16th IEA IEF OPEC
Symposium on Energy Outlooks

IEF Outlooks Comparison Report

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Introduction: IEF Comparative Outlook Analysis Sheds Light on Global Energy Futures informing Policy and Investment Decisions

- The annual energy outlooks of the IEA and OPEC play a central role in shaping global market expectations and guiding producer–consumer policy and investment decisions. Systematic comparison of these outlooks, and transparent discussion of their underlying scenario assumptions through inclusive dialogue, strengthens the interpretation of their results and supports more informed decision-making worldwide.

- The Cancun IEF Ministerial Declaration (2010) called on the IEA, IEF, and OPEC to convene an annual symposium on energy outlooks, establishing a platform for structured producer–consumer dialogue. Since then, the IEF trilateral work programme on energy outlooks and physical and financial energy market interactions has grown in relevance, as geoeconomic shifts, evolving market dynamics, rapid advances in clean energy technologies, and the interplay of energy security, affordability, and sustainability with physical and financial energy market fundamentals shape global market stability and the pursuit of shared energy security, sustainable development, climate and environmental objectives.

- This report supports the 16th IEA–IEF–OPEC Symposium by systematically comparing the key scenarios and underlying methodologies of the latest IEA and OPEC outlooks and situating them within the broader landscape of energy scenarios produced annually by other public and private sector institutions.

- Originally developed to enhance market transparency and investor confidence, energy outlook scenarios have expanded in number and scope, offering an increasingly diverse set of potential future pathways and serving as a key instrument for public engagement. While this expanding range of perspectives reflects differing assumptions and, in some cases, more diverse views on the feasibility of long-term trends, it also broadens the range of uncertainty, potentially complicating investment decisions and slowing the deployment of much needed energy investment.

- Systematic peer review of energy outlooks enhances the consistency of historical baseline data and the transparency of modelling frameworks by aligning timeframes and methods and shedding light on the key assumptions that drive short-, medium-, and long-term projections of energy supply and demand in different scenarios. By doing so, it enables stakeholders to more effectively interpret projected global energy pathways and to assess scenario outcomes against evolving real world market conditions, technological progress, and policy developments.

- Improved comparability of baseline data, and methodologies, including transparent documentation of modelling assumptions provides a range of scenario pathways with more and less probable outcomes dependent on policy perspectives and prevailing market realities by assessing their relevance for real-world policy and investment decisions.

Energy outlook uncertainties emphasize the need for dialogue and collaboration to strengthen security, affordability, and sustainability globally

- The energy outlooks compared by the IEF present a set of scenarios for global energy consumption to 2050, drawing on 14 sources and covering more than 30 scenarios. These can be grouped into three main categories:

  1. *Reference and Evolving Policies scenarios assume the continuation of current trends, adopted policies, and technological progress, with outcomes shaped by pathway-specific dynamics. These scenarios typically project rising energy demand driven by population and economic growth, alongside a gradual shift toward low-carbon energy sources.*

  2. *Ambitious climate scenarios are oriented toward achieving net-zero emissions by mid-century, consistent with limiting global warming to around 1.5 °C, and in some cases up to 1.7 °C by 2100. They entail profound transformations in energy systems, including a reduction in global energy demand, rapid expansion of renewable generation and sustainable fuels, sharply higher electrification and efficiency gains, and the large-scale deployment of carbon removal and other negative-emissions technologies.*

- As in previous editions, the spread across energy projections remains wide and continues to widen over time, reflecting differences in modelling frameworks, perspectives taken and the inherent uncertainty to which complex global energy system interactions are exposed. These divergences stem from varying assumptions on economic growth, technology uptake, costs, and efficiency improvements, while other underlying premises remain implicit and are not always fully transparent.

- The most ambitious scenarios adopt a back-casting approach, defining a target end state, such as achieving net-zero emissions by a given year, and then deriving the pathways required from that future goal to reach the present. By contrast, Reference and Evolving Policies scenarios follow a forward-looking, bottom-up framework in which trajectories emerge from assumptions about economic growth, technology development, and policy settings.

- While energy outlooks were originally designed to enhance predictability and investor confidence, the growing divergence in projected pathways underscores the need for more inclusive producer–consumer dialogue to foster a shared and more comprehensive understanding of energy security, affordability, and sustainability challenges and the pace of change on global energy markets.

- Taken together, the outlook scenarios highlight that pathways toward greater energy security and market resilience by achieving sustainable development and climate objectives, including universal access to affordable, reliable, sustainable, and modern energy, are subject to widening uncertainty. Projections from the IEA show the highest divergence. The Current Polices case, that the IEA reinstated this year shows the highest primary energy demand, while the IEA's Net Zero pathway provides a scenario in which renewable sources provide around 84% of total primary energy demand alongside a substantial contraction in overall energy use by 2050.

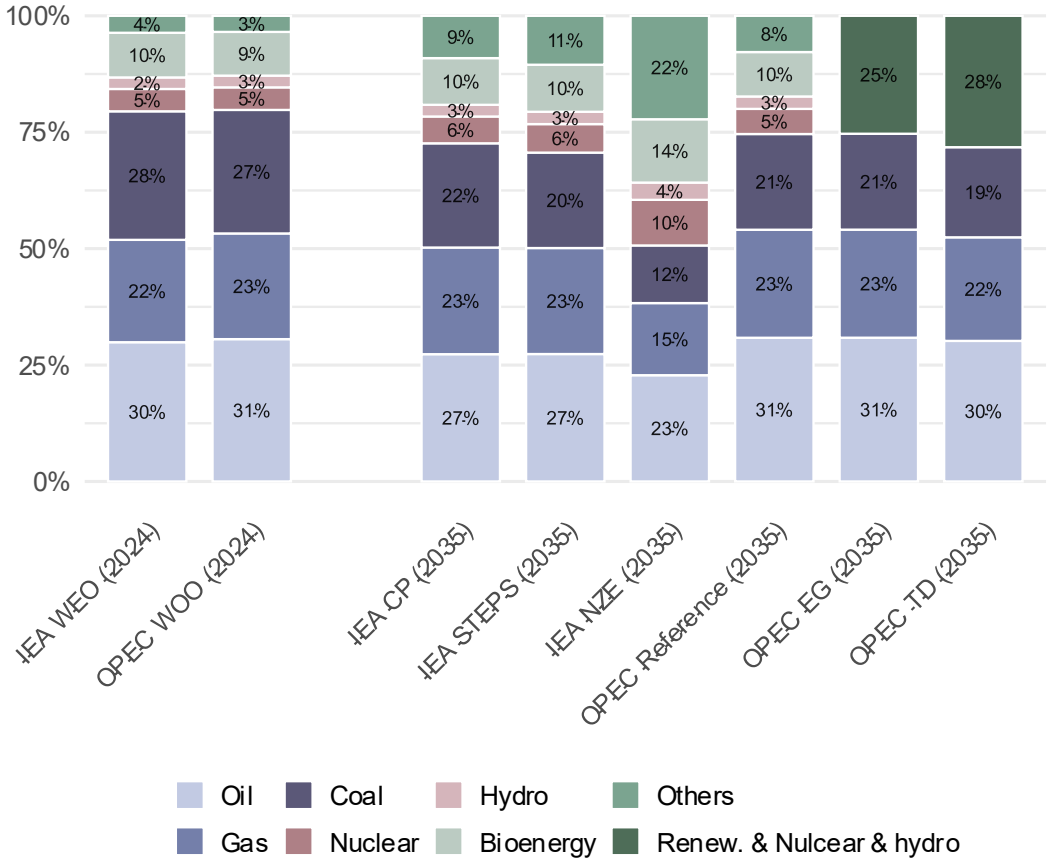
Outlooks Highlights

2035 IEA & OPEC Outlook Highlights:

- Across all IEA and OPEC scenarios, hydrocarbons continue to account for more than two-thirds of total primary energy demand in 2035, with the highest shares in the IEA Current Policies and OPEC Equitable Growth scenarios.
- Low-carbon shares diverge sharply across outlooks, with the combined contribution of renewables, nuclear, and hydropower reaching around 50% in the IEA Net Zero scenario by 2035, compared with only about 25–30% in the Reference and Evolving Growth scenarios.
- Coal's share falls markedly in all scenarios, particularly under the IEA's Net Zero Emissions scenario, whereas oil and gas retain broadly stable shares through to 2035.
- All fuel-mix differences depend entirely on renewable deployment speed, not on hydrocarbons choices.
- Renewable percentage share of the energy mix becomes a measurable policy success indicator for emissions but not necessarily for energy security, affordability, and system resilience.

World Primary Energy Demand Fuel Share Outlook to2035

Percentage of total primary energy demand



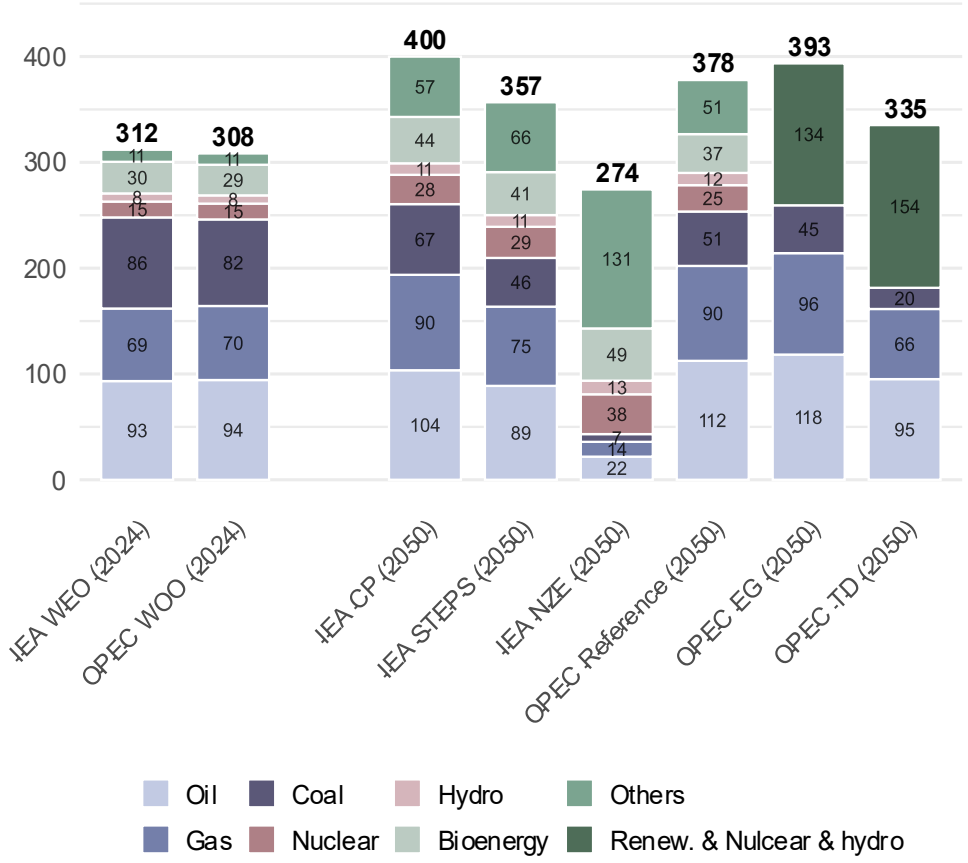
Source: IEF, IEA WEO 2025, and OPEC WOO 2025.

2050 IEA & OPEC Outlook Highlights:

- The 2050 energy outlook shows the largest scenario divergence of any time horizon, with total primary energy ranging from 274 Mboe/d (IEA NZE) to 400 Mboe/d (IEA CP), a difference of roughly 126 mboe/d, exceeding current global oil demand.
- High-growth scenarios cluster around annual energy demand growth of roughly 0.85–1.03% to 2050, moderate scenarios around 0.30–0.53%, while the IEA Net Zero case stands apart with an average decline of about 0.49% per year. The resulting 1.5-percentage-point spread in annual growth rates, between the IEA Current Policies trajectory (~+1%) and the IEA Net Zero pathway (~−0.5%), compounds into a gap of around 126 mboe/d by 2050, equivalent to a divergence of more than 40% from the 2024 baseline of ~310 mboe/d.
- This illustrates the high sensitivity of long-term energy outlooks to small differences in assumed energy demand growth. Relatively modest variations in policy, technology uptake, or behavioral change can translate into structurally different energy systems over a multi-decade horizon.
- Three fundamentally different demand trajectories emerge:
  - (1) high-growth pathways (IEA CP, OPEC Equitable Growth) project around a 28% increase in global energy demand to 2050, implying total demand approaching 400 mboe/d;
  - (2) moderate-growth pathways (OPEC Reference, OPEC TD) foresee demand rising by roughly 9–23%, with total supply in the range of 335–378 mboe/d; and
  - (3) a demand-reduction pathway (IEA Net Zero) projects an approximate 11% decline in global energy use to about 274 mboe/d by 2050, driven by efficiency gains and structural change despite continued economic growth.
- These outcomes correspond to three distinct energy systems: one requiring large-scale expansion of energy infrastructure, one broadly sustaining current growth patterns, and one characterized by policy driven contraction in total energy demand; “degrowth”.

World Primary Energy Demand Outlook to 2050

Million barrels of oil equivalent per day

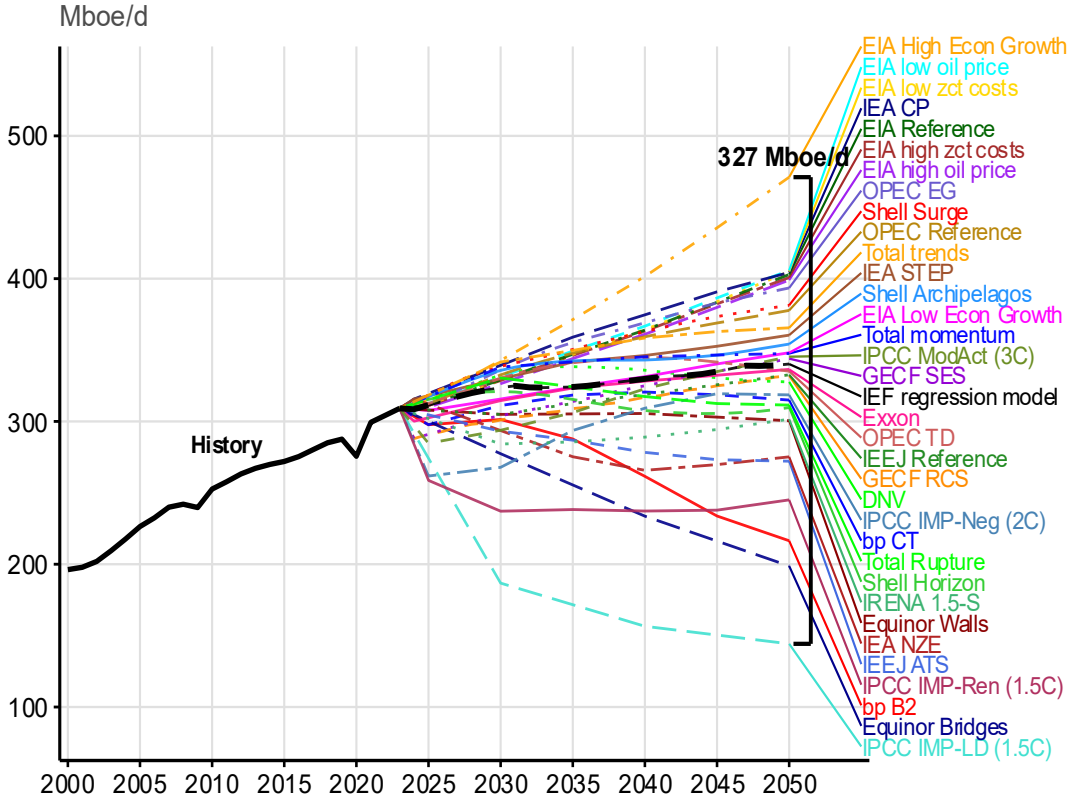


Source: IEF, IEA WEO 2025, and OPEC WOO 2025.

IEA and OPEC Scenarios and Other Long-Term Energy Outlooks:

- This year's scenario set shows that the world's leading energy institutions are not converging on a single "most likely" future, but rather outlining a spectrum of energy system configurations, with total primary demand in 2050 ranging from roughly 150 to 470 mboe/d. This divergence reflects fundamentally different assumptions about economic growth, policy effectiveness, technology deployment, and the pace of energy-efficiency improvement.
- Across outlooks, projections remain closely aligned through the mid-2030s, indicating that near-term demand is largely shaped by pre-existing pathway dependencies on infrastructure, capital stock, and prevailing policy and market realities. Greater divergence emerges after 2035, underscoring that long-term outcomes in 2050 are driven primarily by choices made presently and in the current decade, rather than conditions in 2035.
- The "*IEF regression model*", defines a median trajectory across all published outlooks to capture the key trend emanating from the scenario ensemble. This gives a robust, data-driven benchmark that is less influenced by relative outliers.
- This median pathway follows a moderate expansion through the middle of the scenario range, with total primary energy demand increasing from around 310 mboe/d in 2020 to approximately 340 mboe/d by 2050, indicating a mid-range evolution of the global energy system under current expectations of policy and technology evolution.

Total Primary Energy Demand Scenarios Through 2050



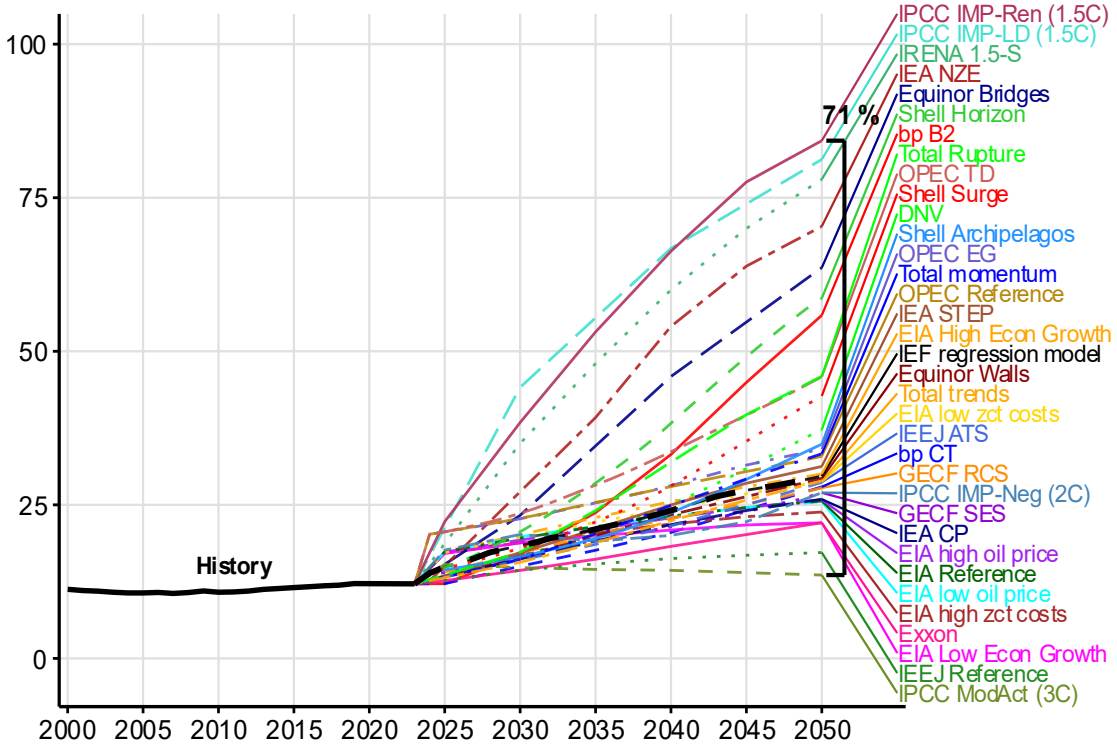
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook 2025, IRENA World Energy Transition Outlook 2024, GECF Global Gas Outlook 2025, DNV's Energy Transition Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

IEA and OPEC Scenarios and Other Long-Term Energy Outlooks:

- Global outlooks project the share of renewables in total primary energy demand in 2050 to range from 13.6% to 84.3%, implying a spread of around 71 percentage points across scenarios. Unlike total energy demand, which remains tightly clustered around 330–410 mboe/d through the mid-2030s, renewable shares diverge early and spread out sharply after 2040.
- Five distinct clusters emerge:
  - (1) very low market share (14–17%, 2 scenarios),
  - (2) low market share (22–29%, 15 scenarios),
  - (3) moderate market share (30–46%, 10 scenarios),
  - (4) high market share (56–70%, 4 scenarios), and
  - (5) very high market share (78–84%, 3 scenarios).
- These groupings reveal that renewable deployment remains primarily a function of policy conditions rather than a self-sustaining market-driven outcome. Baseline and current-policy pathways concentrate in the 22–30% range by 2050, whereas net-zero-aligned trajectories require renewable shares of 70–84% to achieve goals.
- Only 7 of the 34 scenarios exceed a 50% renewable share by mid-century, underscoring that achieving majority renewables is not a continuation of current trends but the result of increased policy ambition and greater dialogue and cooperation to improve market conditions.

Renewable Demand Share of Total Primary Energy Demand Scenarios to 2050

Share of primary energy demand

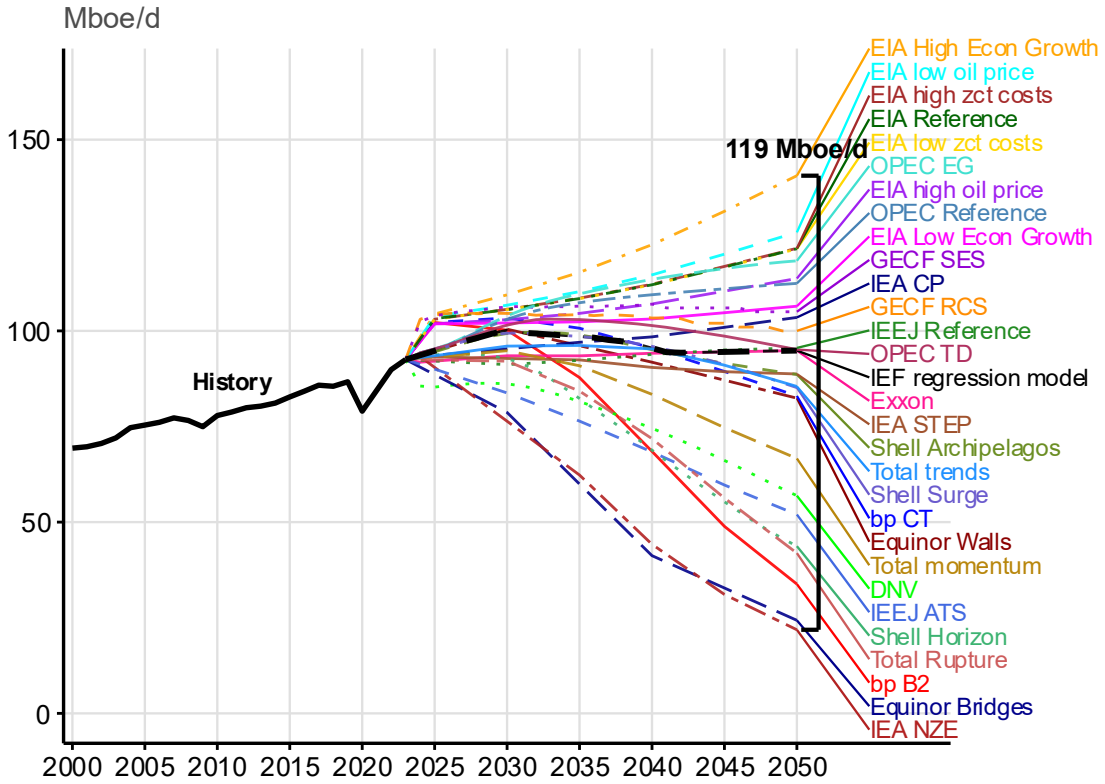


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, TotalEnergies Energy Outlook 2025, IRENA World Energy Transition Outlook 2024, bp Energy Outlook 2025, GECF Global Gas Outlook 2025, DNV's Energy Transition Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections

IEA and OPEC Scenarios and Other Long-Term Energy Outlooks:

- The scenarios show an almost even split in outlooks:
  - (1) fourteen pathways (48% of the total) project continued growth in oil demand, while another
  - (2) fourteen (also 48%) foresee a decline, with only a
  - (3) single scenario indicating broadly flat oil demand.
- This near-symmetry underscores a fundamental division within the scenario modelling community, pointing to the absence of a clear consensus on the long-term trajectory of global oil demand.
- The comparison of global oil demand scenarios highlights that mid-century outcomes are also not predetermined by resource constraints or short-term market dynamics, but by investment and trade conditions shaped by policy, regulatory, and financing choices made in the current decade.
- While near-term demand remains anchored around today's levels due to pathway dependencies (e.g.: infrastructure lock-in and slow turnover of vehicle and industrial capital stock) post-2035 trajectories diverge sharply, reflecting differing assumptions on policy ambitions, efficiency gains, electrification rates, and sustainable fuel deployment.

Oil Demand Scenarios Through 2050

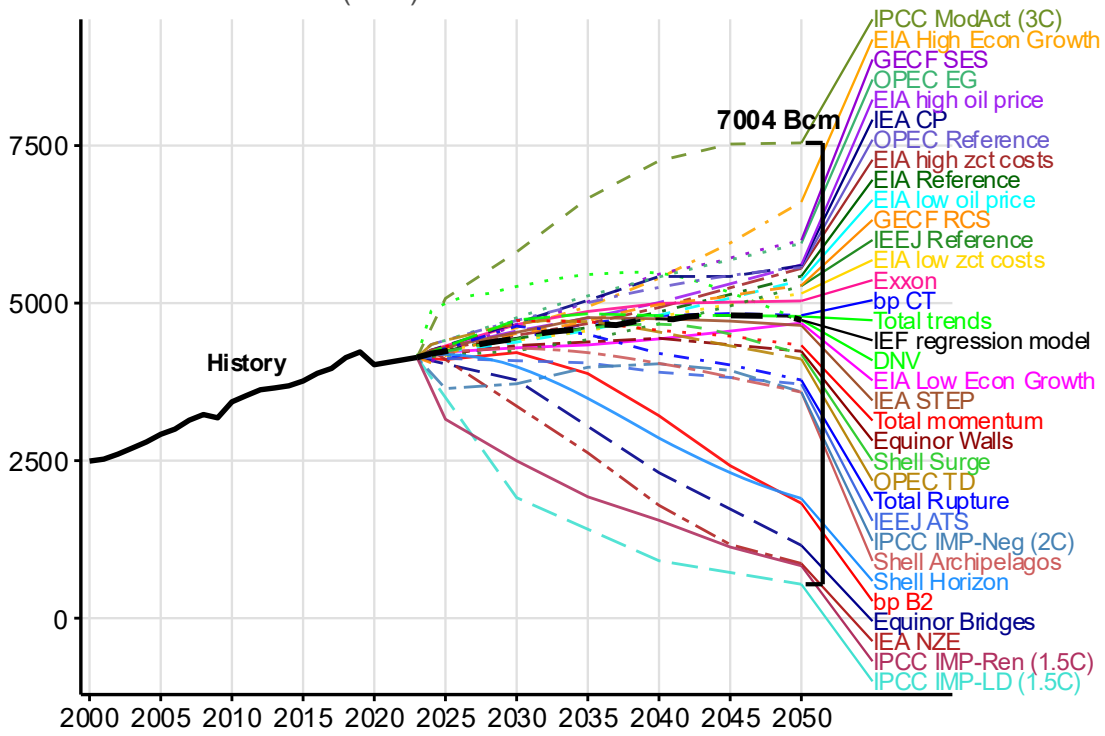


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook 2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, and ExxonMobil Global Outlook 2025. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections.

IEA and OPEC Scenarios and Other Long-Term Energy Outlooks:

- The analysis of natural gas data shows that ~61 percent of scenarios project growth, compared to the 48 percent of oil scenarios showing growth.
- The IEF regression model shows natural gas demand at 4,732 Bcm by 2050, representing 14.4 percent growth from the 2023 baseline, reflecting that overall scenarios project natural gas demand to expand.
- Growth-oriented scenarios account for 20 of the 33 forecasts, with average annual demand growth of around 1%, translating into cumulative increases ranging from about 1.3% to more than 80% over the projection period.
- A small group of around three scenarios occupies a narrow middle ground, showing broadly flat natural gas demand with consumption remaining close to current levels.
- By contrast, around nine scenarios indicate declining trajectories, with average annual rates of change of around −3%, spanning a range from approximately −0.3% to −7.3% per year.

Natural Gas Demand Scenarios Through 2050



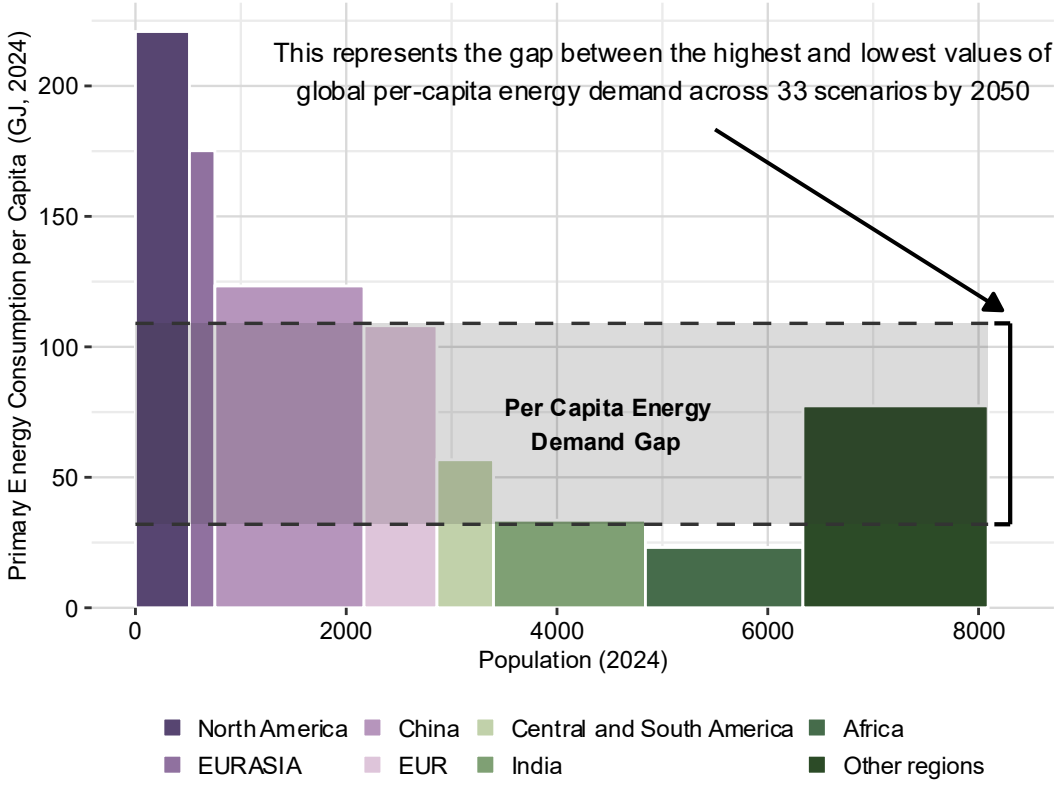
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook 2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections.

Primary energy use per capita across a range of scenarios

- By 2050, marked disparities in primary energy demand per capita are projected to persist, underscoring deep structural inequalities between advanced and developing countries. Across major regions that represent the global population, the data highlights the tight coupling between economic development, energy security and sustainable development and climate goals.
- Nearly 3.5 billion people in non-OECD developing regions are expected to consume only one-quarter to one-tenth as much energy per person as OECD regions. Yet these regions are poised to account for the majority of future energy demand growth over the coming decades.
- The "*Per Capita Energy Demand Gap*" marks a critical energy access challenge, spanning the range of per-capita demand across 33 scenarios by 2050 where future energy demand growth requires substantial energy investment.
- Given the economic and population growth in non-OECD economies over the next two decades, per-capita energy demand in these regions will rise significantly.
- With the OECD maintaining 2024 levels of energy use per capita, a global convergence in energy access will implies continued growth in global primary energy demand.

Primary Energy Consumption Per Capita

Gigajoules per capita



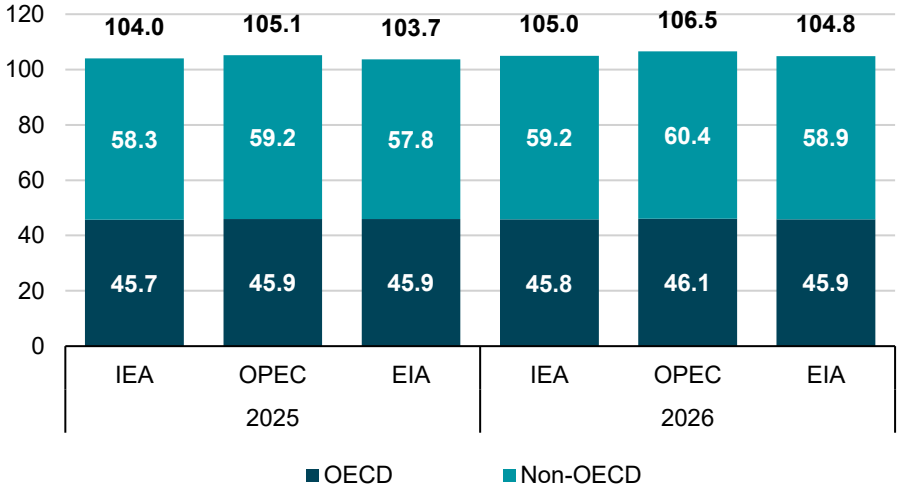
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook 2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6.

Short Term Liquids Outlook
(IEA OMR, OPEC MOMR and EIA STEO 2025-2026 as of January 2026)

Agencies are projecting an average of approximately 1.1 mb/d in both 2025 and 2026

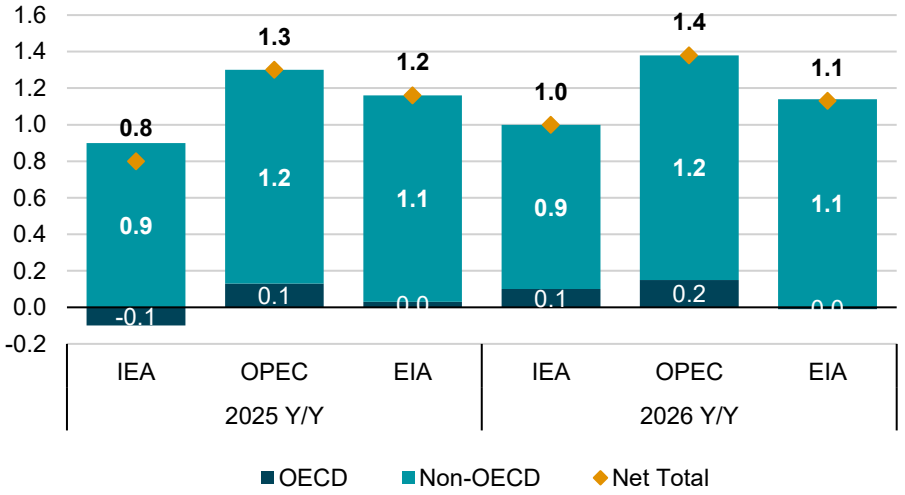
2025 & 2026 Liquid Demand Forecast By Agency

Million barrels per day



2025 & 2026 Liquid Demand Growth By Agency

Million barrels per day



Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, and EIA STEO Jan 2026.

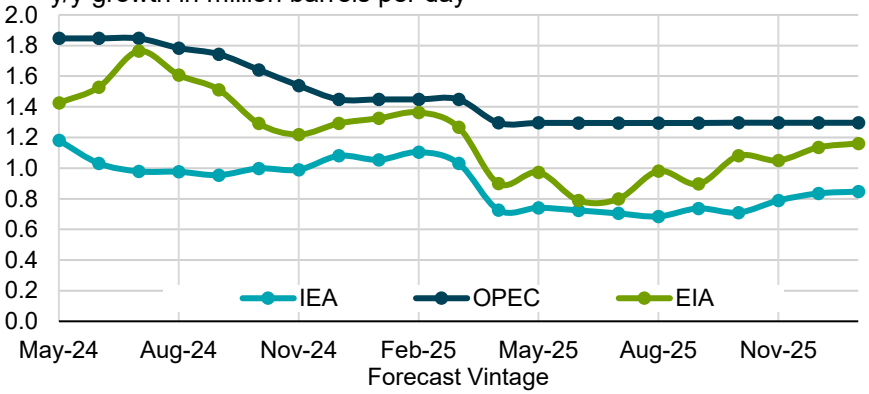
Around 1.7 mb/d divergence is observed across agencies' estimates of global oil demand in 2026, compared with about 1.5 mb/d in 2025

2025-2026 Liquid Demand Forecast by Agency								
	2025				2026			
million barrels per day	IEA	OPEC	EIA	Range (high-low)	IEA	OPEC	EIA	Range (high-low)
Total OECD	**45.7**	**45.94**	**45.90**	**0.24**	**45.8**	**46.09**	**45.89**	**0.29**
Americas	25.3	25.40	24.84	0.56	25.3	25.52	24.87	0.65
Europe	13.4	13.44	13.46	0.06	13.4	13.48	13.46	0.08
Asia Oceania	7.0	7.10	7.6	0.6	7.0	7.08	7.56	0.56
Total Non-OECD	**58.3**	**59.20**	**57.79**	**1.41**	**59.2**	**60.43**	**58.93**	**1.5**
Asia	32.0	32.33	31.55	0.78	32.6	33.02	32.30	0.72
China	*16.8*	*16.87*	*16.60*	*0.27*	*17.0*	*17.06*	*16.81*	*0.25*
Middle East*	9.2	8.94	9.39	0.45	9.3	9.10	9.45	0.35
Latin America	6.6	6.88	6.97	0.37	6.7	7.01	7.11	0.41
Europe and Eurasia	5.7	6.18	5.89	0.48	5.6	6.27	5.88	0.67
Russia	*3.54*	*4.04*	*3.80*	*0.5*	*3.51*	*4.09*	*3.78*	*0.58*
Africa	4.8	4.87	4.79	0.08	5.0	5.03	4.99	0.04
World	**104.0**	**105.14**	**103.69**	**1.45**	**105.0**	**106.52**	**104.82**	**1.7**

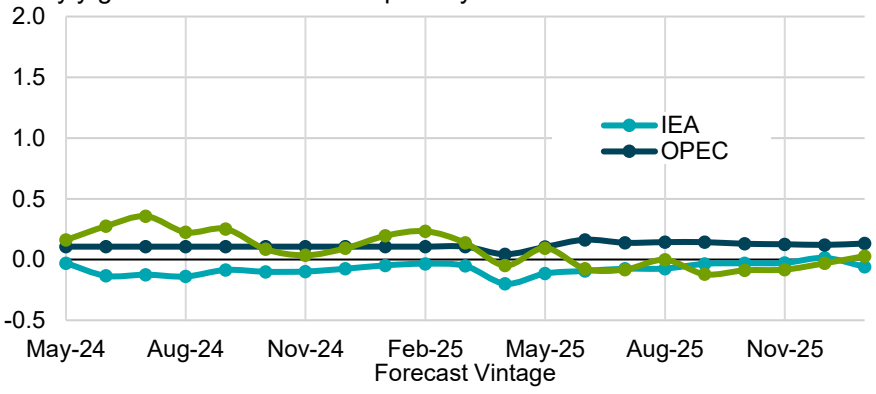
Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, and EIA STEO Jan 2026. Note: The differences between the IEA and OPEC Middle East baselines relate to data sources.

Divergence in global oil demand estimates across agencies is around 0.5 mb/d in 2025

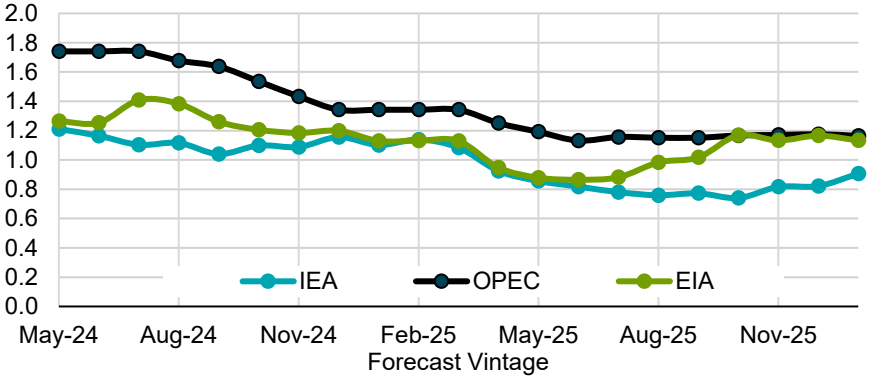
Global Demand Growth
Evolution of 2025 Forecasts
y/y growth in million barrels per day



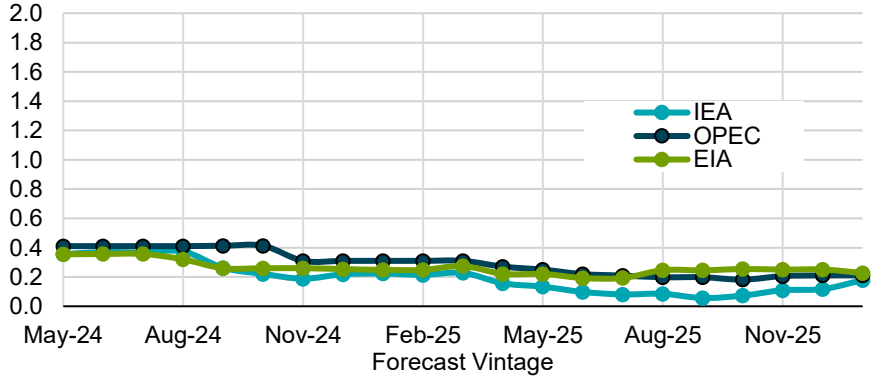
OECD Demand Growth
Evolution of 2025 Forecasts
y/y growth in million barrels per day



Non-OECD Demand Growth
Evolution of 2025 Forecasts
y/y growth in million barrels per day



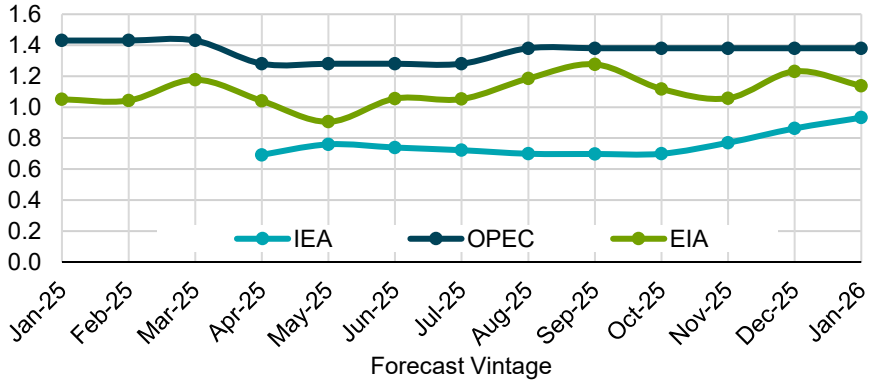
Chinese Demand Growth
Evolution of 2025 Forecasts
y/y growth in million barrels per day



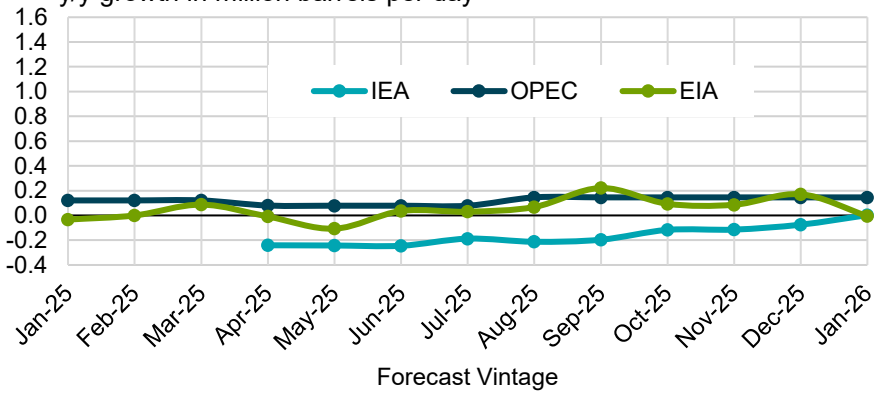
Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, EIA STEO Jan 2026.

All agencies are aligned in their estimates of Chinese oil demand growth in 2026

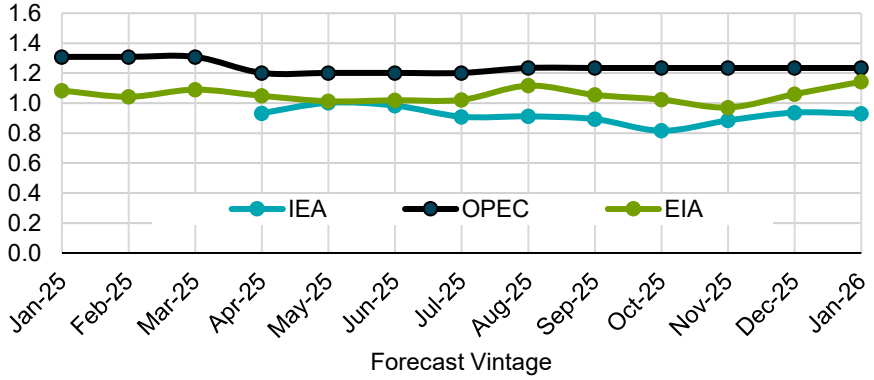
Global Demand Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



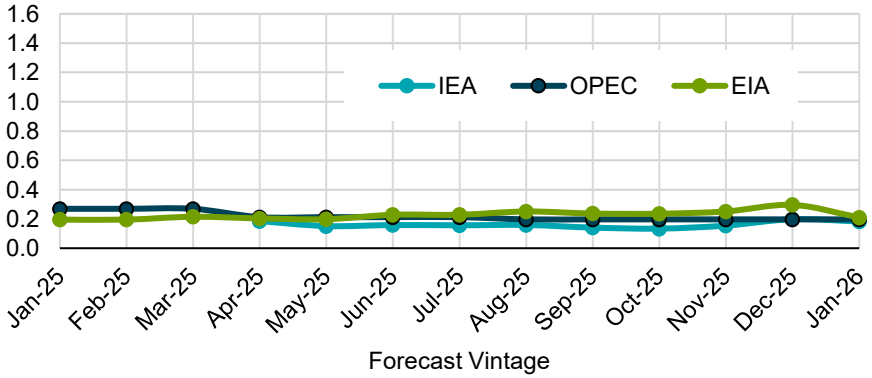
OECD Demand Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



Non-OECD Demand Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



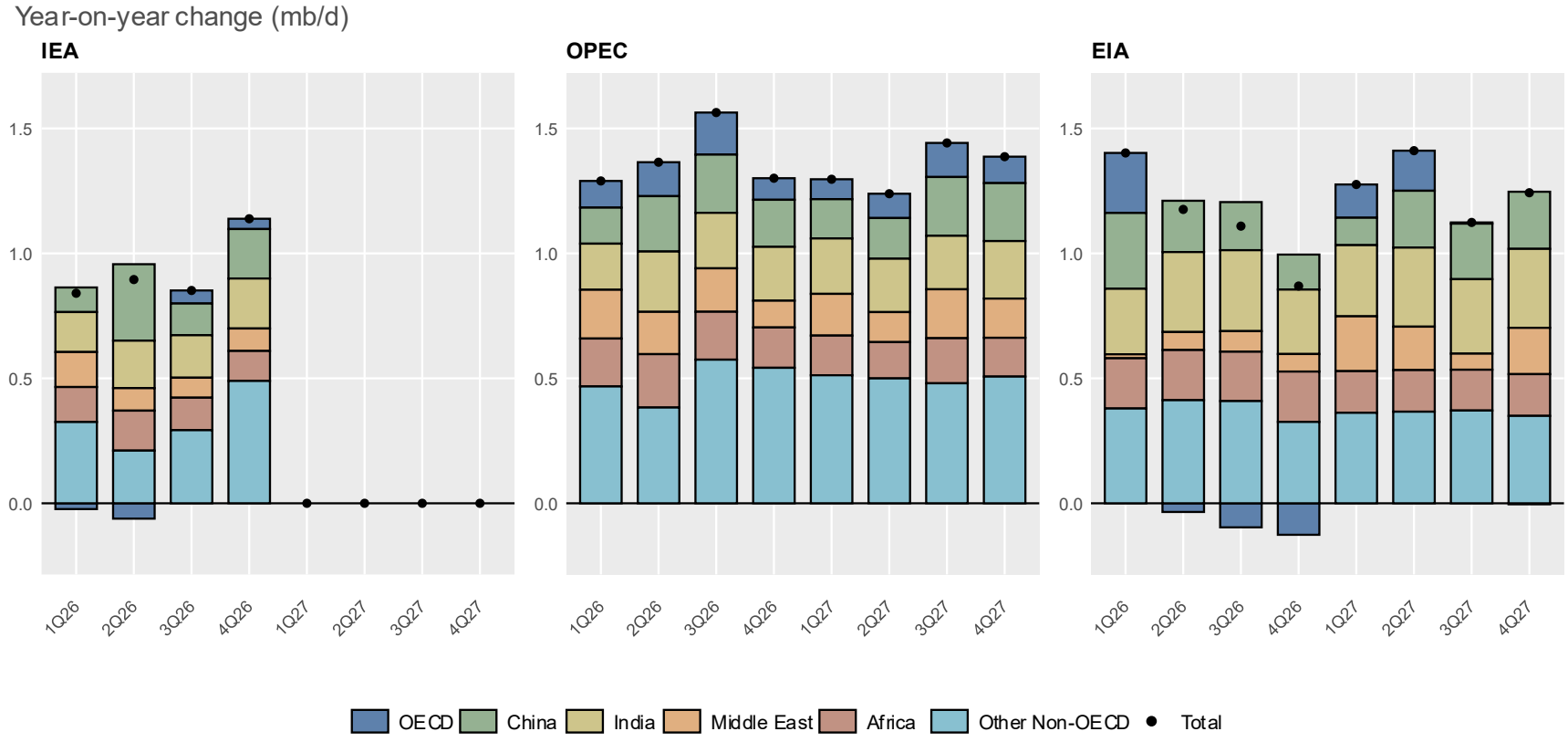
Chinese Demand Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, EIA STEO Jan 2026. Note: IEA first published a 2025 forecast in April 2025.

OPEC projects average global oil demand growth of around 1.4 mb/d in both 2026 and 2027

Quarterly Oil Demand Growth by Region



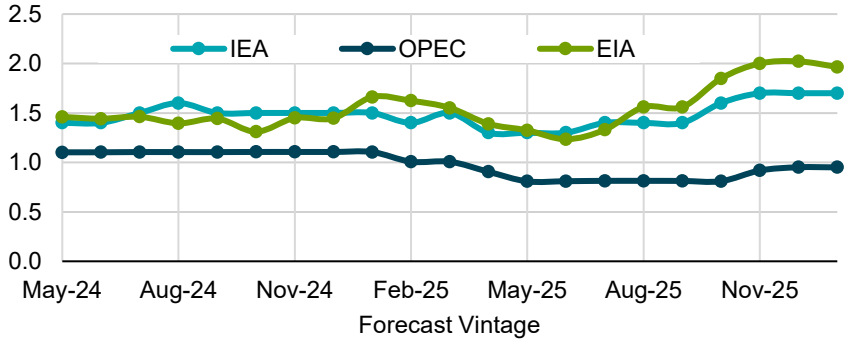
Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026 and EIA STE0 Jan 2026. Note: IEA data are not yet available for 2027.

EIA's estimate of non-DoC supply growth is more than one mb/d higher than OPEC's

Non-DoC Supply Growth

Evolution of 2025 Forecasts

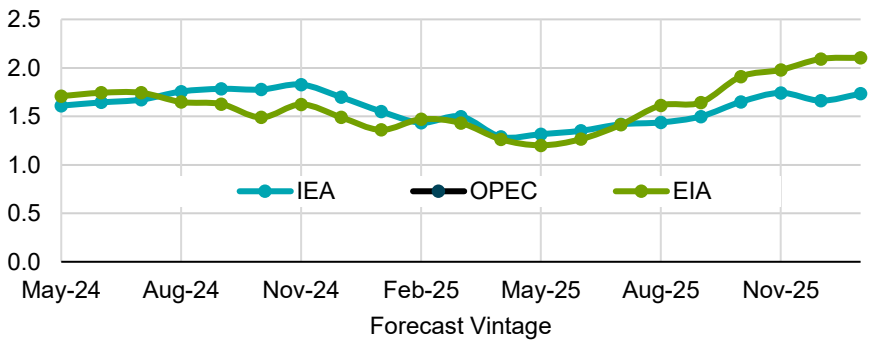
y/y growth in million barrels per day



Non-OPEC Supply Growth

Evolution of 2025 Forecasts

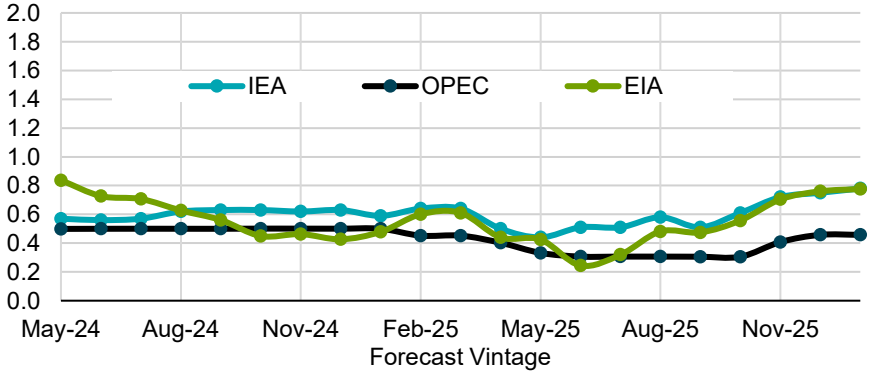
y/y growth in million barrels per day



US Supply Growth

Evolution of 2025 Forecasts

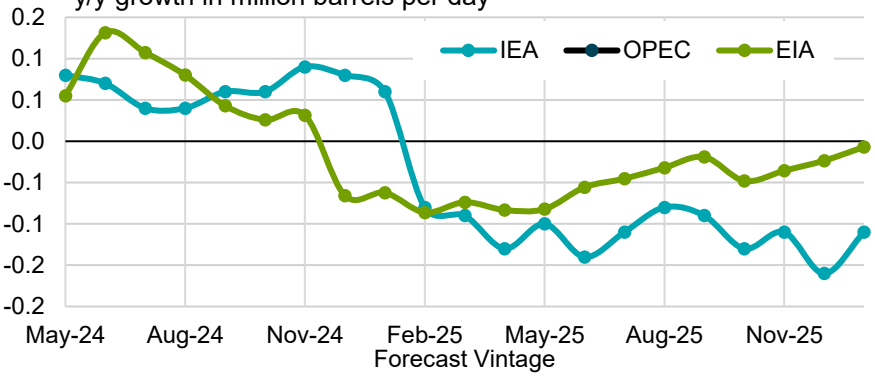
y/y growth in million barrels per day



Russia Supply Growth

Evolution of 2025 Forecasts

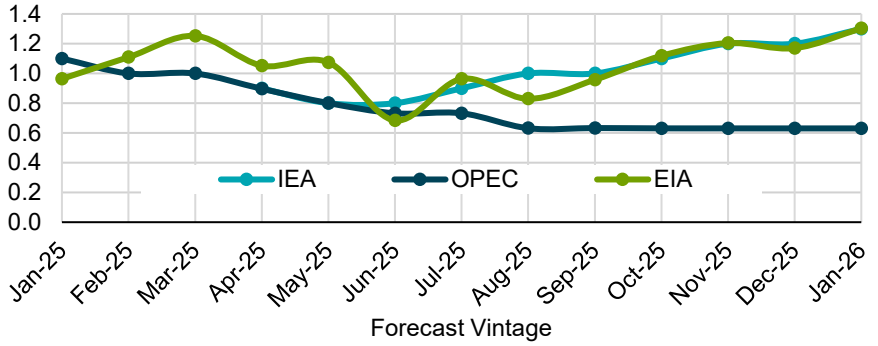
y/y growth in million barrels per day



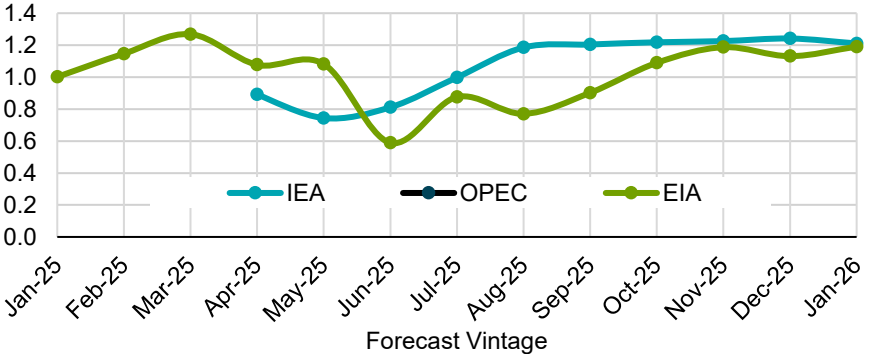
Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, EIA STEO Jan 2026.

Greater alignment is observed between the EIA and IEA estimates of non-DoC supply growth for 2026

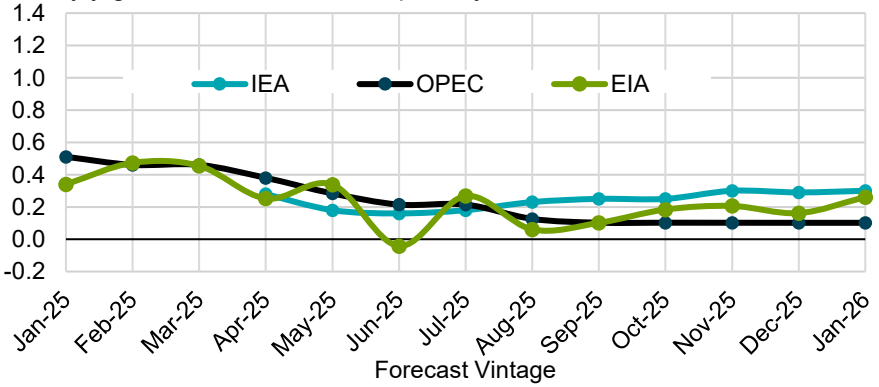
Non-DoC Supply Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



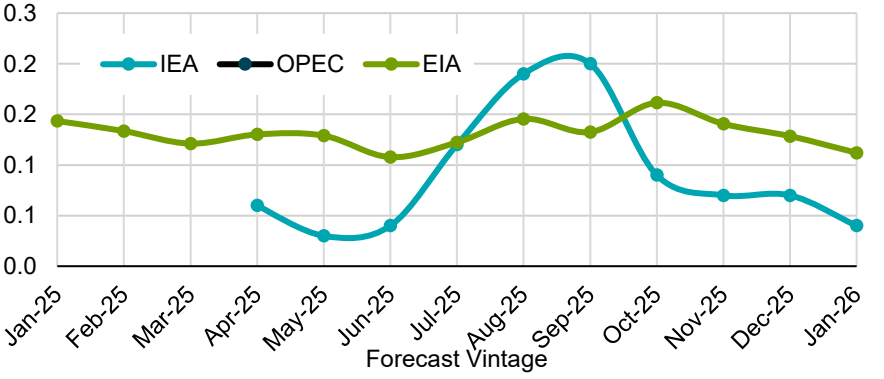
Non-OPEC Supply Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



US Supply Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day

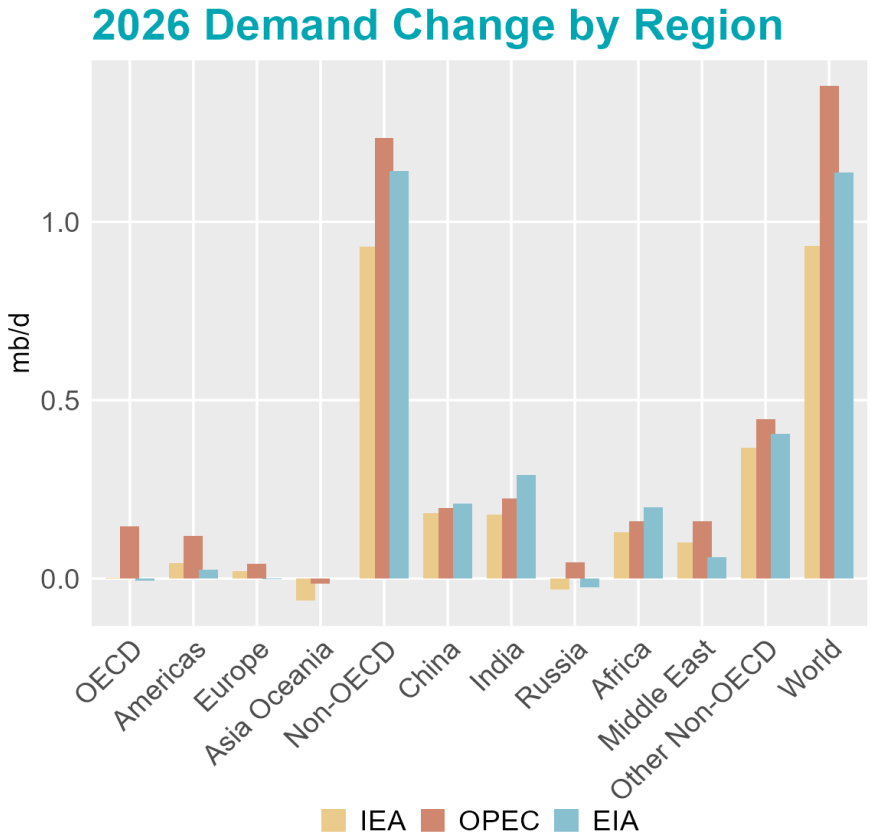


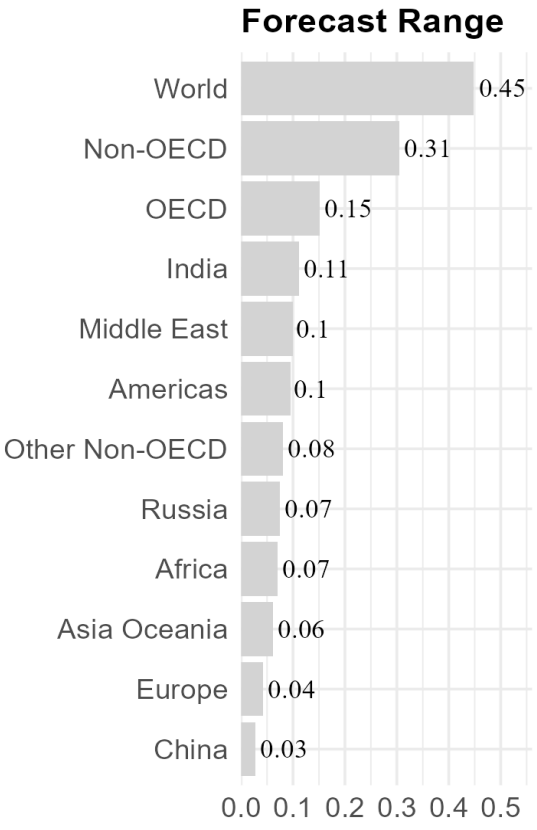
Russia Supply Growth
Evolution of 2026 Forecasts
y/y growth in million barrels per day



Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, EIA STEO Jan 2026.

India's oil demand growth is expected to rise by around 0.3 mb/d year-on-year this year





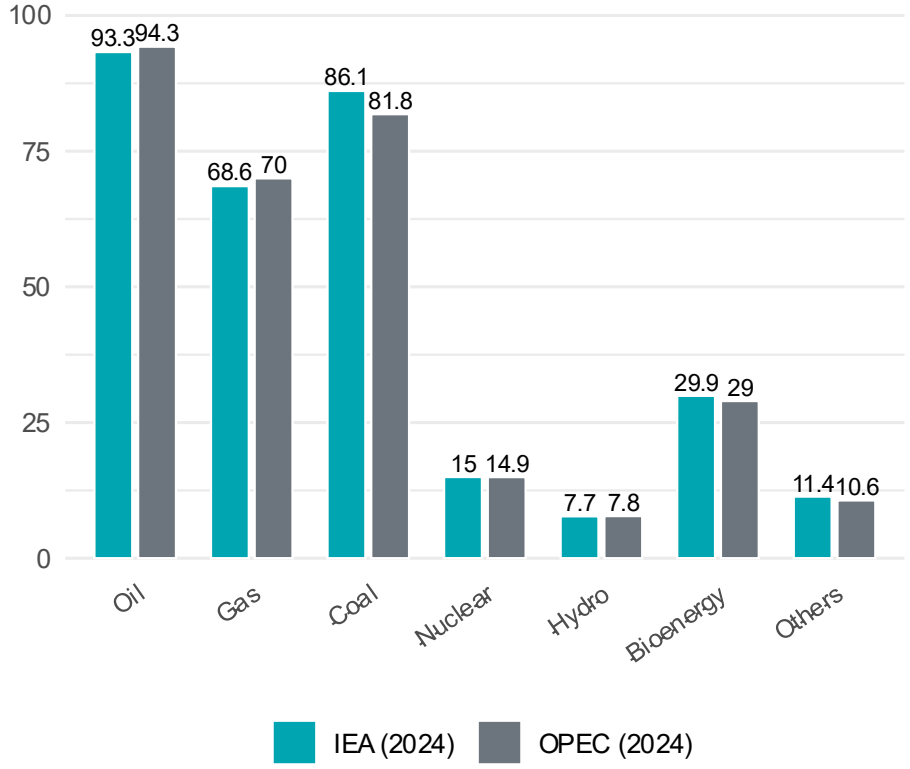
Source: IEF, IEA OMR Jan 2026, OPEC MOMR Jan 2026, and EIA STEO Jan 2026.

Baseline Energy Data
(IEA WEO and OPEC WOO)

IEA and OPEC show broad alignment in 2024 global primary energy demand, with differences largely concentrated in coal

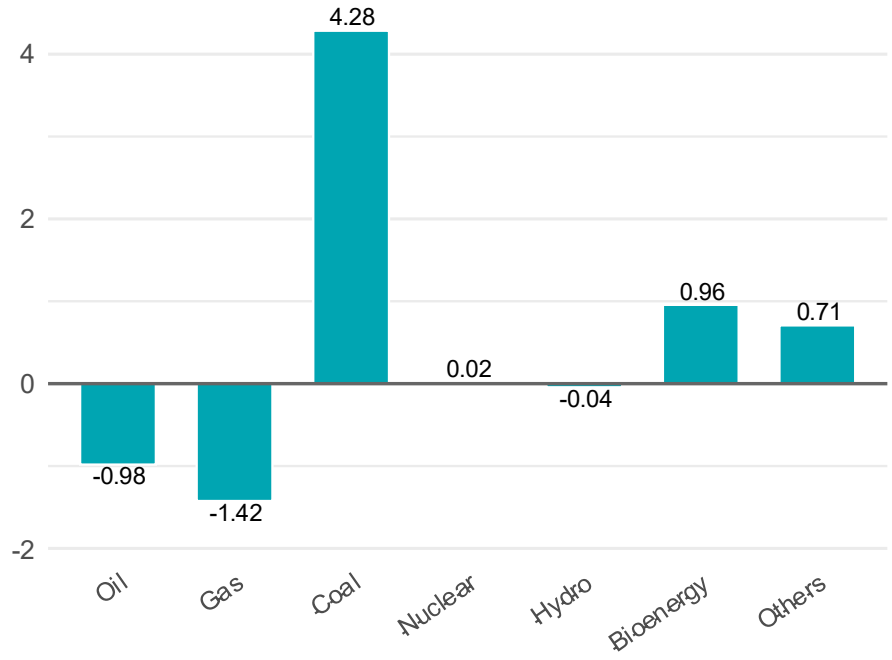
2024 World Primary Energy Demand

Million barrels of oil equivalent per day



IEA vs. OPEC: 2024 World Primary Energy Demand

Million barrels of oil equivalent per day

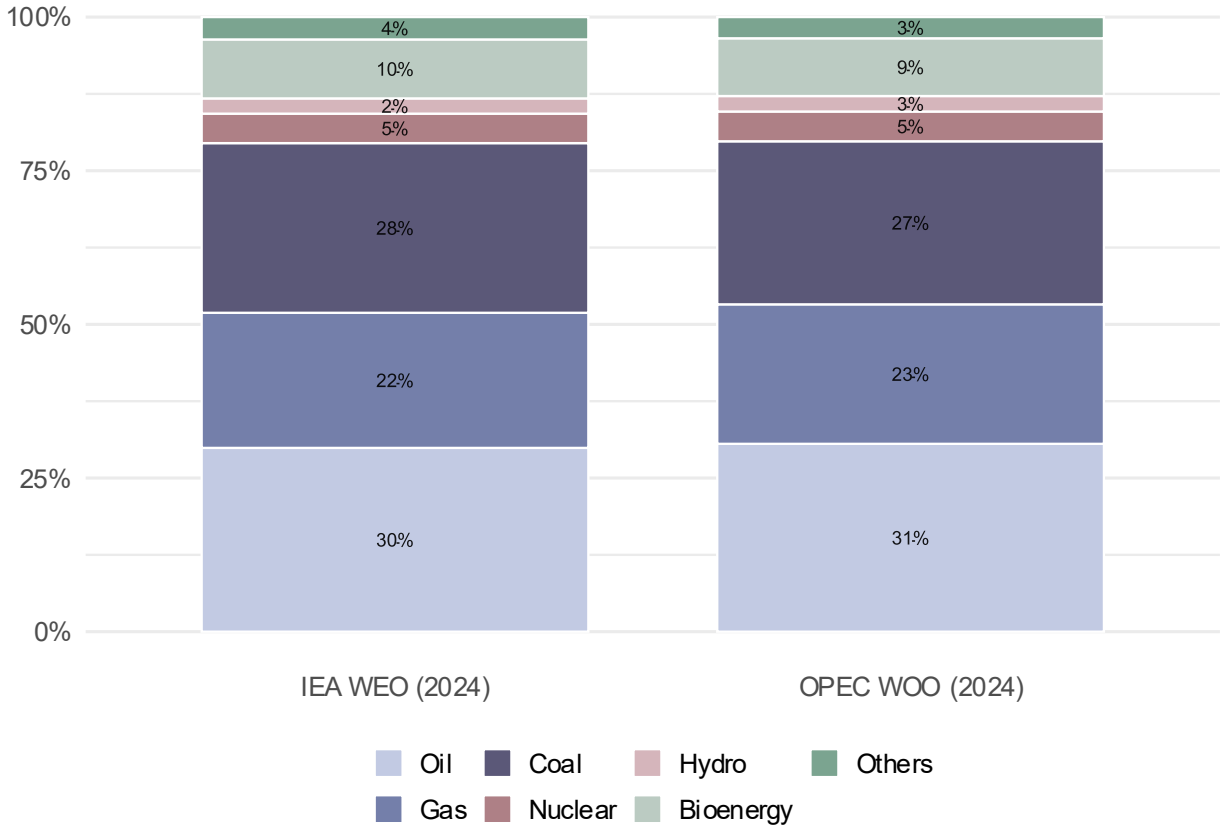


Source: IEF, IEA WEO 2025, and OPEC WOO 2025.

Global primary energy supply remains heavily dependent on hydrocarbons in 2024

2024 World Primary Energy Demand Fuel Share

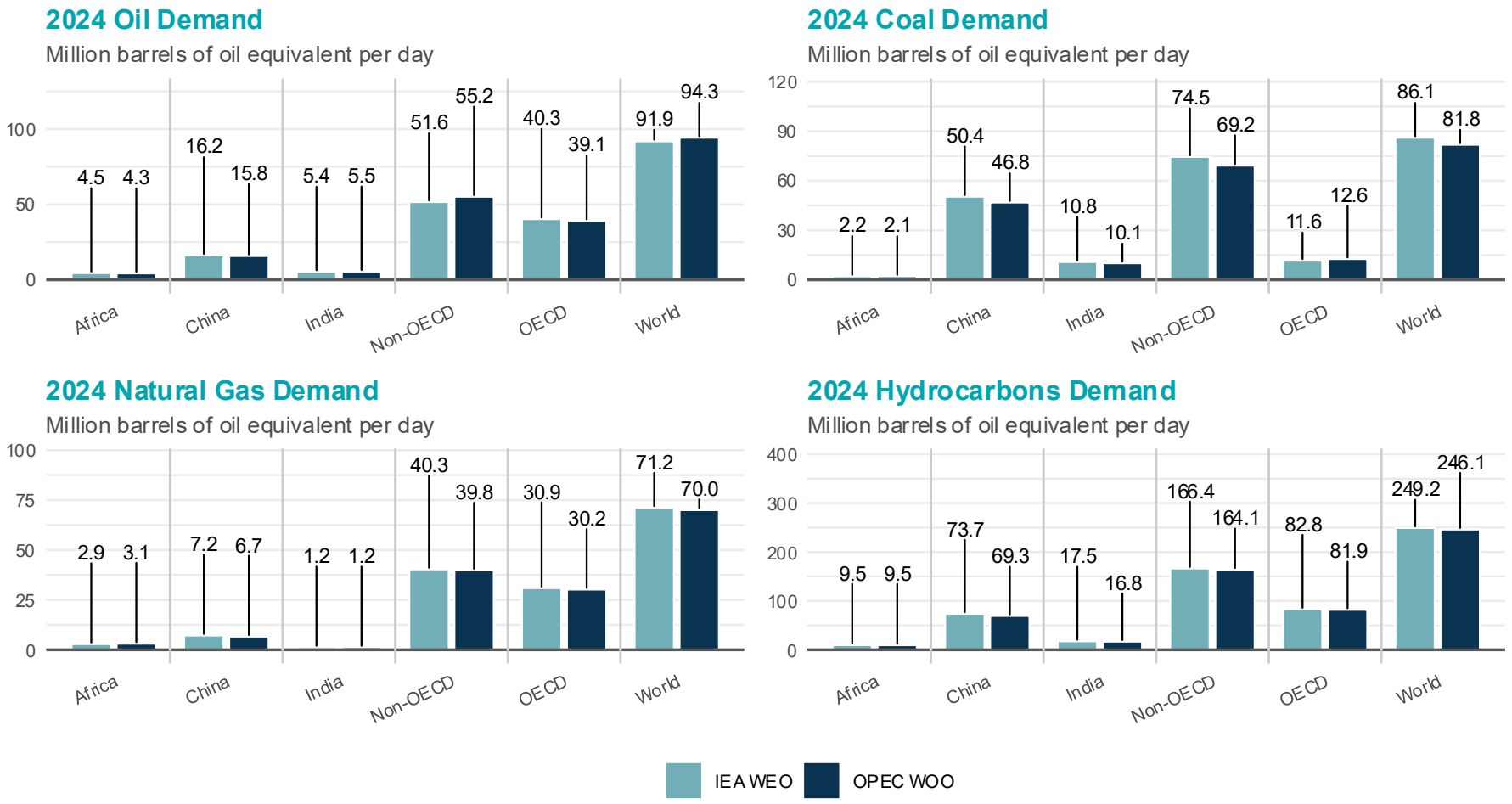
Percentage of total primary energy demand



- Hydrocarbons account for more than four-fifths of global primary energy demand in 2024 in both the IEA WEO and OPEC WOO.
- Renewables, nuclear, and hydropower combined account for less than one-fifth of global primary energy demand.

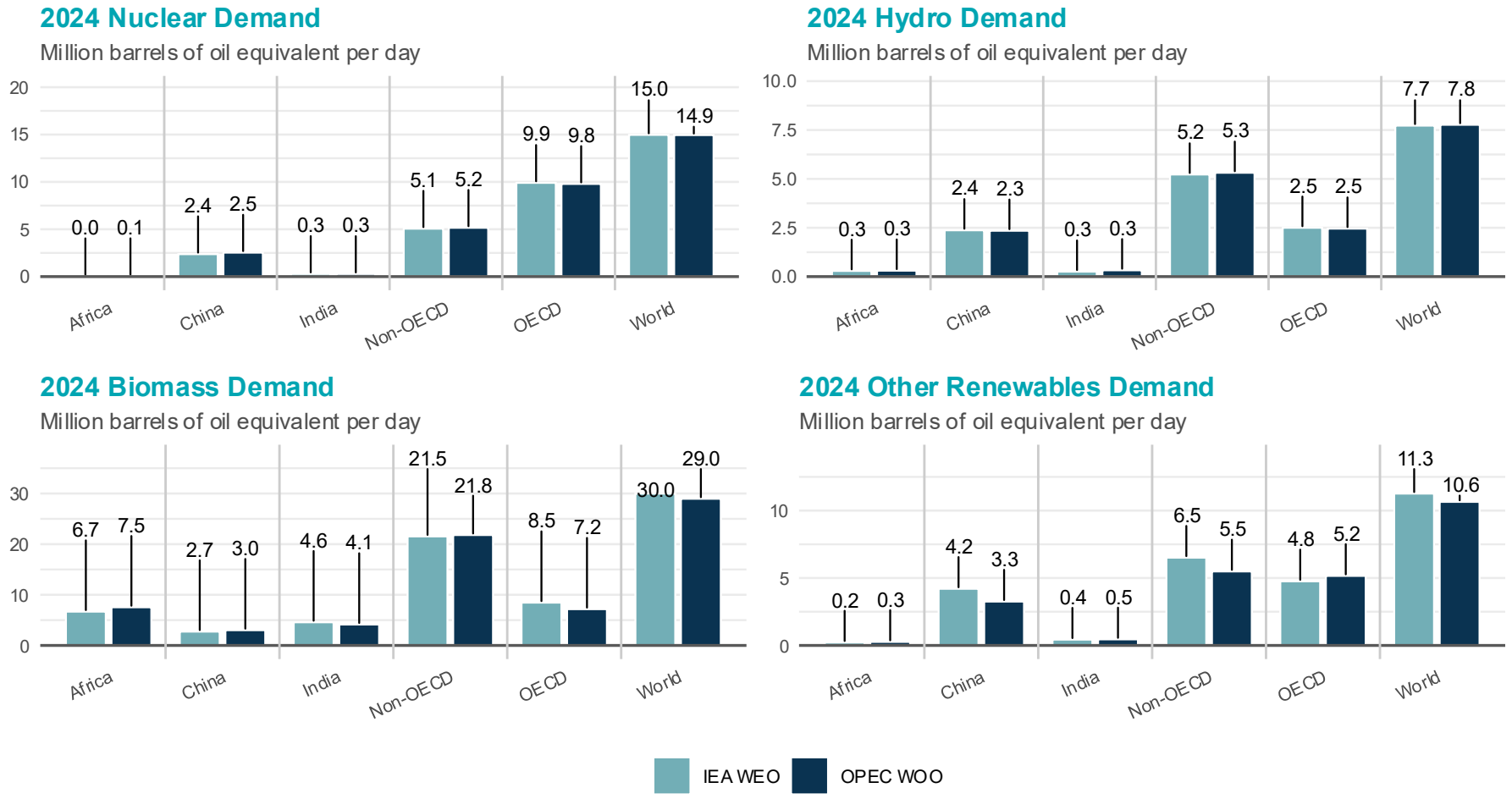
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Coal consumption in non-OECD regions is more than sixfold higher than in the OECD



Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

China shows the highest demand for other renewable sources in 2024



Source: IEF, IEA 2025, and OPEC WOO 2025. Notes: Other renewables includes wind, solar, geothermal, and modern bioenergy.

Outlooks to 2035
(IEA and OPEC)

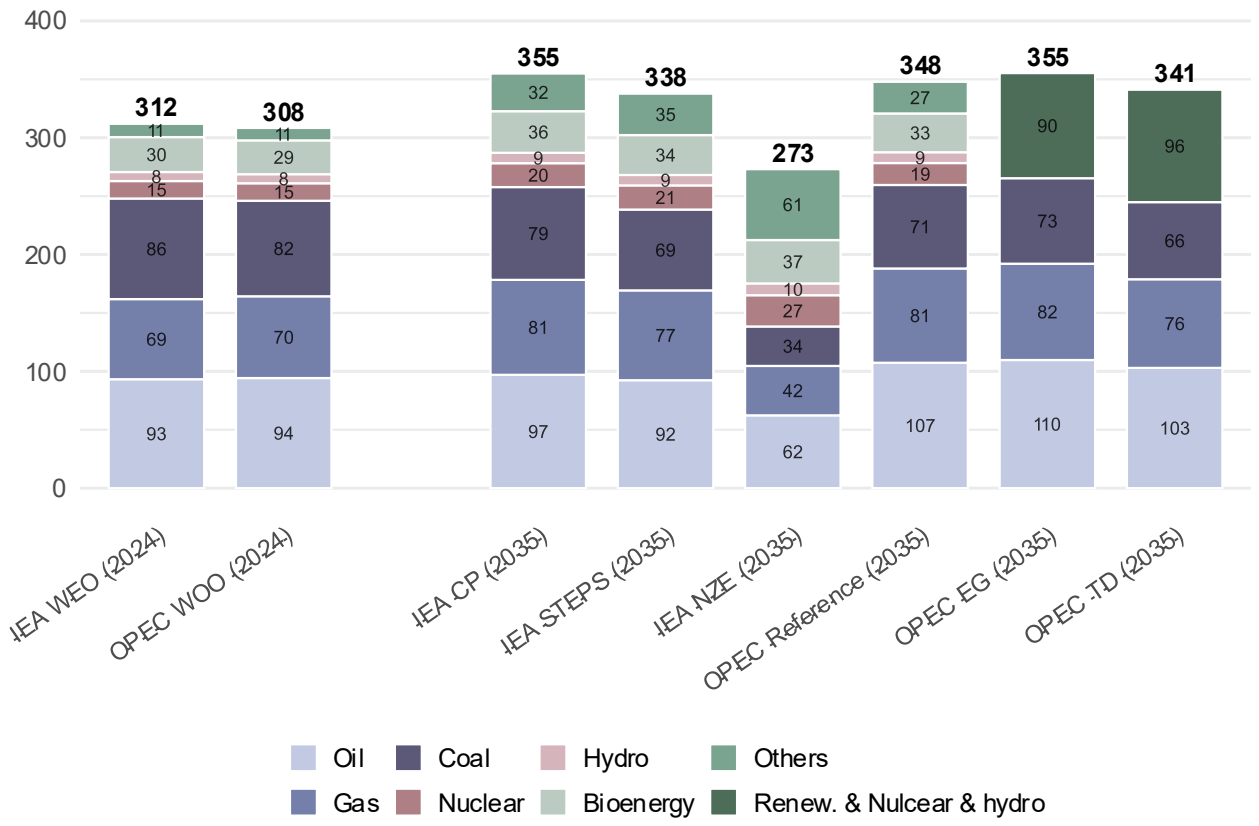
IEA and OPEC Scenario Descriptions and Assumptions

IEA WEO 2025 Scenarios	OPEC WOO 2025 Scenarios
Current Policies Scenario (CP): represents a counterfactual baseline in which the evolution of the global energy system and associated emissions is determined solely by energy and climate policies that are already enacted and legally binding at the time of assessment, without assuming the strengthening, acceleration, or full realization of announced targets or future policy commitments.	**Reference Case:** This scenario assumes the continued implementation of announced and enacted energy policies, to the extent that they are technically feasible and financially viable. In this scenario, all primary fuel types, except for coal, are expected to increase over the outlook period.
Stated Policies Scenario (STEPS): "This scenario provides a sense of the prevailing direction of travel for the energy sector based on a detailed reading of the latest policy settings in countries around the world."	**Technology-Driven Mitigation Scenario (TD):** This scenario presents an alternative approach to the prevalent emissions reduction narrative, which aims to limit the global temperature rise to well below 2°C. The scenario focuses on greater deployment of CCUS, hydrogen, and increased adoption of the Circular Carbon Economy (CCE).
Net Zero Emissions by 2050 (NZE): "This scenario portrays a pathway for the global energy sector to achieve net zero CO_2 emissions by 2050 which is consistent with limiting long-term global warming to 1.5 °C with limited overshoot (with a 50% probability)."	**Equitable Growth Scenario (EG):** This scenario outlines a strategic framework aimed at fostering a fairer and more prosperous economic landscape for developing countries. It emphasizes a tailored approach to achieving emission reduction goals, considering the unique circumstances and timelines of each nation. Consequently, this framework anticipates an increase in overall energy consumption, with a specific rise in oil demand.

Global primary energy demand expands across most pathways

World Primary Energy Demand Outlook to 2035

Million barrels of oil equivalent per day



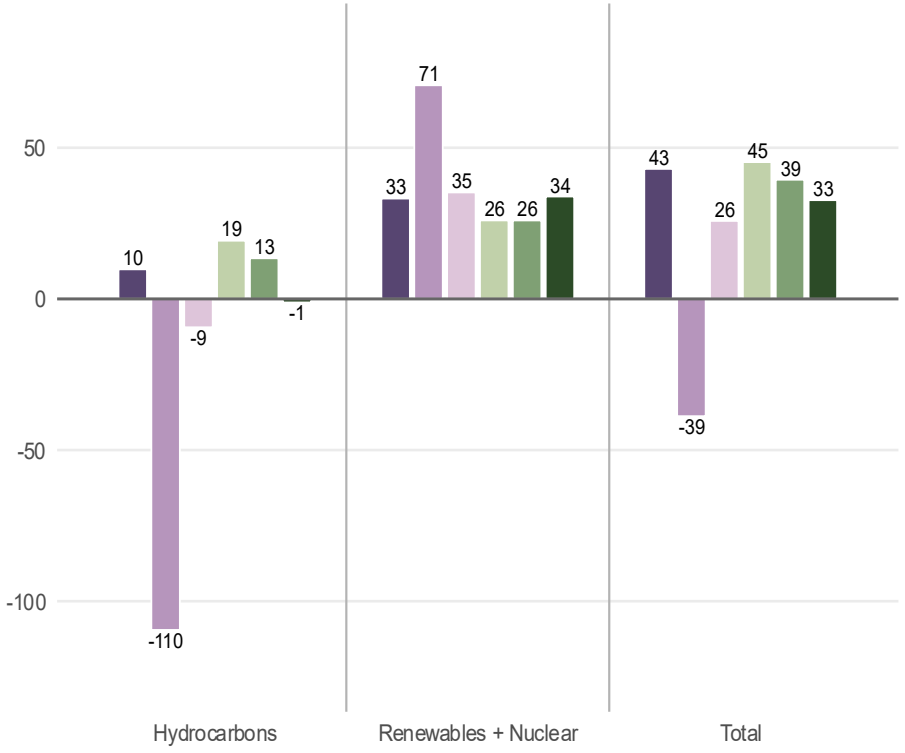
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

- Global primary energy demand continues to grow in most scenarios, rising from around 310 mboe/d in 2024 to roughly 338–355 mboe/d by 2035.
- Across all scenarios, the increase in total primary energy demand is driven primarily by renewables, nuclear, and bioenergy, while coal declines and oil and gas growth moderates.

Renewables and nuclear together increase by around 60% on average by 2035 across all scenarios

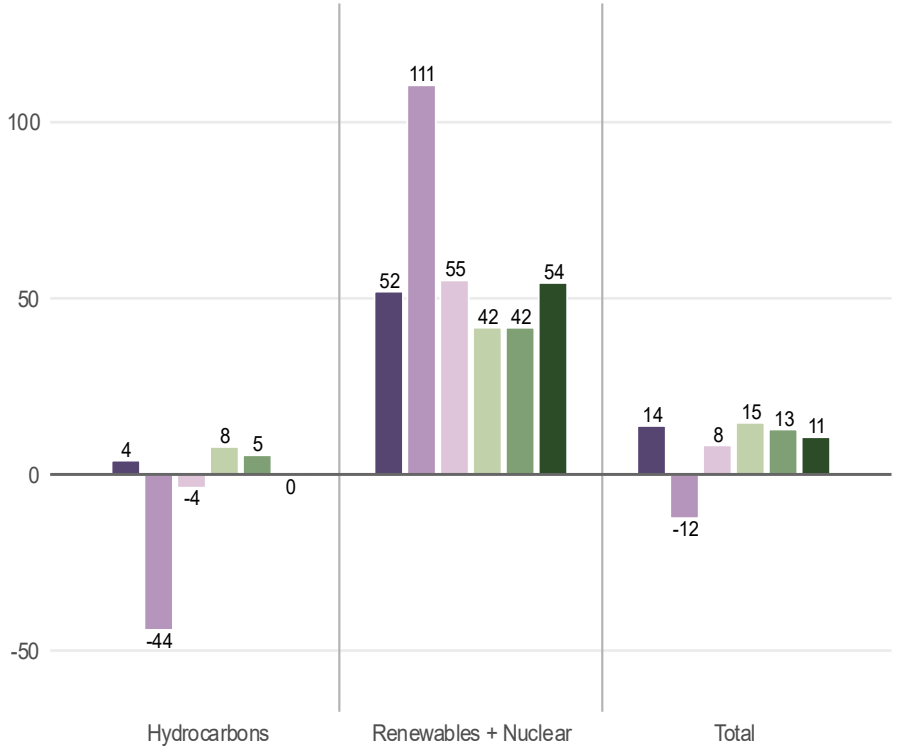
Change in World Primary Energy Demand by Source: 2035 vs 2024

Million barrels of oil equivalent per day



World Primary Energy Demand 2035 vs 2024

% change by energy source



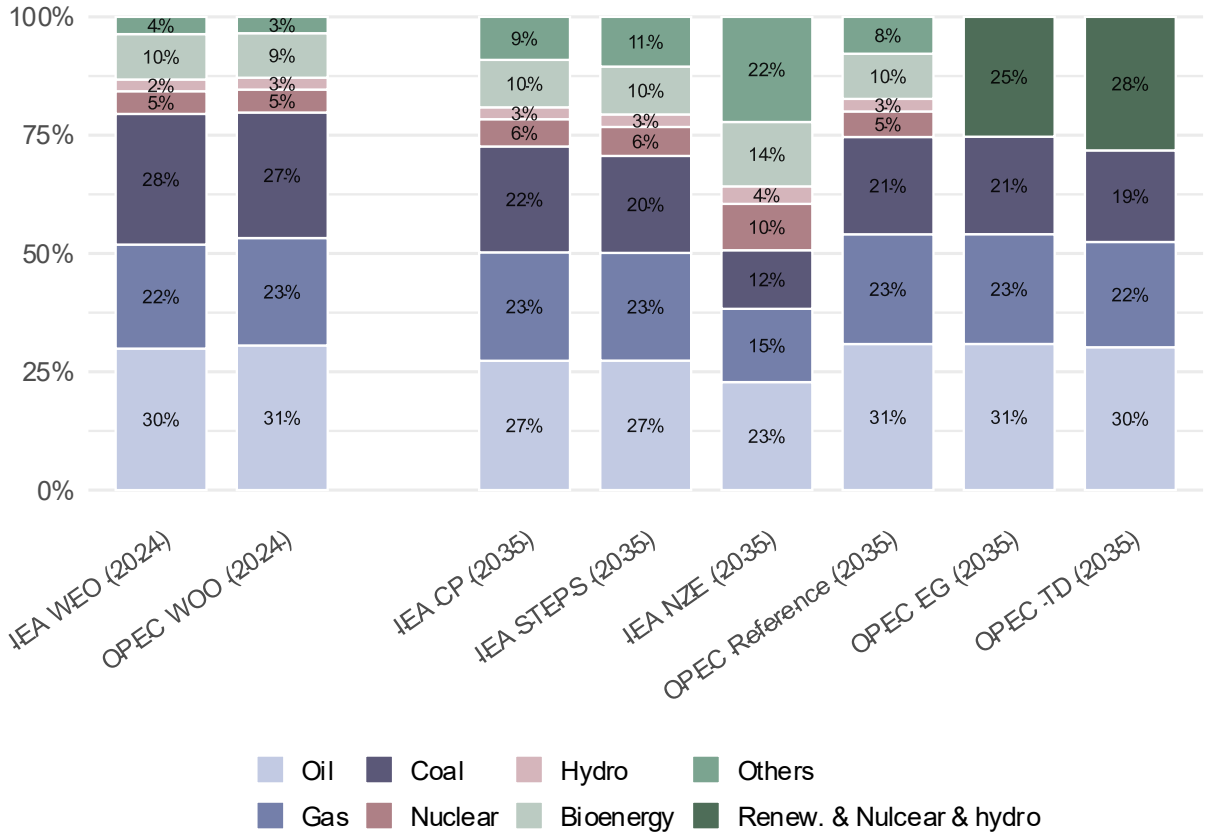
IEA CP IEA NZE IEA STEP OPEC EG OPEC Reference OPEC TD

Sources: Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: 'Renewables + Nuclear' includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios . OPEC's EG and TD only report the aggregate and not components for renewables and nuclear .

The global primary energy mix shifts gradually towards 2035, with hydrocarbons remaining dominant across most scenarios

World Primary Energy Demand Fuel Share Outlook to 2035

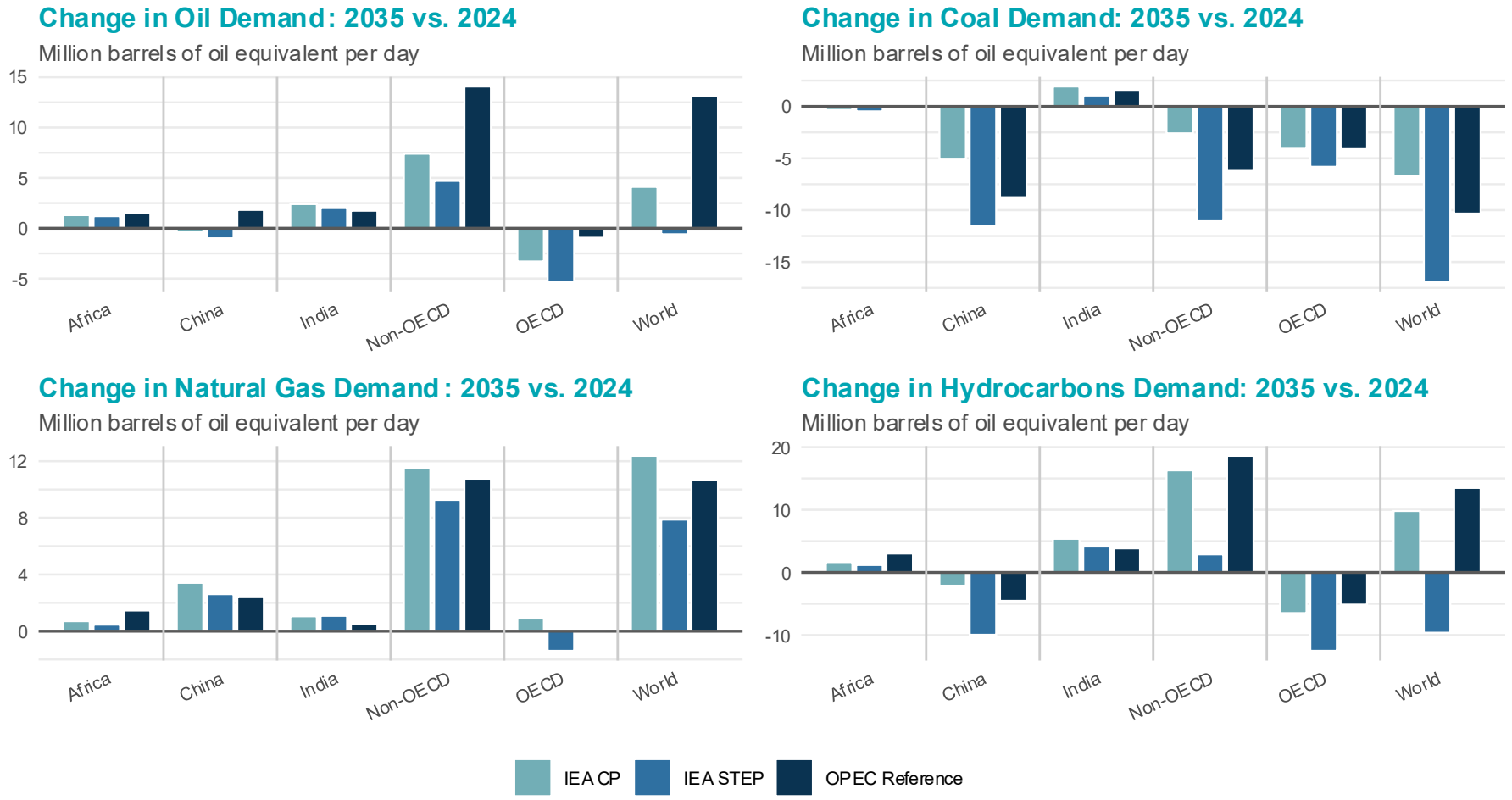
Percentage of total primary energy demand



Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

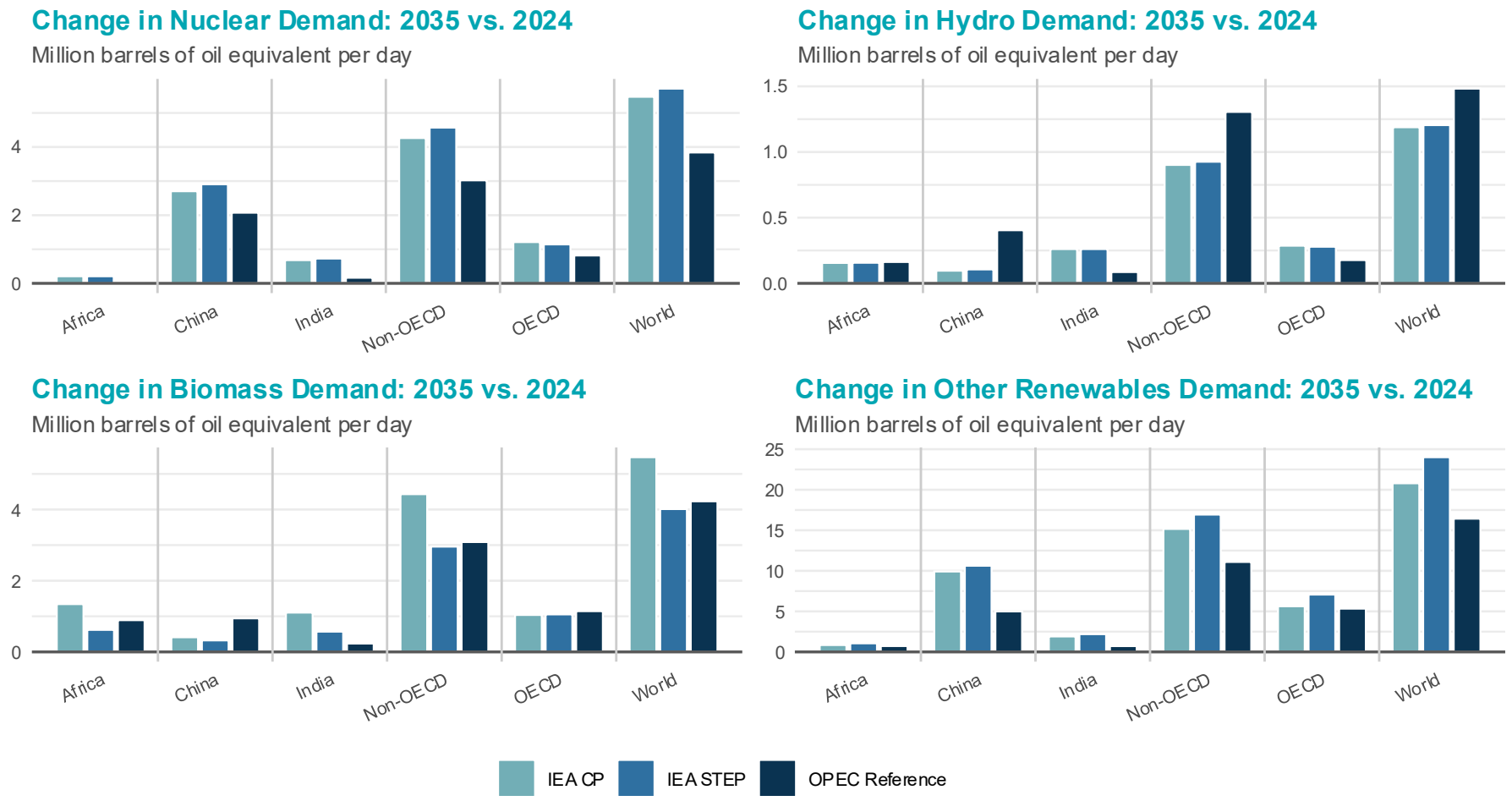
- Excluding the IEA's NZE scenario, hydrocarbons account for more than 70% of total primary energy demand in 2035 across all other outlooks, with the highest shares in OPEC's Equitable Growth scenario.
- Oil and gas together account for more than half of total primary energy demand across most scenarios.
- Other renewables, including wind and solar, increase by at least threefold over the next decade.

Global natural gas demand rises by around 11–17% by 2035 relative to 2024 consumption



Source: IEF, IEA 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Growth in wind and solar demand accelerates faster than that of all other renewable sources by 2035



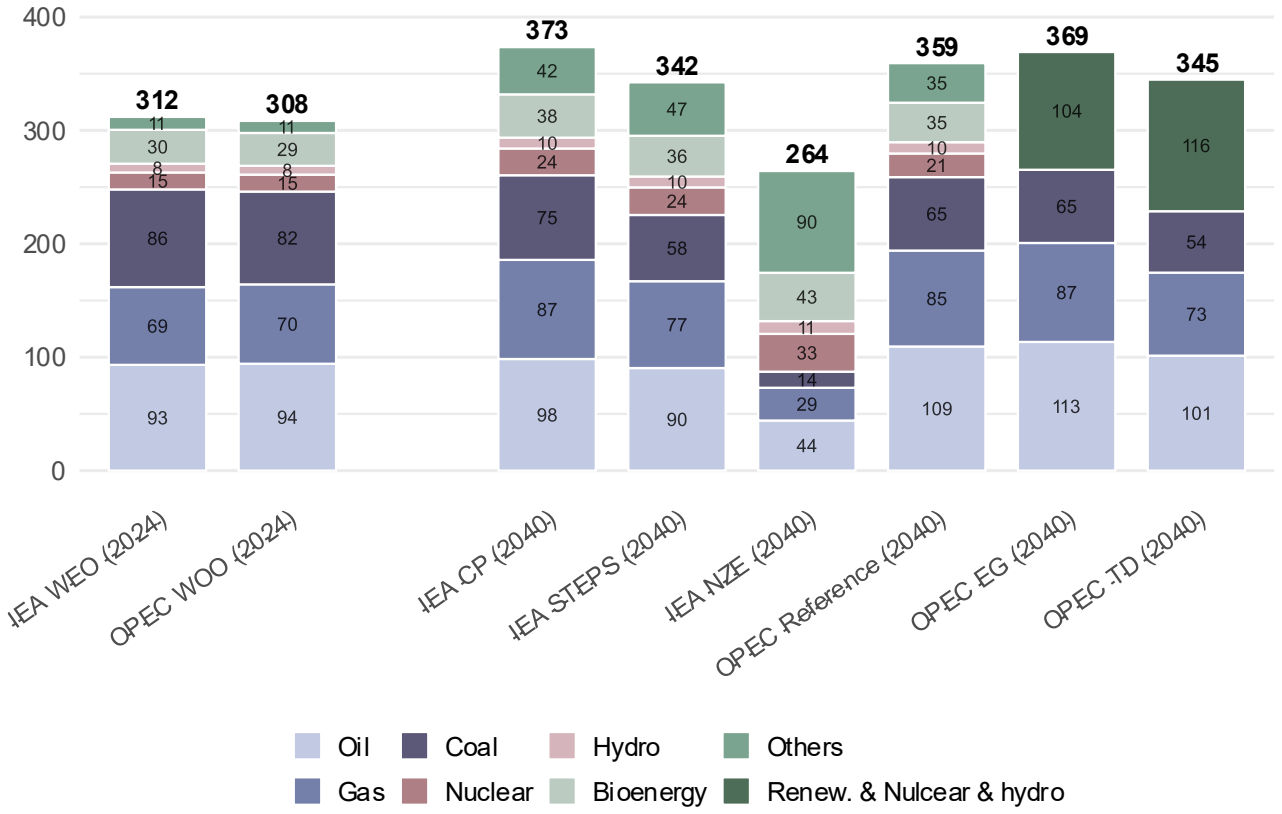
Source: IEF, IEA 2025, and OPEC WOO 2025. Notes: Other renewables includes wind, solar, geothermal, and modern bioenergy.

Outlooks to 2040
(IEA and OPEC)

Global primary energy demand continues to expand to 2040 across all outlooks except IEA's Net Zero Emissions scenario

World Primary Energy Demand Outlook to 2040

Million barrels of oil equivalent per day



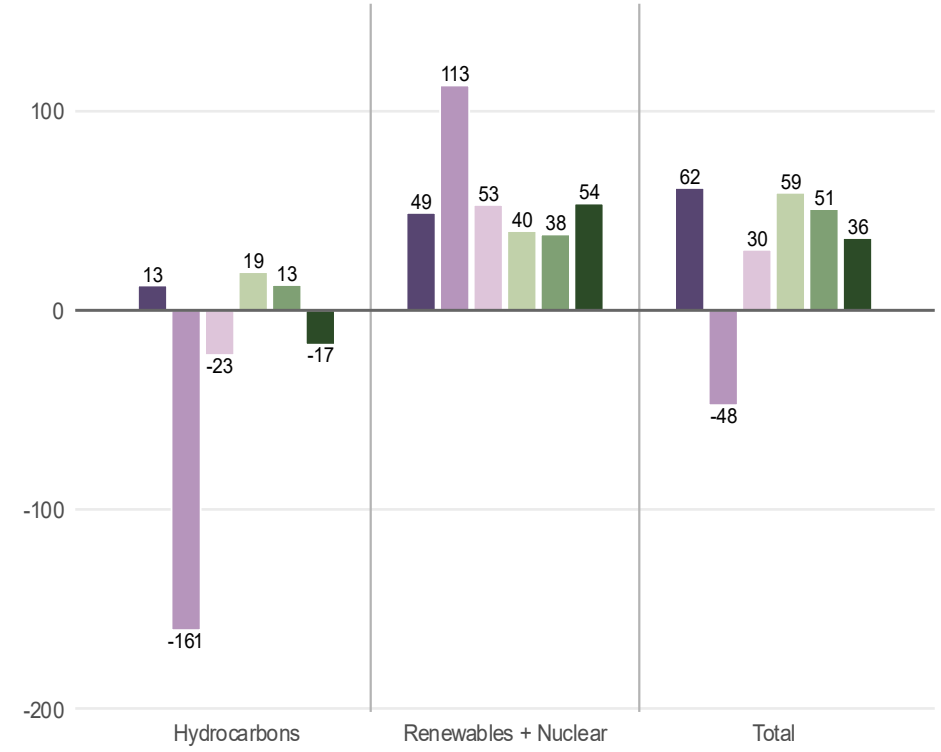
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

- Uncertainty in the global primary energy outlook is wide, with some scenarios projecting sustained annual growth of around 1%, while others imply a persistent contraction of roughly 1% per year, highlighting the sharply divergent pathways that the world's energy system could follow.
- IEA and OPEC Scenarios differ primarily on policy setup, not technology. Both envision similar energy mix transitions but differ on demand assumptions.
- Under the IEA Current Policies Scenario, total primary energy demand rises from about 312 mboe/d in 2024 to roughly 373 mboe/d by 2040.

Combined renewables and nuclear primary energy demand rises by around 60–177% by 2040 across scenarios

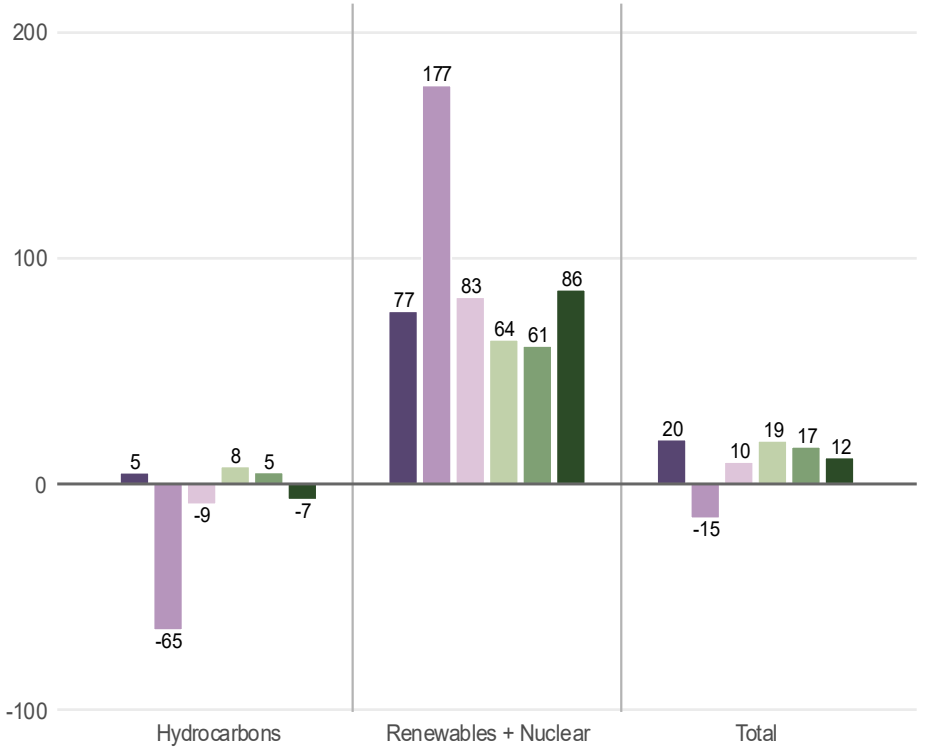
Change in World Primary Energy Demand by Source: 2040 vs 2024

Million barrels of oil equivalent per day



World Primary Energy Demand 2040 vs 2024

% change by energy source



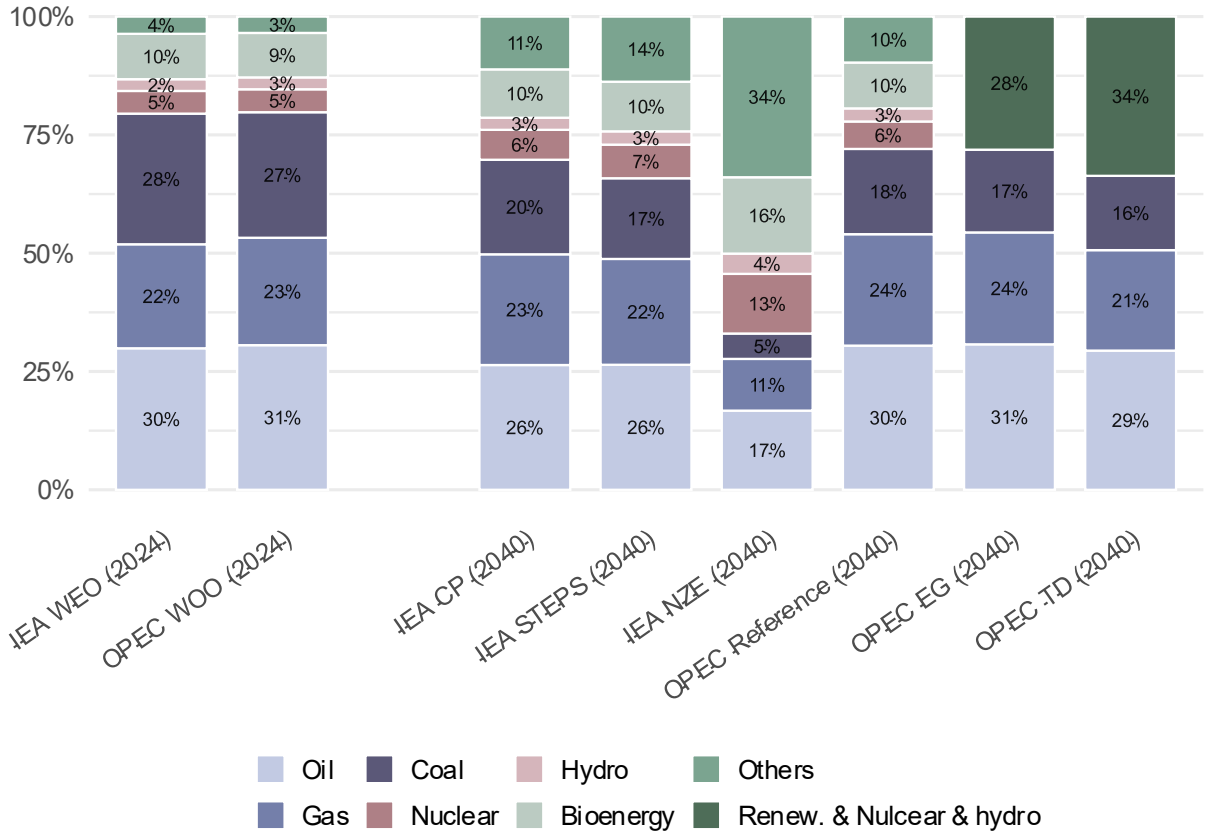
IEA CP | IEA NZE | IEA STEP | OPEC EG | OPEC Reference | OPEC TD

Sources: Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: 'Renewables + Nuclear' includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios . OPEC's EG and TD only report the aggregate and not components for renewables and nuclear .

Low-Carbon energy gains share as the global fuel mix transforms by 2040

World Primary Energy Demand Fuel Share Outlook to 2040

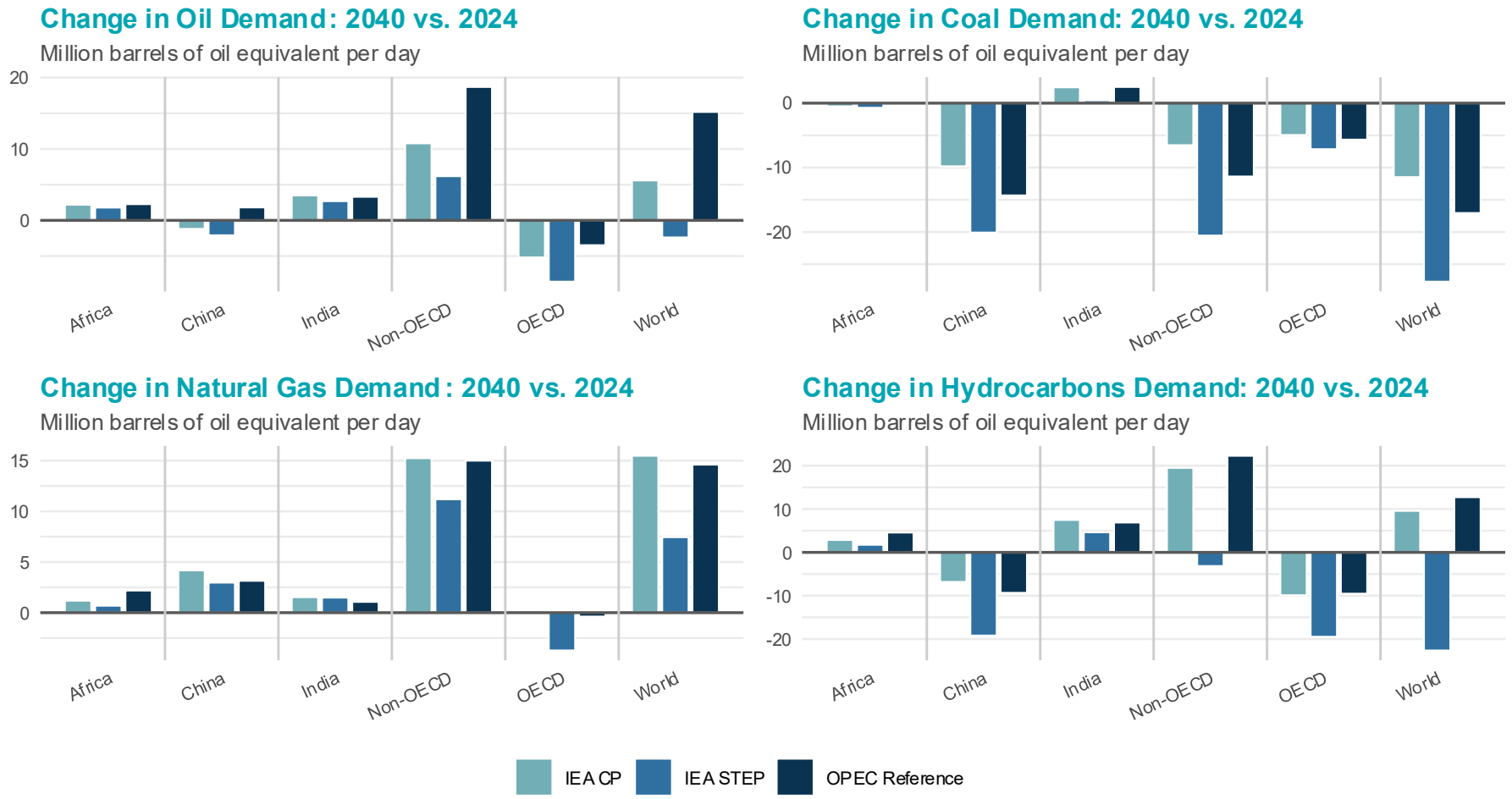
Percentage of total primary energy demand



- Coal falls consistently across all scenario from ~27% in 2024 to 5% in IEA NZE or 18% in OPEC Reference scenario.
- Even in IEA's NZE scenario, oil still comprises 17% of primary energy demand in 2040.

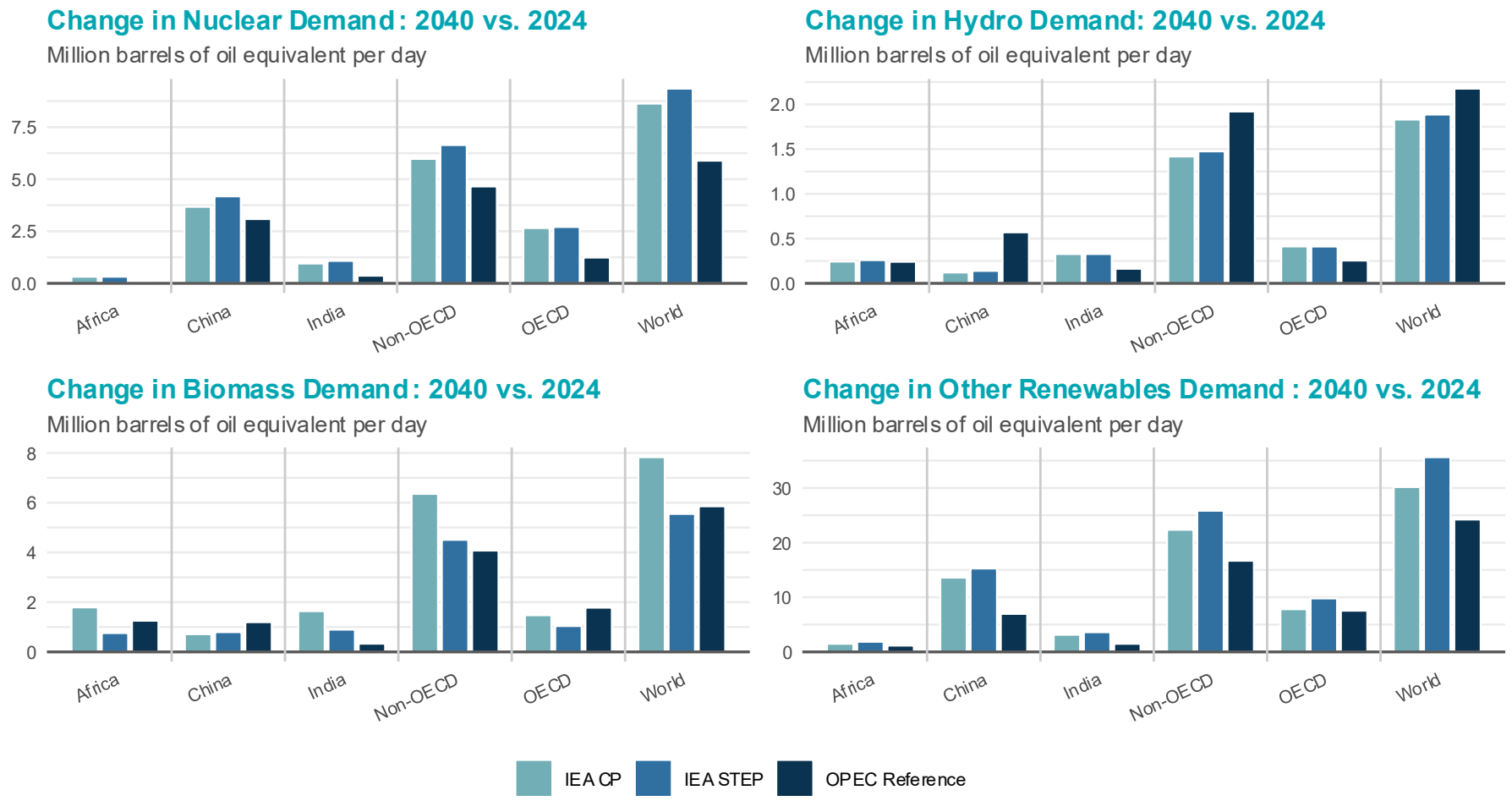
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

A decline in coal demand is shown in the IEA's Current and Stated Policies outlooks as well as in OPEC's Reference scenario, by 2040



Source: IEF, IEA 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Renewable energy expands substantially between 2024 and 2040 in the IEA's CP and STEP outlooks, as well as in OPEC's Reference case

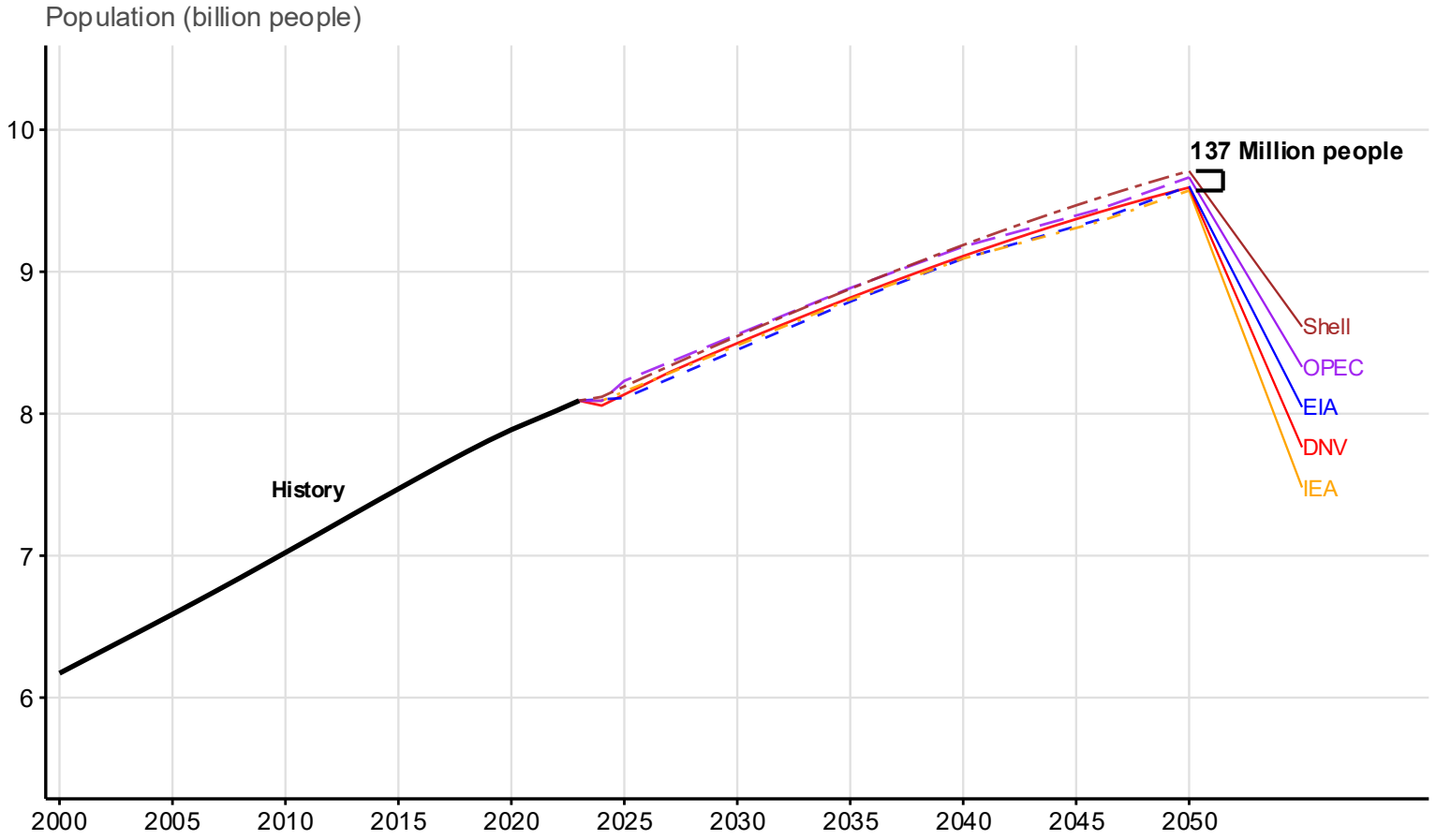


Source: IEF, IEA 2025, and OPEC WOO 2025. Notes: Other renewables includes wind, solar, geothermal, and modern bioenergy.

Outlooks to 2050
(IEA and OPEC)

Population serves as a key input to energy projections, with differences in population growth estimates exceeding 130 million by 2050

Global Population Projections to 2050, by Source

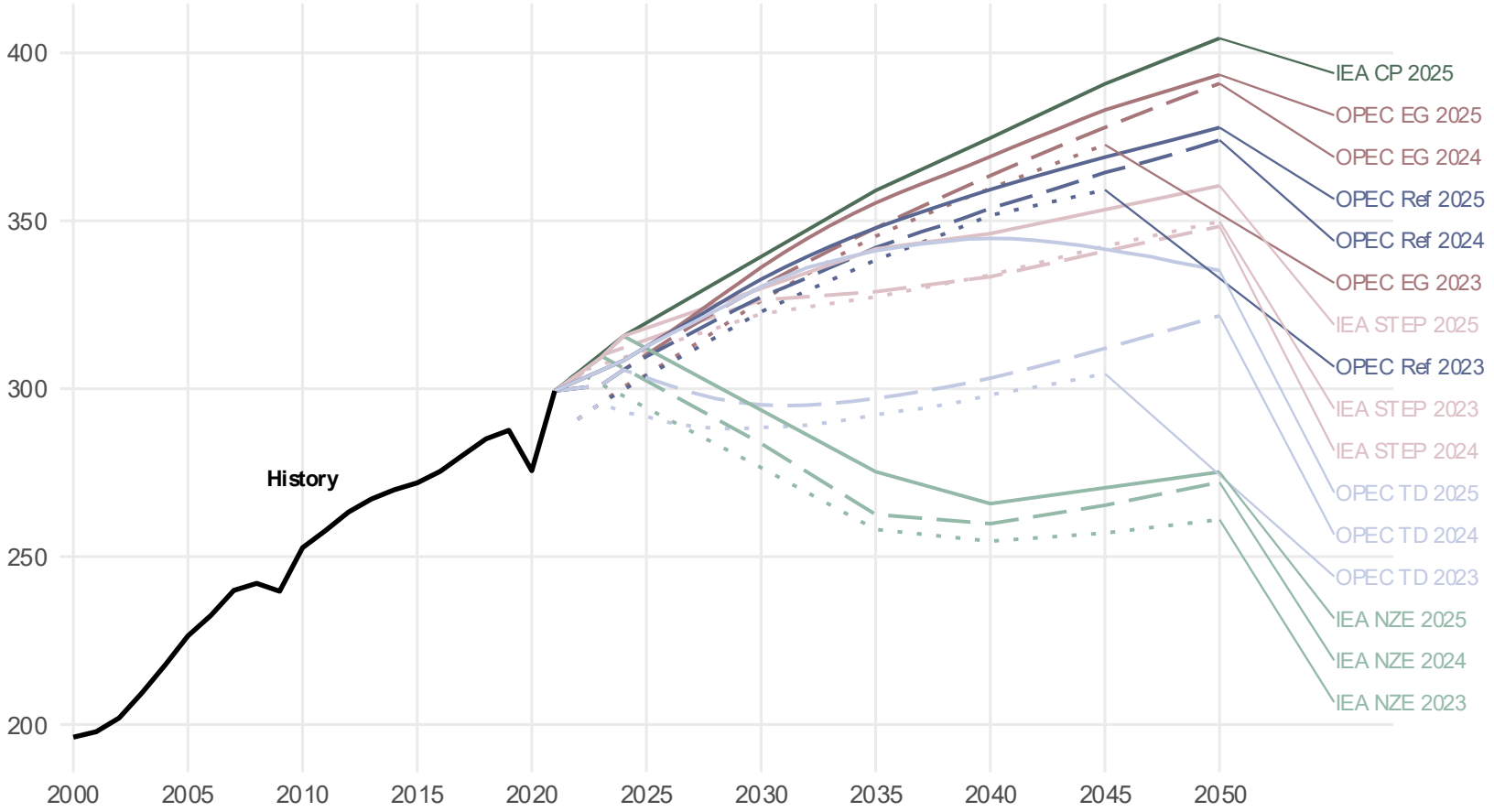


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, DNV's Energy Transition Outlook 2025, EIA IEO 2023 and Shell Energy Security Scenarios 2025.

Agencies continue to revise their projections of global primary energy demand upward relative to previous editions

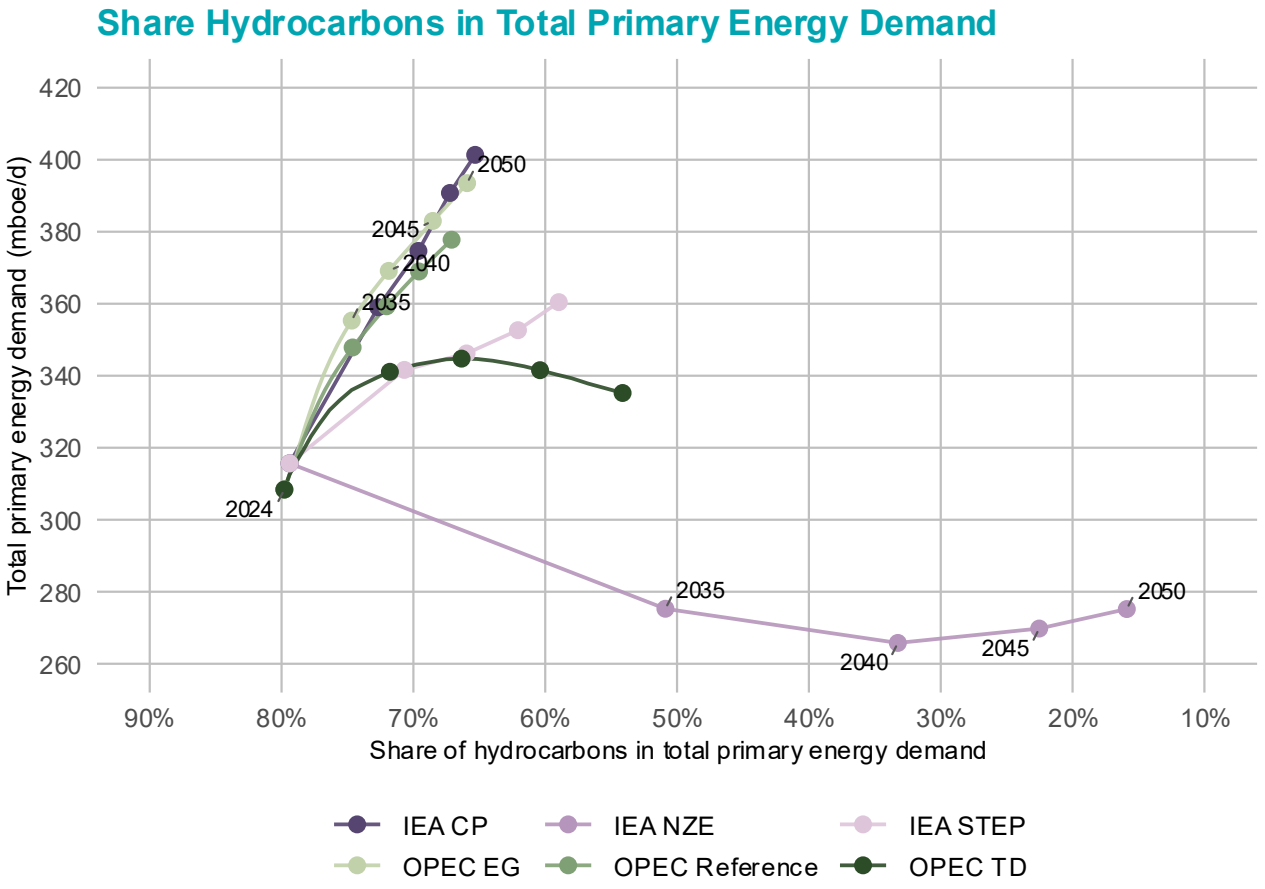
Total Primary Energy Demand by Scenario Vintage

Million barrels of oil equivalent per day



Source: IEF, IEA WEO 2025, and OPEC WOO 2025.

Hydrocarbons remain dominant in global primary energy demand across most outlooks to 2050



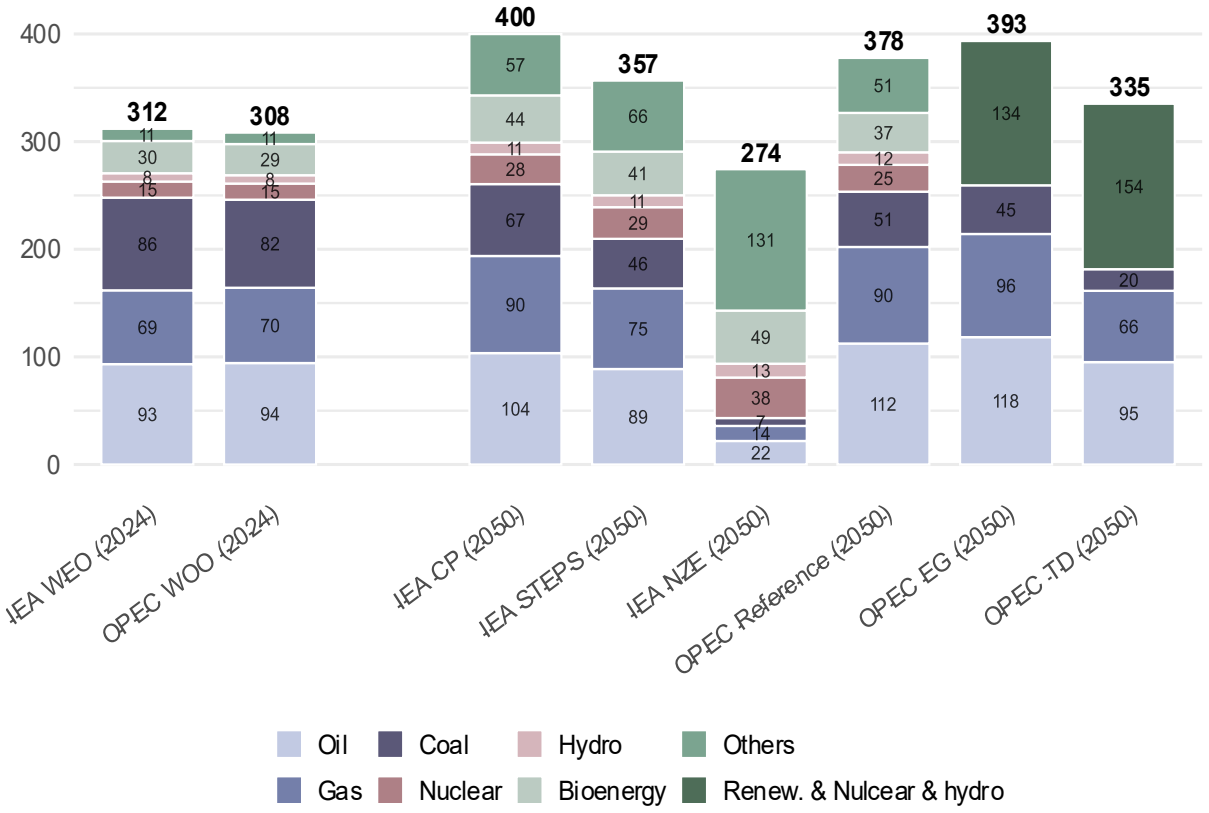
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

- Total energy demand grows even as hydrocarbon shares fall. Outside the Net Zero case, total primary energy demand rises to around 350–400 mboe/d by 2050, meaning that a declining hydrocarbon share does not necessarily translate into falling hydrocarbon volumes.
- Only the IEA Net Zero pathway shows a structural break, with the share of hydrocarbons falling below 20% by 2050 and total primary energy demand declining in absolute terms, in contrast to continued growth in all other scenarios.

Under the Reference and Evolving Policies scenarios, oil and gas demand continues to rise through to 2050

World Primary Energy Demand Outlook to 2050

Million barrels of oil equivalent per day



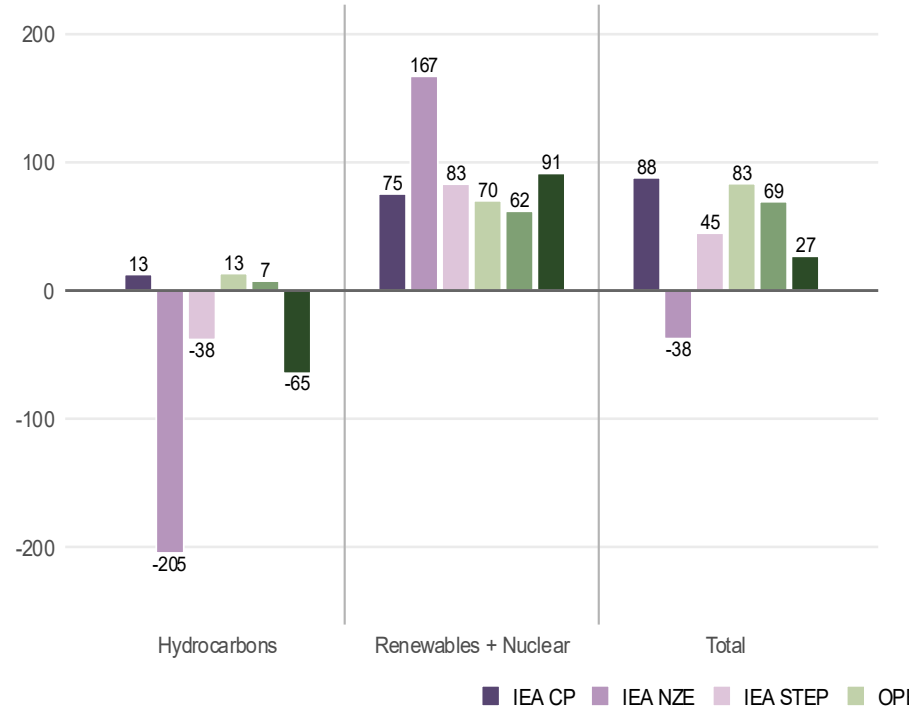
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

- Across most scenarios, global primary energy demand rises by around 8–30% by 2050 relative to 2024 levels.
- In most pathways, absolute oil and gas demand continues to increase over the next two decades.
- Under Ambitious scenarios, coal demand declines by more than 80% by mid-century.
- Wind and solar demand, within the broader category of other renewables, increases more than fivefold by 2050 in reference scenarios.

The IEA's Net Zero pathway shows renewable growth that is nearly twice as rapid as in the other scenarios

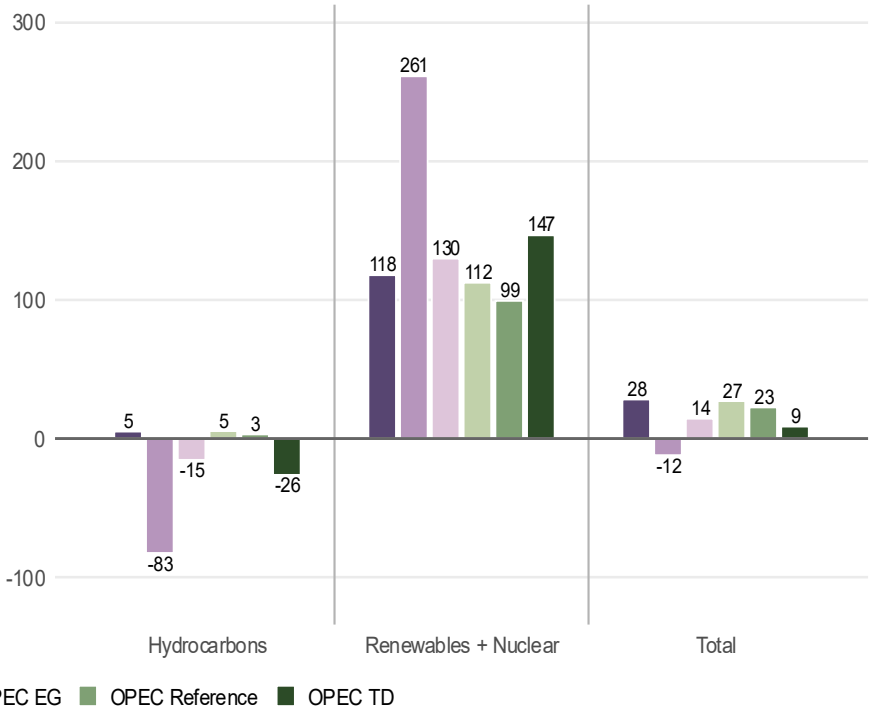
Change in World Primary Energy Demand by Source: 2050 vs 2024

Million barrels of oil equivalent per day



World Primary Energy Demand 2050 vs 2024

% change by energy source



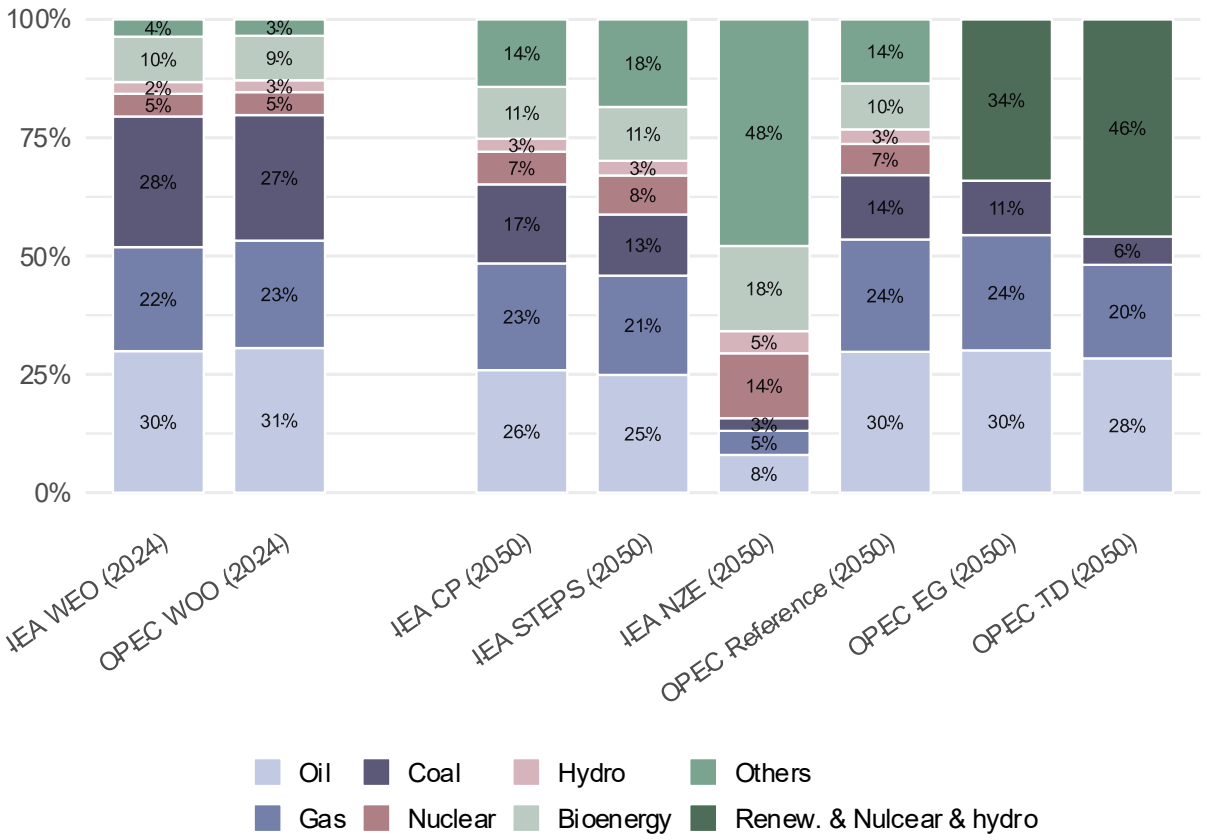
IEA CP IEA NZE IEA STEP OPEC EG OPEC Reference OPEC TD

Sources: Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: 'Renewables + Nuclear' includes nuclear, hydro, biomass, and other renewables. Renewables are grouped with nuclear to be able to compare all scenarios OPEC's EG and TD only report the aggregate and not components for renewables and nuclear .

Total renewables penetration in primary energy demand reaches, on average, more than 40% by 2050

World Primary Energy Demand Fuel Share Outlook to 2050

Percentage of total primary energy demand



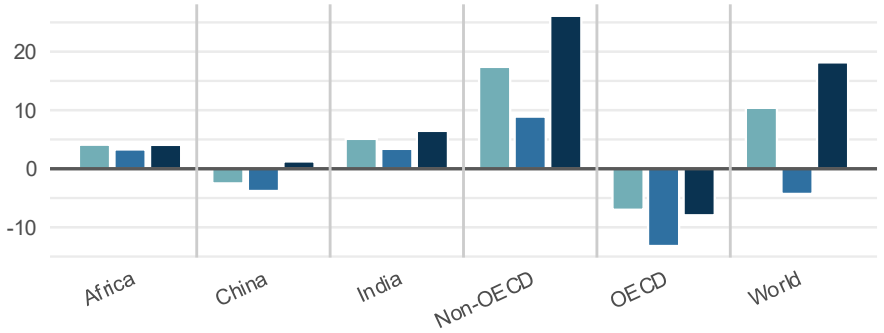
Source: IEF, IEA WEO 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

- Reference and Evolving Policies scenarios maintain hydrocarbons at well above half of total primary energy demand by mid-century.
- Natural gas and oil broadly retain their current shares through 2050 across most scenarios, except for the IEA's Net Zero pathway.
- The combined share of other renewables, led by wind and solar, rises from around 3% in 2024 to more than 20% on average by 2050.

Coal demand declines across the IEA's Current Policies and Stated Policies outlooks, as well as in OPEC's Reference case

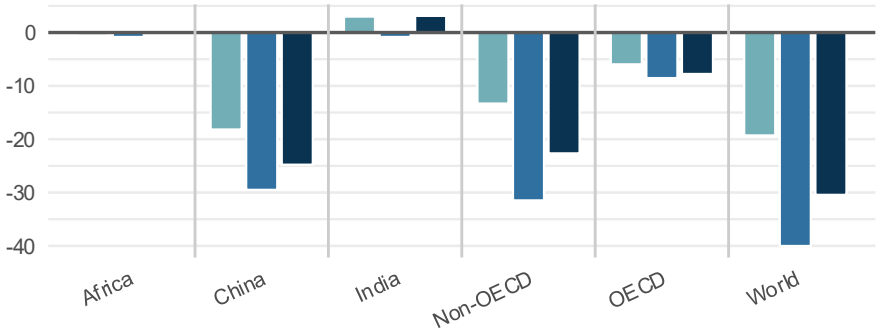
Change in Oil Demand: 2050 vs. 2024

Million barrels of oil equivalent per day



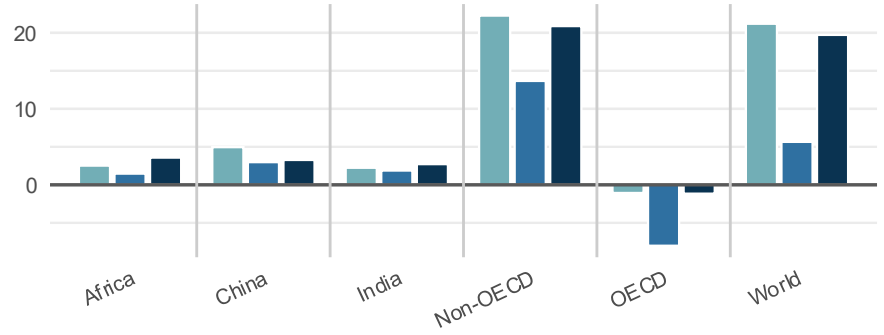
Change in Coal Demand: 2050 vs. 2024

Million barrels of oil equivalent per day



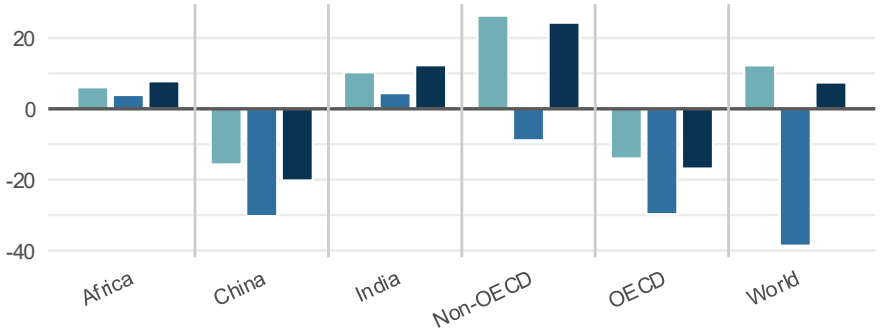
Change in Natural Gas Demand: 2050 vs. 2024

Million barrels of oil equivalent per day



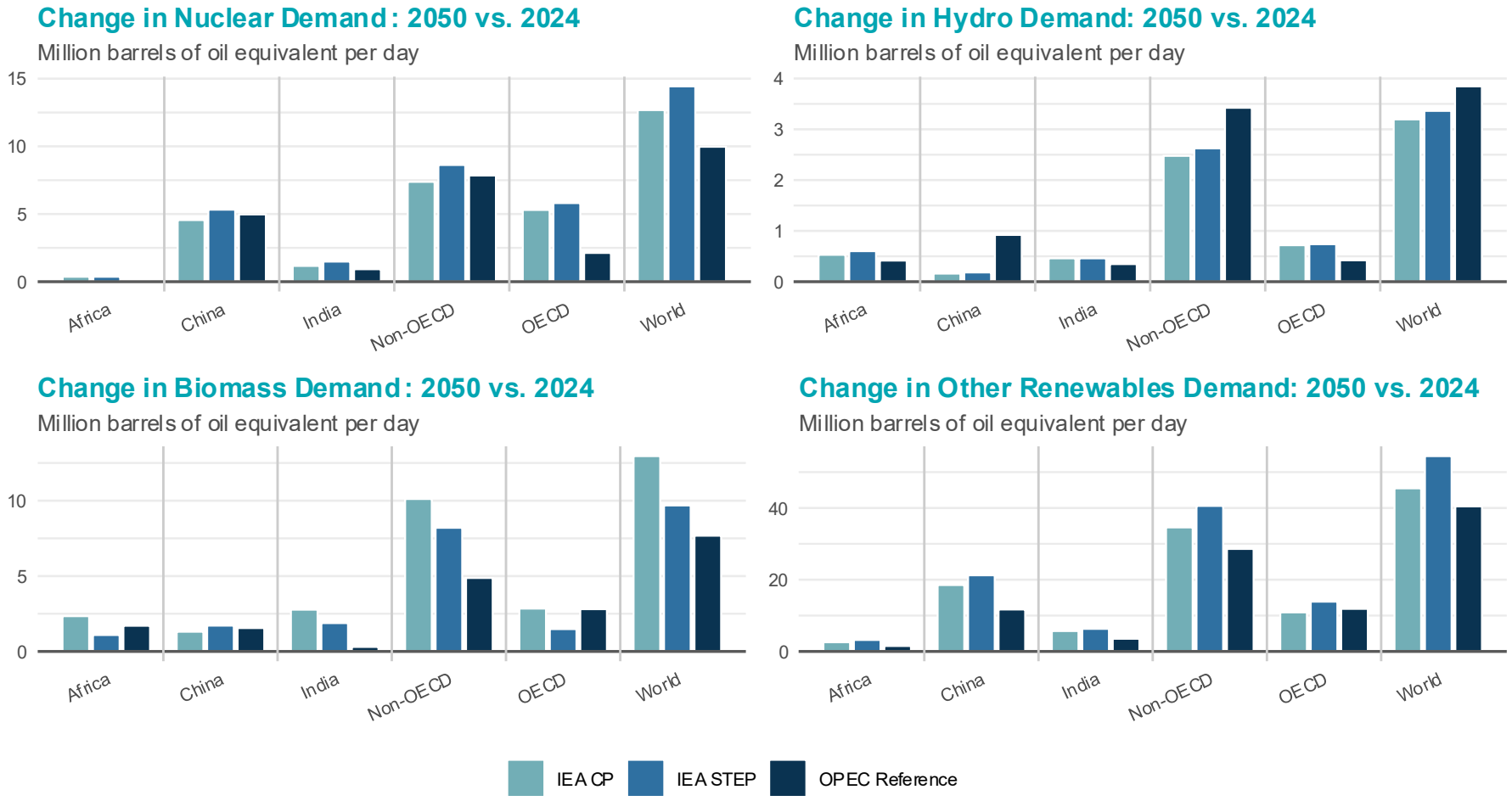
Change in Hydrocarbons Demand: 2050 vs. 2024

Million barrels of oil equivalent per day



Source: IEF, IEA 2025, and OPEC WOO 2025. Note: Oil excludes biofuels, coal-to-liquids, and gas-to-liquids (see appendix for more information).

Wind and solar demand, within the broader category of other renewables, is projected to increase five- to sixfold by mid-century relative to 2024 levels



Source: IEF, IEA 2025, and OPEC WOO 2025. Notes: Other renewables includes wind, solar, geothermal, and modern bioenergy.

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

Additional Scenario Descriptions and Assumptions

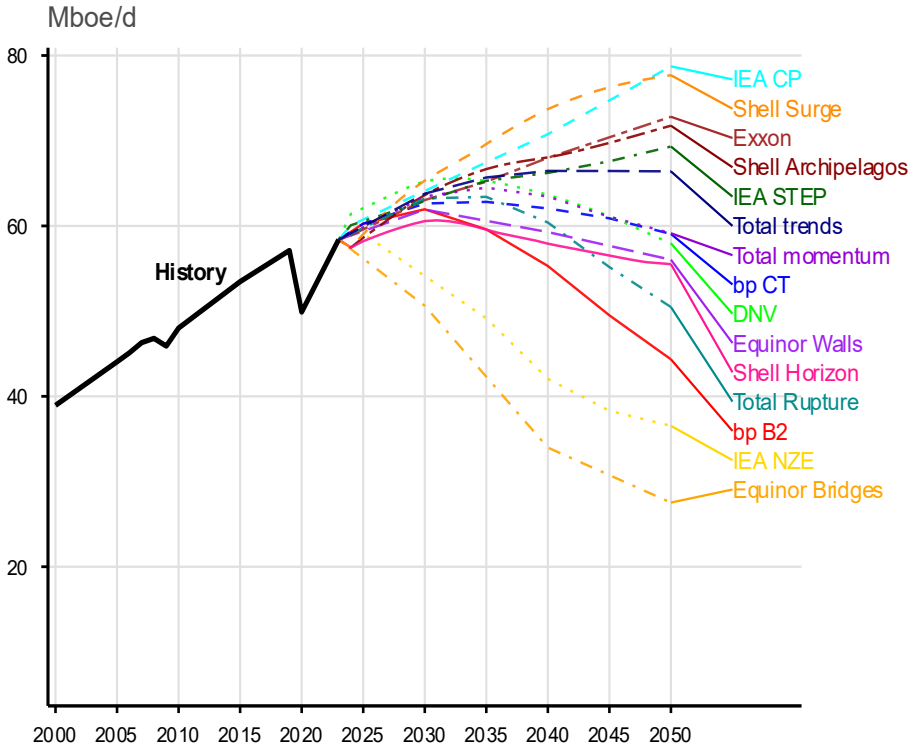
Total	Trends**	The Trends scenario projects a global temperature increase of 2.6-2.7°C by 2100, incorporating current technological and policy trajectories.
	Momentum**	Integrates decarbonization strategies of NZ50 countries and others' NDCs.
	Rupture*	Aims to limit global temperature rise through aggressive global decarbonization efforts.
BP	Current Trajectory **	In this scenario, greenhouse gas emissions, measured in carbon dioxide equivalents, reach their highest point in the mid-2020s and subsequently decrease to approximately 75% of 2022 levels by 2050.
	Net Zero*	The Net Zero scenario envisions a substantial strengthening of environmental regulations.
IPCC AR6 WGIII	ModAct**	NDCs are implemented. Current trajectory leads to >2°C warming.
	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.
Equinor	Walls**	Current trends in the market, technology, and policies show that the energy transition is accelerating slowly but is not reaching climate goals.
	Bridges*	Broadly consistent with IPCC 1.5°C.
ExxonMobil	Reference **	Current trends in market, technology and policies.
DNV	Reference **	Current trends in market, technology and policies.
GECF	Reference (RCS)**	Projects the most likely path for global energy and gas markets through 2050, based on current trends and assuming continuation of present economic and demographic patterns.
	Sustainable Energy Scenario (SES)**	Emphasizes natural gas's potential to address energy poverty, promote economic growth, and contribute to environmental protection through decarbonization, highlighting its role as an affordable, reliable, and cleaner energy source.
IEEJ	Reference**	Mirrors historical patterns in technological advancements and existing energy strategies, without implementing bold initiatives for carbon reduction measures.
	Advanced Technology (ATS)*	Energy and environmental technologies are feasible and fully implemented.
EIA	Reference **	Reflects current energy trends and existing laws and regulations. Assumes global GDP growth averages 2.6% from 2022-2050.
	High and Low Economic Growth**	The High Economic case assumes global GDP growth for 2022-2050 averages 3.4% while the low case assumes 1.8%.
	Oil Price Cases (High & Low)**	Explore how sustained deviations in international crude oil prices from the Reference trajectory, either higher or lower, alter global energy demand, fuel substitution patterns, and production incentives.
	Zero-Carbon Technology Cost Cases (High & Low) **	Examine how alternative assumptions on the future capital costs of low- and zero-carbon power technologies influence their deployment rates, the competitiveness of fossil fuels, and the pace of decarbonisation in the global energy system.
IRENA	Planned**	Reference case based on planned targets and government policies.
	1.5-S*	Describes an energy transition pathway aligned with a 1.5C climate goal. It prioritizes readily available technology solutions that can be scaled up.
Shell	Surge**	A high-growth, technology-driven world in which rapid innovation and AI deployment boost productivity and energy demand.
	Archipelagos **	A fragmented, geopolitically divided world prioritizing energy security and national resilience.
	Horizon*	A cooperative, policy-driven pathway consistent with achieving net-zero emissions by mid-century through rapid decarbonization and system transformation.

Note: *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 28.

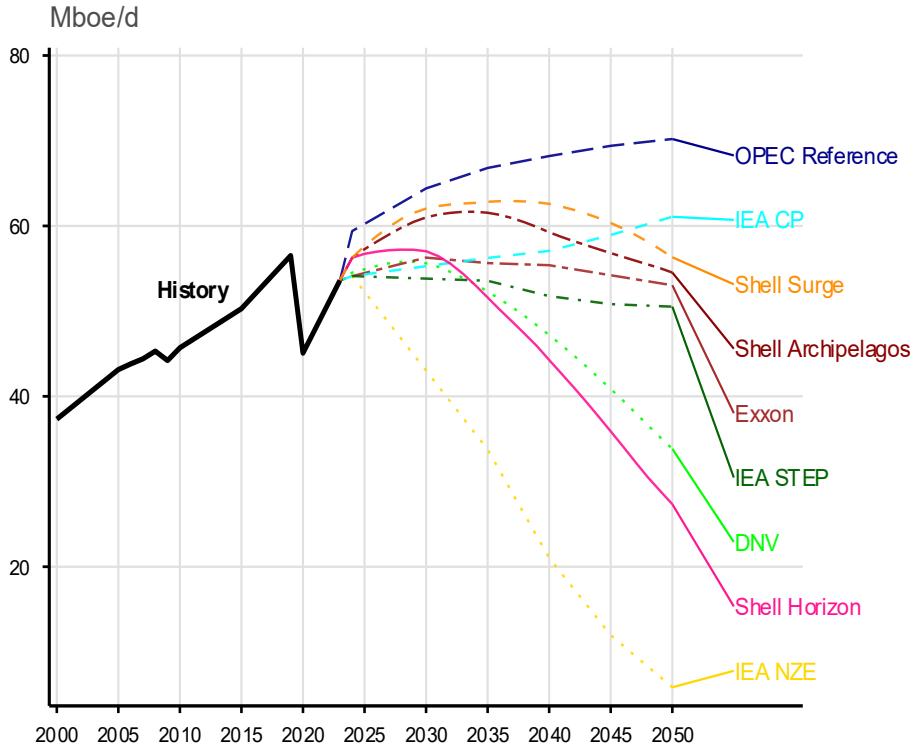
Sector Spotlight
Transport

The transport sector continues to account for a large share of global energy demand and more than half of total oil consumption through 2050

Global Energy Demand in the Transportation Sector



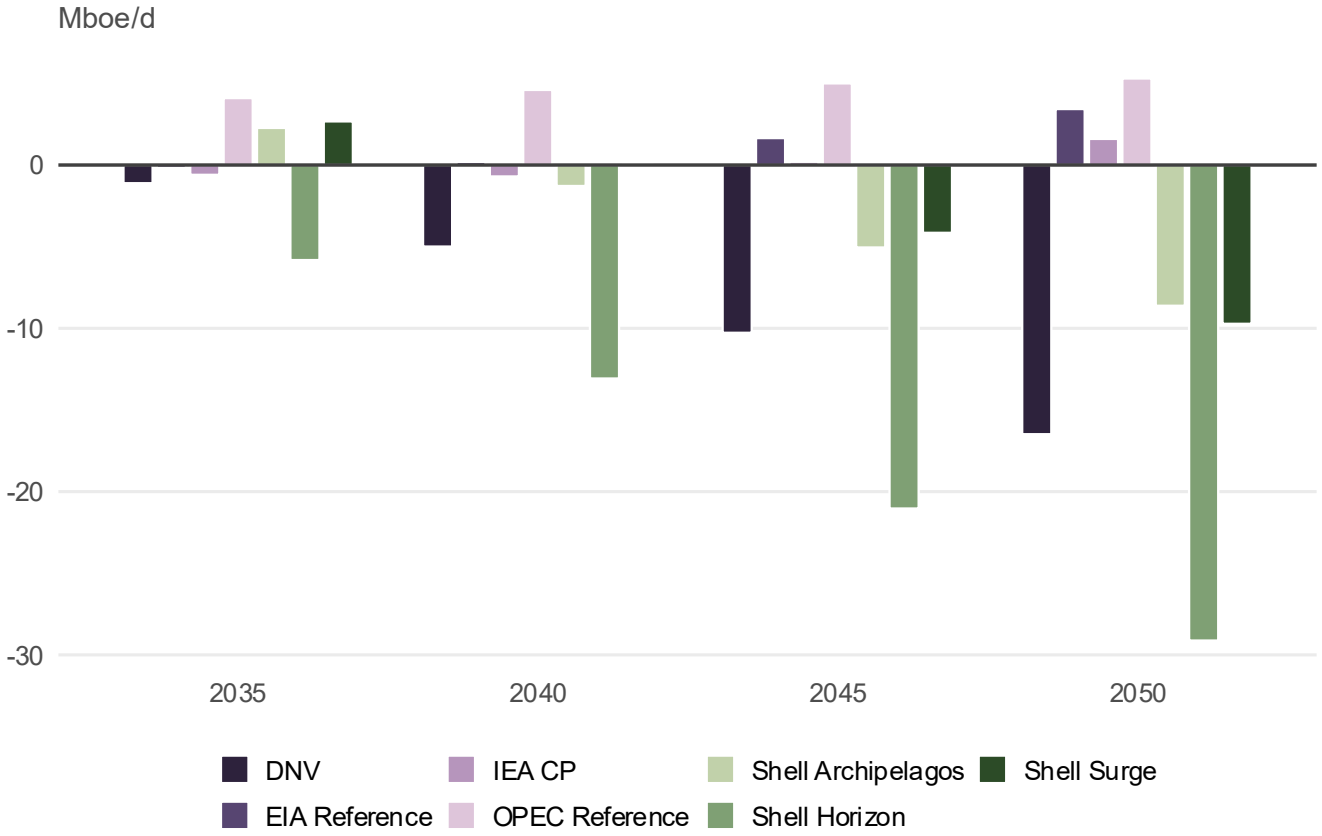
Global Oil Demand in the Transportation Sector



Sources: IEF, DNV's Energy Transition Outlook2025, bp Energy Outlook 2025, Equinor Energy Perspectives 2025, ExxonMobil Global Outlook 2025, IEA WEO 2025, Shell Energy Security Scenarios 2025, TotalEnergies Energy Outlook 2025, and OPEC WOO 2025. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

Oil demand in the road transport sector

Global Road Transport Oil Demand , Change Relative to 2024

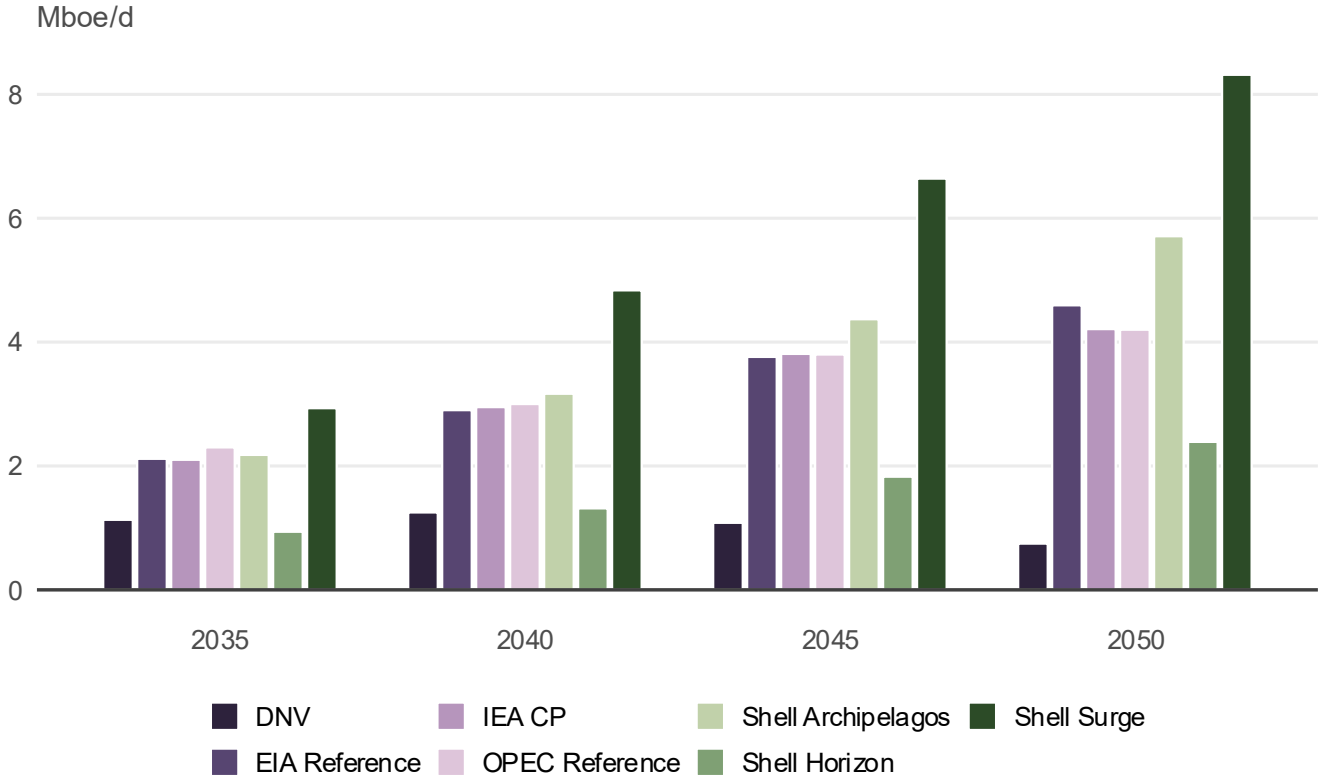


Sources: DNV's Energy Transition Outlook2025, OPEC WOO 2025, IEA WEO 2025, Shell Energy Security Scenarios 2025, and EIA IEO 2023.

- A substantial degree of uncertainty characterizes projections of road transport oil demand, which range from an increase of around 10% to a decline of nearly 40% relative to 2024 consumption.
- This uncertainty is driven primarily by differing assumptions regarding the pace of electric vehicle adoption and the uptake of sustainable fuels, including bioenergy, hydrogen, and other low-carbon options.

Oil demand in the aviation sector

Global Air Transport Oil Demand, Change Relative to 2024



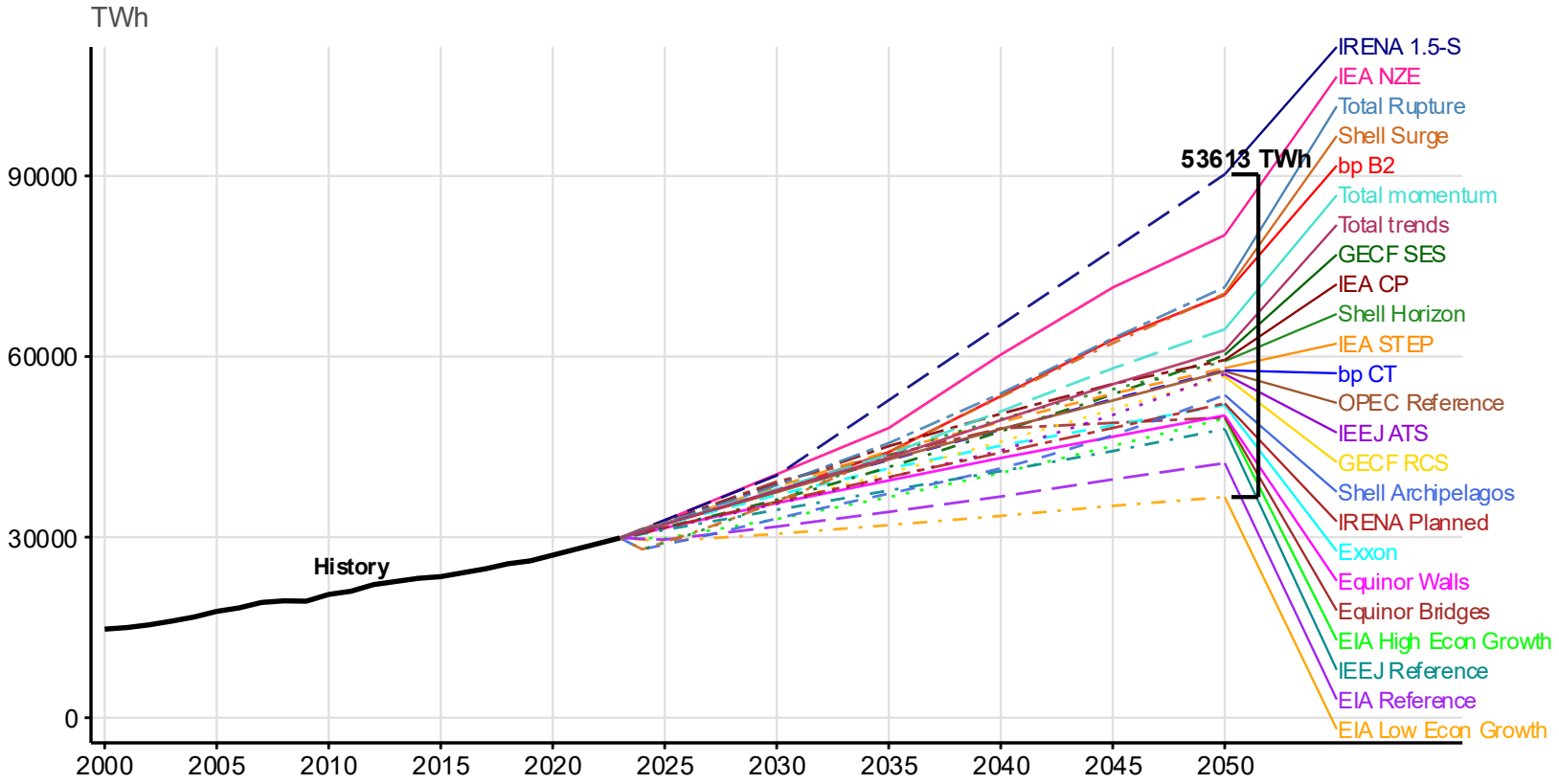
Sources: DNV's Energy Transition Outlook2025, OPEC WOO 2025, IEA WEO 2025, Shell Energy Security Scenarios 2025, and EIA IEO 2023. Note: The IEA presents data for aviation and shipping together. To enable comparison proportions from the world's final consumption, data by transport mode have been used to disaggregate these statistics. OPEC statistics, including liquid fuels.

- Across all scenarios, oil demand from aviation continues to grow over the coming decades, with each pathway projecting continued growth through mid-century, although the pace of expansion varies substantially.
- Aviation oil demand, despite declines in other sectors, rises around 70% by 2050 relative to current levels.
- By mid-century, the aviation sector is expected to account for more than 10% of global oil consumption.

Sector Spotlight
Electricity

Around half of scenarios project electricity generation to reach roughly twice today's level by 2050

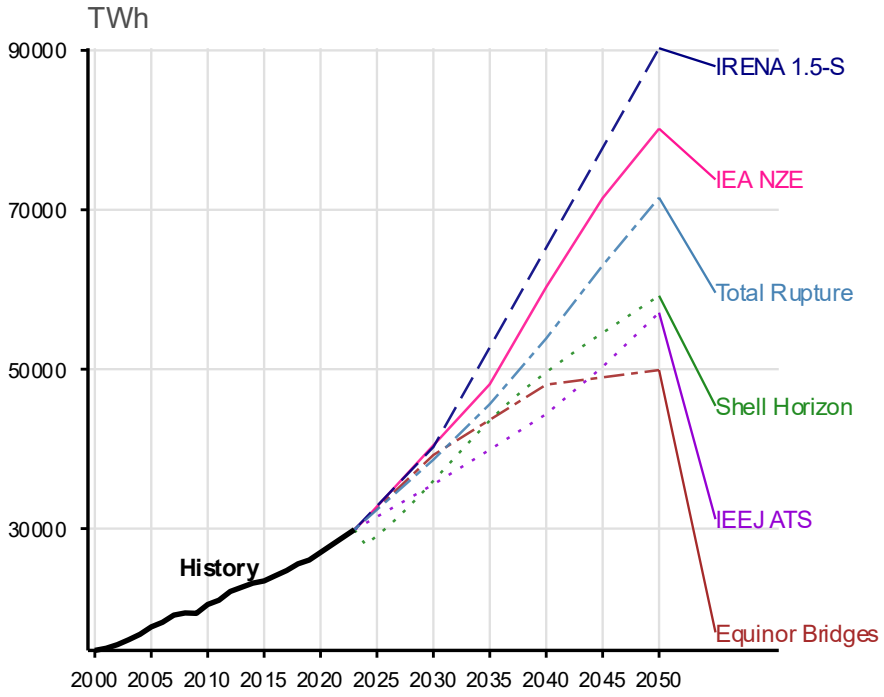
Electricity Generation Scenarios Through 2050



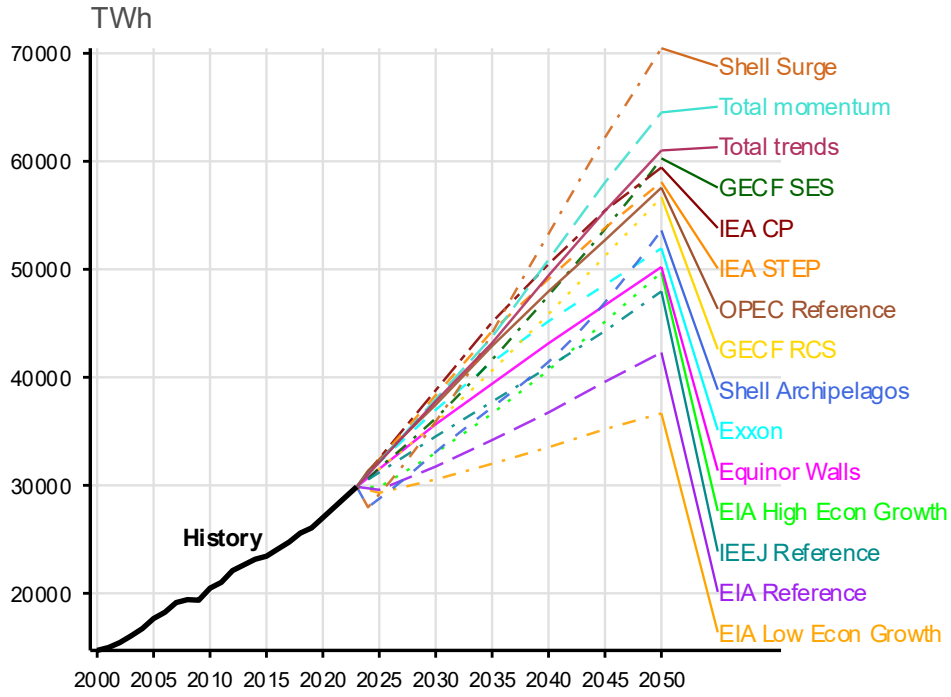
Sources: IEF, IEA WEO 2025, TotalEnergies Energy Outlook 2025, IRENA World Energy Transition Outlook2024, bp Energy Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and OPEC WOO 2025. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

Ambitious scenarios project an average increase of ~12,000 TWh in electricity generation by 2050 relative to the Reference cases

Electricity Generation: Ambitious Climate Scenarios



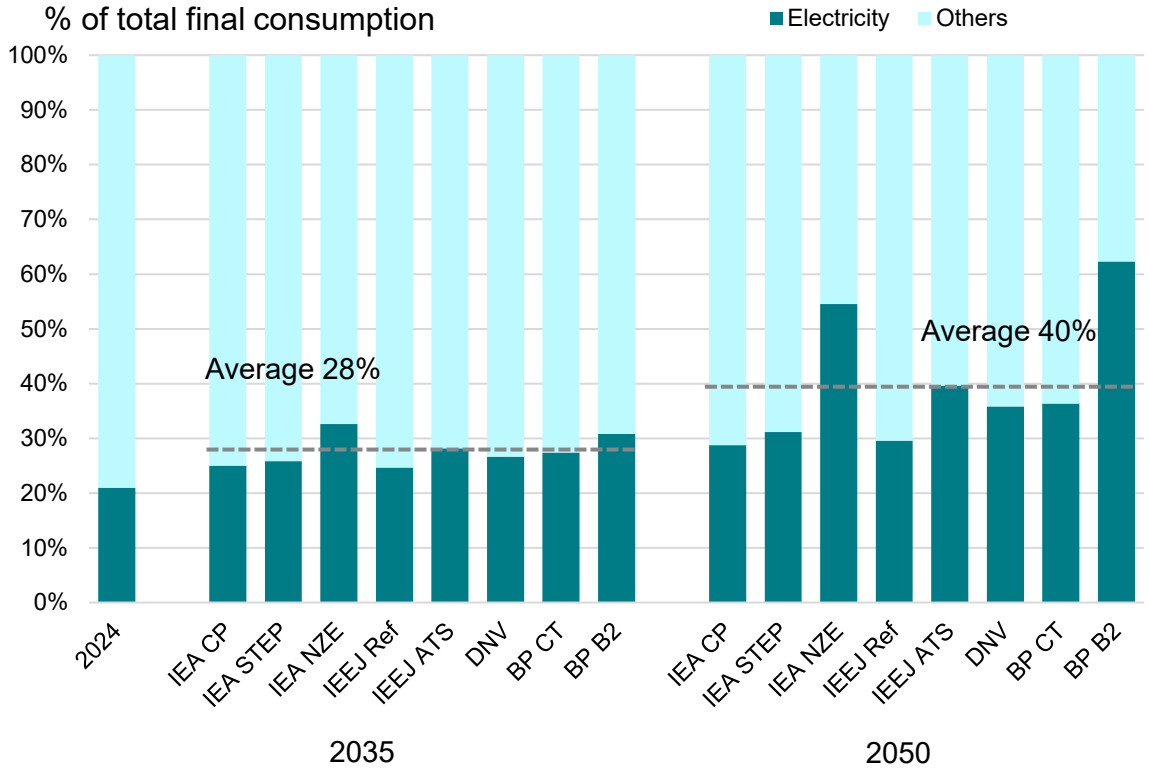
Electricity Generation: Reference and Evolving Policies



Sources: IEF, IEA WEO 2025, TotalEnergies Energy Outlook 2025, IRENA World Energy Transition Outlook 2024, bp Energy Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and OPEC WOO 2025. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

Electricity is expected to account for around 40% of total final energy consumption by 2050

Electricity Consumption



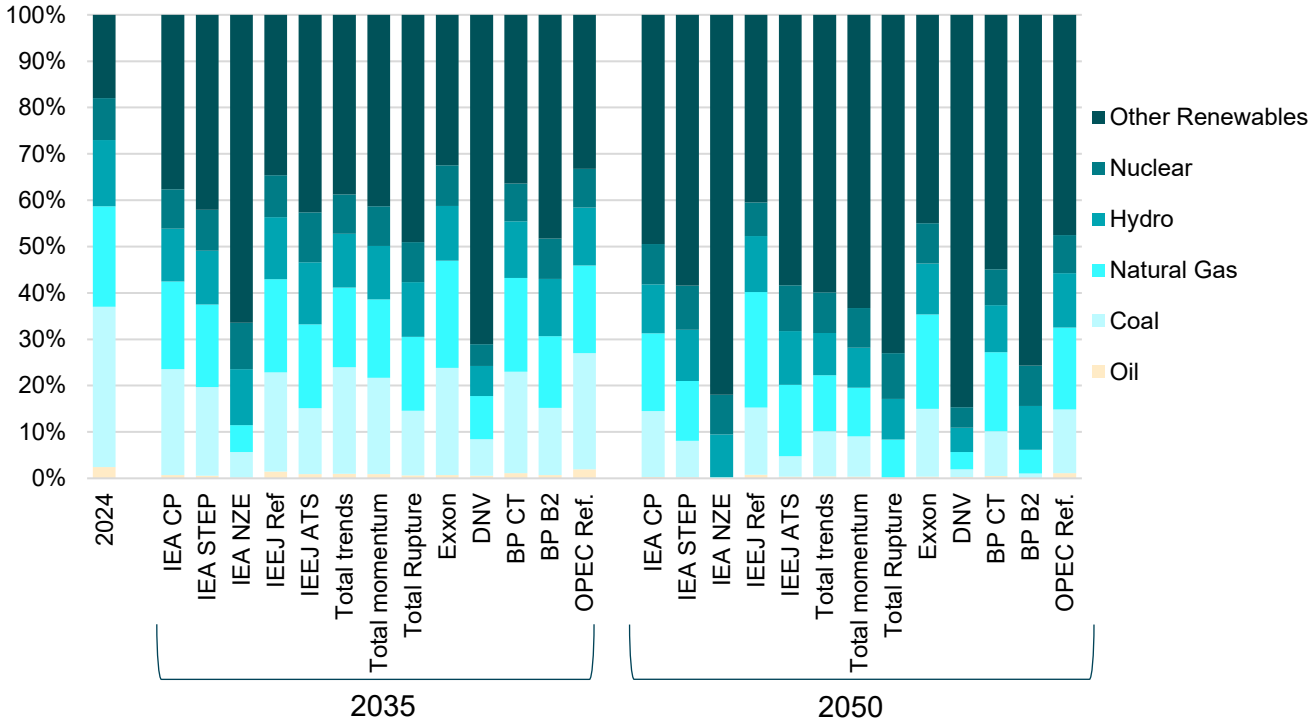
- The role of electricity in the global energy system is set to expand markedly over the coming decades, reflecting accelerating electrification across end-use sectors and rapidly rising power demand from data centres, cooling and digital infrastructure.
- Across scenarios, electricity's share of total final energy consumption increases substantially from around 20% today, reaching about 30% by mid-century in reference cases and exceeding 50% under more ambitious climate scenarios.

Source: IEF, IEA WEO 2025, IEEJ Outlook 2024, DNV's Energy Transition Outlook 2025, and BP Energy Outlook 2025.

Scenarios indicate a major shift in the global power mix by 2050

Electricity Generation by type

% of total electricity generation



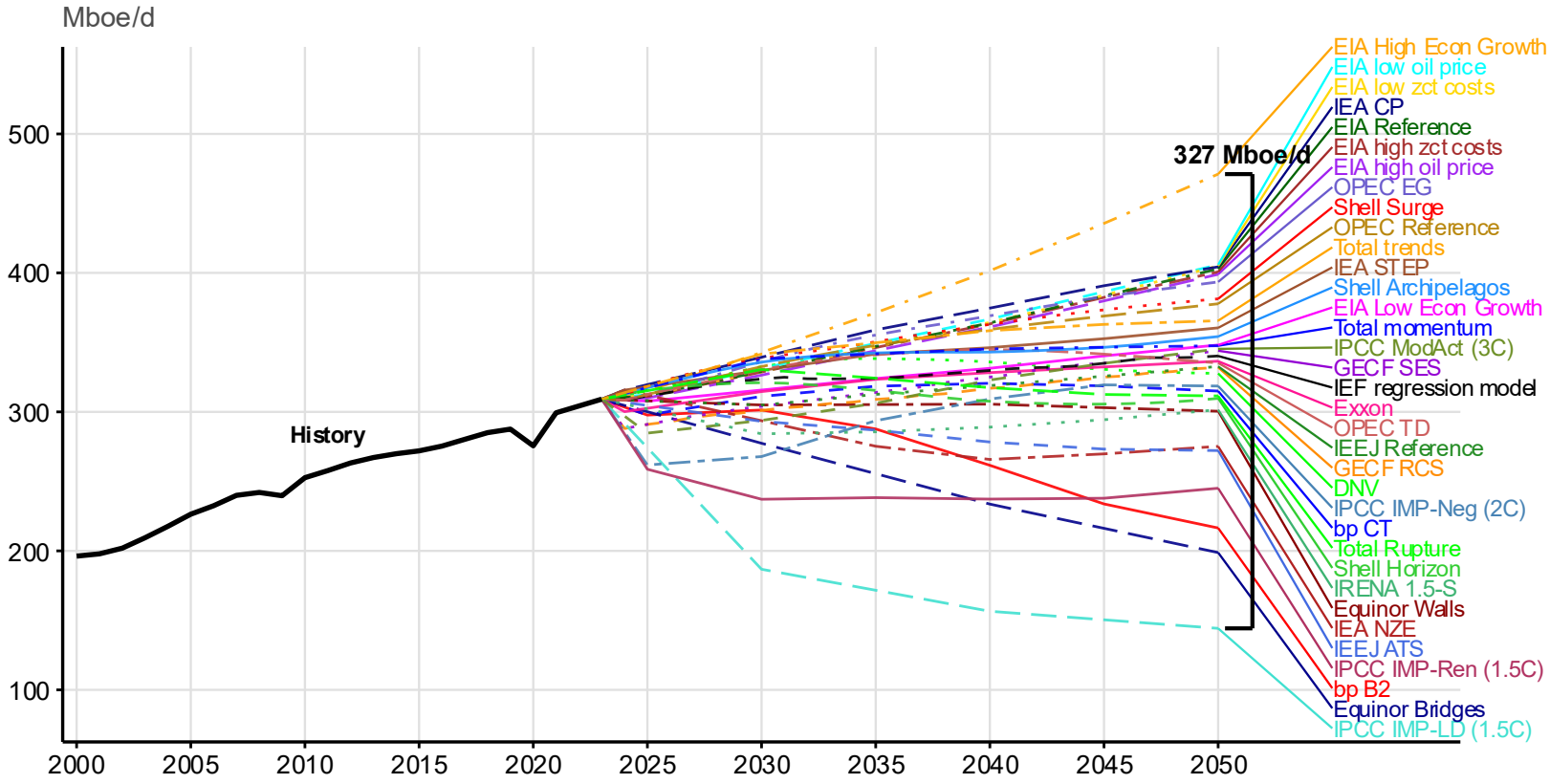
- By 2035, the share of renewables in global electricity generation is projected to rise sharply from around 18% in 2024 to an average of about 45%, while coal's contribution declines from roughly 35% to 17%.
- By 2050, net-zero pathways project that renewables supply, on average, reaches around 62% of global electricity generation.
- Under reference and evolving policy scenarios, hydrocarbons are still projected to supply, on average, more than 30% of global electricity generation by 2050.

Source: IEF, IEA WEO 2025, OPEC WOO 2025, IEEJ Outlook 2024, Total Energy Outlook 2025, DNV's Energy Transition Outlook 2025, ExxonMobil Global Outlook 2025, and BP Energy Outlook 2025.

Concluding Observations on Scenario Projections

Despite shared views on population growth, primary energy demand projections differ; ambitious scenarios show energy demand decline

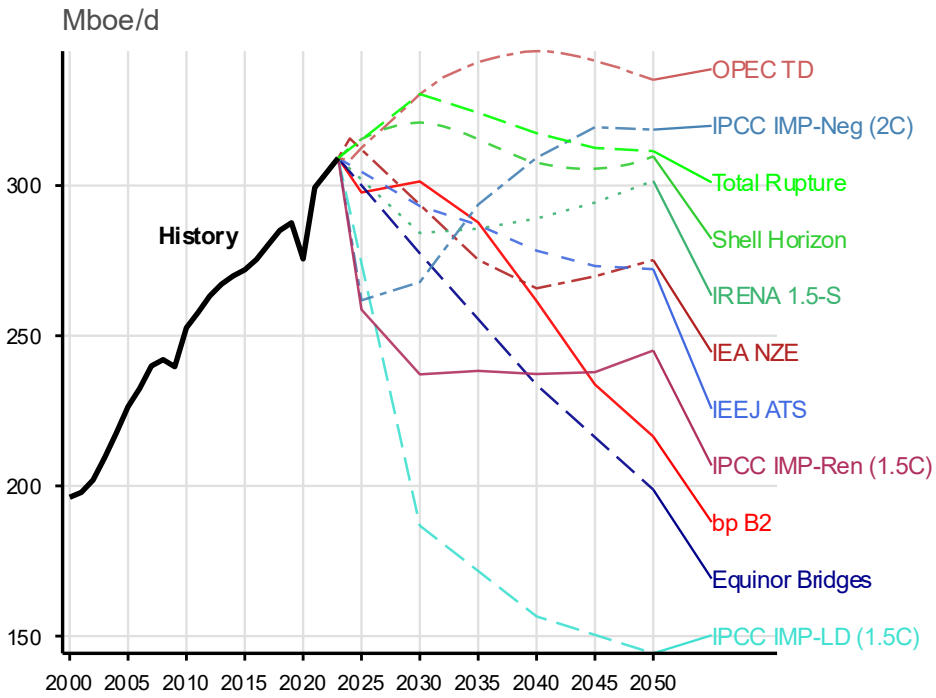
Total Primary Energy Demand Scenarios Through 2050



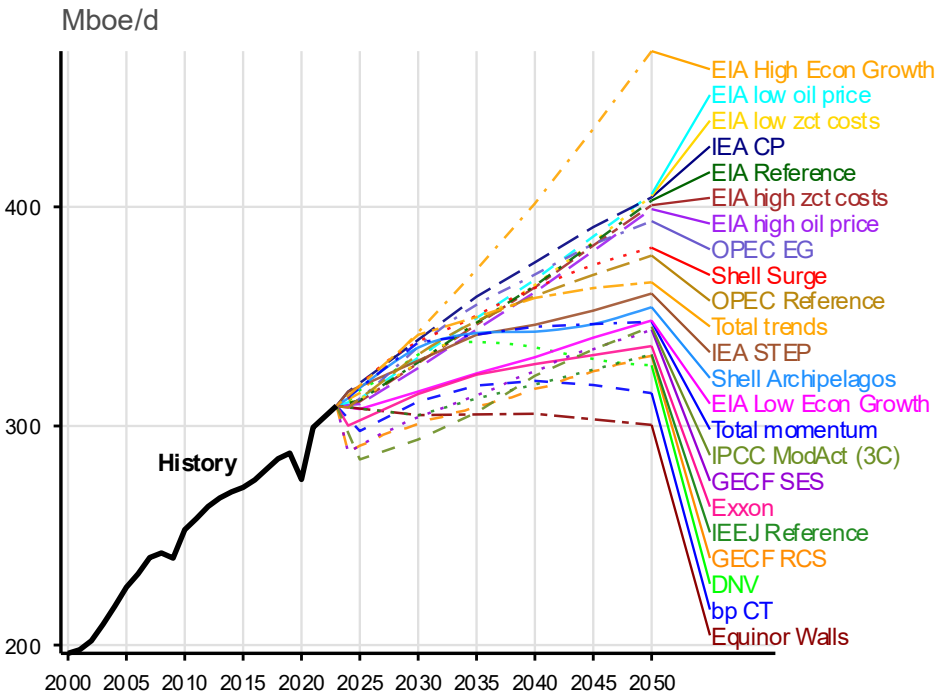
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, IRENA World Energy Transition Outlook 2024, GECF Global Gas Outlook 2025, DNV's Energy Transition Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

Only the most deep-decarbonization climate-ambitious scenarios project a decline in total primary energy demand over time

Total Primary Energy Demand: Ambitious Climate Scenarios



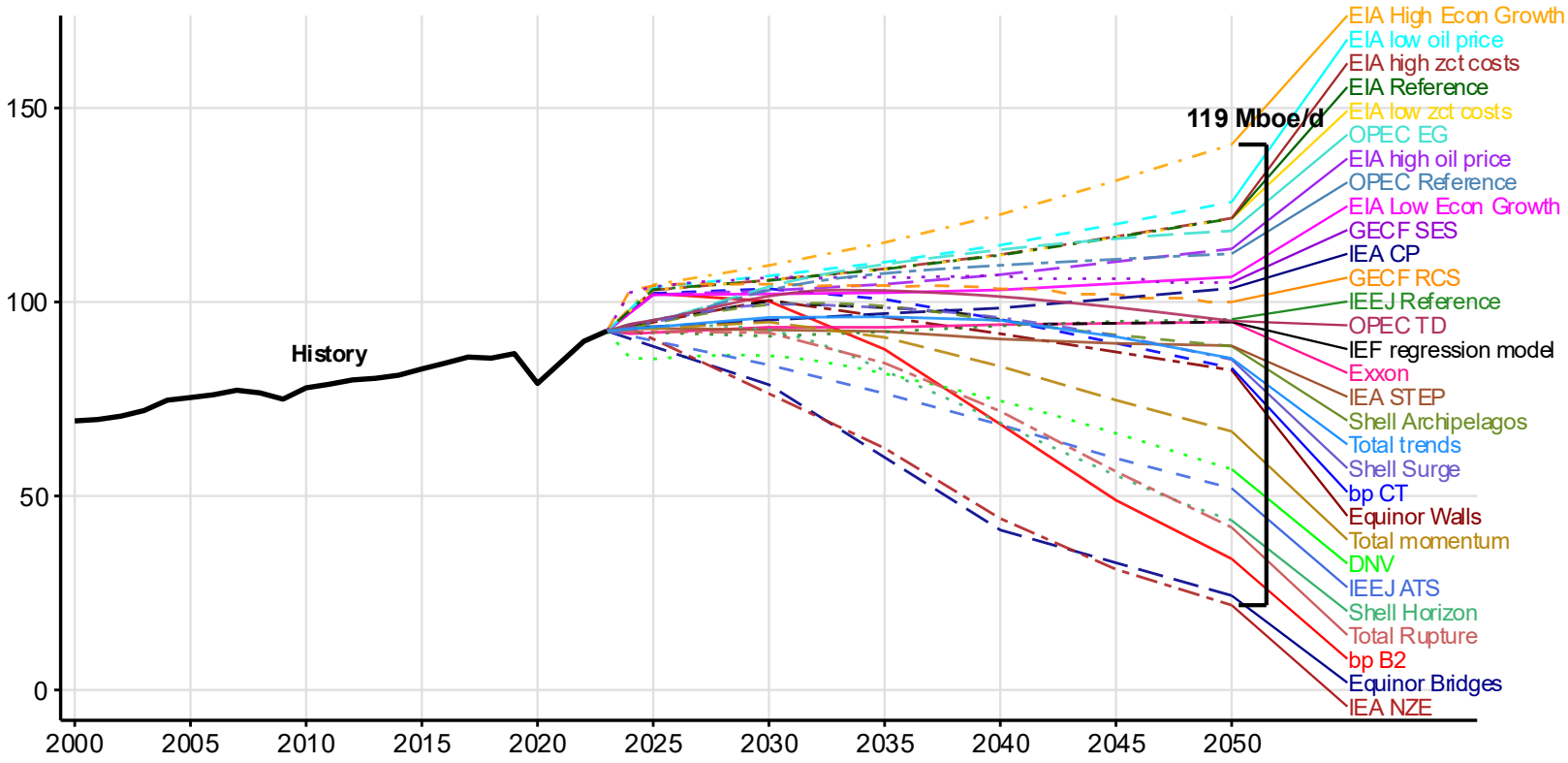
Total Primary Energy Demand: Reference and Evolving Policies



Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, IRENA World Energy Transition Outlook 2024, GECF Global Gas Outlook2025, DNV's Energy Transition Outlook 2025, Equinor Energy Perspectives2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

More than two-thirds of scenarios show oil demand trends plateauing or rising over the coming decades

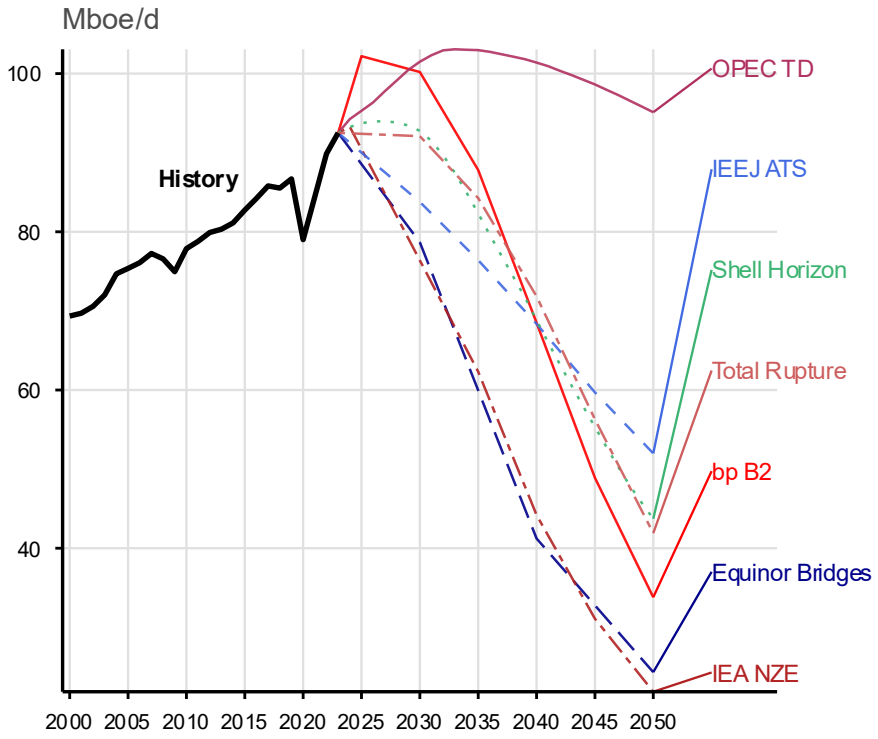
Oil Demand Scenarios Through 2050



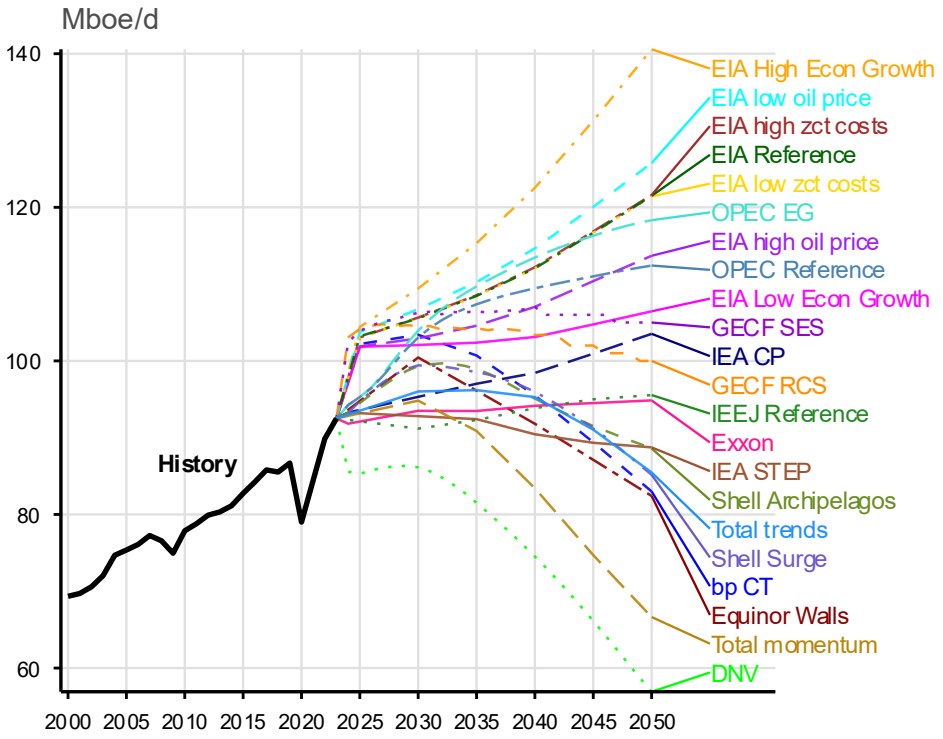
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, and ExxonMobil Global Outlook2025. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections

In the Reference and Evolving Policies scenarios, average oil demand continues to rise, exceeding 100 Mboe/d by 2050

Oil Demand: Ambitious Climate Scenarios



Oil Demand: Reference and Evolving Policies

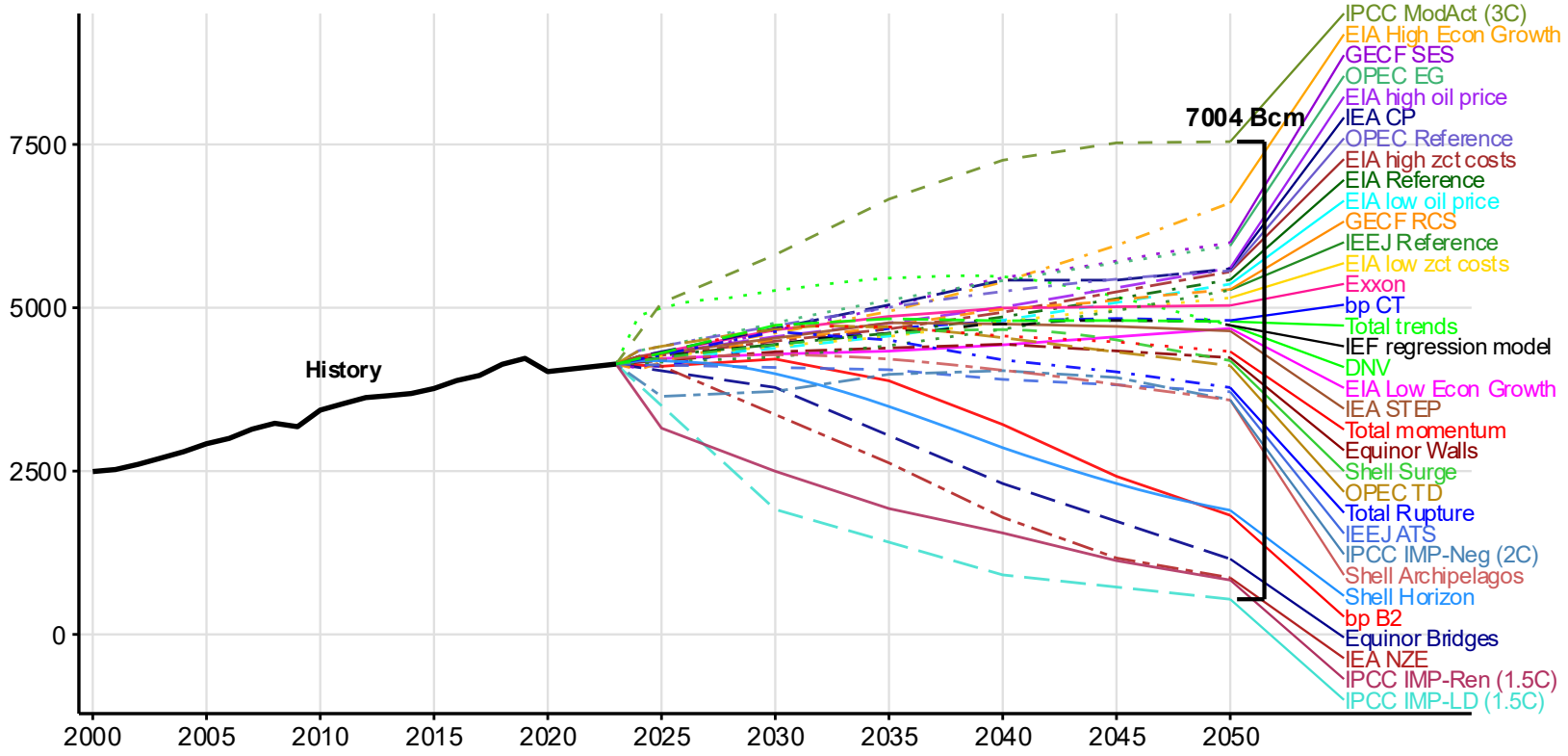


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, and ExxonMobil Global Outlook 2025. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

Natural gas consumption is projected to rise by ~5% by 2050 relative to today's levels, despite marked volatility

Natural Gas Demand Scenarios Through 2050

Billion cubic metres (Bcm)

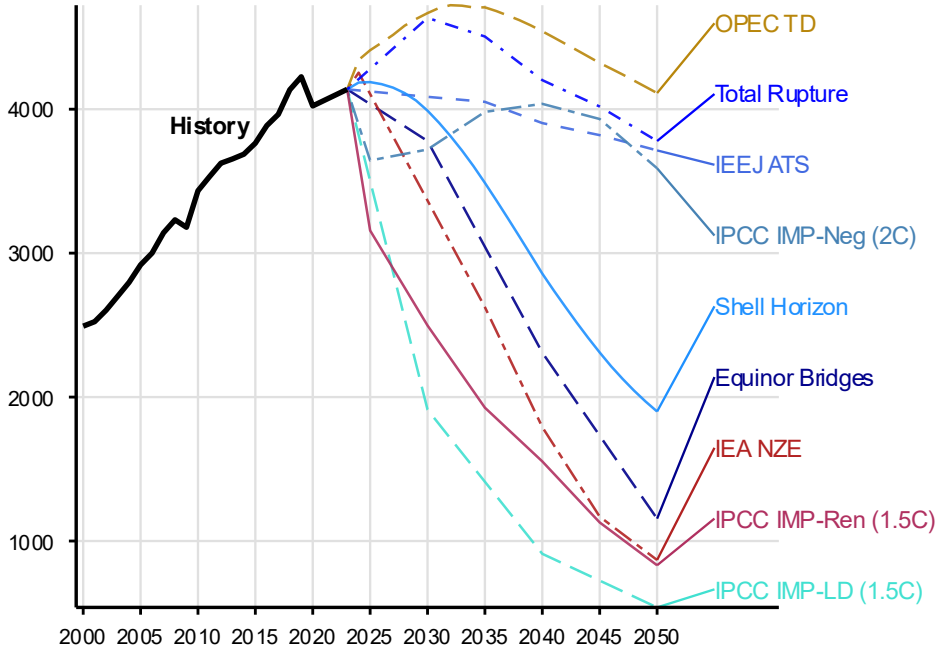


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook 2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook2025, and IPCC AR6. Note: Some scenarios start after the historical series ends, their curves therefore begin at the first year each outlook reports projections .

Nearly all Evolving policies scenarios project an upward trajectory for natural gas demand over time

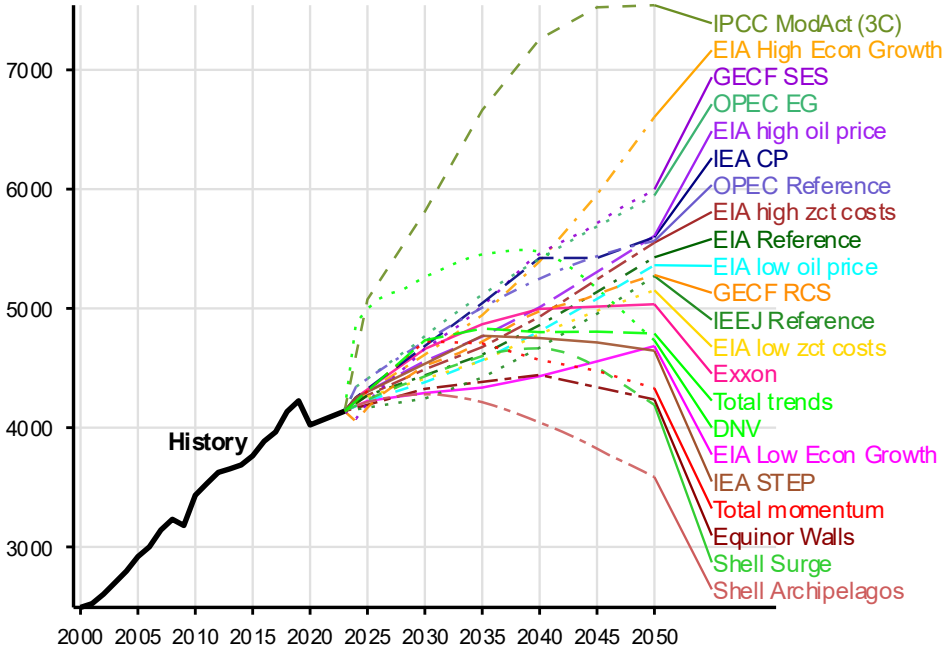
Natural Gas Demand: Ambitious Climate Scenarios

Billion cubic metres (Bcm)



Natural Gas Demand: Reference and Evolving Policies

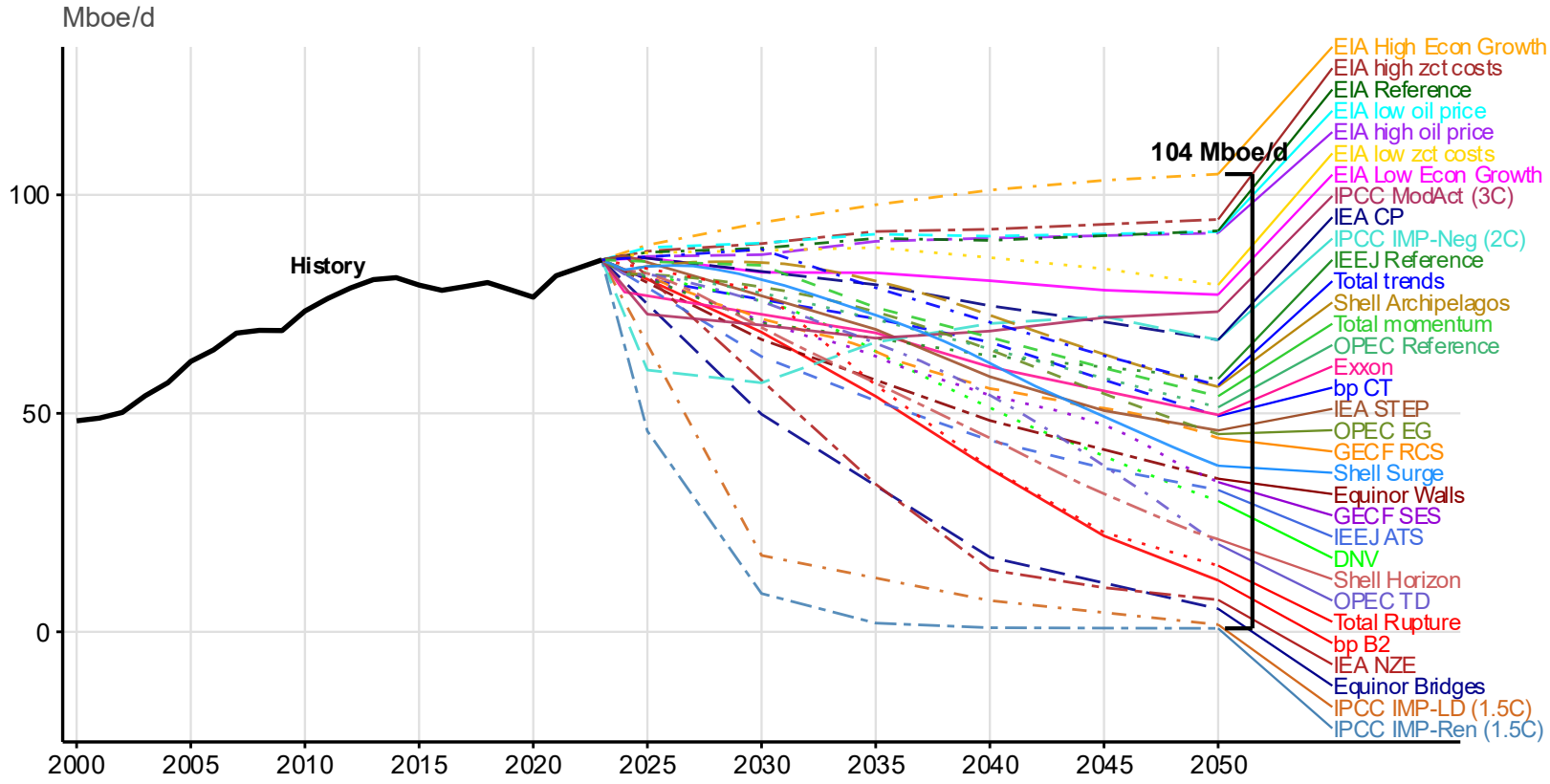
Billion cubic metres (Bcm)



Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

Around one-third of scenarios project a decline in coal demand to nearly half of today's level by 2050

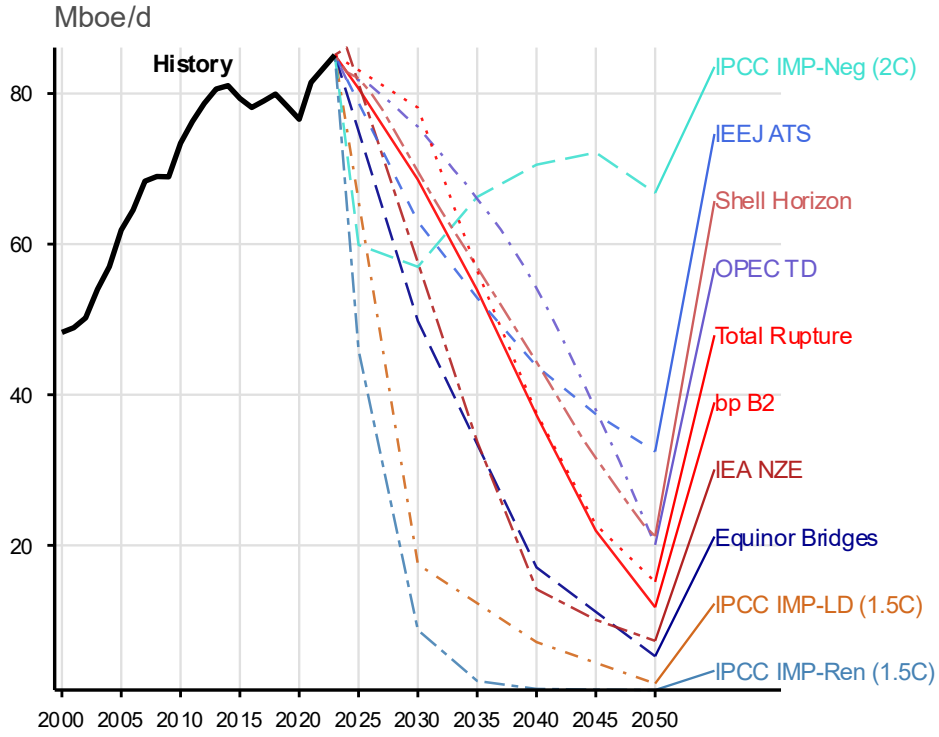
Coal Demand Scenarios Through 2050



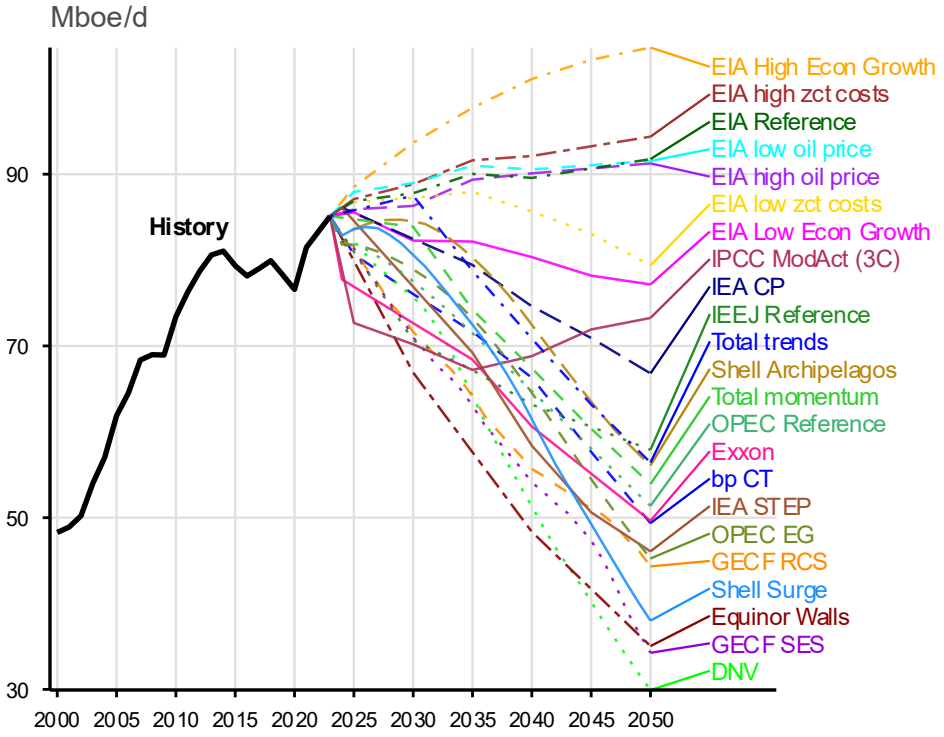
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections

Only a limited number of scenarios project rising coal demand over the coming decades

Coal Demand: Ambitious Climate Scenarios



Coal Demand: Reference and Evolving Policies

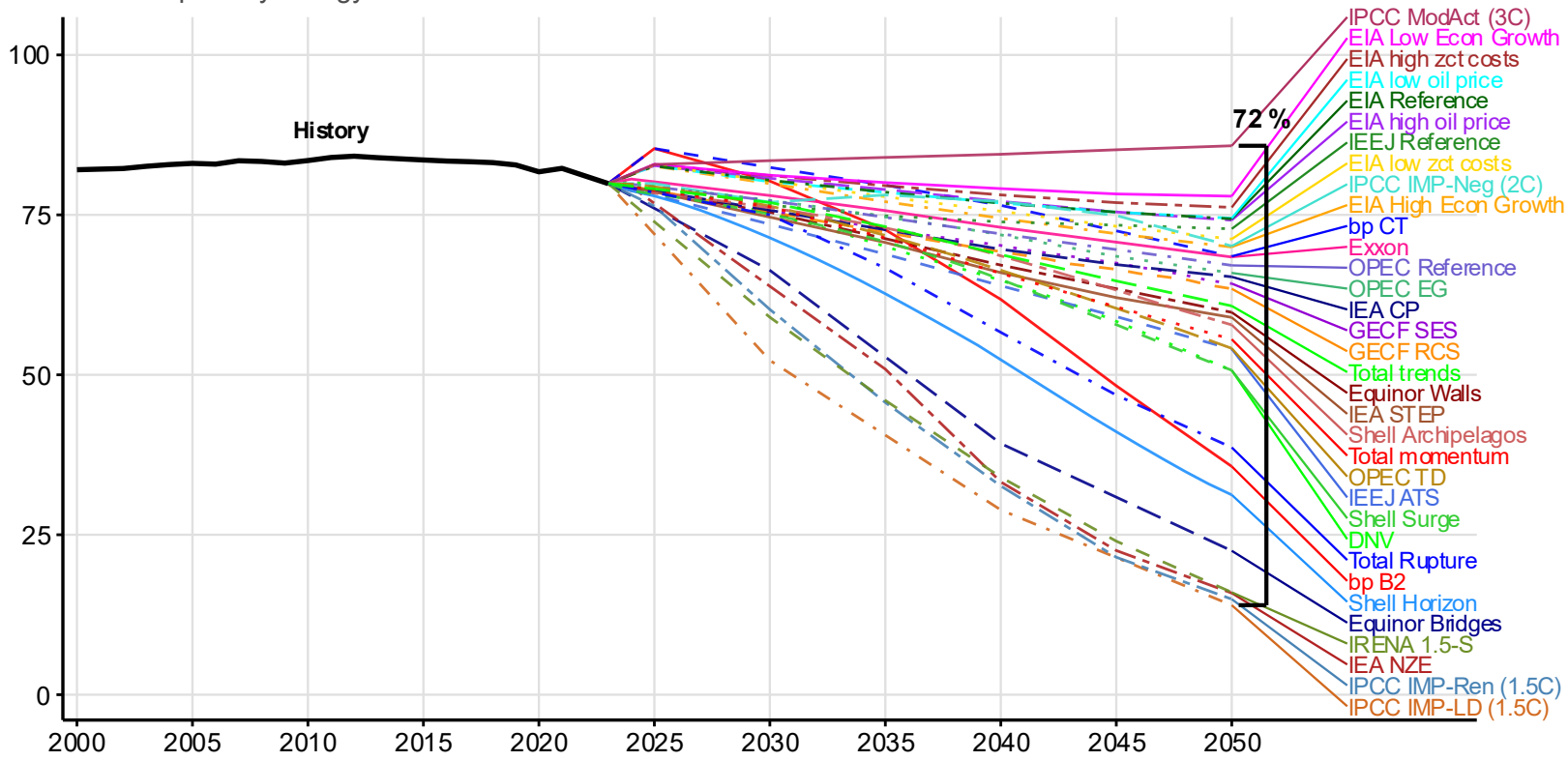


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

A projected decline in the hydrocarbons share of total primary energy demand is driven primarily by reductions in coal demand

Hydrocarbons Share of Primary Energy Demand Scenarios Through 2050

Share of primary energy demand

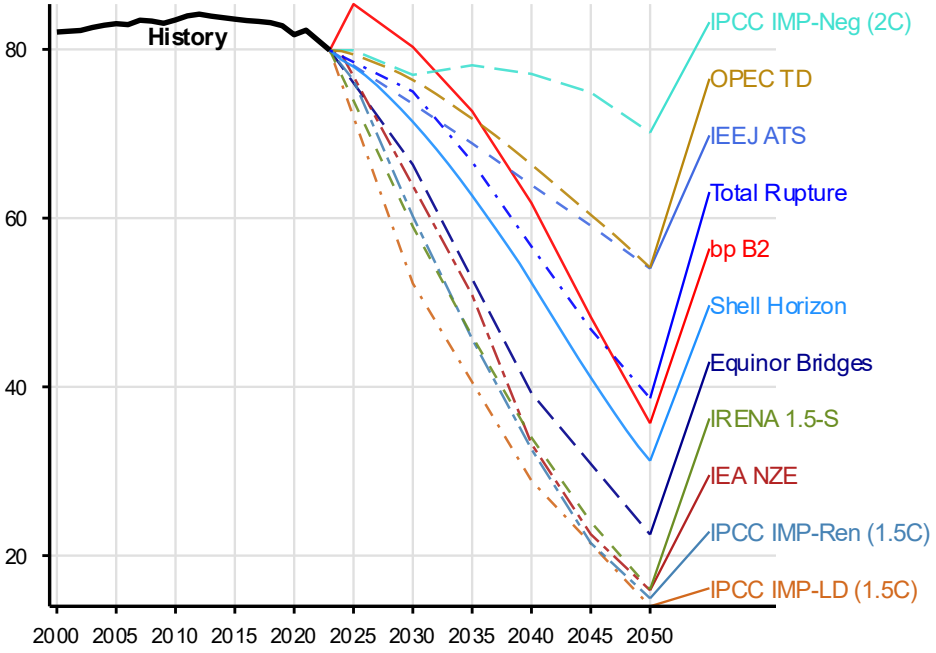


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, IRENA World Energy Transition Outlook 2024, GECF Global Gas Outlook 2025, DNV's Energy Transition Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

Across all Reference cases, hydrocarbons still account for more than half of total primary energy demand in 2050, despite declining coal use

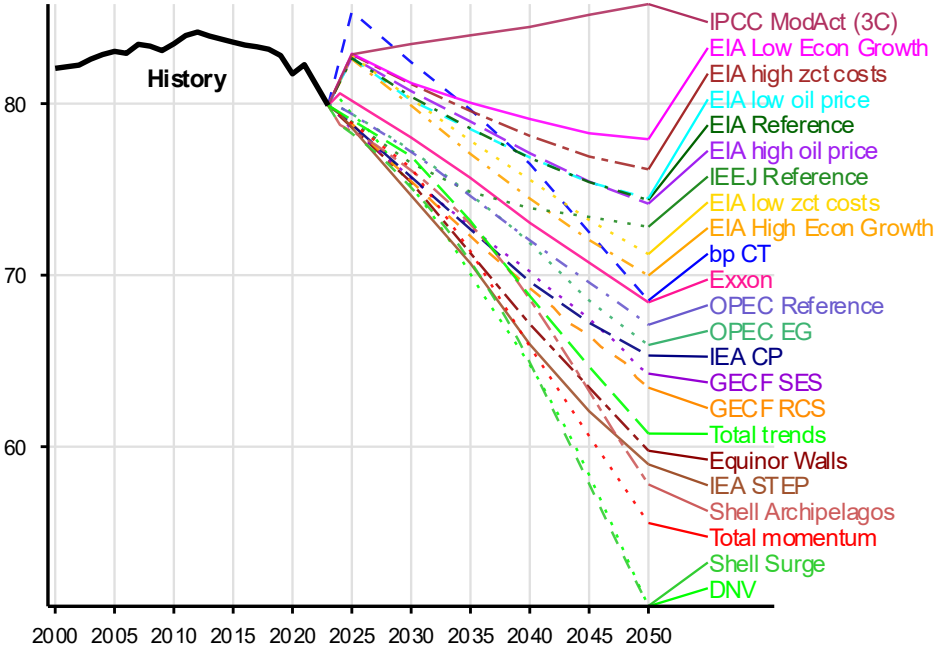
Hydrocarbons Share of Primary Energy Demand: Ambitious Climate Scenarios

Share of primary energy demand



Hydrocarbons Share of Primary Energy Demand: Reference and Evolving Policies

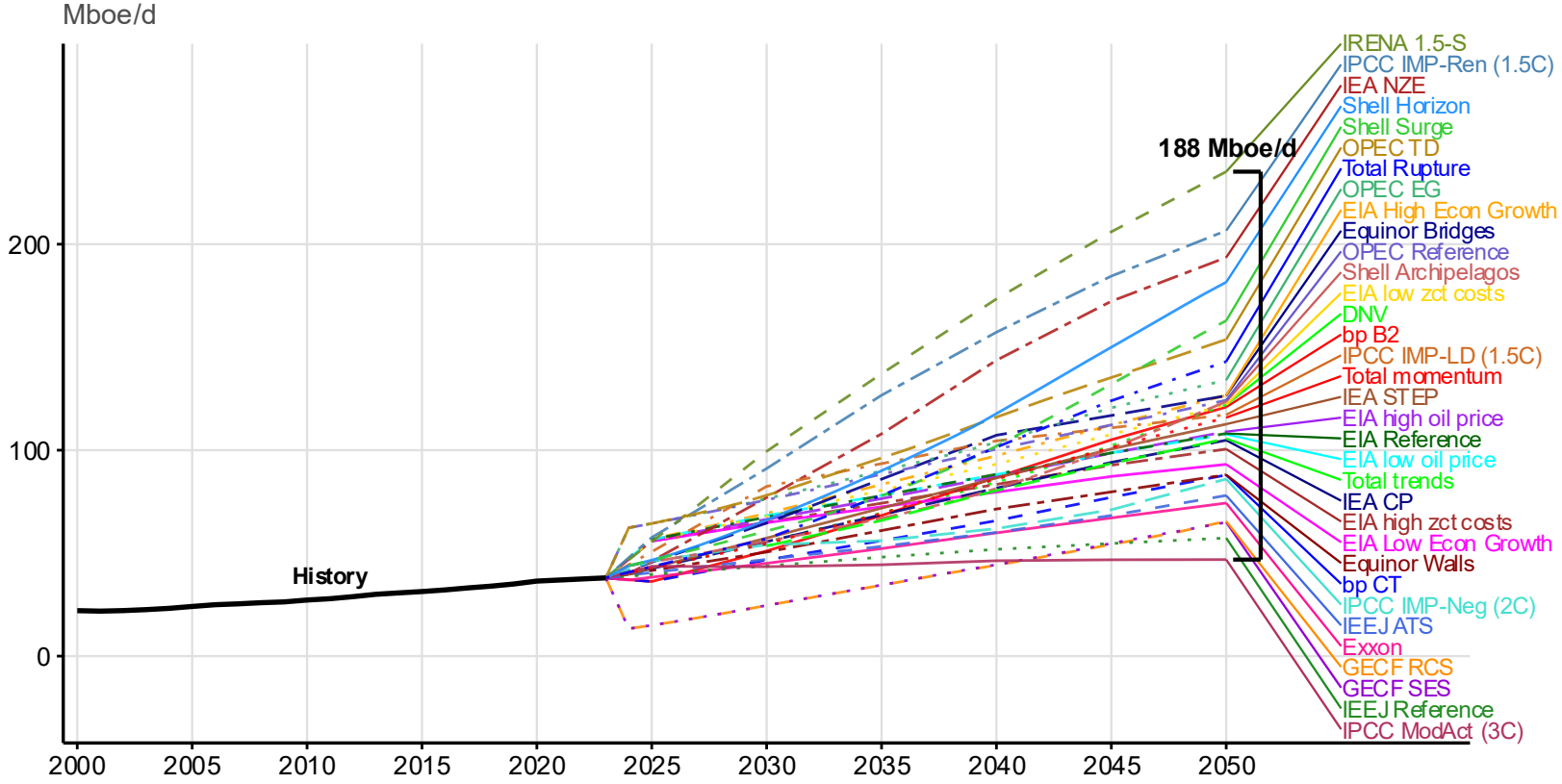
Share of primary energy demand



Sources: IEF, IEA WEO 2025, OPEC WOO 2025, bp Energy Outlook 2025, TotalEnergies Energy Outlook2025, IRENA World Energy Transition Outlook 2024, GECF Global Gas Outlook2025, DNV's Energy Transition Outlook 2025, Equinor Energy Perspectives2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

The uncertainty gap between the highest and lowest projections for 2050 renewables demand is around five times larger than today's level

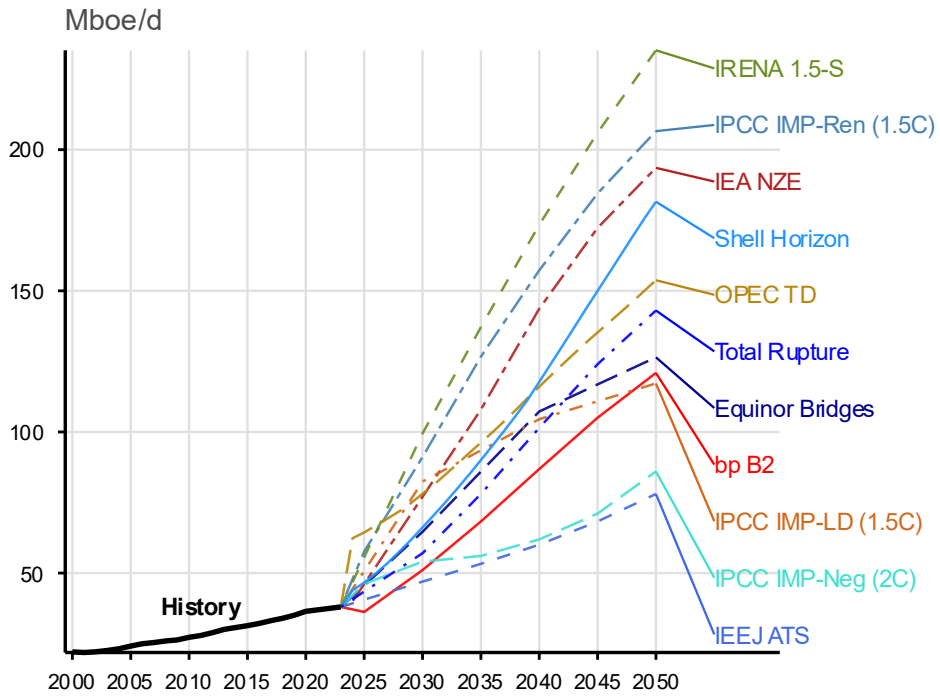
Renewable Demand Scenarios Through 2050 (includes wind, solar, geothermal, biomass, and biofuels)



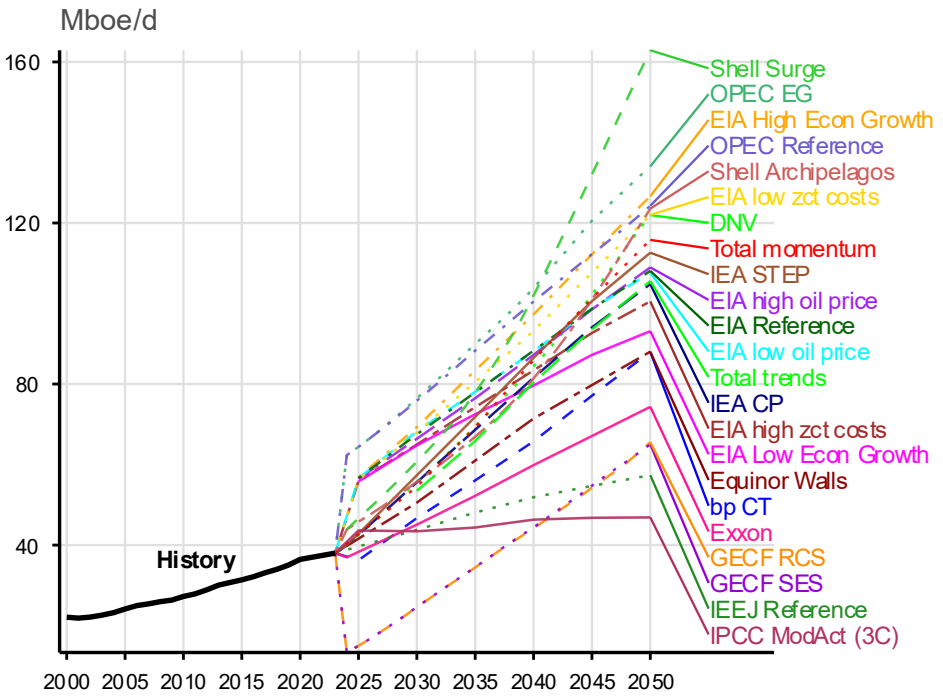
Sources: IEF, IEA WEO 2025, OPEC WOO 2025, IRENA World Energy Transition Outlook 2024, bp Energy Outlook 2025, GECF Global Gas Outlook 2025, DNV's Energy Transition Outlook2025, Equinor Energy Perspectives 2025, TotalEnergies Energy Outlook2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

Across Ambitious scenarios, renewable demand exhibits an average annual increase of ~1.5 mboe/d relative to the Evolving policies cases

Renewable Demand: Ambitious Climate Scenarios



Renewable Demand: Reference and Evolving Policies



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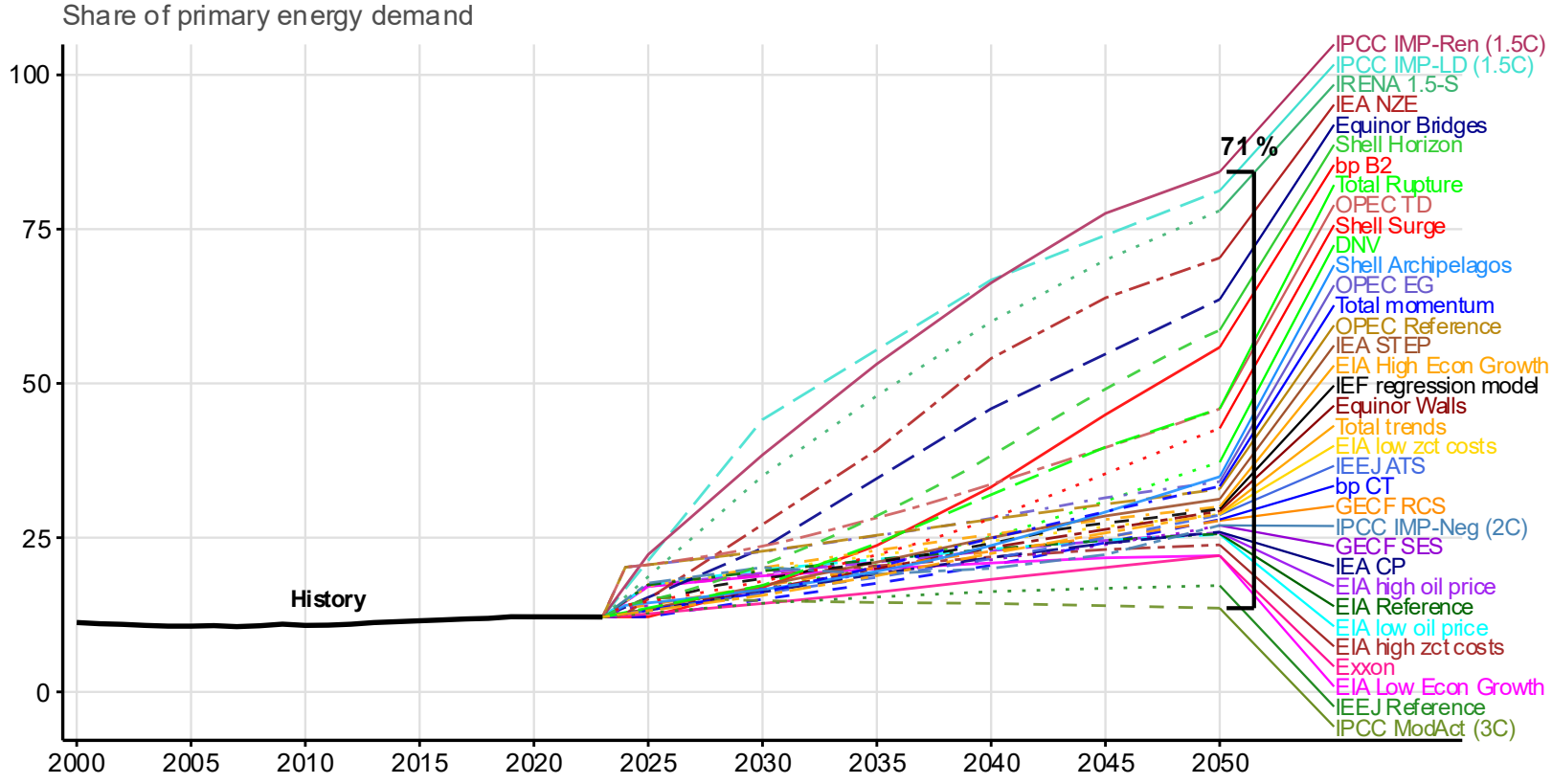
Over two-thirds of scenarios show renewables remaining below a 50% share of total primary energy demand by 2050

Renewable Demand Share of Total Primary Energy Demand Scenarios to2050

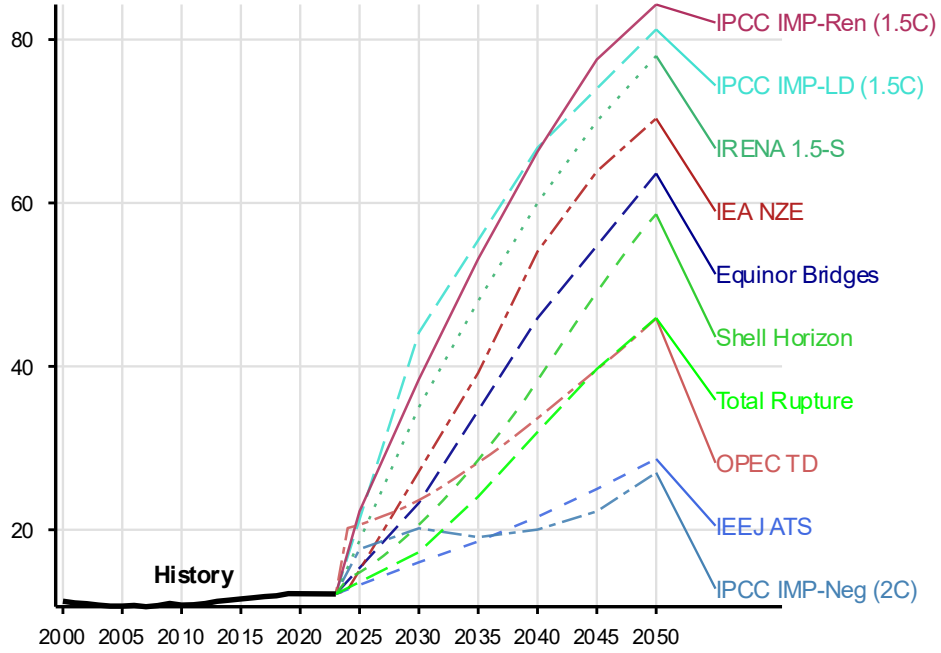


Sources: IEF, IEA WEO 2025, OPEC WOO 2025, TotalEnergies Energy Outlook 2025, IRENA World Energy Transition Outlook2024, bp Energy Outlook 2025, GECF Global Gas Outlook 2025, DNV's Energy Transition Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

Among Ambitious scenarios, the penetration of renewables in total primary energy demand by 2040 rises to around three times today's level

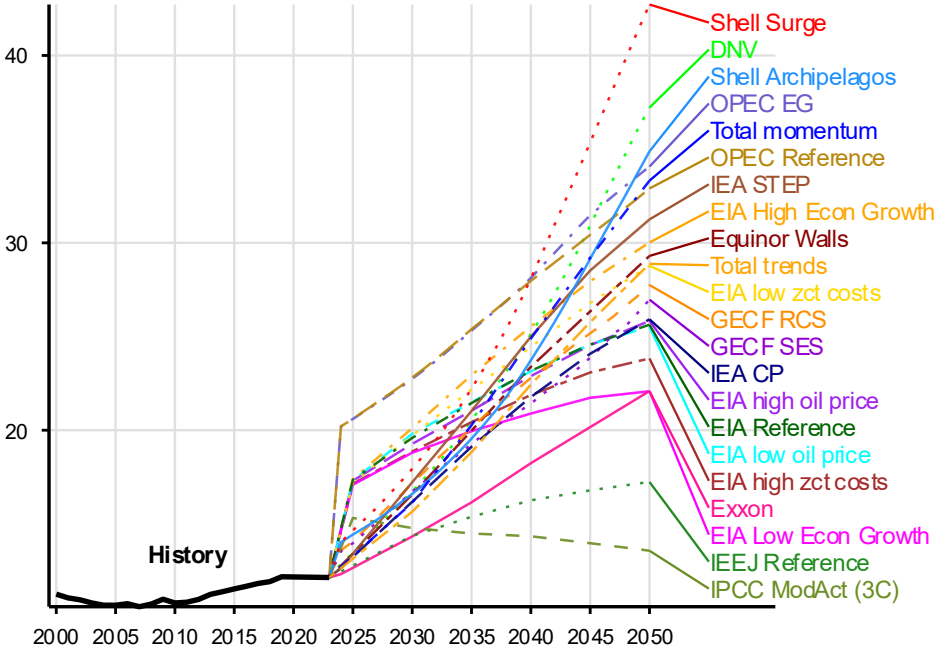
Renewable Demand Share: Ambitious Climate Scenarios

Share of primary energy demand



Renewable Demand Share: Reference and Evolving Policies

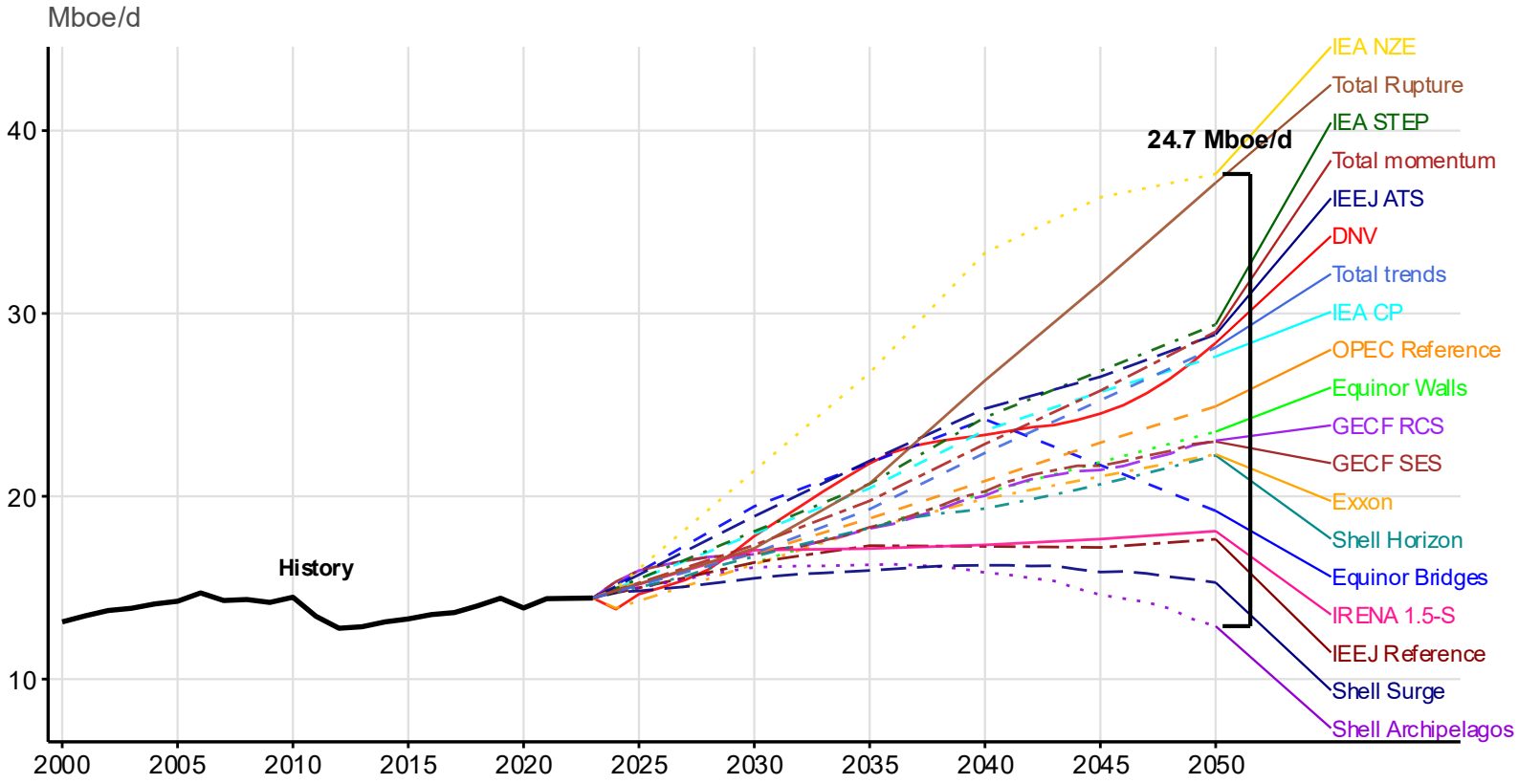
Share of primary energy demand



Sources: IEF, IEA WEO 2025, OPEC WOO 2025, TotalEnergies Energy Outlook2025, IRENA World Energy Transition Outlook2024, bp Energy Outlook 2025, GECF Global Gas Outlook2025, DNV's Energy Transition Outlook 2025, Equinor Energy Perspectives2025, IEEJ Outlook 2024, EIA IEO 2023, Shell Energy Security Scenarios 2025, ExxonMobil Global Outlook2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections .

The difference between the highest and lowest scenarios for nuclear demand in 2050 is nearly twice today's level

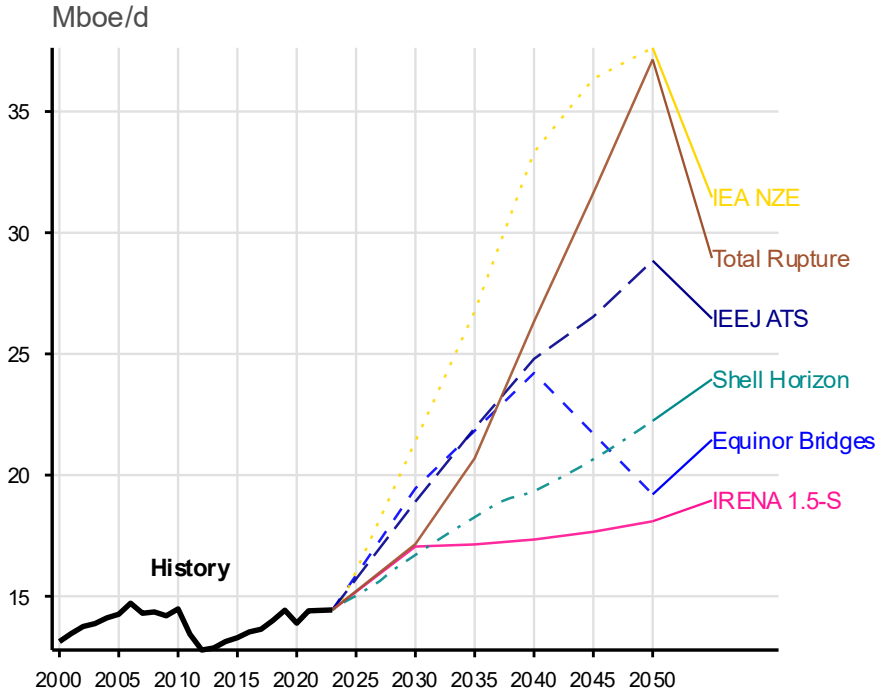
Nuclear Demand Scenarios Through 2050



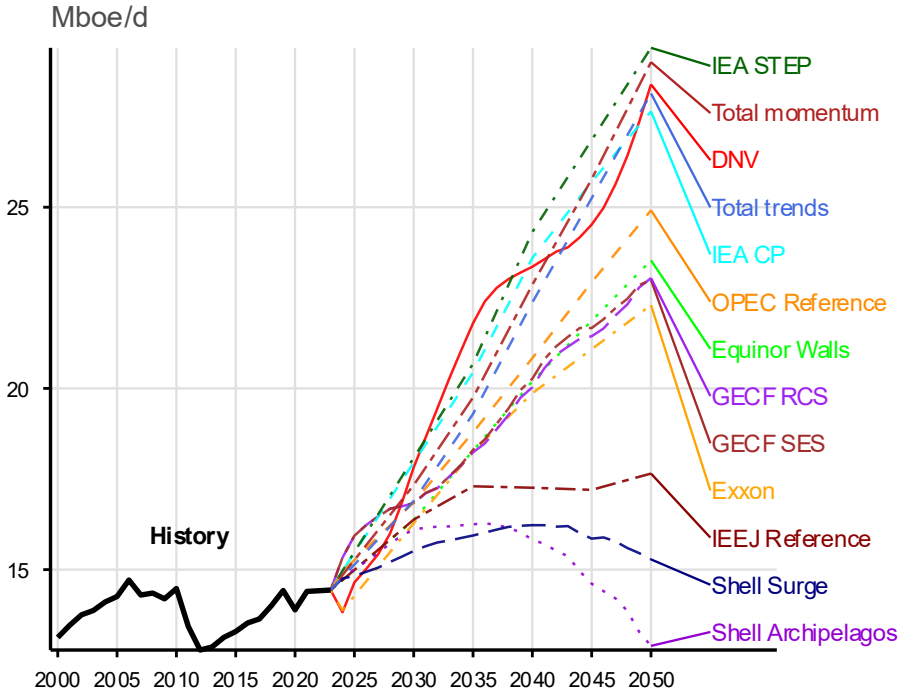
Sources: IEF, IEA WEO 2025, DNV's Energy Transition Outlook 2025, TotalEnergies Energy Outlook2025, IRENA World Energy Transition Outlook 2024, ExxonMobil Global Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, Shell Energy Security Scenarios2025, and OPEC WOO 2025. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections

A rise in nuclear demand over time is observed in both the Ambitious and Evolving Policies scenarios

Nuclear Demand: Ambitious Climate Scenarios



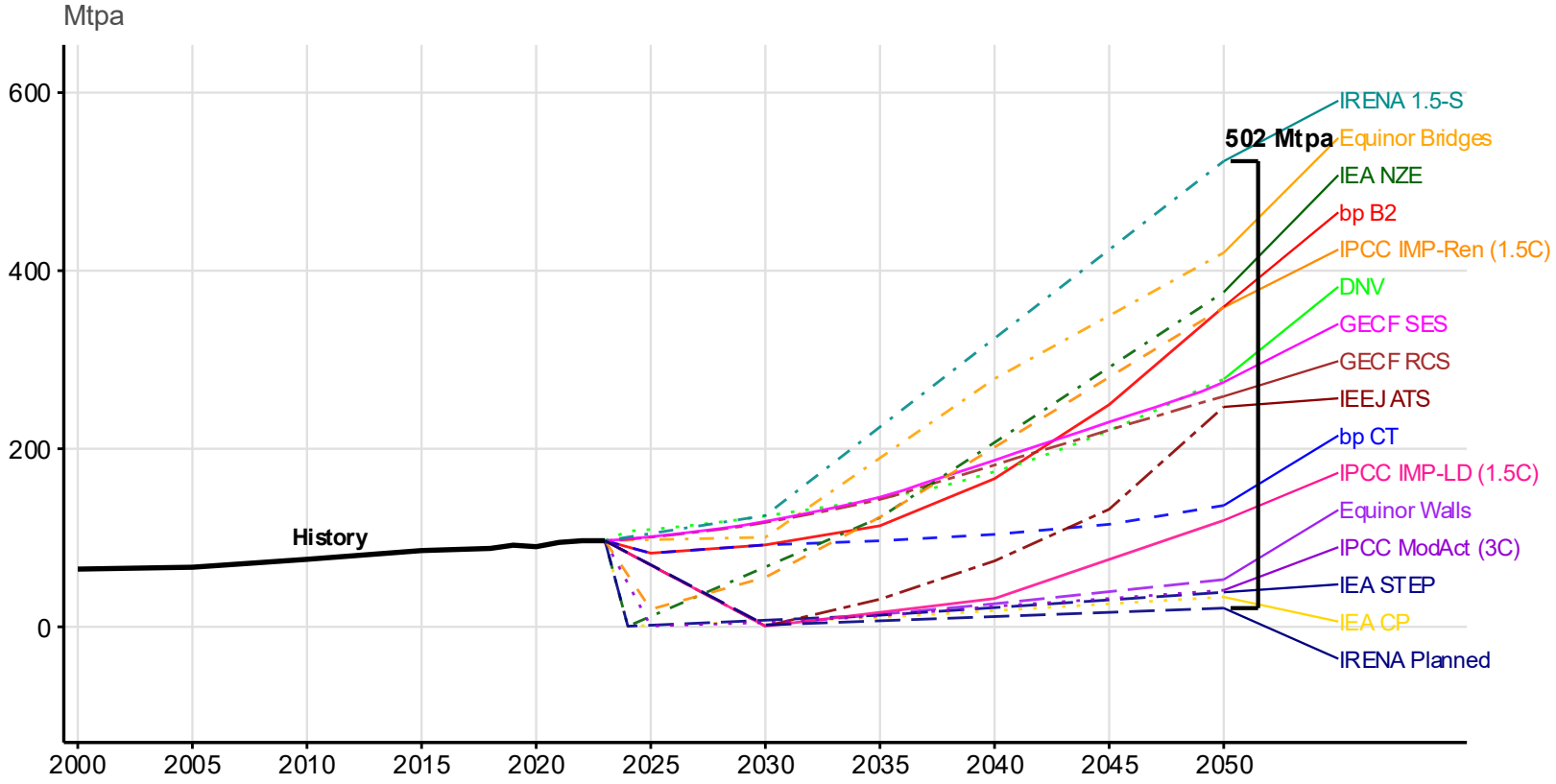
Nuclear Demand: Reference and Evolving Policies



Sources: IEF, IEA WEO 2025, DNV's Energy Transition Outlook 2025, TotalEnergies Energy Outlook 2025, IRENA World Energy Transition Outlook 2024, ExxonMobil Global Outlook2025, GECF Global Gas Outlook2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, Shell Energy Security Scenarios 2025, and OPEC WOO 2025. Note: Some scenarios start after the historical series ends ; their curves therefore begin at the first year each outlook reports projections .

Global hydrogen demand grows at an average annual rate of around 2% over the period 2020–2050

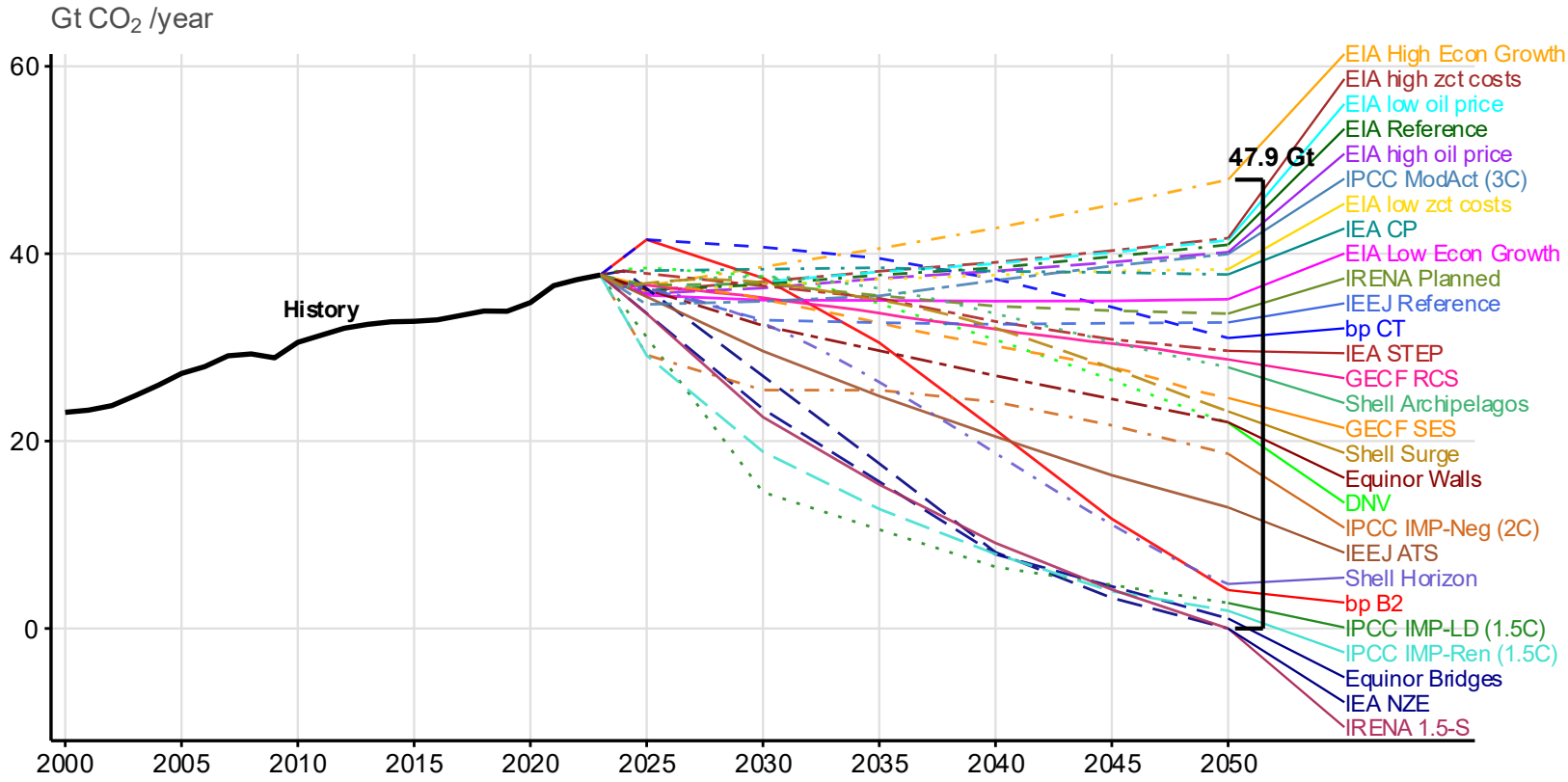
Hydrogen Demand Scenarios Through 2050



Sources: IEF, IEA WEO 2025, DNV's Energy Transition Outlook 2025, bp Energy Outlook 2025, IRENA World Energy Transition Outlook 2024, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, IEEJ Outlook 2024, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections . Some scenarios only provide an outlook for low-carbon hydrogen, while others include hydrogen made from unabated fossil fuels .

Across the full set of scenarios, a majority project a sustained decline in global CO_2 emissions

CO_2 Emissions Scenarios Through 2050



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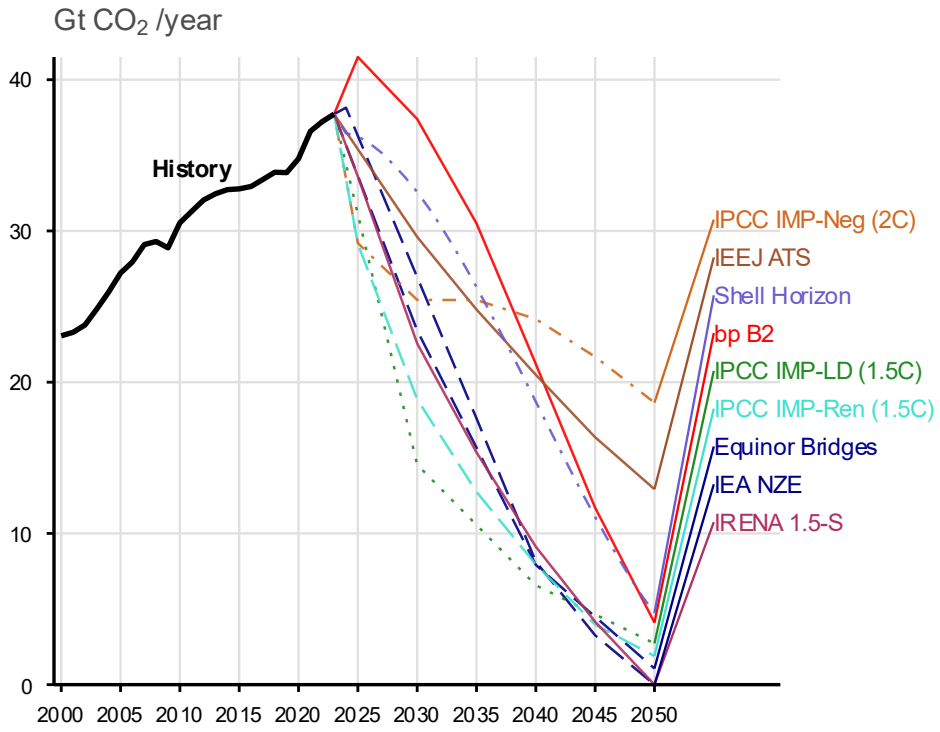
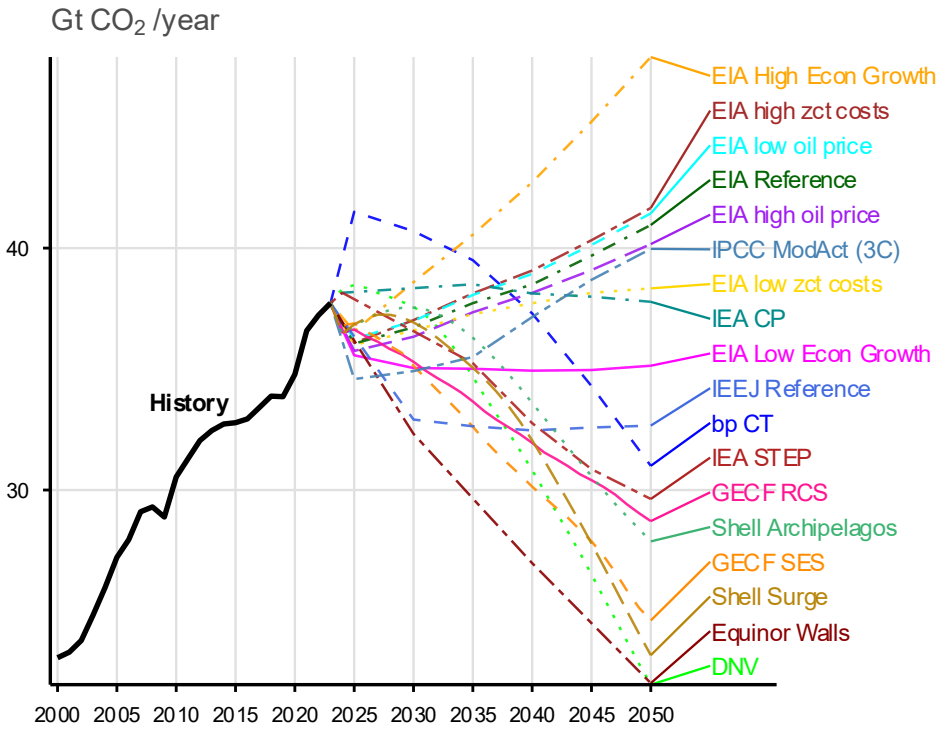
In roughly half of the Reference and Evolving policies pathways, global CO_2 emissions remain flat or continue to rise through 2050

CO_2 Emissions: Ambitious Climate Scenarios



CO_2 Emissions: Reference and Evolving Policies



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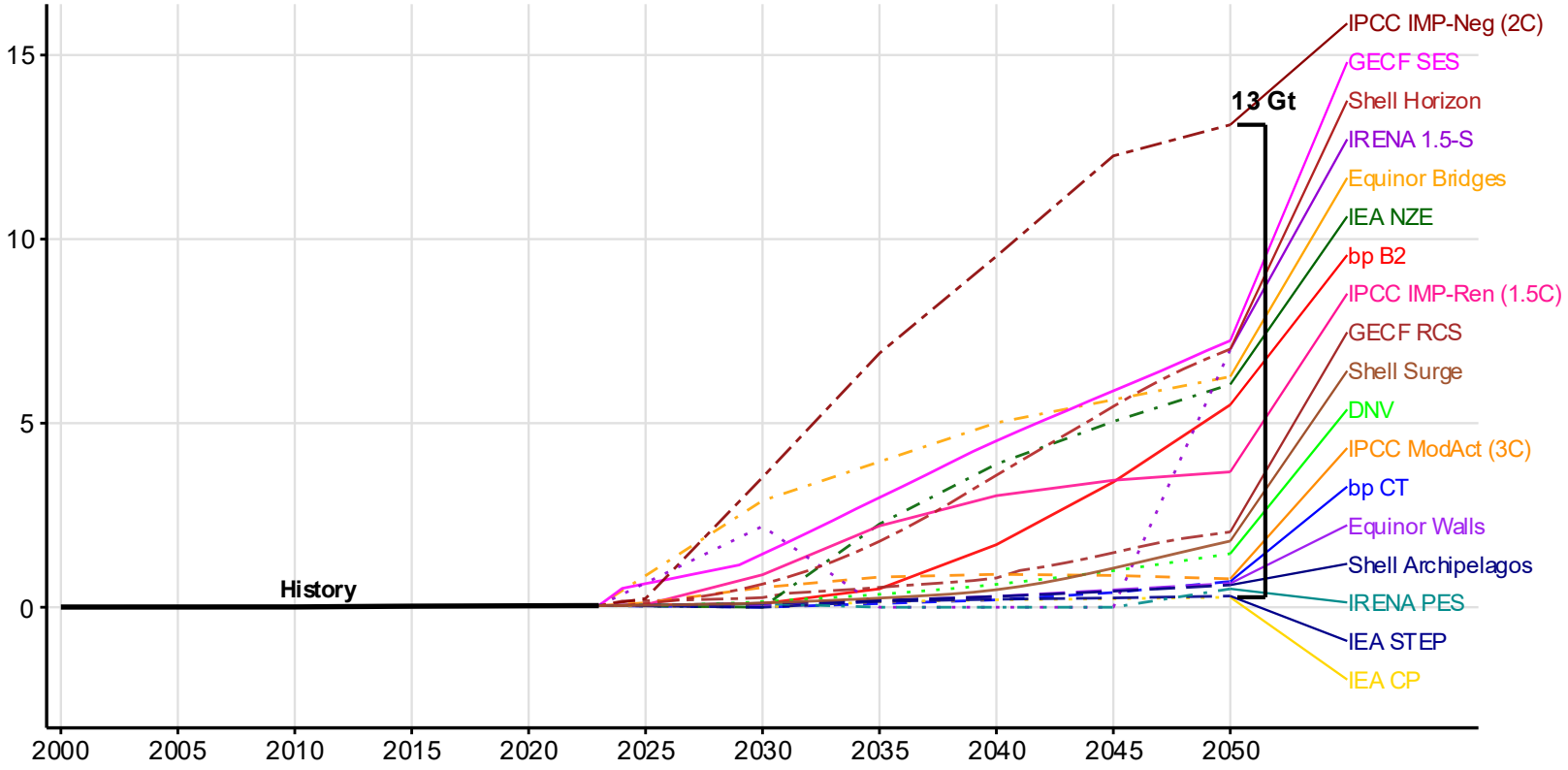
Despite wide variation across scenarios, projected CO_2 capture averages at around 4 Gt by 2050

Carbon Capture (CCUS, CCS, BECCS, Industrial)

Gt CO_2 /year

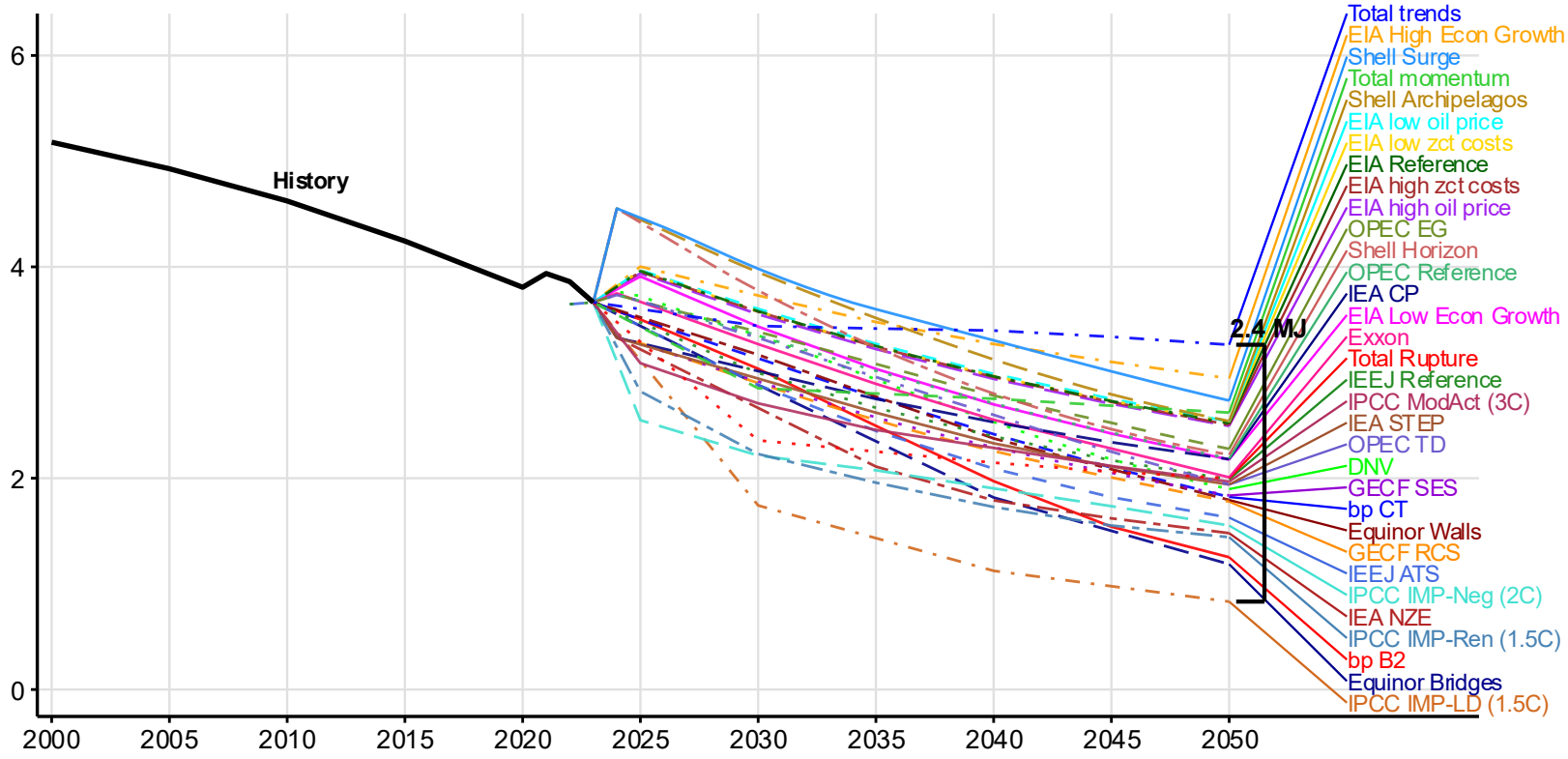


Sources: IEF, IEA WEO 2025, Shell Energy Security Scenarios 2025, IRENA World Energy Transition Outlook 2024, bp Energy Outlook 2025, DNV's Energy Transition Outlook 2025, GECF Global Gas Outlook 2025, Equinor Energy Perspectives 2025, and IPCC AR6. Note: Some scenarios start after the historical series ends; their curves therefore begin at the first year each outlook reports projections

All scenarios show a continued decline in energy intensity

Primary Energy Consumption Per Unit of GDP

MJ per 2023 USD PPP



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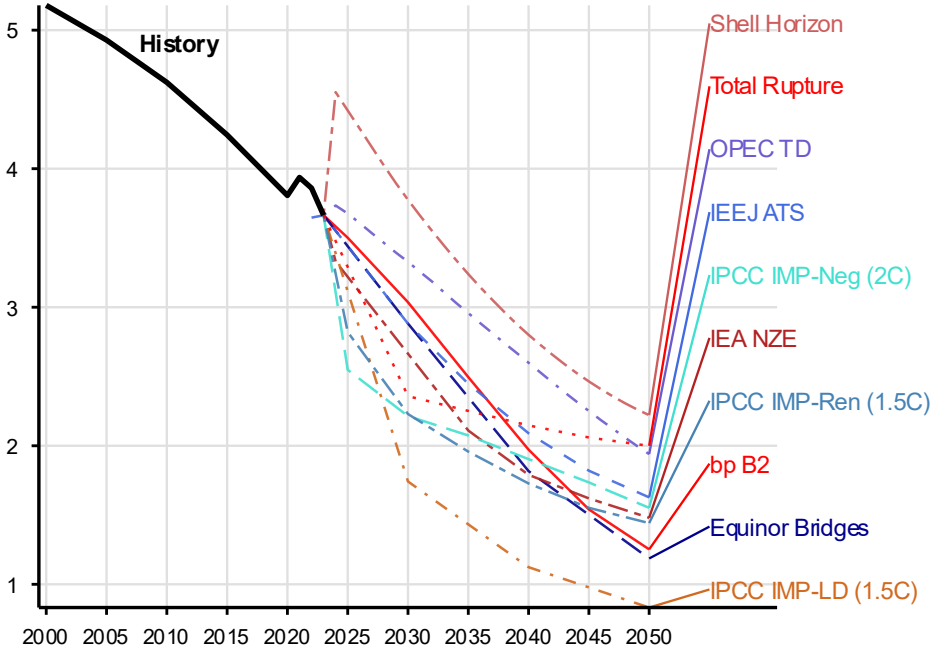
Over half of the Reference and Evolving-policies scenarios display rising or plateauing trends in primary energy consumption per unit of GDP

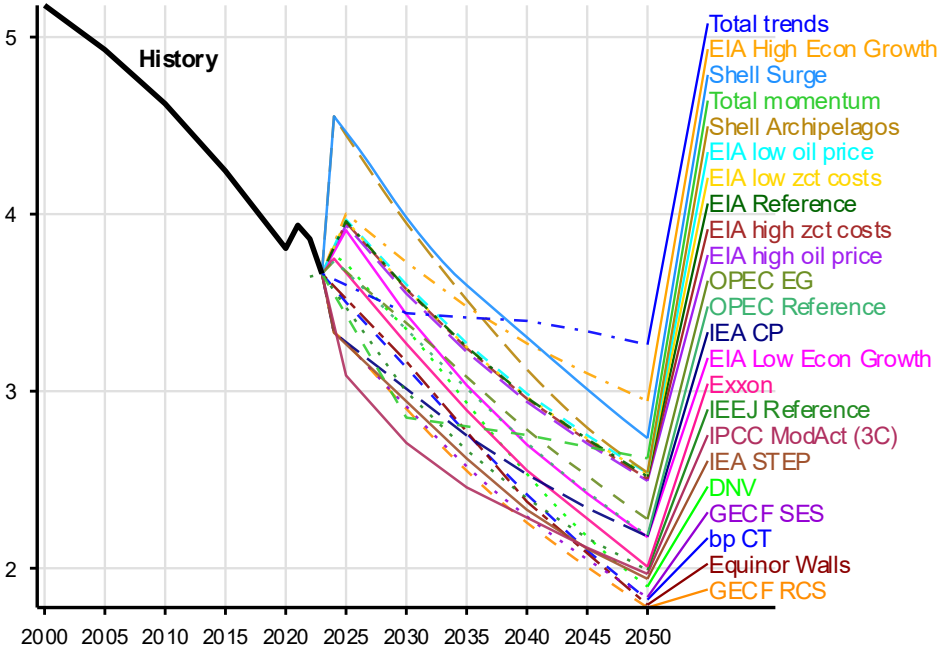
Primary Energy Consumption Per Unit of GDP: Ambitious Climate Scenarios

MJ per 2023 USD PPP



Primary Energy Consumption Per Unit of GDP: Reference & Evolving Policies

MJ per 2023 USD PPP



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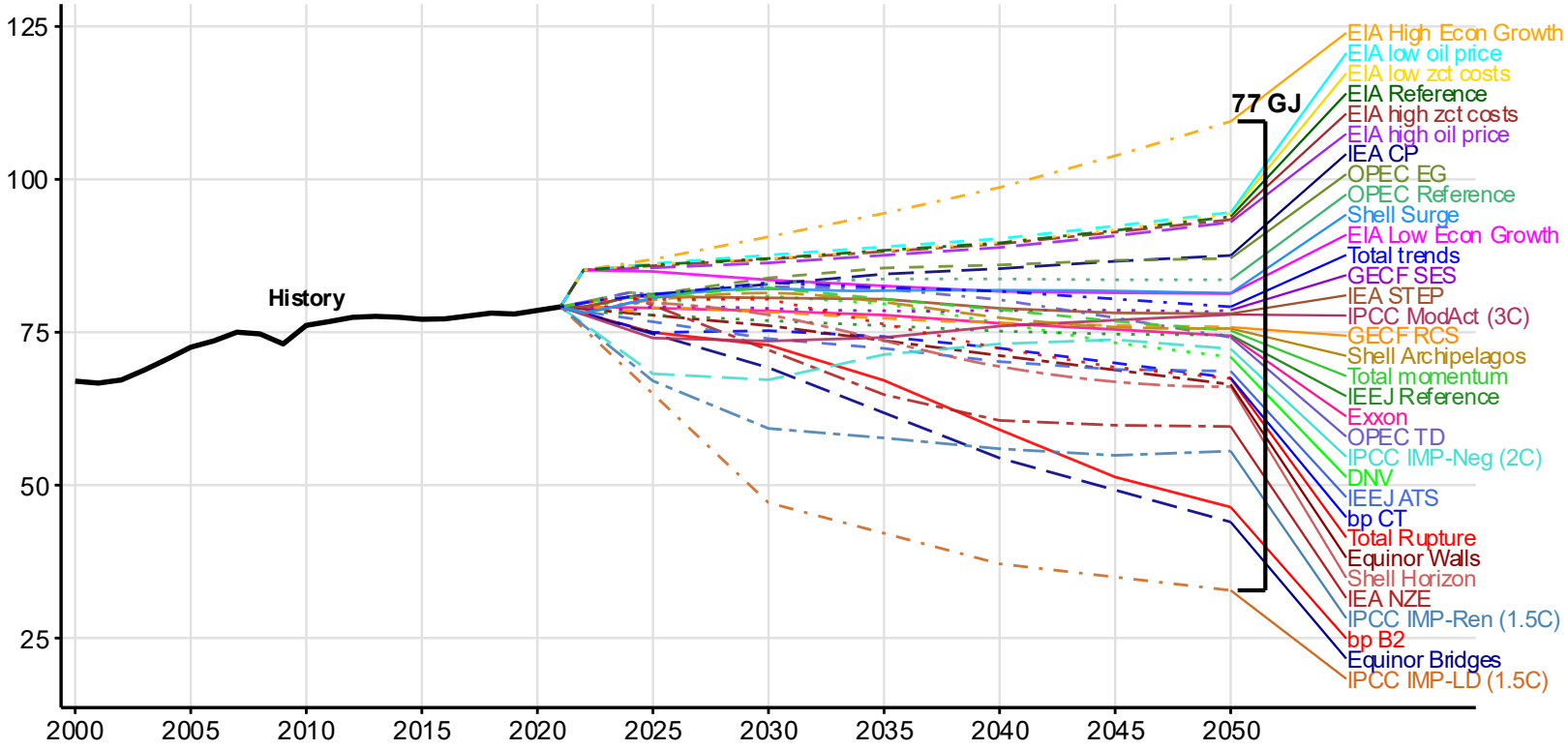
A 77 GJ per-capita gap reflects differing assumptions about future energy access and productivity in 2050

Primary Energy Consumption Per Capita

Gigajoules per capita



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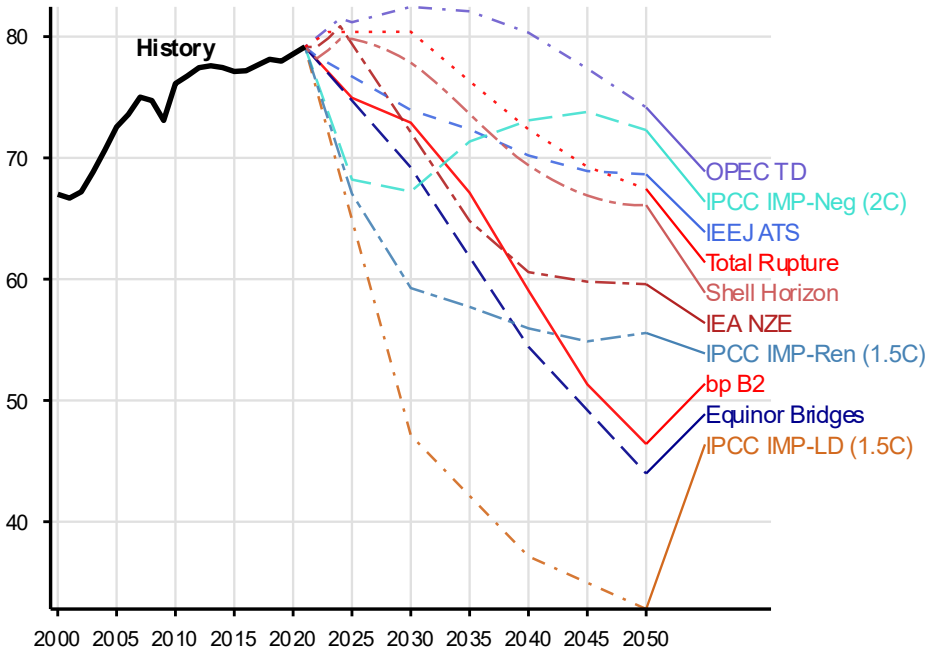
Ambitious climate scenarios project significant reductions in per-capita energy use relative to Evolving policies scenarios

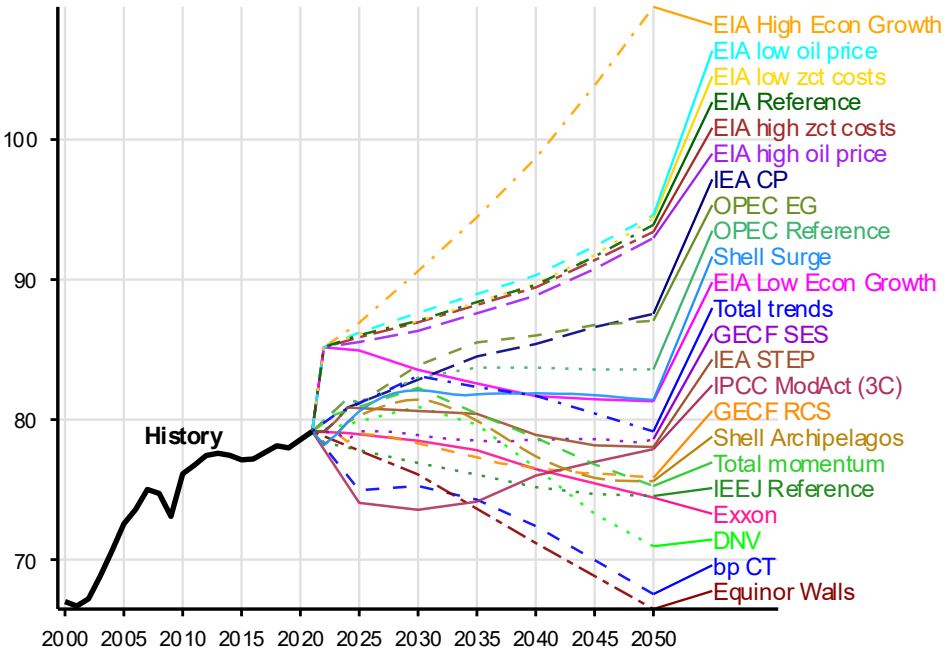
Primary Energy Consumption Per Capita: Ambitious Climate Scenarios

Gigajoules per capita



Primary Energy Consumption Per Capita: Reference & Evolving Policies

Gigajoules per capita



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Appendix

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 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.

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