



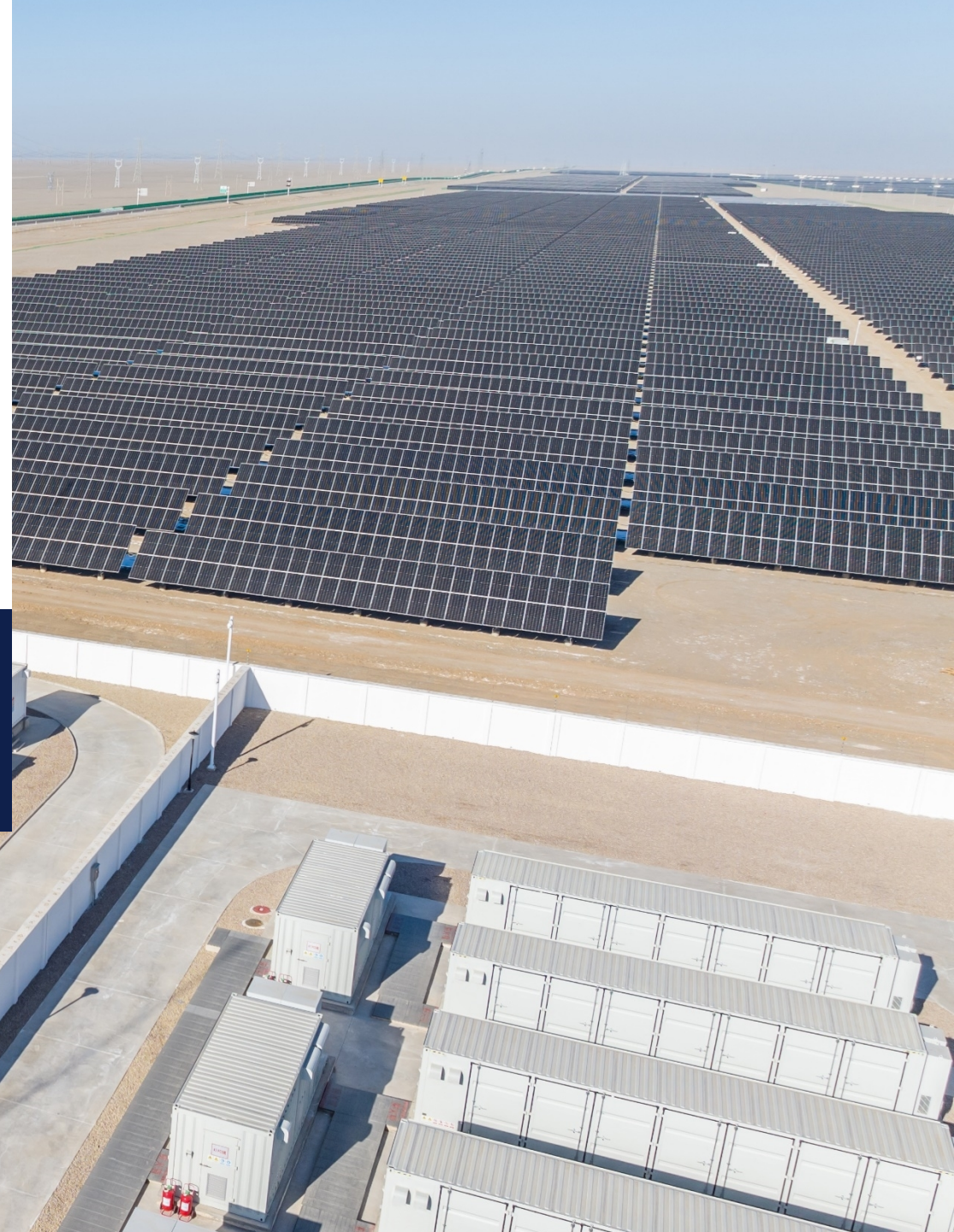
WHEN TRUST MATTERS

Energy Transition Outlook 2024

A global and regional forecast to 2050

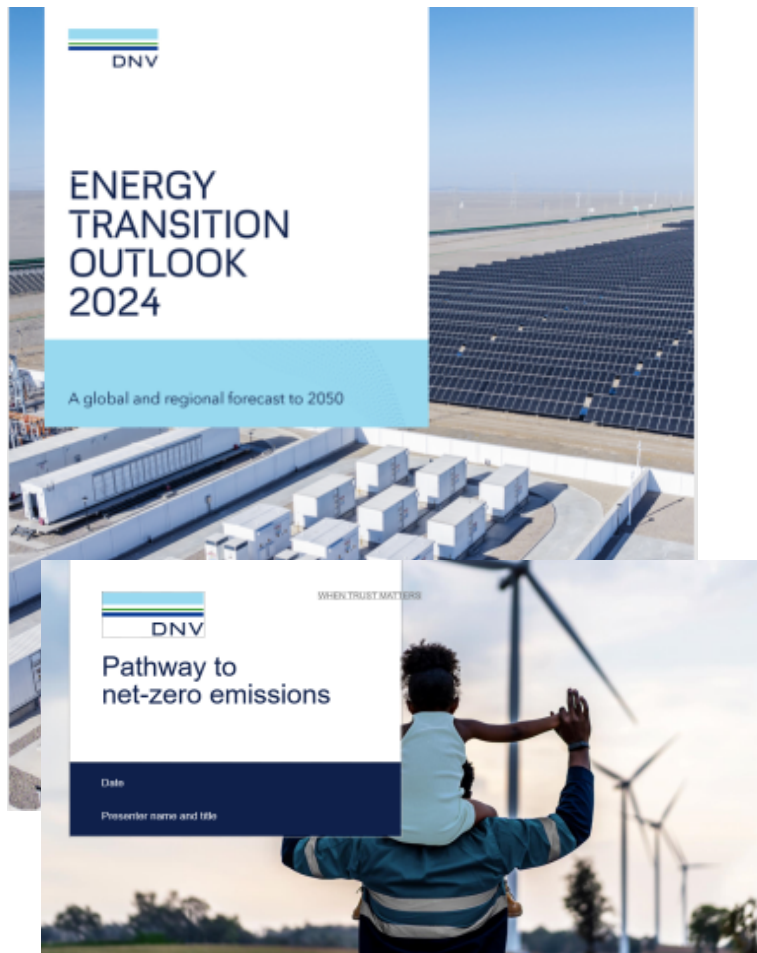
For NBA

Abby Zhou, DNV Energy Systems
2024.10.29



Suite of publications available on eto.dnv.com

Main publication



Regional reports



Sector reports



Highlights



2024 is likely the year of peak energy emissions, but the slow decline in post-peak emissions keeps key climate goals out of reach

Slow developments in hard-to-electrify sectors contrast with rapid cost reduction and growth of PV and batteries

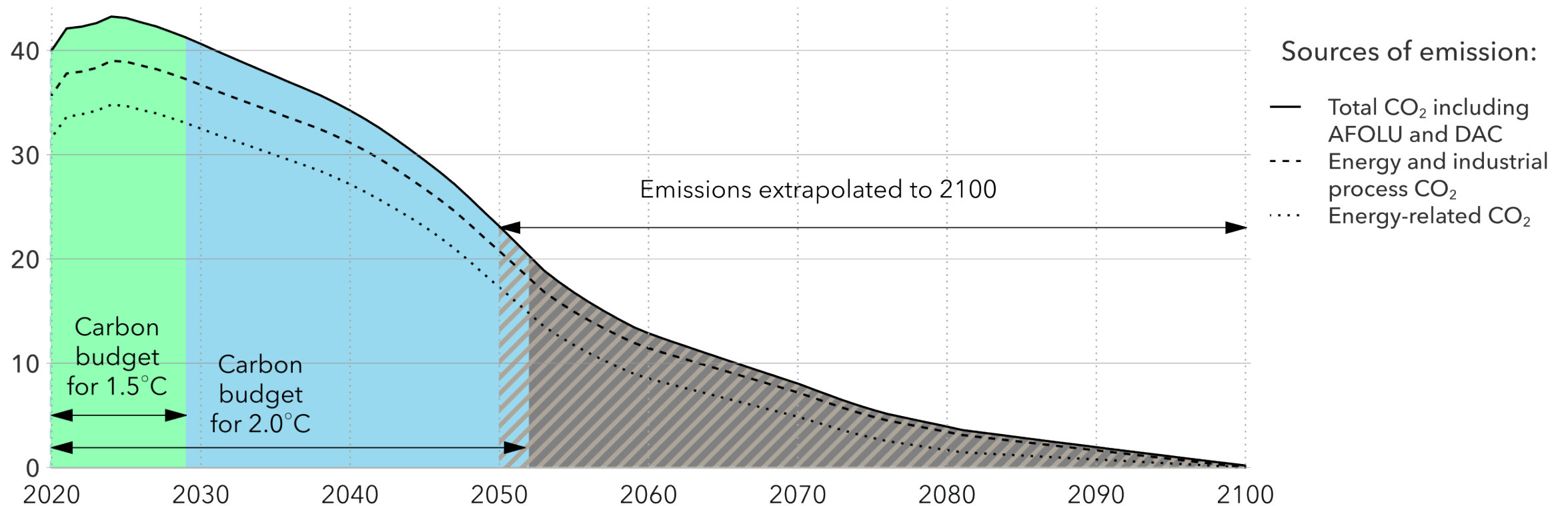
Highly competitive Chinese clean technology is speeding up the transition, but rival national economic and security priorities are headwinds

Market forces are necessary but insufficient; energy policy needs urgent alignment with climate goals

Cumulative emissions exhaust 1.5°C budget in 2029, 2°C budget in 2052: Indicates 2.2°C global warming by the end of the century

World CO₂ emissions and associated carbon budgets

Units: GtCO₂/yr

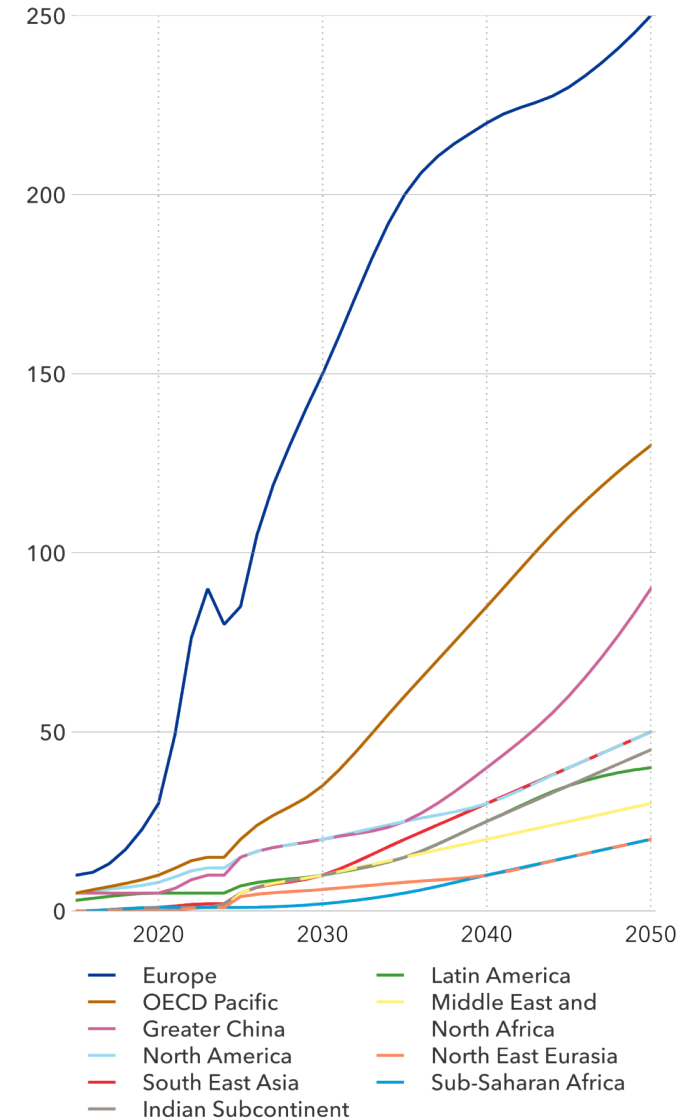


Large regional variation in carbon pricing

- Regions Greater China, Europe, North America are projected to reach carbon-price levels in the range of USD 20 to 150/tCO₂ by 2030 and USD 50 to 250/tCO₂ by 2050.
- Across the 10 Outlook regions, carbon pricing by mid-century is projected to range between USD 20/tCO₂ (North East Eurasia, Sub-Saharan Africa) and USD 250/tCO₂ (Europe)
- ‘All carrot and no stick’ approaches insufficiently disincentives emissions and unabated fossil fuels

Carbon price by region

Units: USD/tCO₂

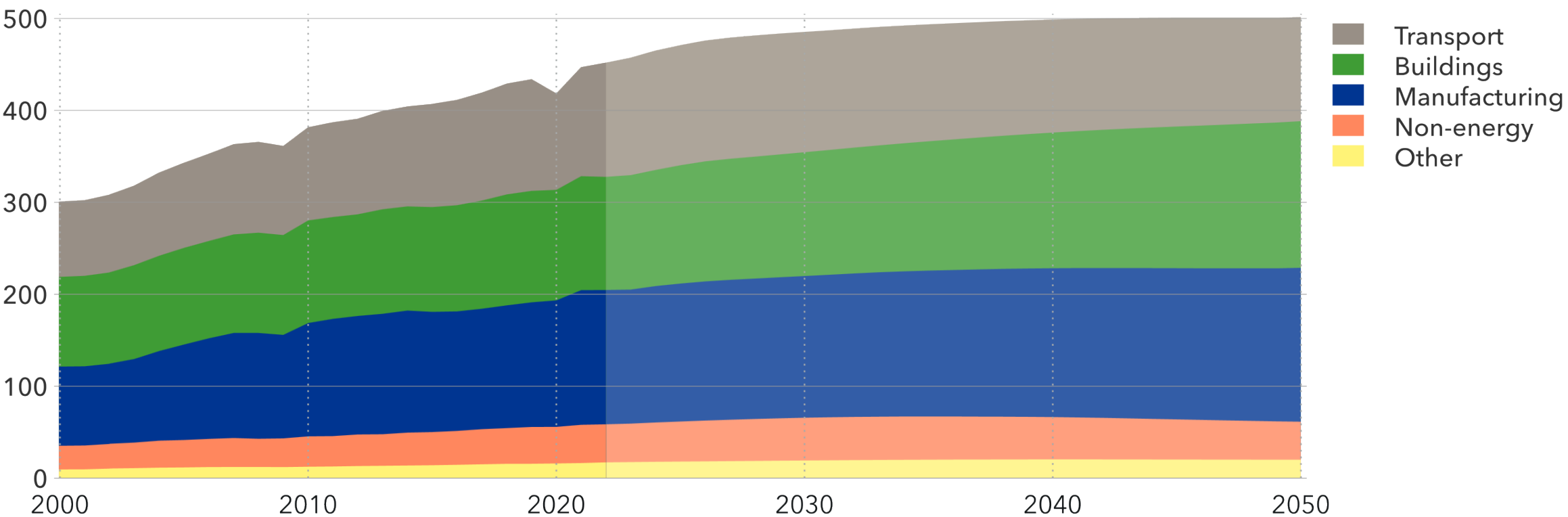


Energy Demand Outlook

Final energy demand levels off from 2040

World final energy demand by sector

Units: EJ/yr



Historical data source: IEA WEB (2024)

Transport sector key findings

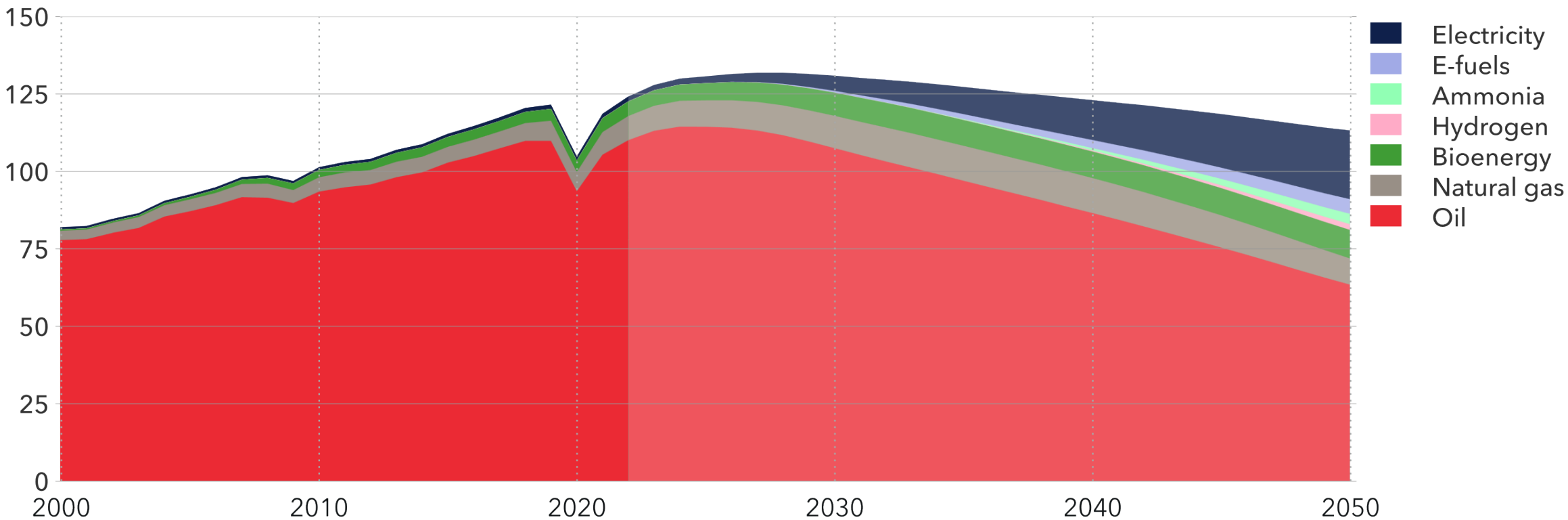
- Electrification of road transport is fast, and by the next decade we will see 50% of all new passenger vehicle sales will be EVs, globally.
- Total sector oil use, led by road transport, will halve by 2050
- Maritime and aviation will decarbonize with biofuels, hydrogen, and synthetic fuels with incentivizing policies for market uptake



Efficient electricity makes big inroads in transport, and oil use halves

World transport energy demand by carrier

Units: EJ/yr

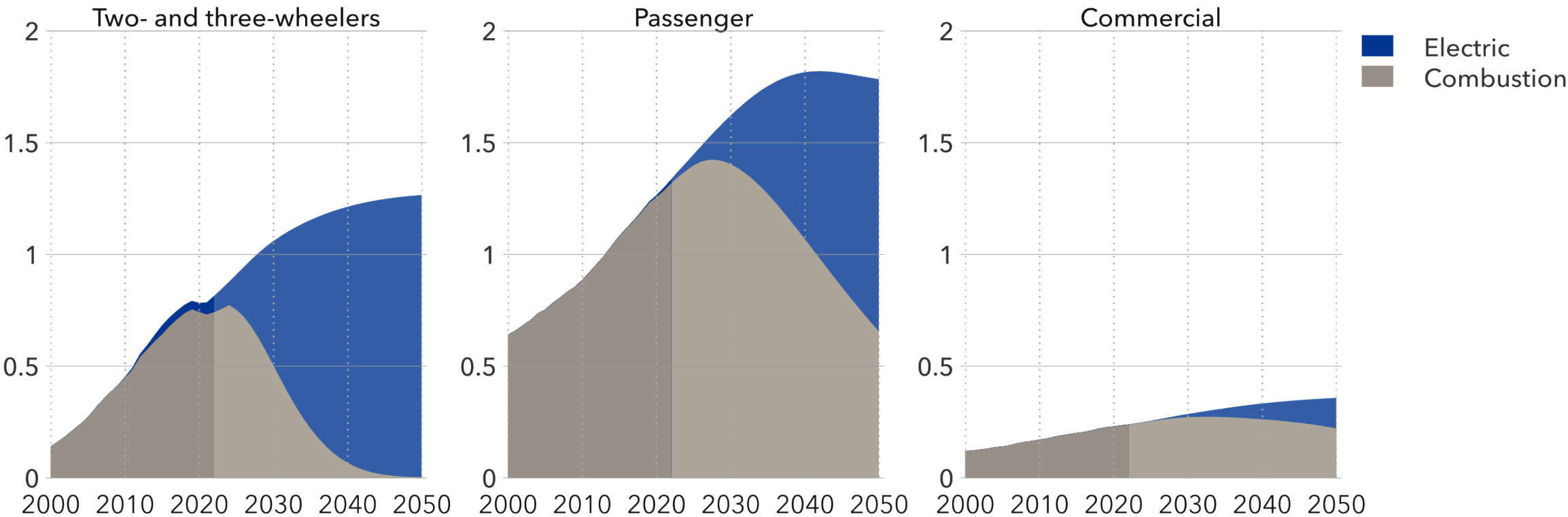


Historical data source: IEA WEB (2024)

60% more passenger vehicles in 2050, over 2/3 being EVs

World number of road vehicles by type and drivetrain

Units: Billion vehicles

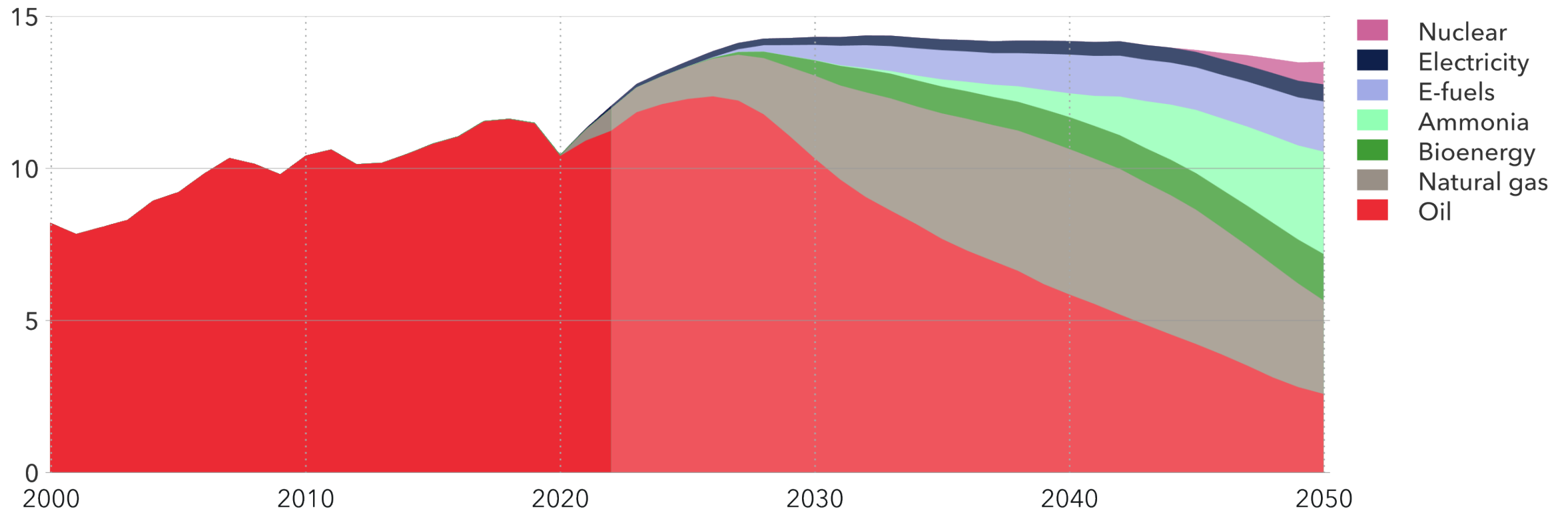


Note: Combustion vehicles include ICEs and PHEVs. Electric is >99% battery electric and <1% fuel cell electric.
Historical data source: Marklines (2022), IEA EV Outlook (2023), EV Volumes (2022)

The maritime fuel mix will change dramatically

Maritime energy demand by carrier

Units: EJ/yr



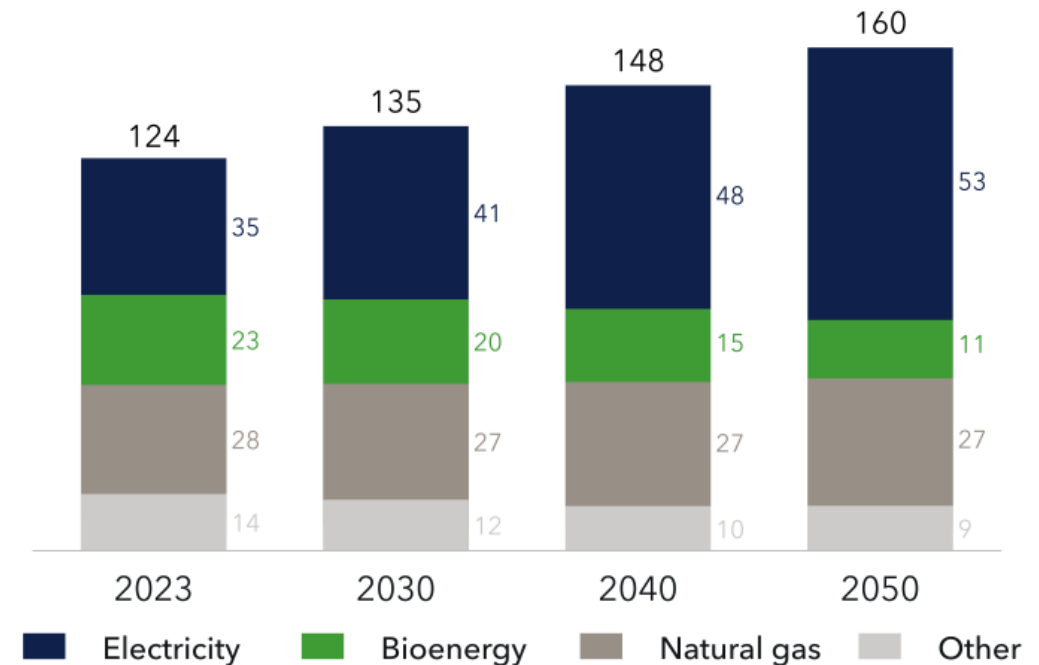
Historical data source: IEA WEB (2024)

Building sector key findings

- Global energy demand for buildings is set to grow nearly 30% over the next three decades, from 124 EJ per year in 2023 to 160 EJ per year in 2050.
- Electricity's share of buildings energy mix will grow from 35% in 2023 to 53% in 2050, with demand nearly doubling from 43 EJ in 2023 to 85 EJ in 2050.
- In space heating, large efficiency gains, particularly from heat-pumps will reduce energy demand by 10%

Buildings energy demand by carrier

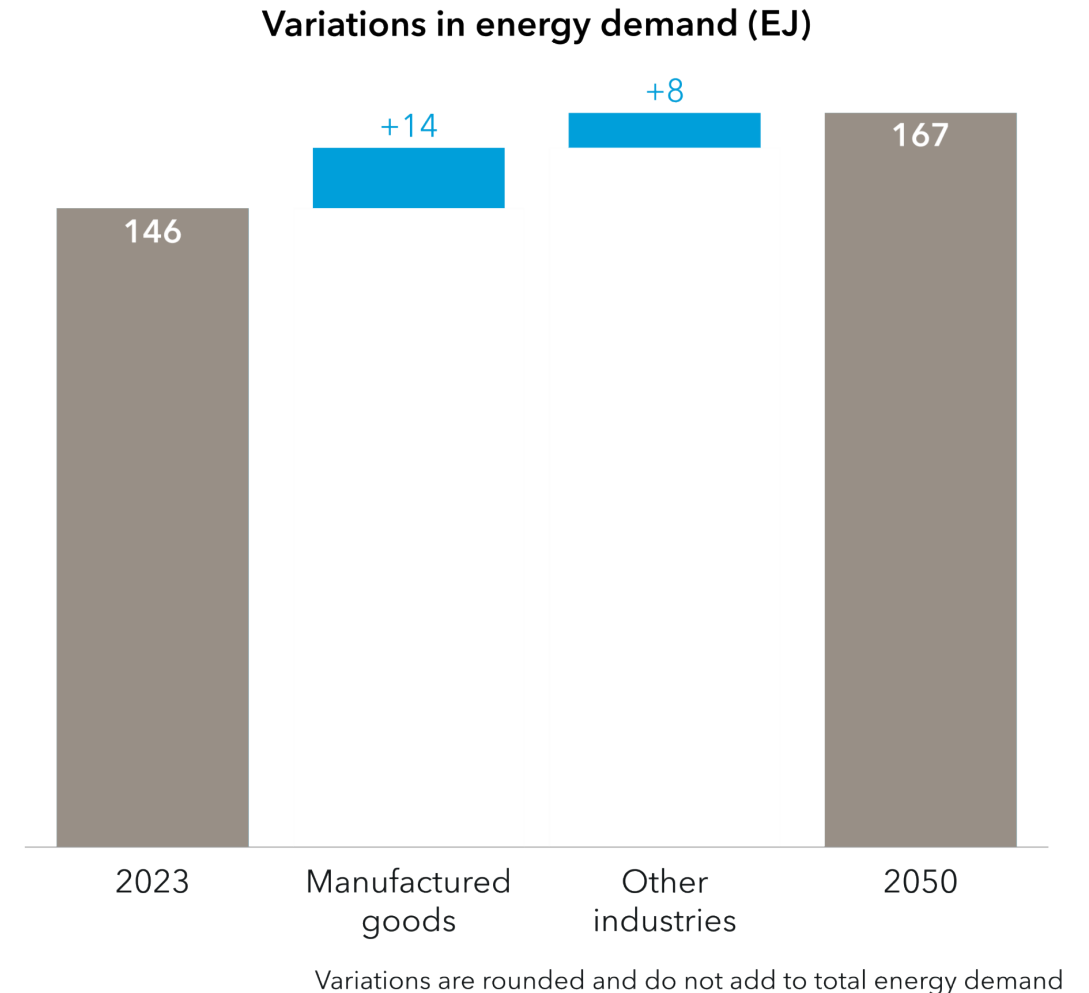
Units: EJ/yr



Historical data source: IEA WEB (2024)

Manufacturing sector key findings

- Despite electrification and other efficiency improvements, energy demand grows slowly until 2050, 15% higher than today
- Demand from heavy industries decline in China, while it grows in other regions like the Indian Subcontinent
- Hydrogen starts replacing coal and gas in high-heat processes from 2030s, but still supplies only 6% of final energy demand by 2050

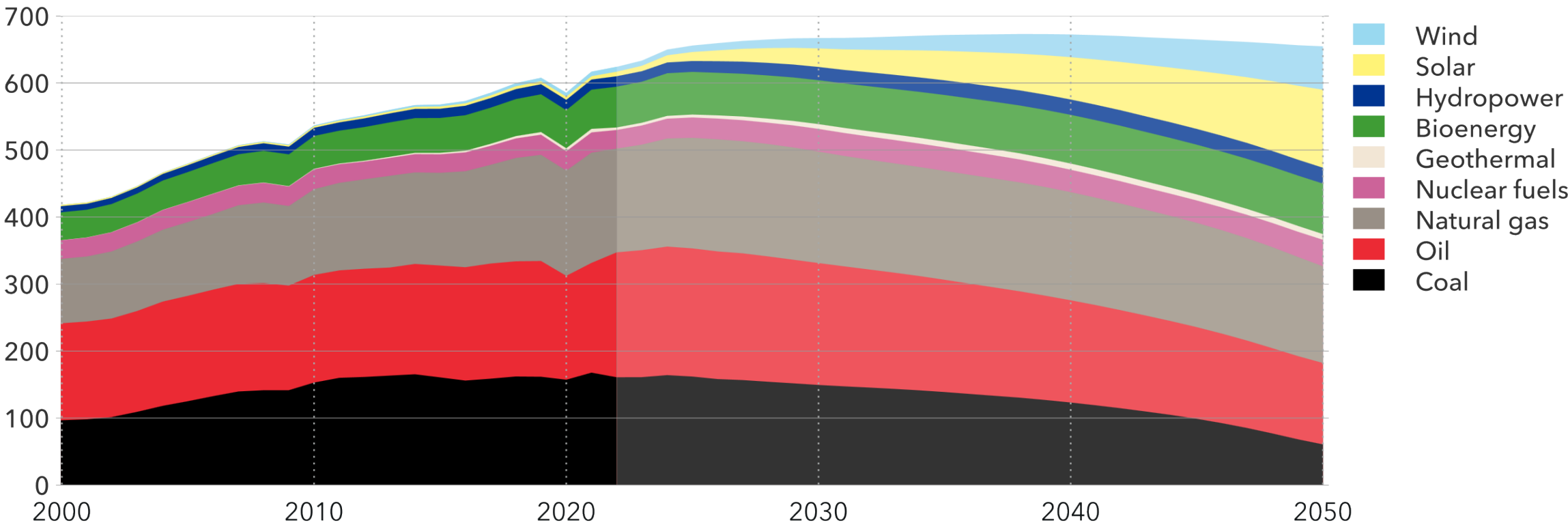


Energy Supply Outlook

Primary energy supply peaks in 2038

World primary energy supply by source

Units: EJ/yr



Historical data source: IEA WEB (2024)

Electricity and renewables key findings

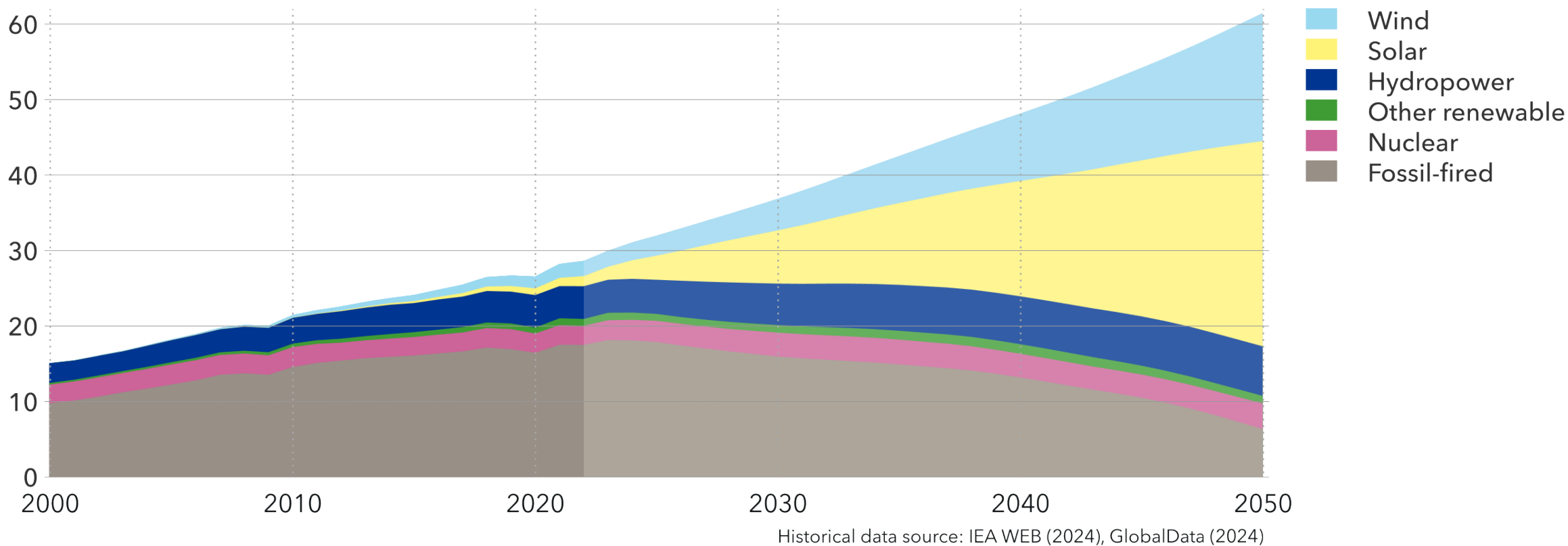
- Global electricity share in final energy demand almost doubles from 20% to 36% in 2050
- Variable renewables come to dominate the power mix - solar PV and wind have a 72% share in 2050
- Grid infrastructure needs significant improvements - with storage, and flexibility-enabling technologies key to integrate variable renewables effectively



72% of electricity will come from solar and wind in 2050

World grid-connected electricity generation by power station type

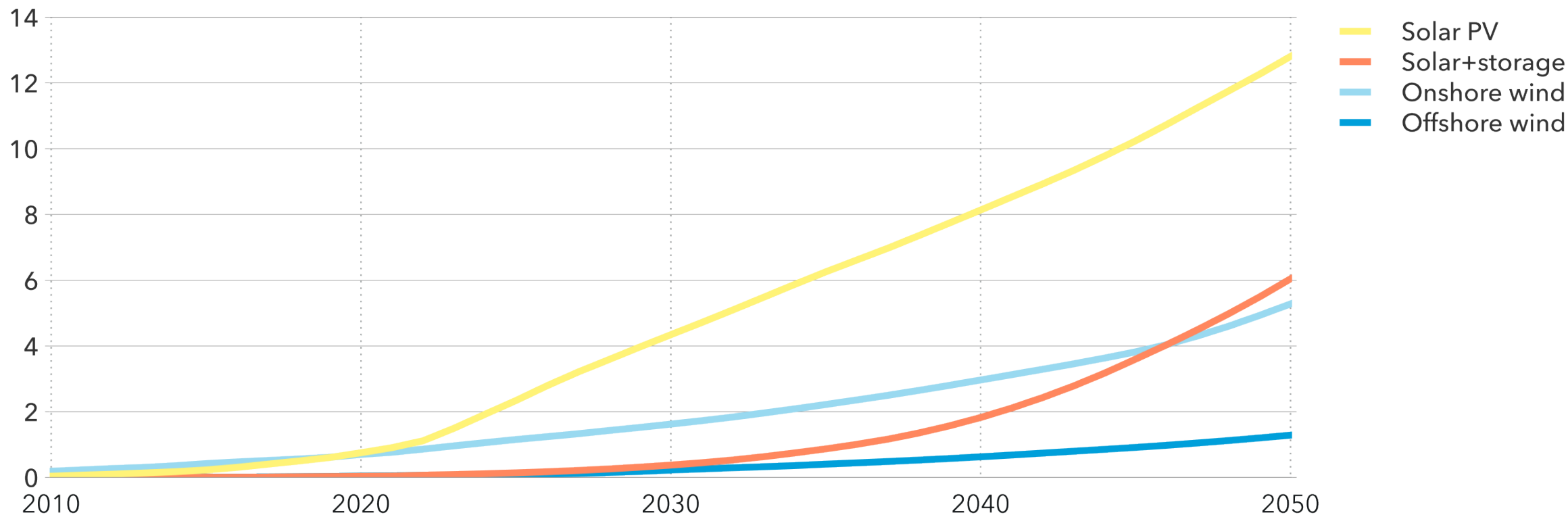
Units: PWh/yr



Rapid expansion of solar PV and wind, but starting from a low base

World grid-connected and off-grid installed capacity from solar and wind

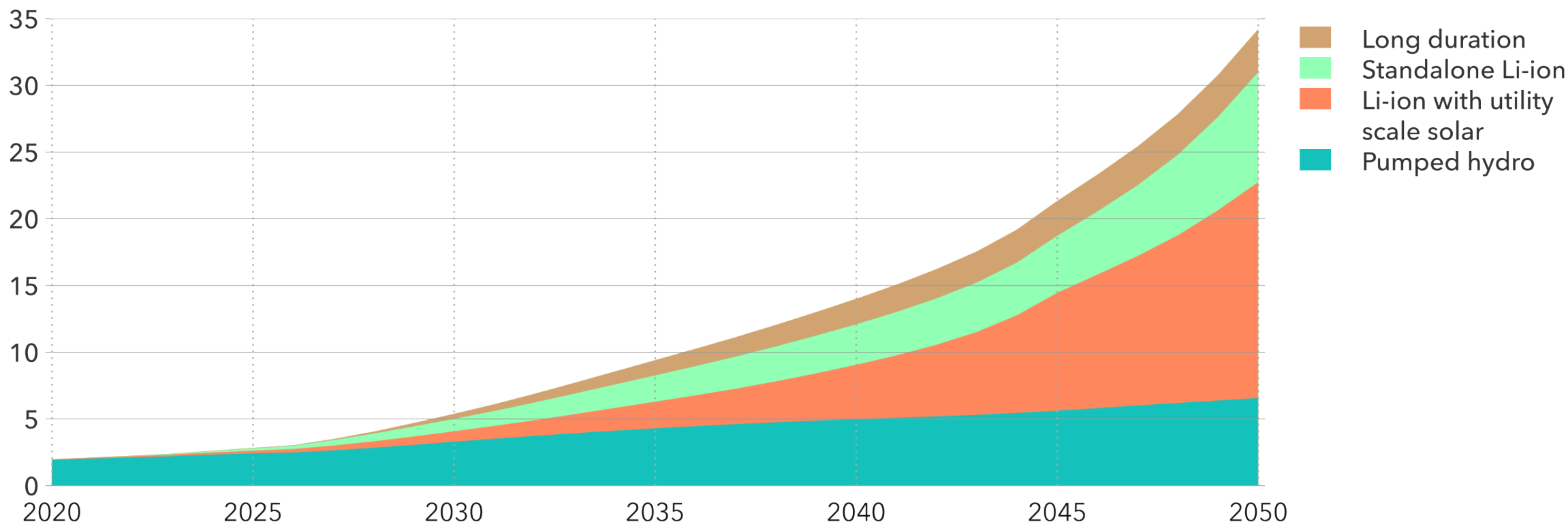
Units: TW



Storage is essential for the inclusion of variable renewables in electricity

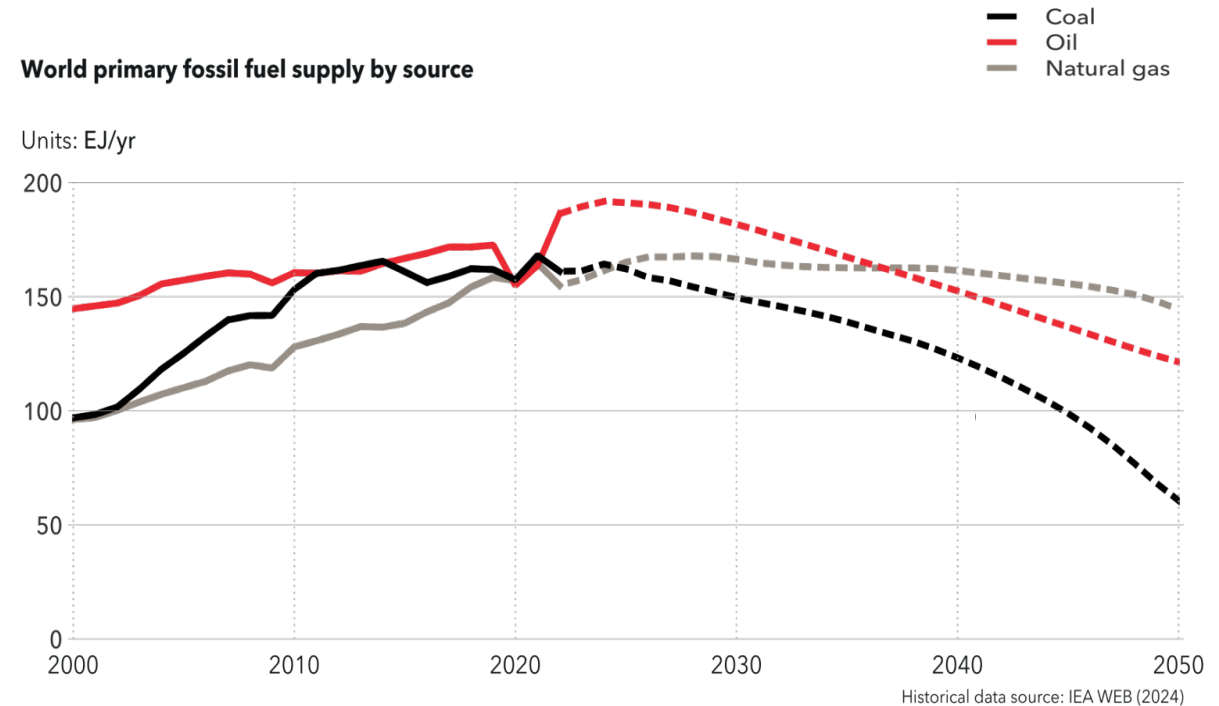
World utility-scale electricity storage capacity

Units: TWh

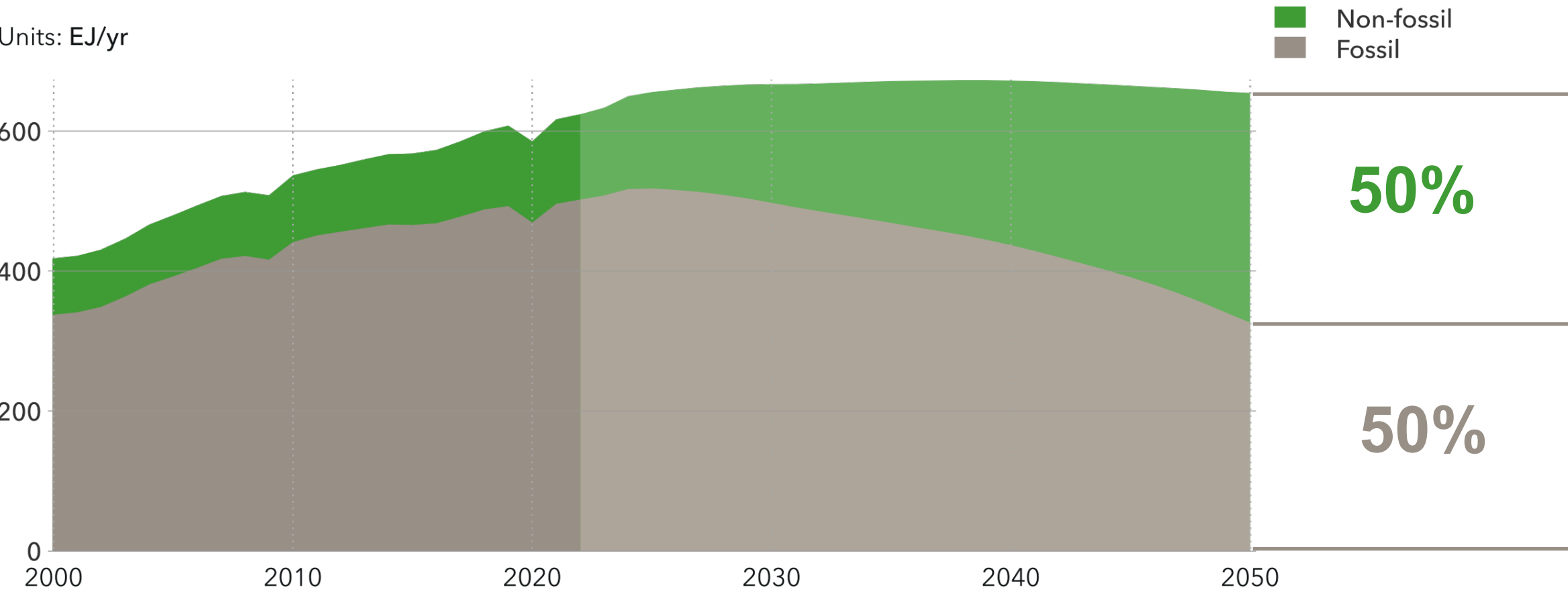


Oil and gas key findings

- 2024 is projected to be peak oil demand, before a projected slow decline due to a decreasing use in transport.
- Gas demand will peak before 2030 but, due to its role as a dispatchable, cleaner energy source (relative to coal and oil), it will only decline by 14% from today's levels by 2050.
- Coal was slated to peak in 2014, but there was a secondary peak in 2022 due to the global energy crisis. Coal primary supply is still projected to decline, by almost 20% by 2030, and 65% by 2050, due to a declining use for electricity production.



Non-fossil energy reaches 50% in 2050



Hydrogen key findings

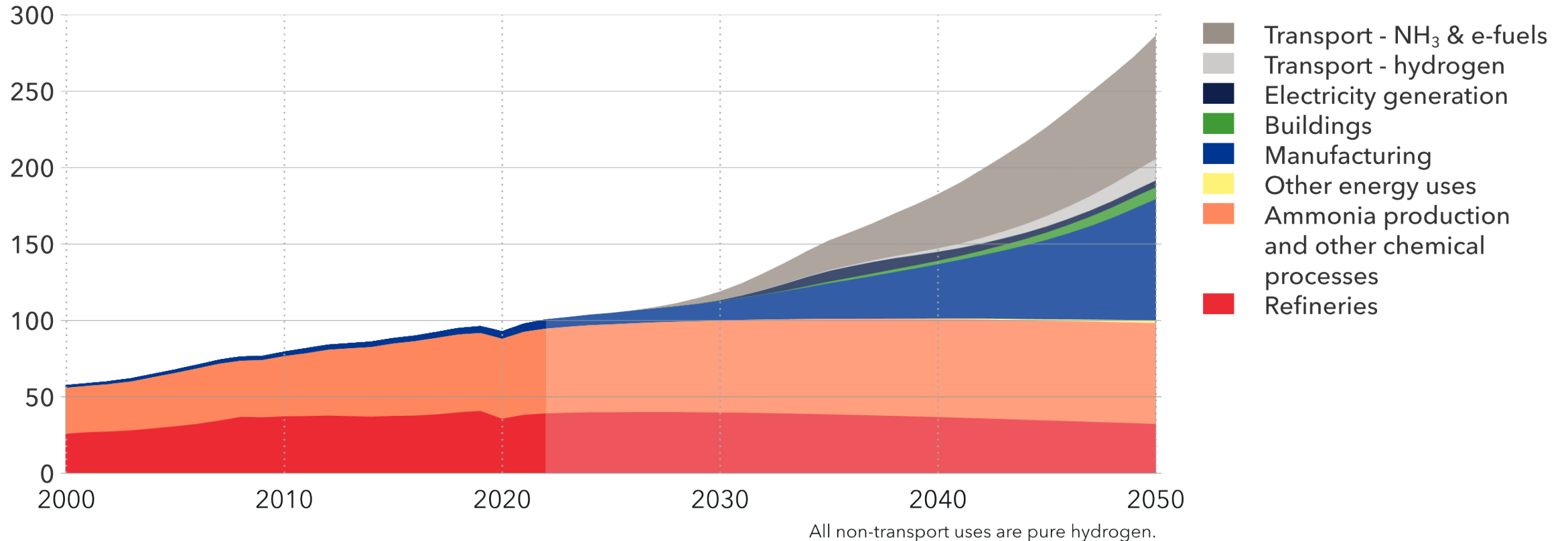
- Hydrogen and hydrogen-derivates are the most promising solution to decarbonize hard-to-electrify sectors, but will still be only 4% of global final demand in 2050
- Hydrogen will only be competitive globally vs incumbent technologies in 2040s
- Green hydrogen will dominate over time, mainly from dedicated renewables sources



Hydrogen - late but strong growth: 4% of global energy demand in 2050

Global demand for hydrogen and its derivatives by sector

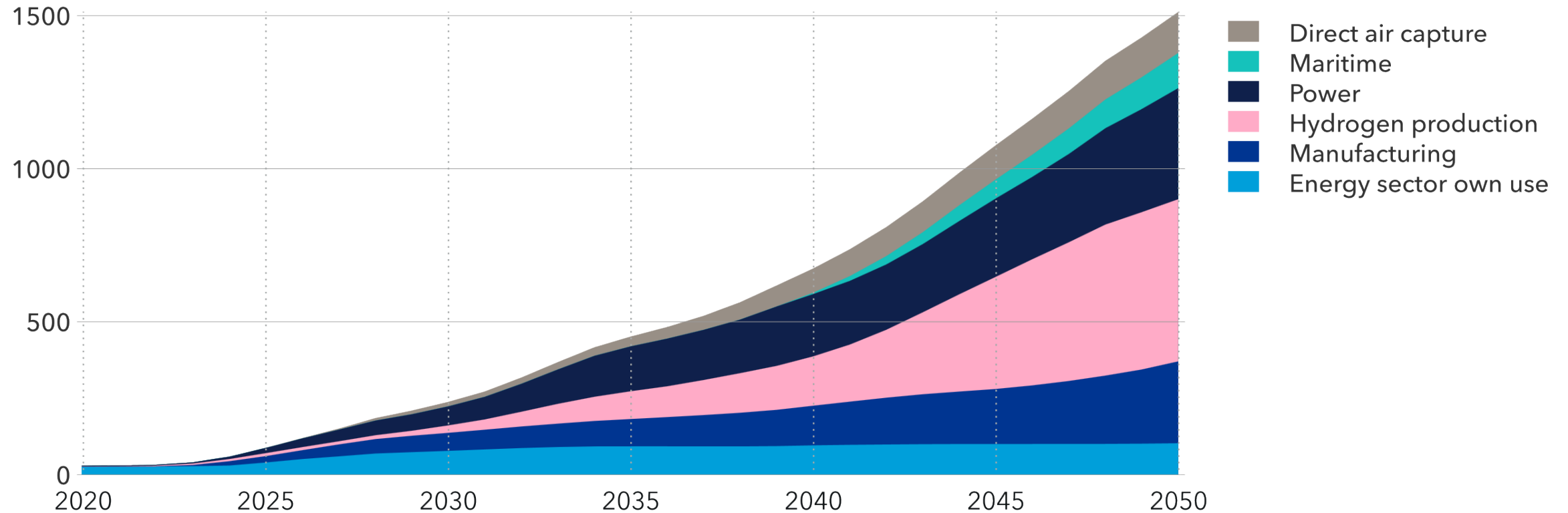
Units: MtH₂/yr



CCS picks up slowly and captures 6% of emissions in 2050

World CO₂ emissions captured by sector

Units: MtCO₂/yr

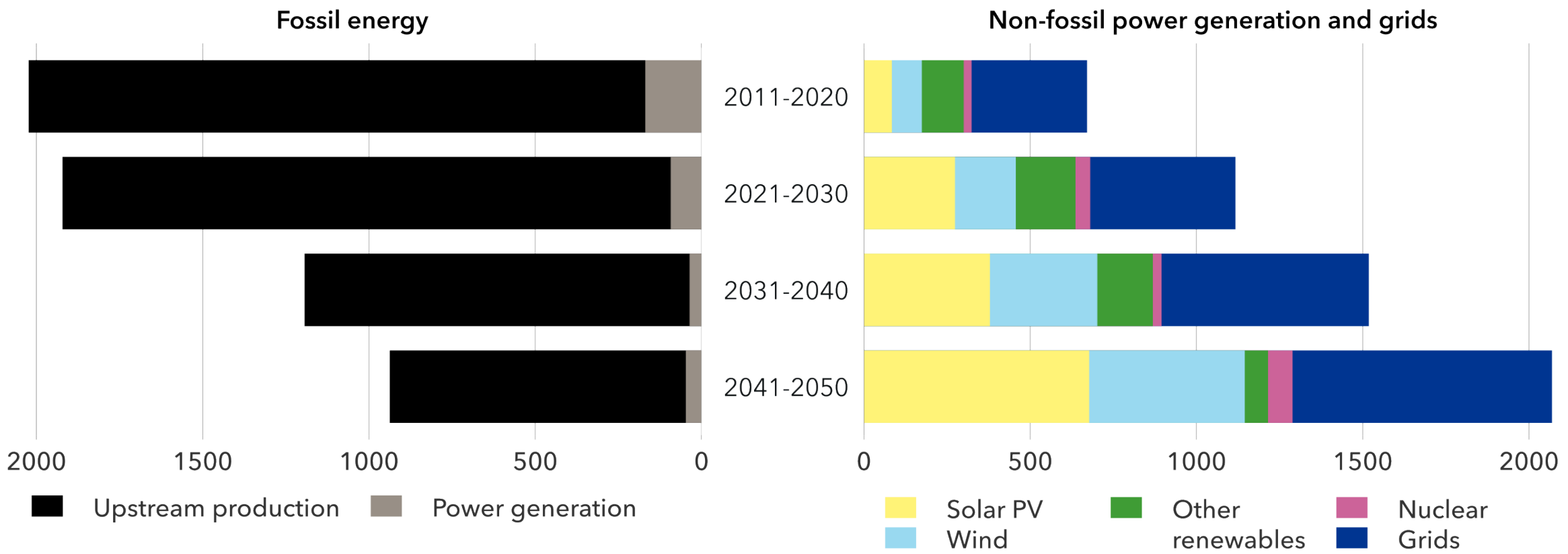


Hydrogen production includes production of ammonia and e-fuels.

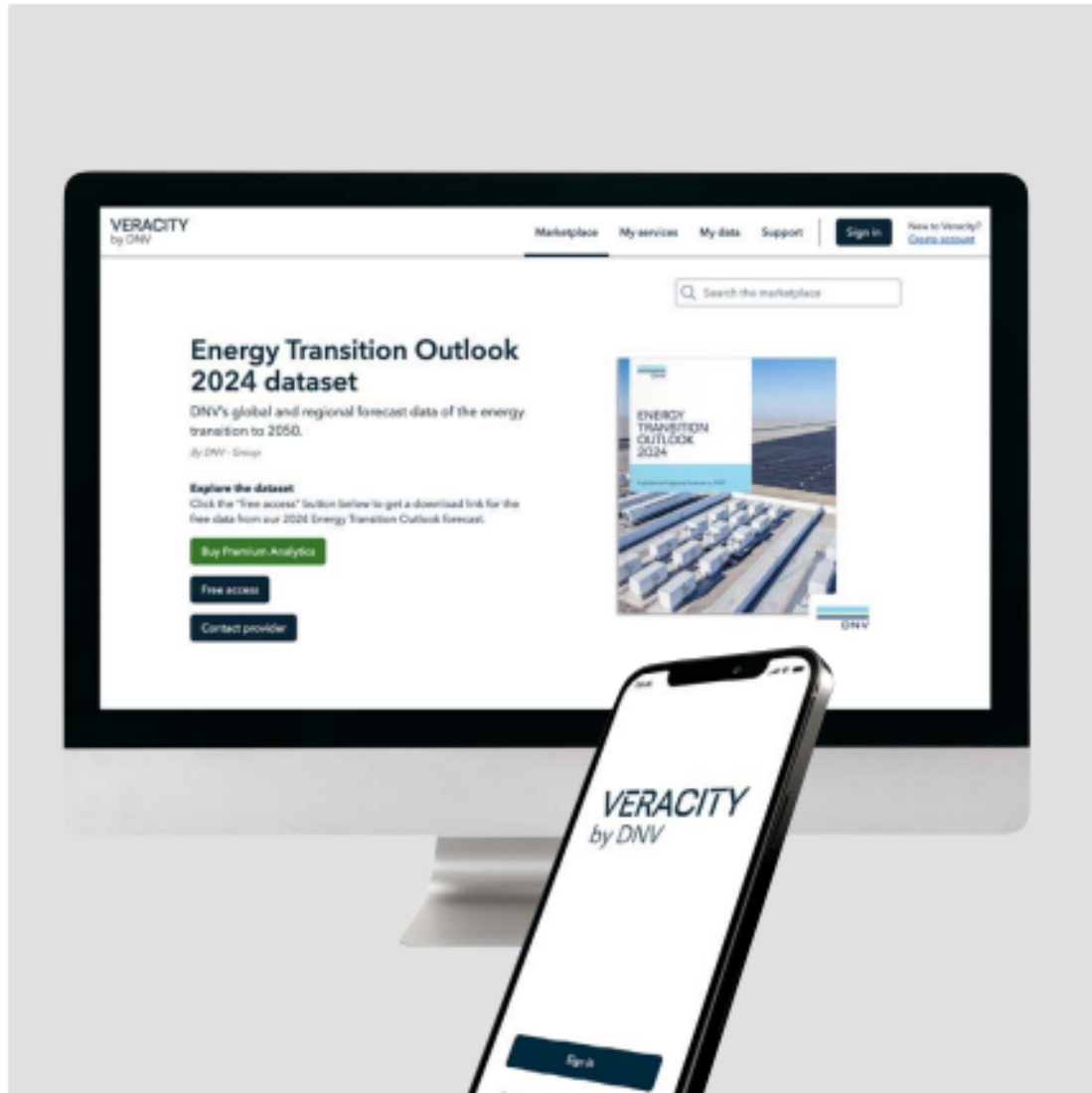
Energy transition is an affordable investment transition

Average yearly investments in the energy system

Units: USD billion/yr



Access our forecast data



All the forecast data in DNV's suite of Energy Transition Outlook reports, and further detail from our model, is accessible on Veracity — DNV's secure industry data platform.

dnv.com/eto-data



Thank you!

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