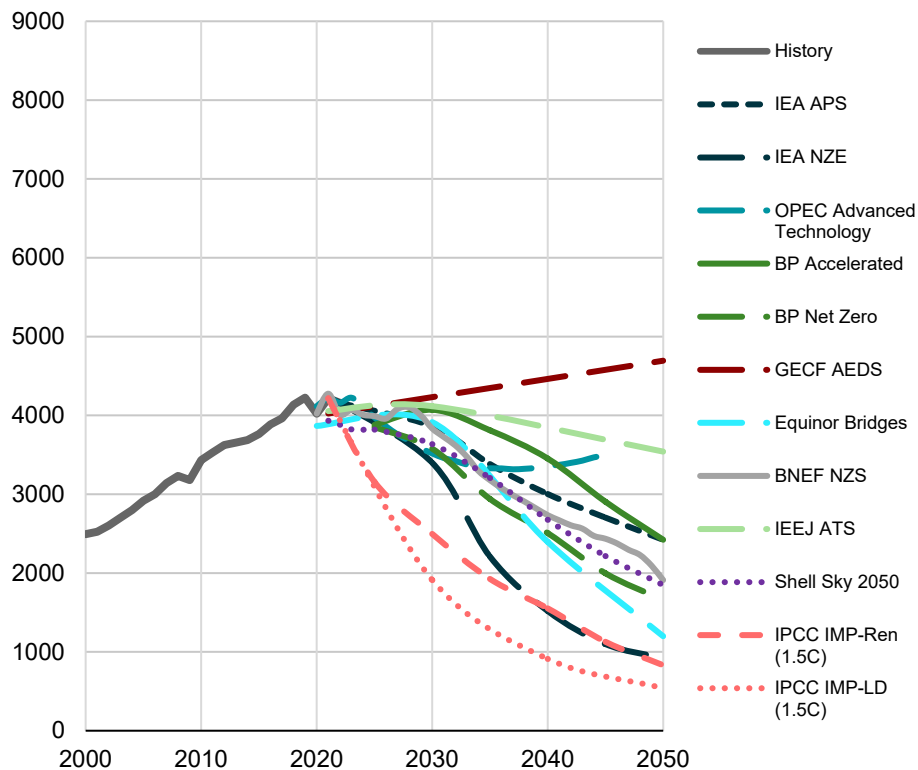


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

# Natural gas demand: Most Paris-compliant scenarios show a peak and fall in demand by the 2030s while many reference cases show a plateau or continued growth

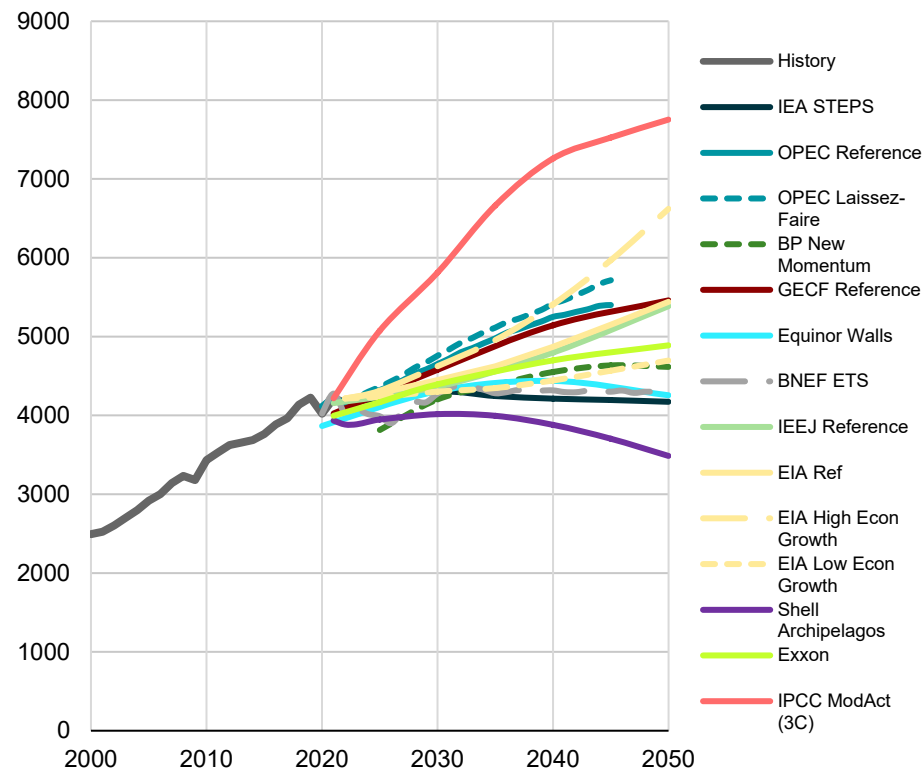
## Natural Gas Demand: Ambitious Climate Scenarios

Billion cubic metres



## Natural Gas Demand: Reference Cases and Evolving Policies

Billion cubic metres

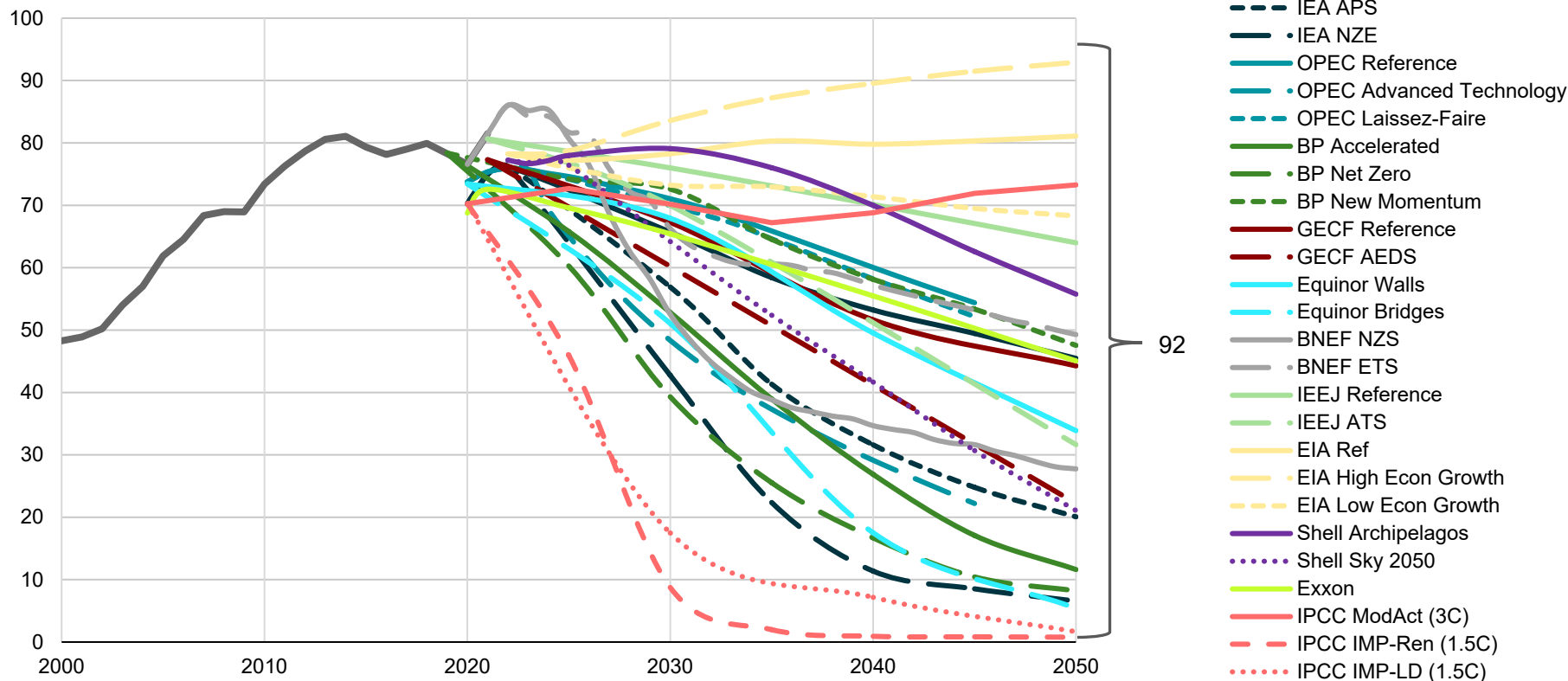


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

# Coal demand: Half of all scenarios show coal demand falling by >50% by 2050

Coal Demand Scenarios Through 2050

MBOE/D

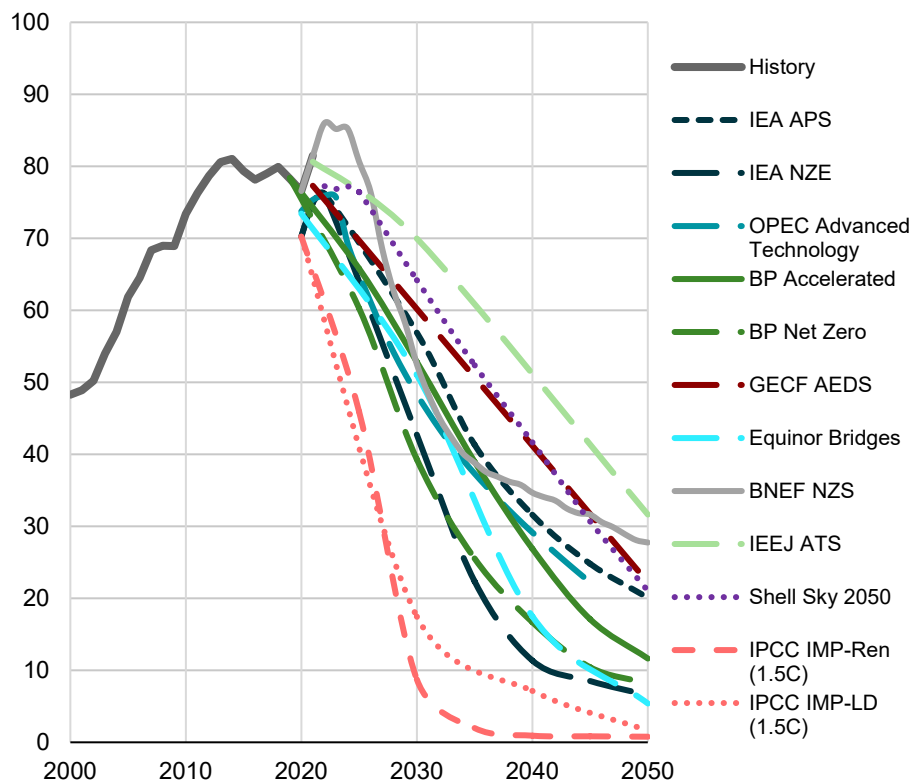


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

# Coal demand: Most of the reference and evolving policies scenarios show a peak and fall in coal demand, albeit at a slower pace than the ambitious climate scenarios

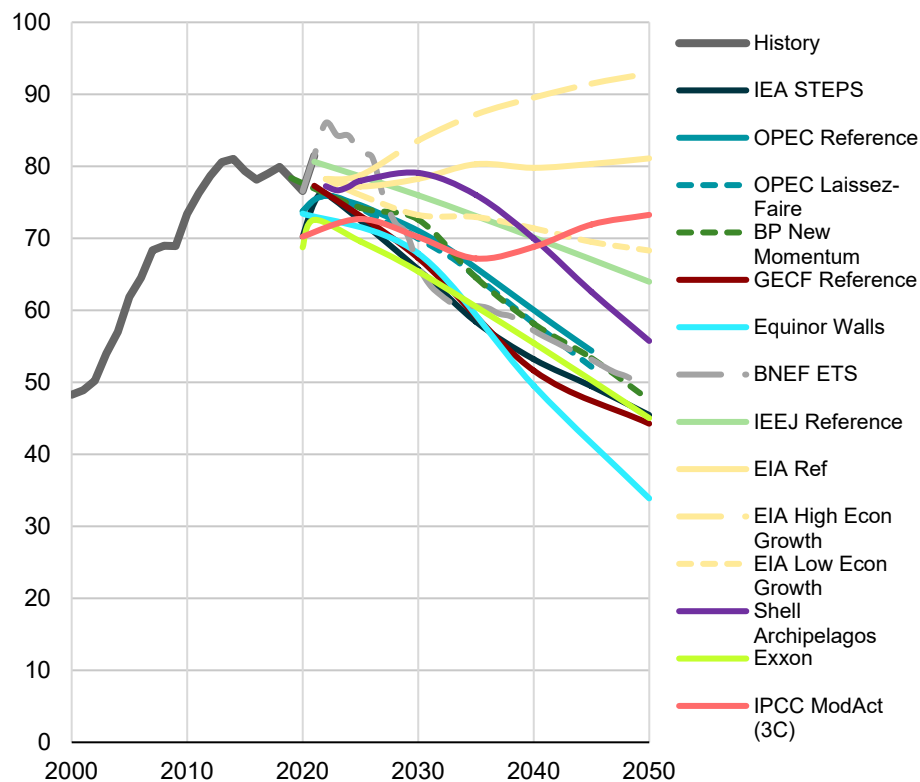
Coal Demand: Ambitious Climate Scenarios

MBOE/D



Coal Demand: Reference Cases and Evolving Policies

MBOE/D

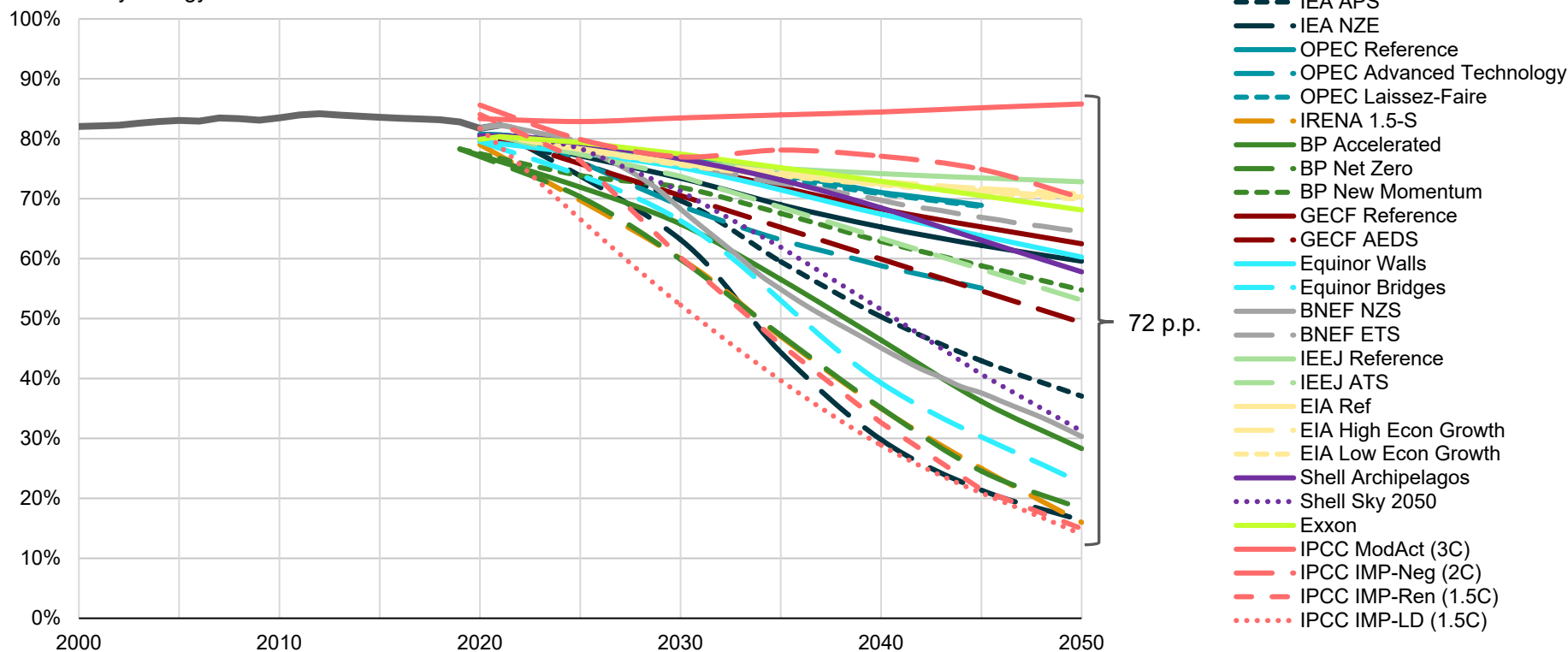


Source: IEF, IEA WEO 2023, OPEC WOO 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

# Fossil fuels share of total demand: More than half of all scenarios have fossil fuels accounting for more than 50% of total primary energy demand in 2050

Fossil Fuels Share of Primary Energy Scenarios Through 2050

% of Primary Energy



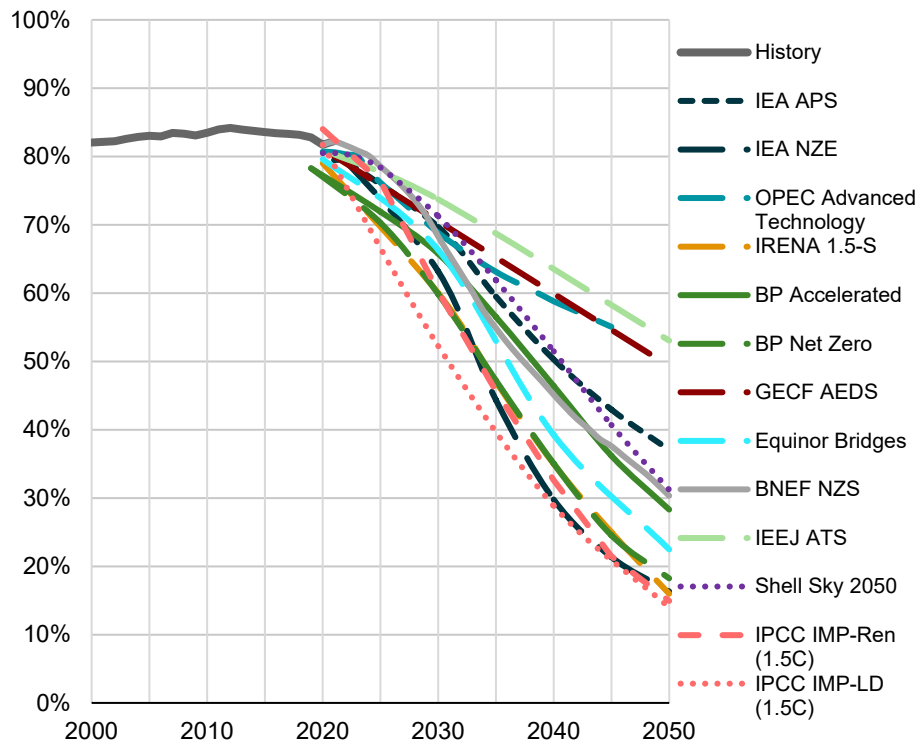
Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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



# Fossil fuels share of total demand: Fossil fuels account for 55-70% of 2050 primary demand in many reference cases vs. 15-30% in many net zero scenarios

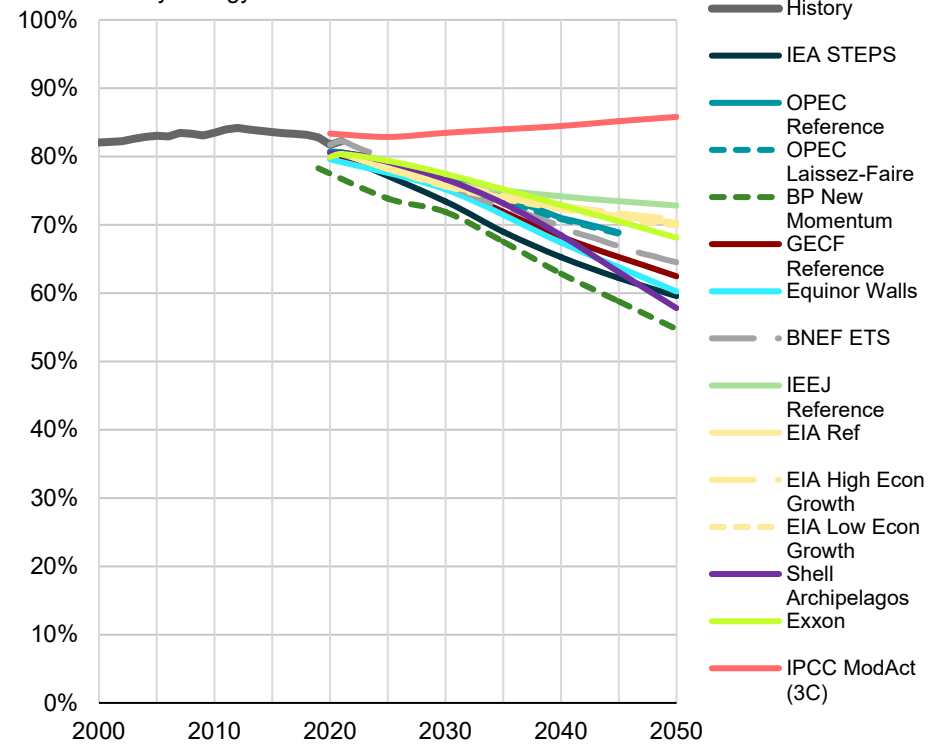
## Fossil Fuels Share of Total Energy: Ambitious Climate Scenarios

% of Primary Energy



## Fossil Fuels Share of Total Energy: Reference Cases & Evolving Policies

% of Primary Energy

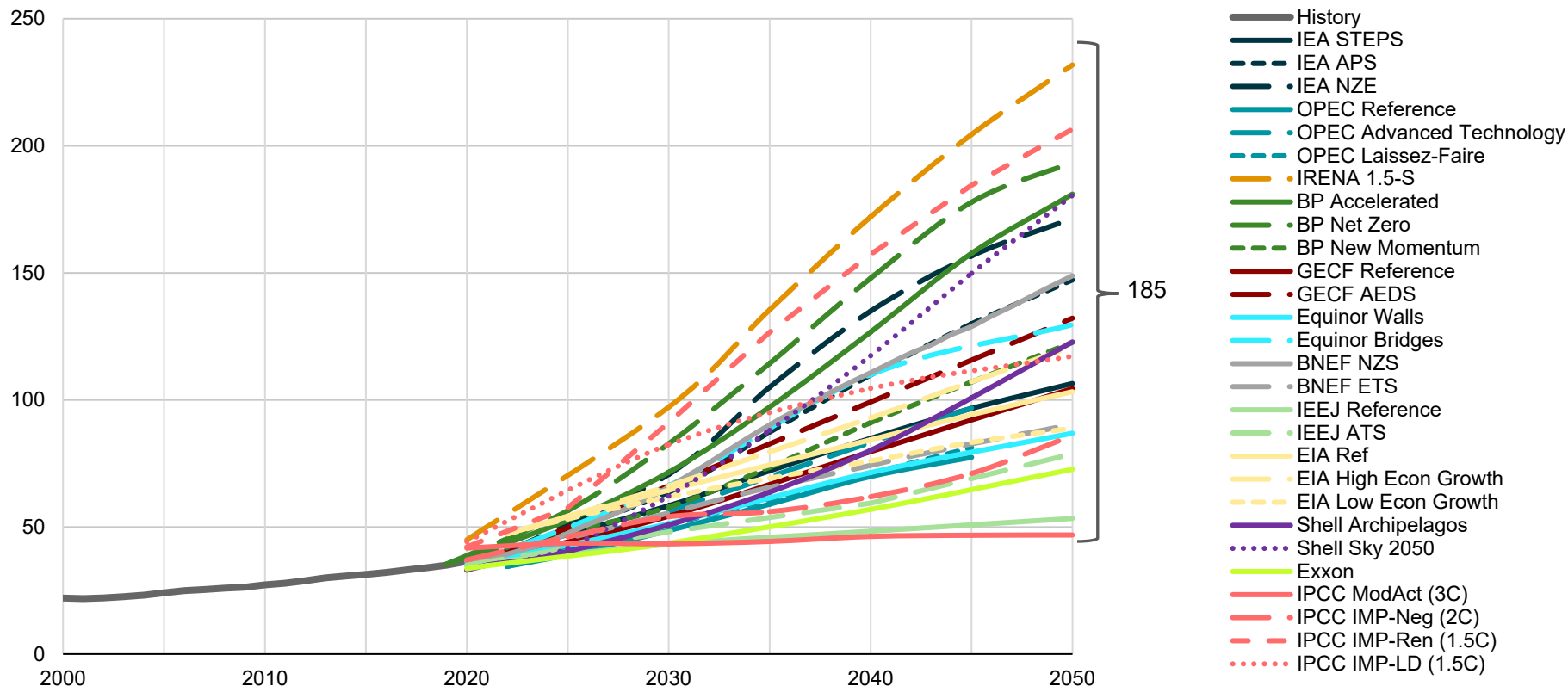


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# Renewables demand: The range of the high and low forecasts for 2050 renewables demand is ~5 times greater than current renewables demand

## Renewables Demand Scenarios Through 2050

MBOE/D



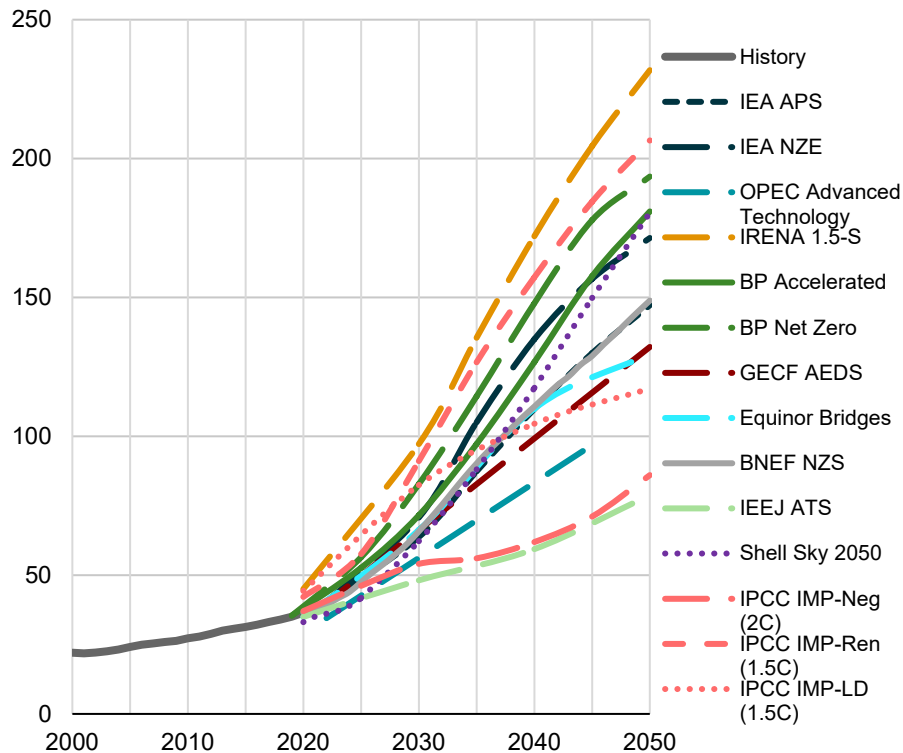
\*Includes wind, solar, geothermal, modern and traditional bioenergy. EIA includes hydro.

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

# Renewables demand: The median 2050 demand forecast for ambitious climate scenarios is 40% higher than the median forecast for reference and evolving policies

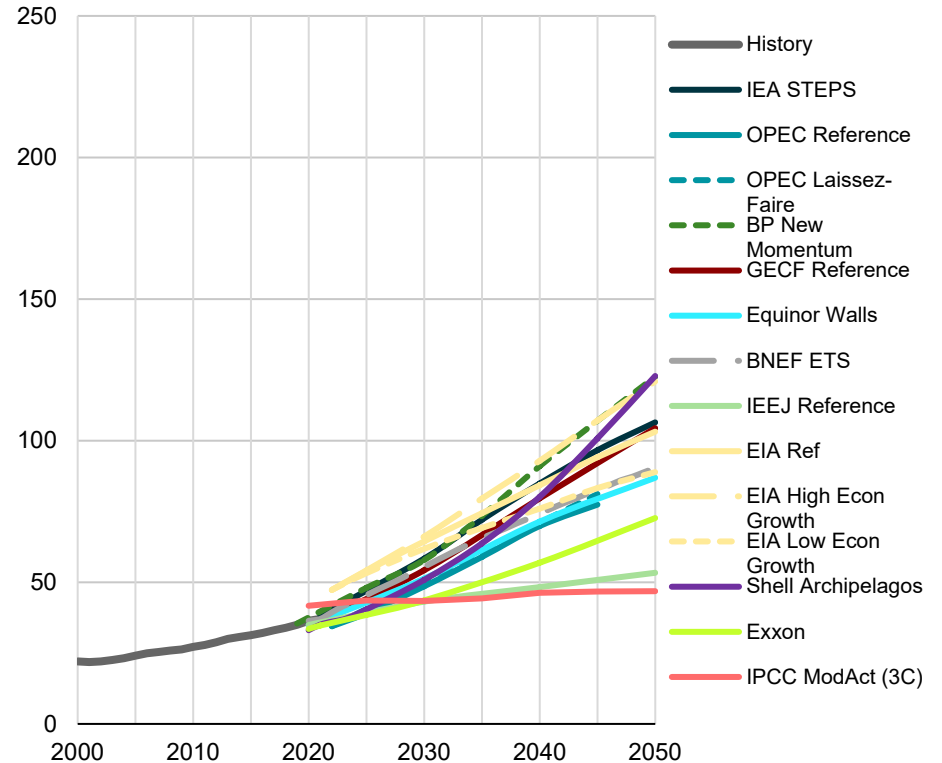
Renewables Demand: Ambitious Climate Scenarios

MBOE/D



Renewables Demand: Reference Cases and Evolving Policies

MBOE/D



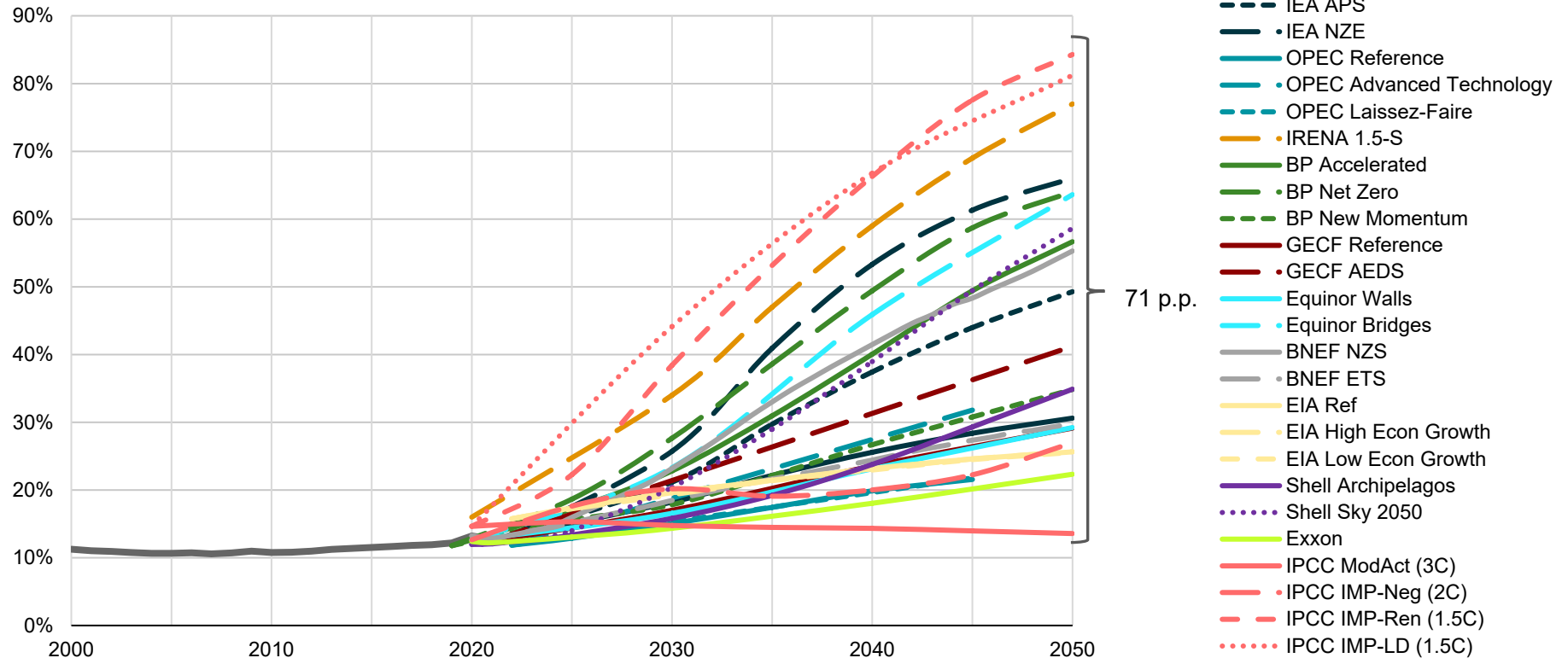
\*Includes wind, solar, geothermal, modern and traditional bioenergy. EIA includes hydro.

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

# Renewables share of energy demand: Only 35% of scenarios show renewables accounting for >50% of primary energy demand in 2050

Renewable Demand Share of Total Primary Energy Demand Scenarios to 2050

Share of Primary Energy Demand



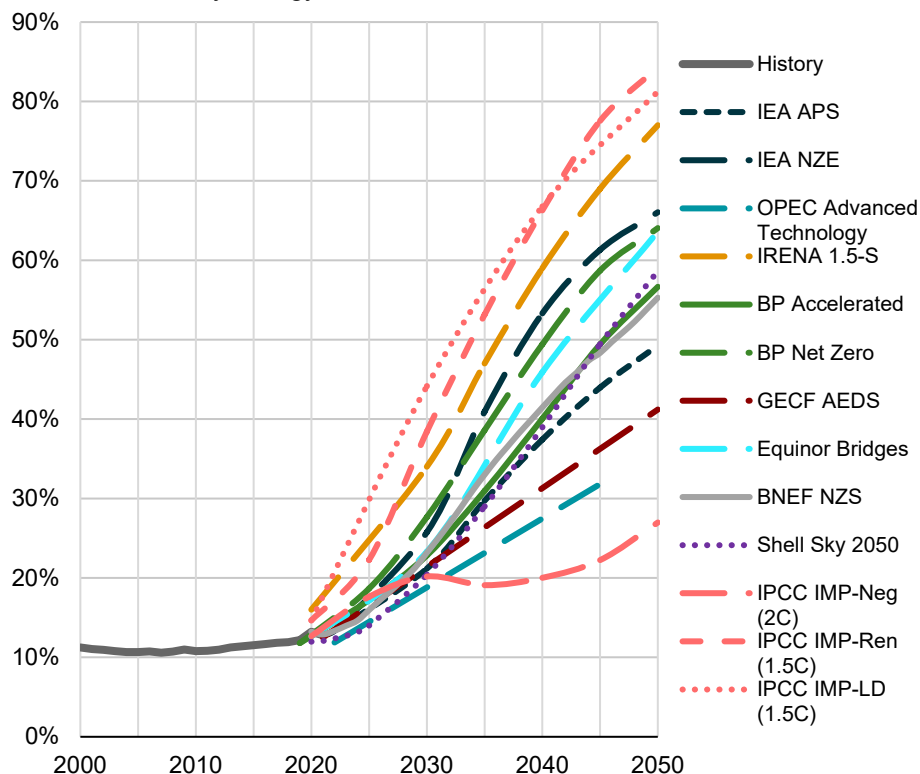
\*Includes wind, solar, geothermal, modern and traditional bioenergy. EIA includes hydro.

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, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook, IPCC AR6

# Renewables share: Even the more ambitious climate scenarios show a wide range of renewables penetration, ranging from 27%-84% of primary demand

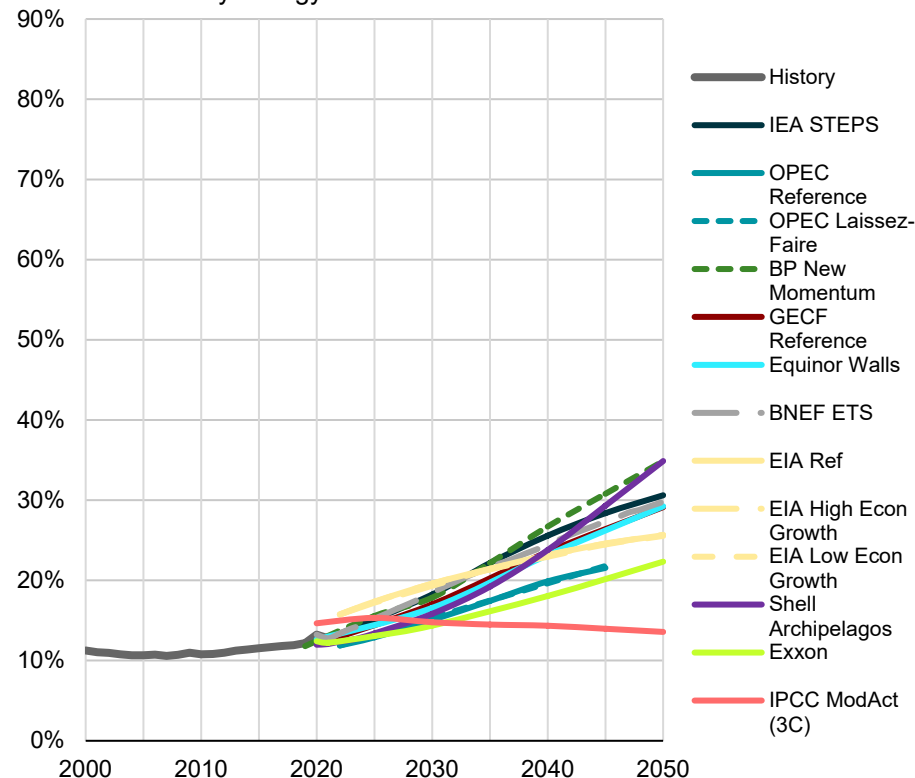
## Renewable Demand Share: Ambitious Climate Scenarios

Share of Primary Energy Demand



## Renewable Demand: Reference Cases and Evolving Policies

Share of Primary Energy Demand



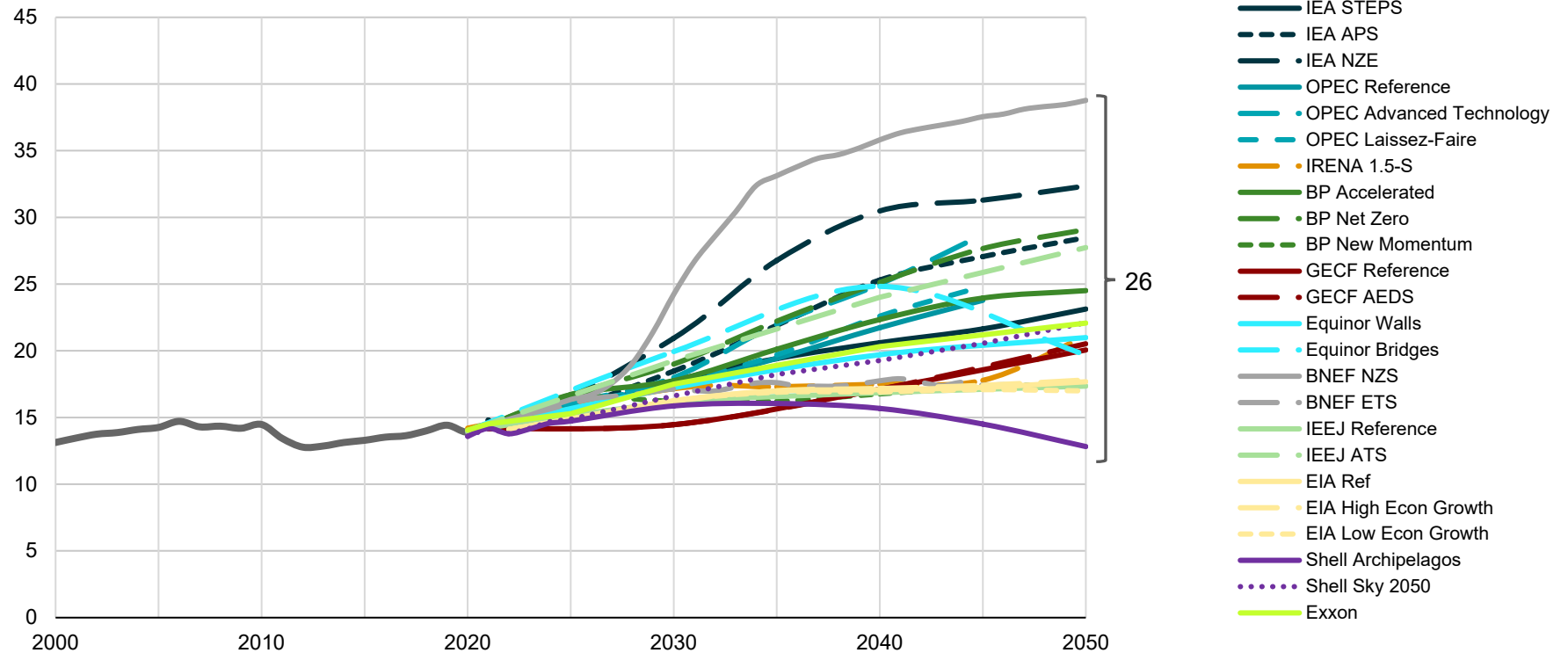
\*Includes wind, solar, geothermal, modern and traditional bioenergy. EIA includes hydro.

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, 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 levels

## Nuclear Demand Scenarios Through 2050

MBOE



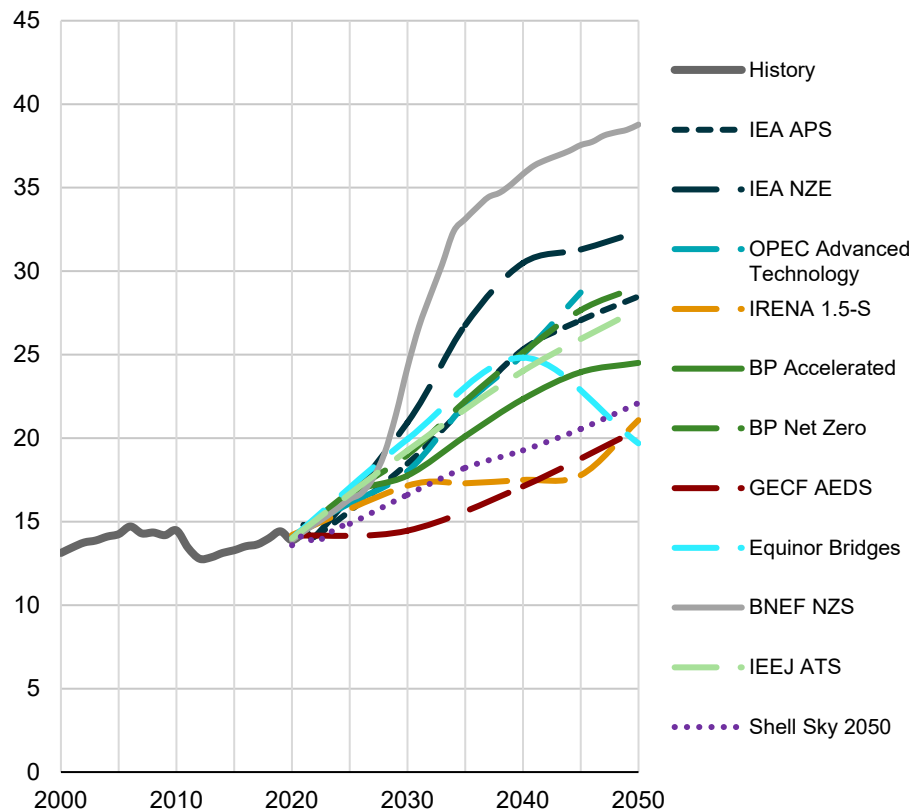
\*Some calculations have been made to correct for different primary energy conversion efficiency assumptions.

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

# Nuclear demand: Many of the more ambitious climate scenarios rely on a higher deployment of nuclear energy

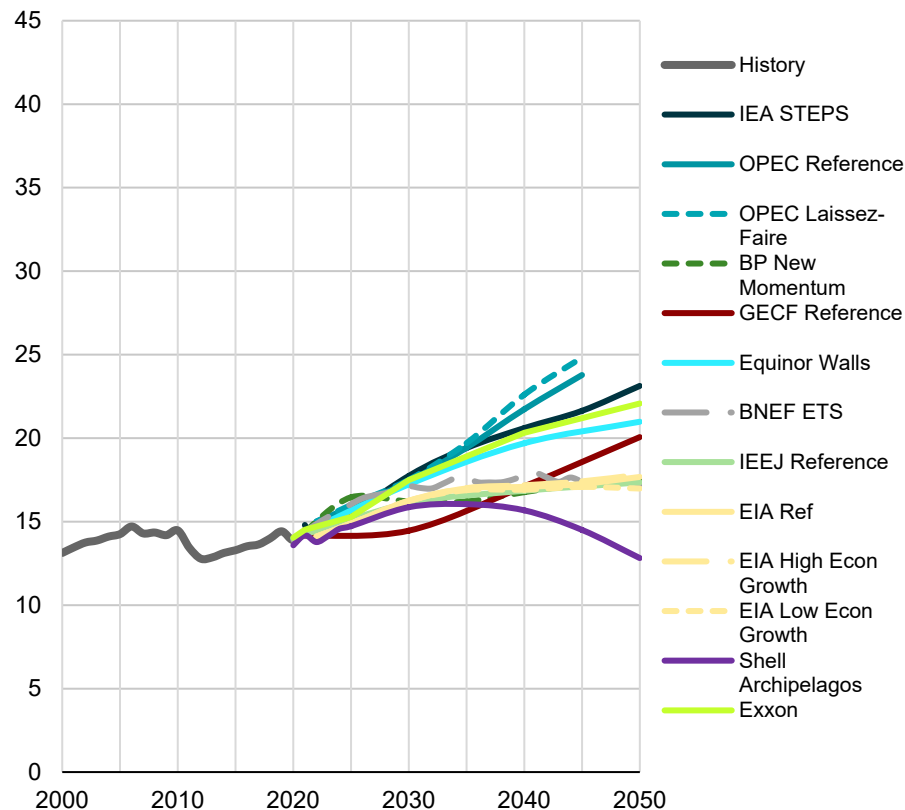
## Nuclear Demand: Ambitious Climate Scenarios

MBOE



## Nuclear Demand: Reference Cases and Evolving Policies

MBOE

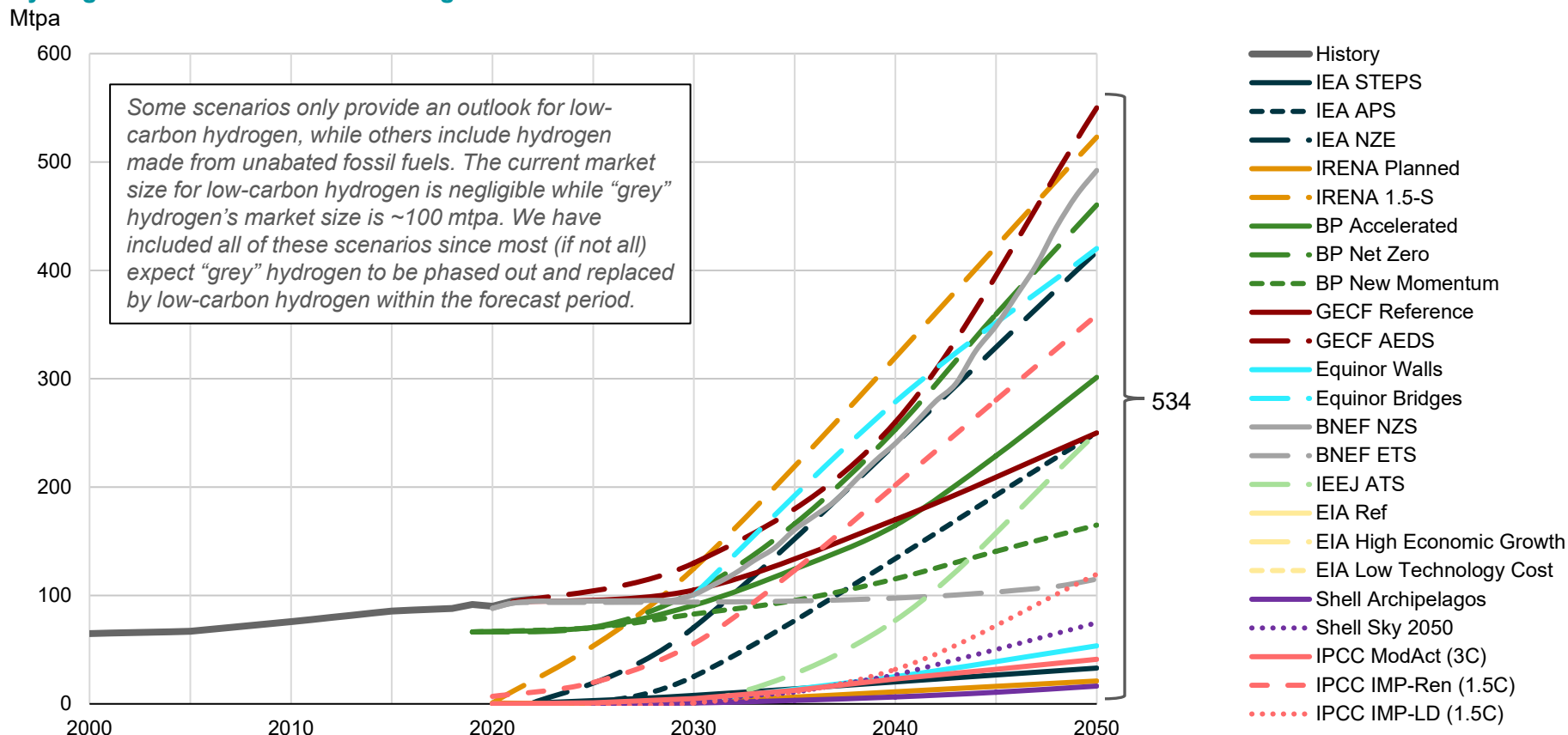


\*Some calculations have been made to correct for different primary energy conversion efficiency assumptions.

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

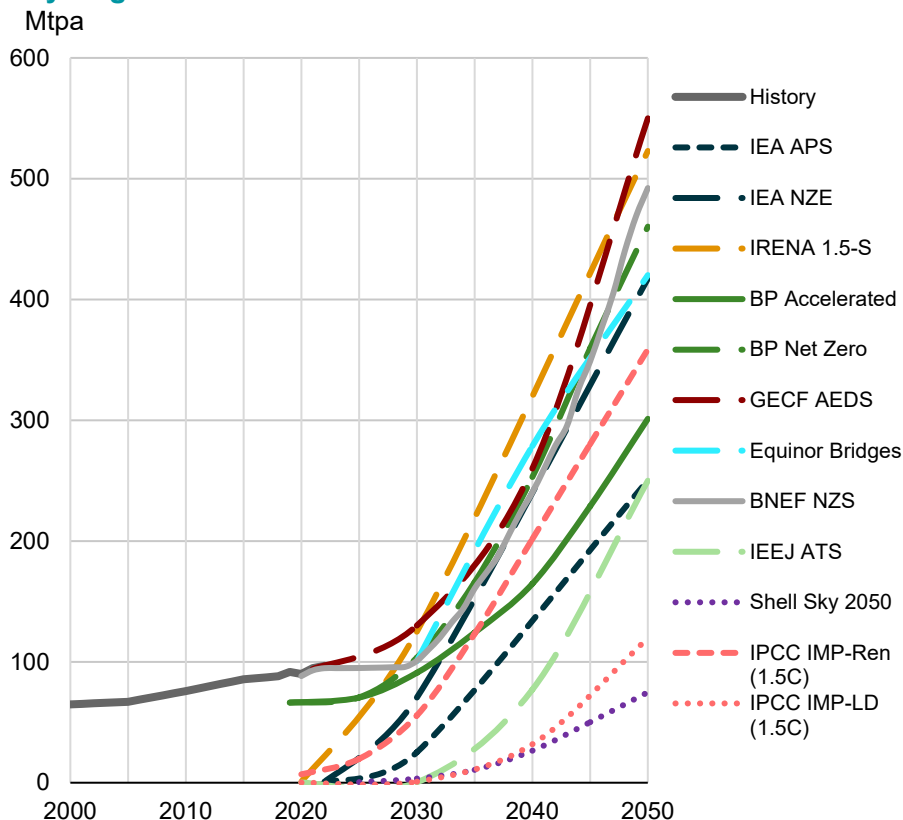


Source: IEF, IEA WEO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, IPCC AR6

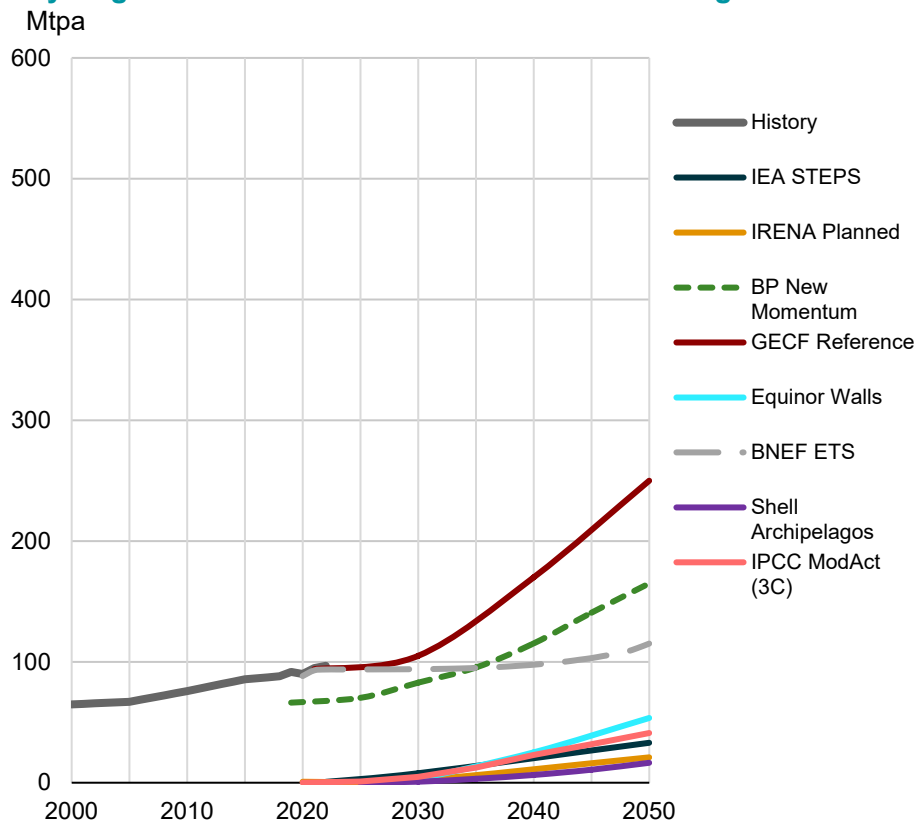


# Hydrogen demand: Many of the more ambitious climate scenarios see a significantly stronger scale-up of hydrogen

## Hydrogen Demand: Ambitious Climate Scenarios



## Hydrogen Demand: Reference Cases and Evolving Policies

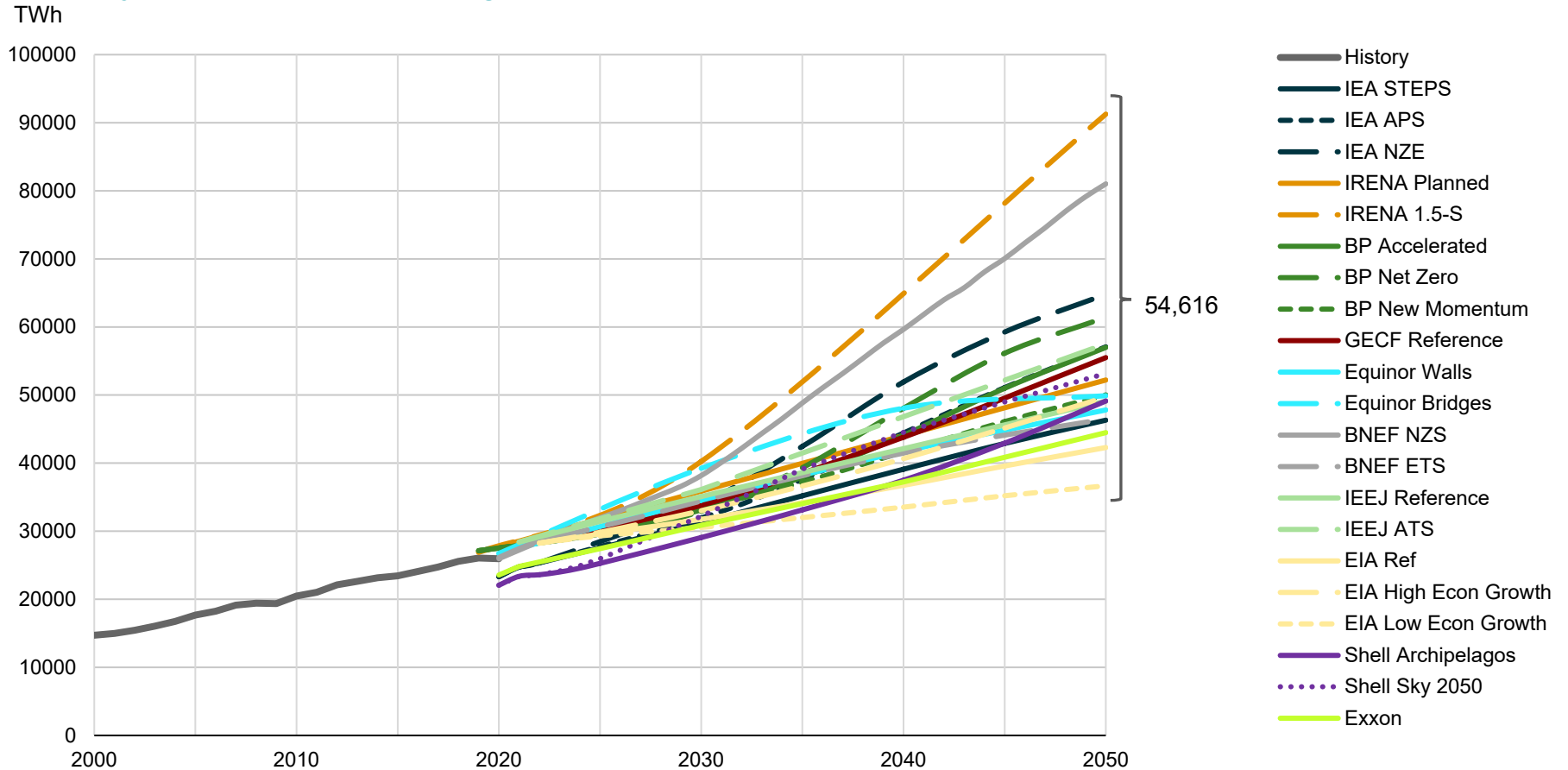


Some scenarios only provide an outlook for low-carbon hydrogen, while others include hydrogen made from unabated fossil fuels. The current market size for low-carbon hydrogen is negligible while “grey” hydrogen’s market size is ~100 mtpa. We have included all of these scenarios since most (if not all) expect “grey” hydrogen to be phased out and replaced by low-carbon hydrogen within the forecast period, meaning the projections are comparable by 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

# Electricity generation: Most scenarios show electricity generation nearly doubling by 2050

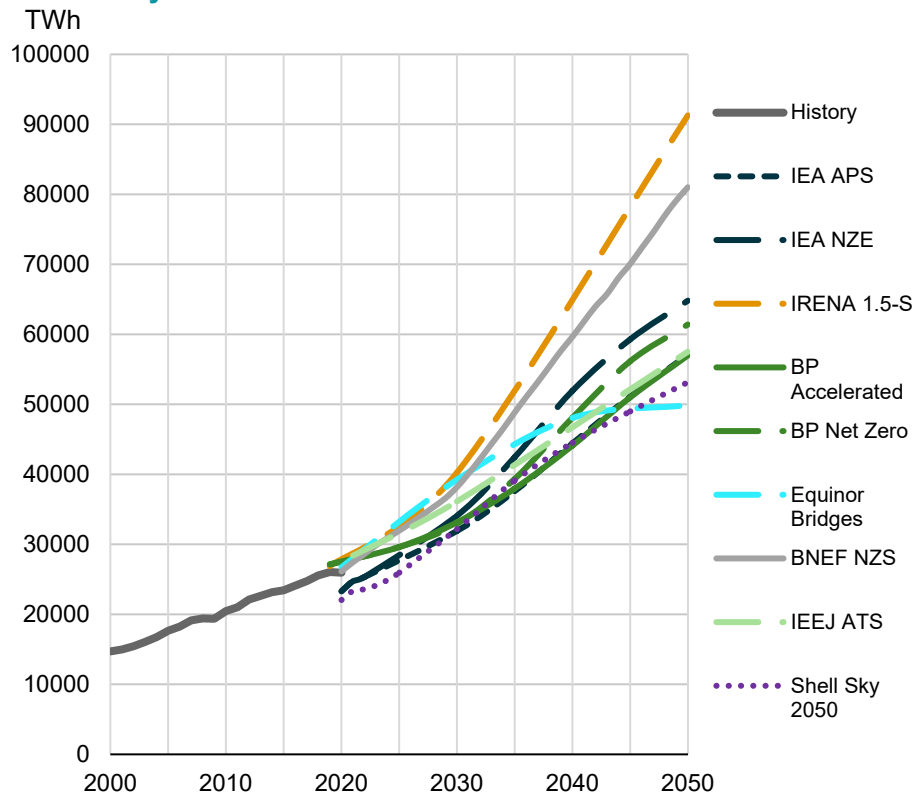
Electricity Generation Scenarios Through 2050



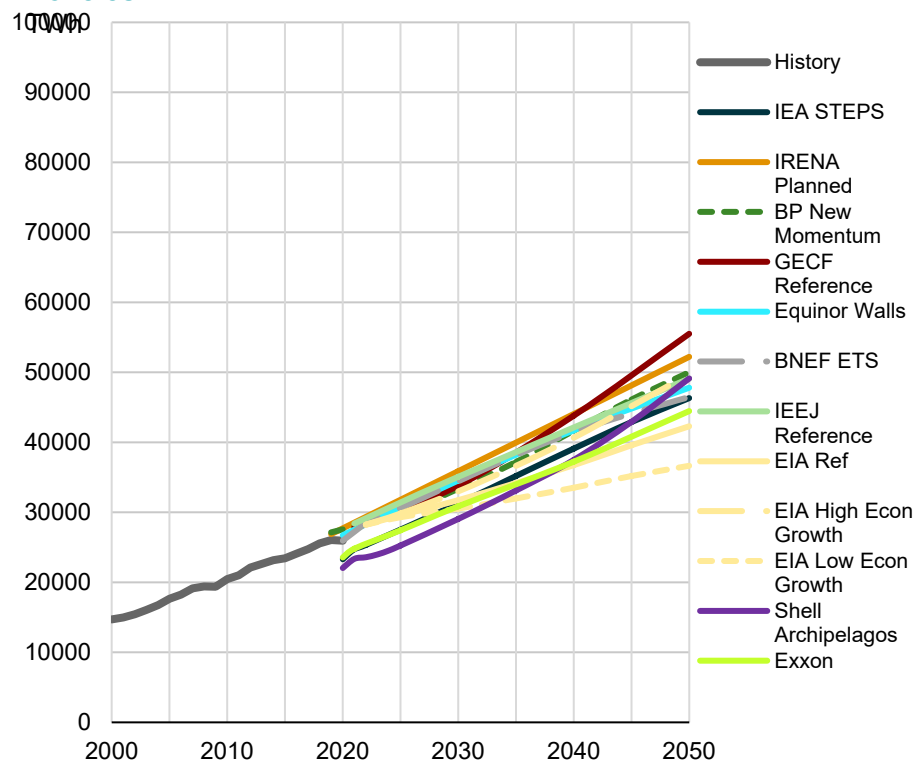
Source: IEF, IEA WEO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook

# Electricity generation: The median 2050 electricity generation for more ambitious climate scenarios is nearly 20% above that for reference case scenarios

Electricity Generation: Ambitious Climate Scenarios



Electricity Generation: Reference Cases and Evolving Policies

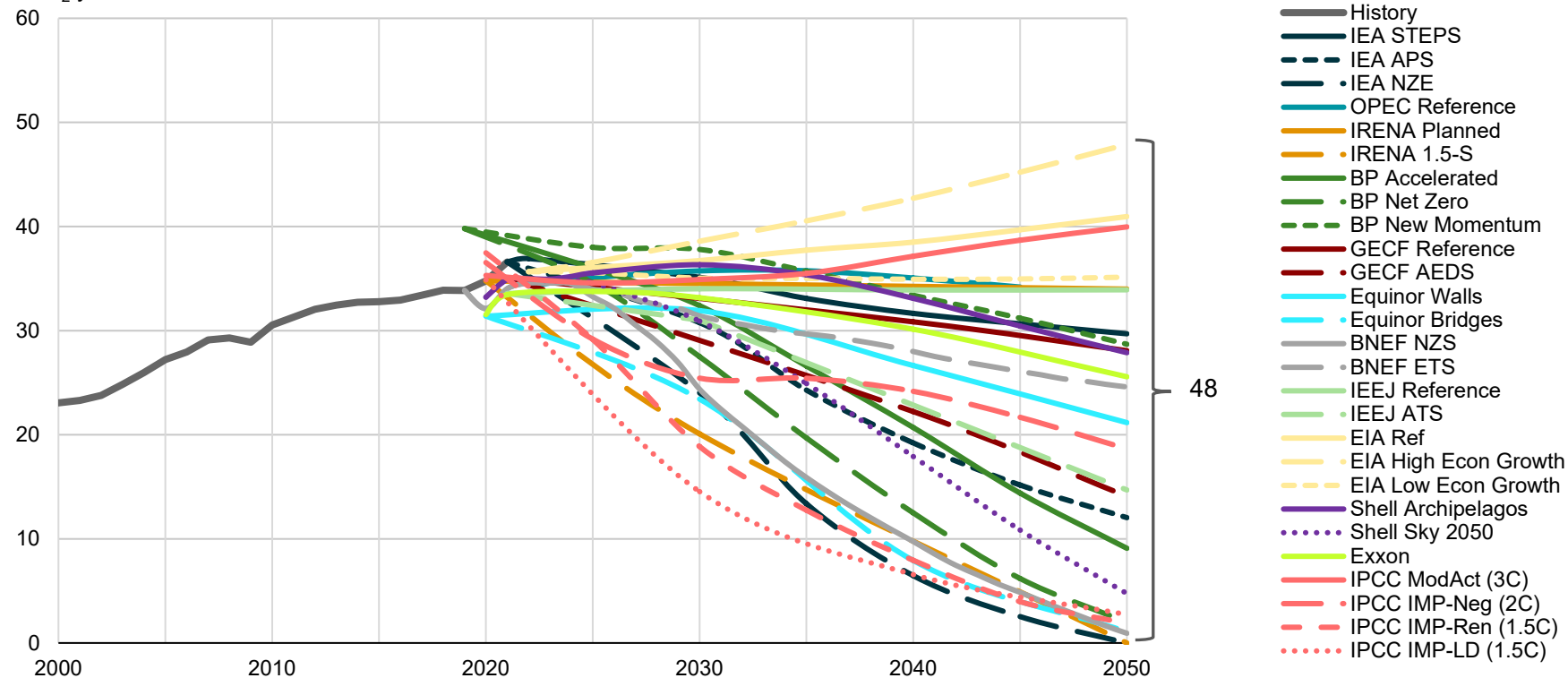


Source: IEF, IEA WEO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook

# CO<sub>2</sub> emissions: Nearly half of all scenarios show at least a 40% drop in CO<sub>2</sub> emissions by 2050

## CO<sub>2</sub> Emissions Scenarios Through 2050

Gt CO<sub>2</sub>/year

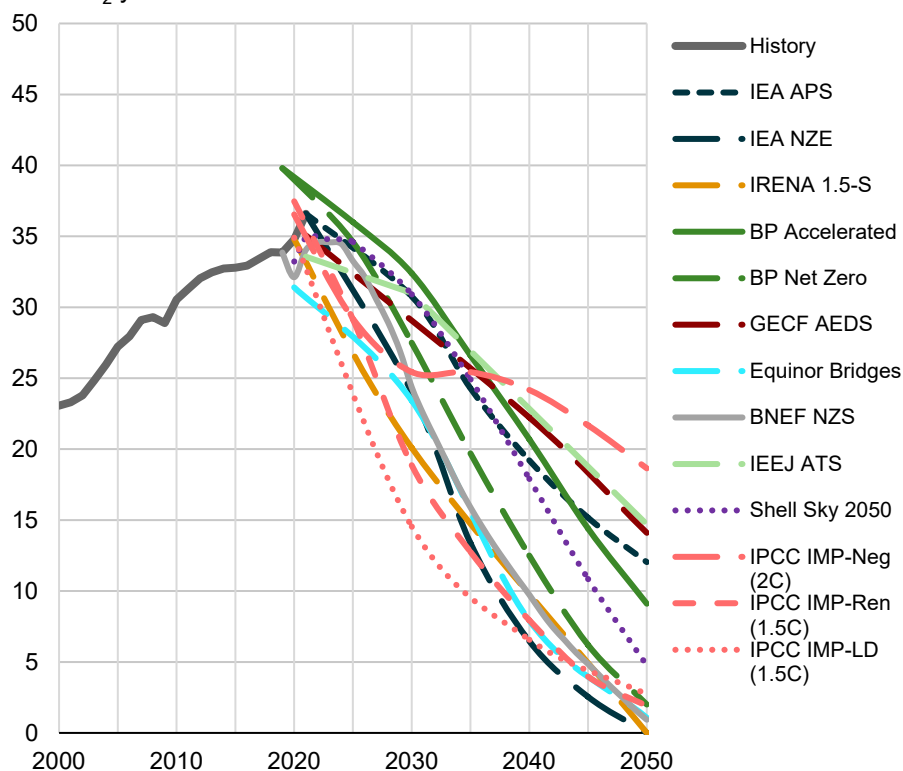


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# CO<sub>2</sub> emissions: Nearly half of the reference cases and evolving policies scenarios show CO<sub>2</sub> emissions plateauing or growing to 2050

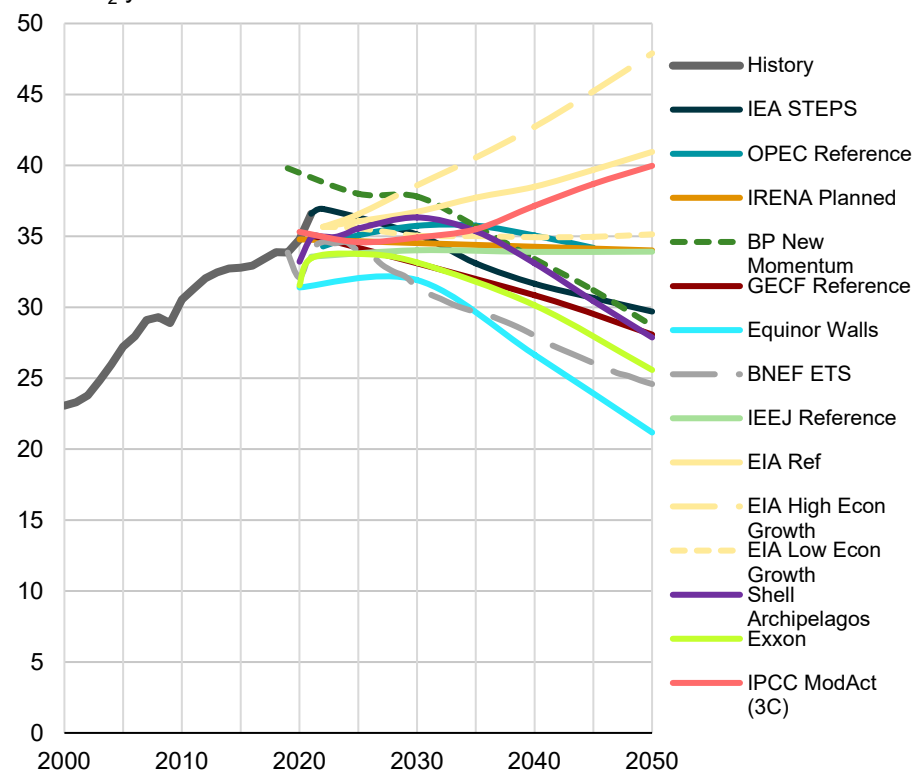
**CO<sub>2</sub> Emissions: Ambitious Climate Scenarios**

Gt CO<sub>2</sub>/year



**CO<sub>2</sub> Emissions: Reference Cases and Evolving Policies**

Gt CO<sub>2</sub>/year

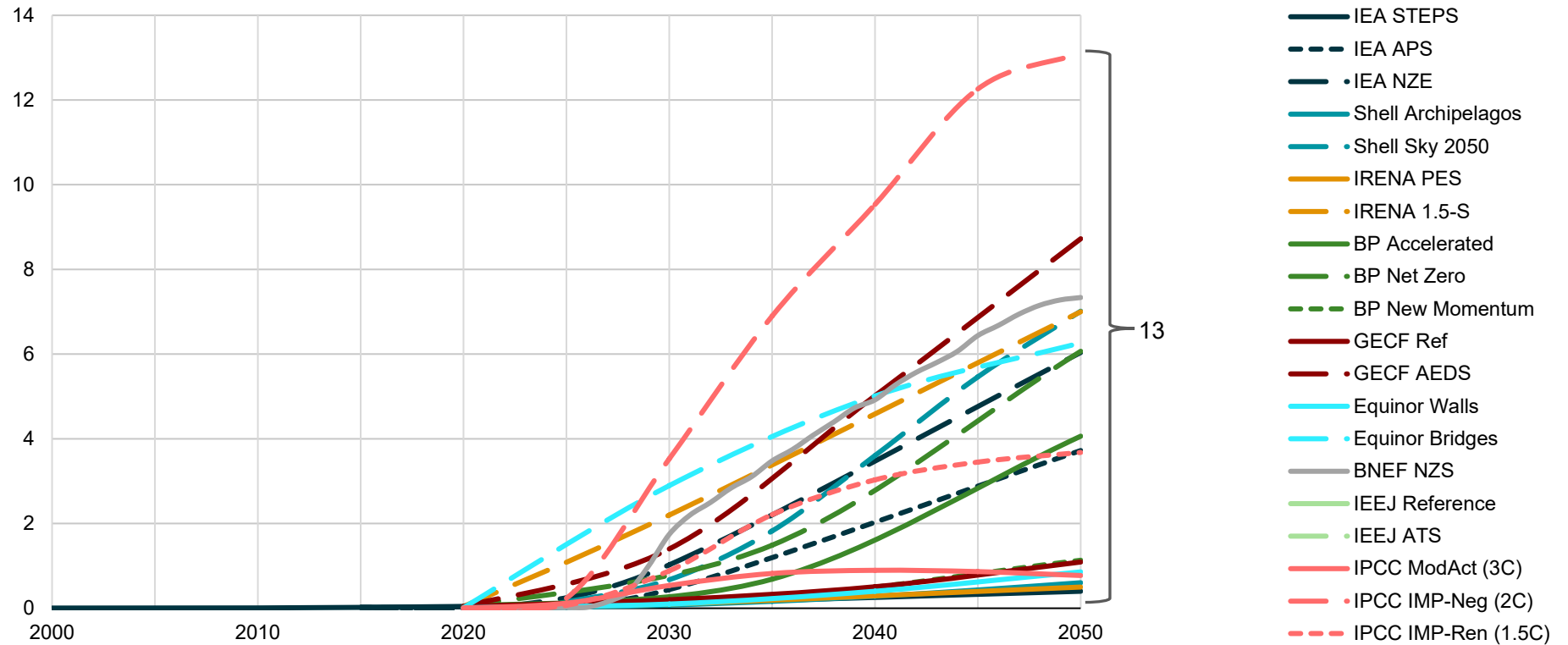


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# Carbon capture: Carbon capture expands to at least ~6-8 Gt of CO<sub>2</sub> per annum in many of the ambitious net zero scenarios

## Carbon Capture (CCUS, CCS, BECCS, Industrial)

Gt CO<sub>2</sub>/year

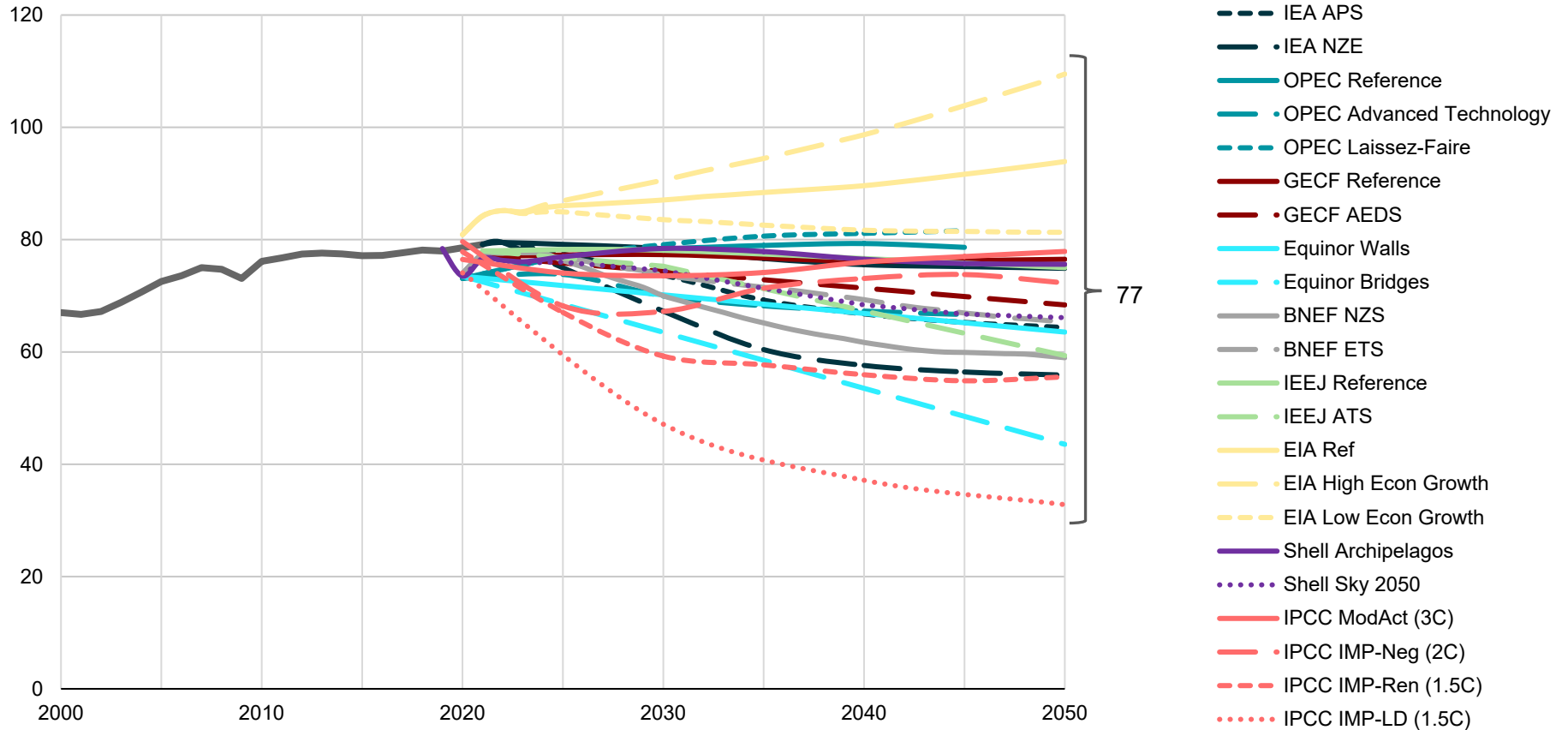


Source: IEF, IEA WEO 2023, OPEC WOO 2023, IRENA World Energy Transitions Outlook 2023, BP Energy Outlook 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, Exxon Global Outlook,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

# Energy demand per capita: Most scenarios show the energy use per person remaining stable or falling by 2050

## Primary Energy Consumption Per Capita

GJ per capita

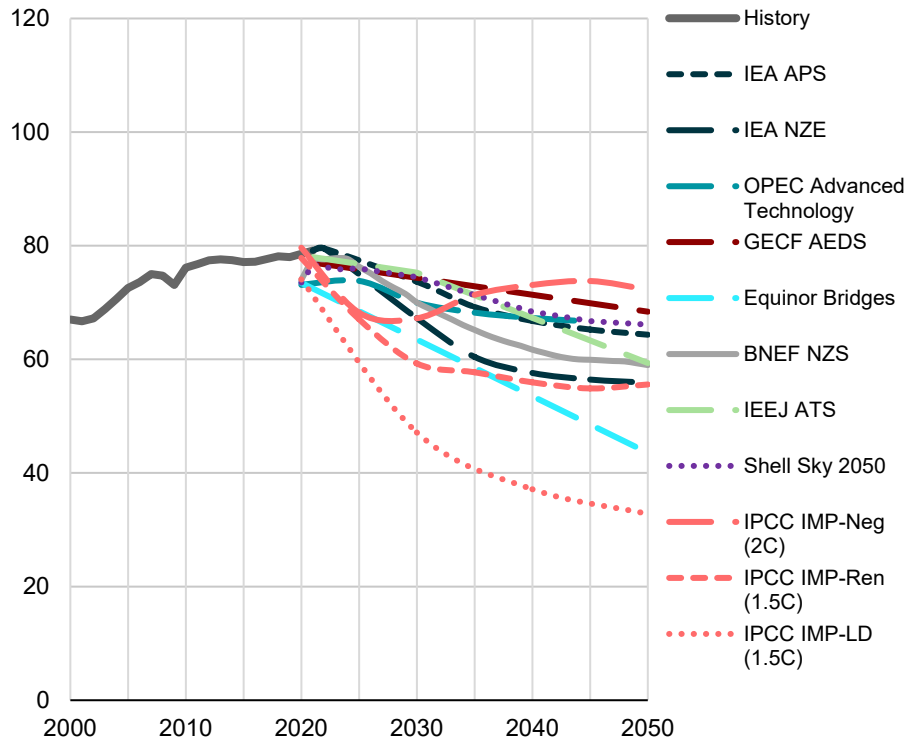


Source: IEF, IEA WEO 2023, OPEC WOO 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, IPCC AR6

# Energy demand per capita: The more ambitious climate scenarios show the per capita use of energy falling over time, reversing the historical trend

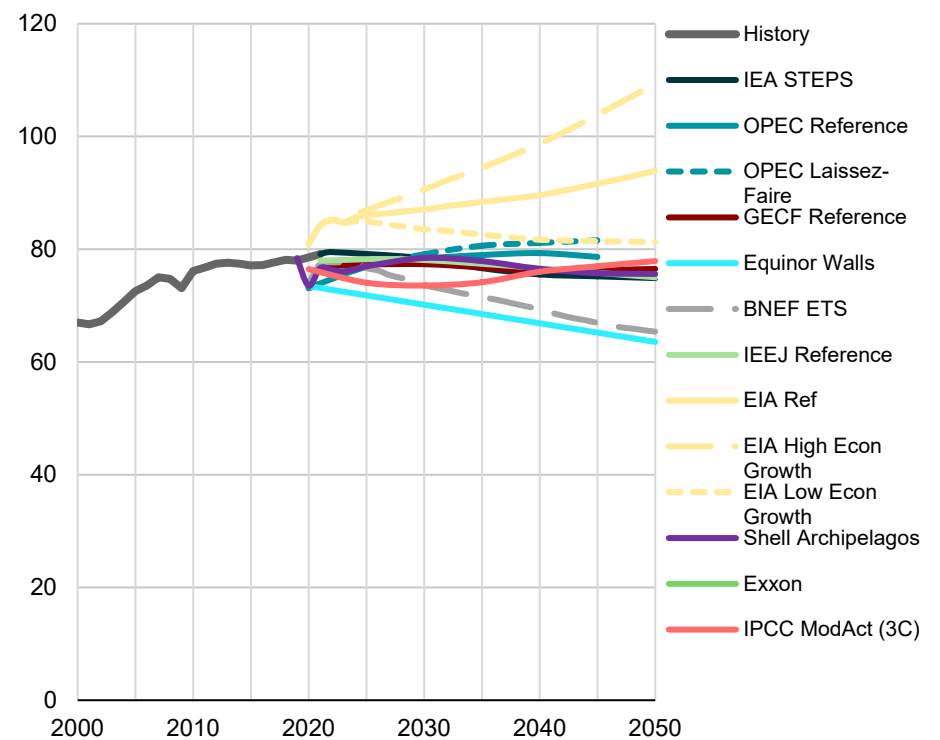
**Primary Energy Consumption Per Capita: Ambitious Climate Scenarios**

GJ per capita



**Primary Energy Consumption Per Capita: Reference Cases and Evolving Policies**

GJ per capita

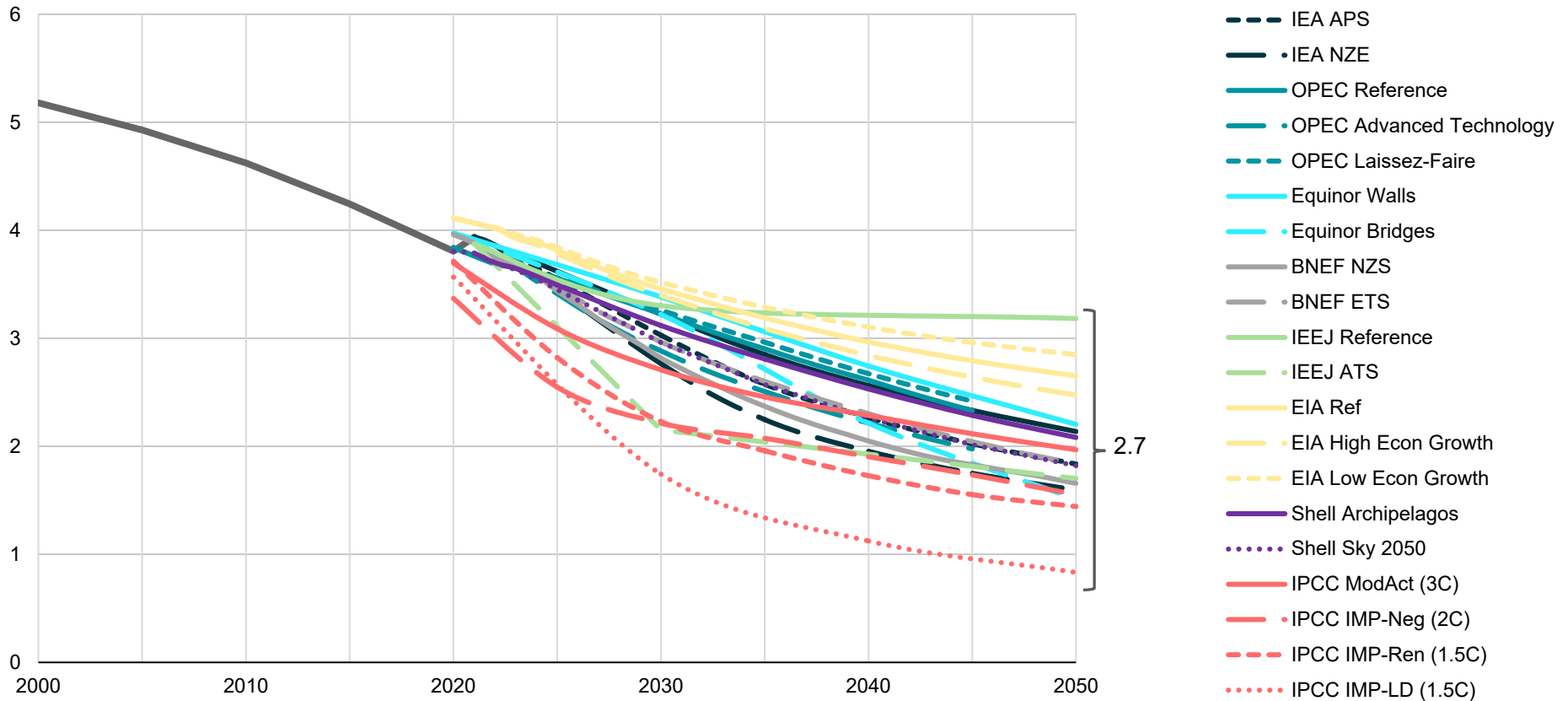


Source: IEF, IEA WEO 2023, OPEC WOO 2023, GECF 2023 Global Gas Outlook to 2050, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, IPCC AR6



# Global energy intensity of GDP: Energy use per GDP is expected to continue falling in all scenarios

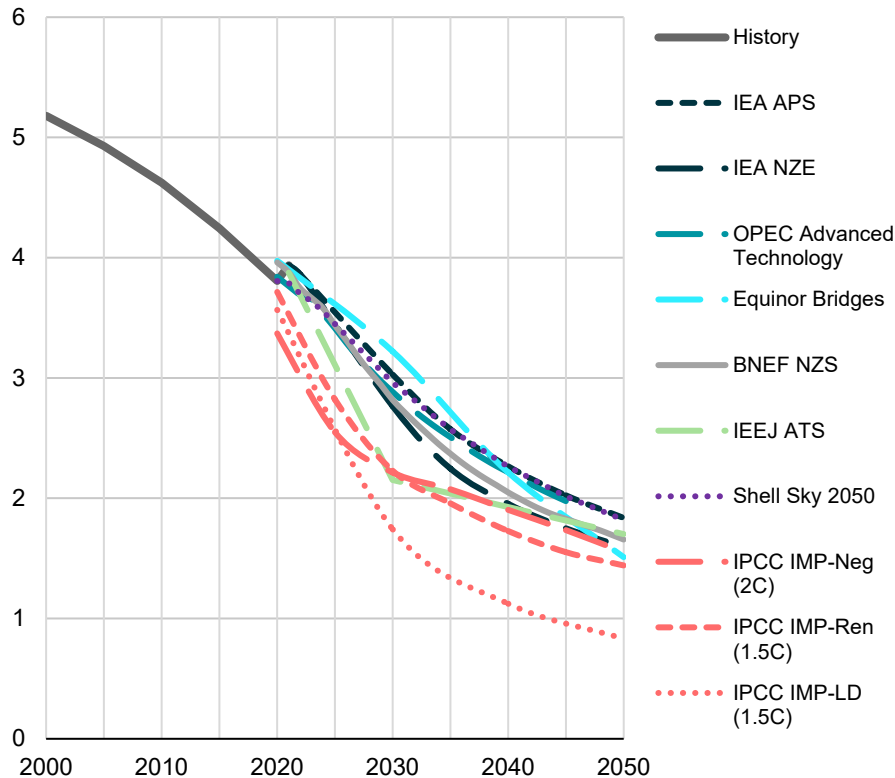
**Energy Intensity: Global Primary Energy Demand Per GDP**  
MJ per 2022 USD PPP



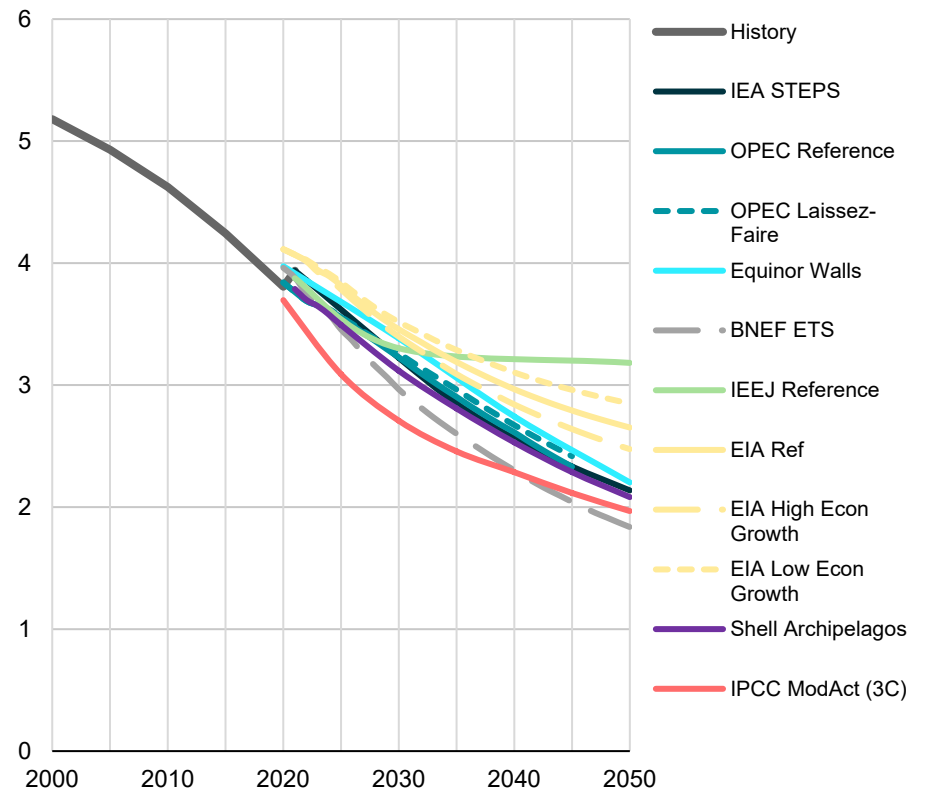
Source: IEF, IEA WEO 2023, OPEC WOO 2023, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, IPCC AR6

# Global energy intensity: The more ambitious climate scenarios show the energy intensity falling to a median 1.6 MJ/USD by 2050 vs. 2.3 MJ/USD in the reference cases and evolving policies

**Energy Demand Intensity of GDP: Ambitious Climate Scenarios**  
MJ per 2022 USD PPP



**Energy Demand Intensity of GDP: Reference Cases and Evolving Policies**  
MJ per 2022 USD PPP



Source: IEF, IEA WEO 2023, OPEC WOO 2023, Equinor Energy Perspectives 2023, BNEF New Energy Outlook 2024, IEEJ Outlook 2023, EIA IEO 2023, Shell Energy Security Scenarios, IPCC AR6

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# Appendix

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## Notes:

- Data in tables and charts may not sum due to rounding.
- Some divergences may be explained by different energy conversion efficiency assumptions.
- To enable comparability between agencies, biofuels (volumetric equivalent) were added to IEA regional oil supply data unless stated otherwise stated.
- Processing gains were subtracted from EIA regional oil supply data to enable comparability.
- In most instances in this report, when oil is reported in the context of primary energy demand it excludes biofuels, coal-to-liquids and gas-to-liquids and is reported in energy equivalent units (mboe/d) to allow for a comparison between different fuel types.

## Acknowledgements:

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

The IEF would like to thank 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.



This report was prepared in support of the 14<sup>th</sup> IEA IEF OPEC Symposium on Energy Outlooks