ENERGY TOMORROW

Global Oil Demand to Grow Through 2040

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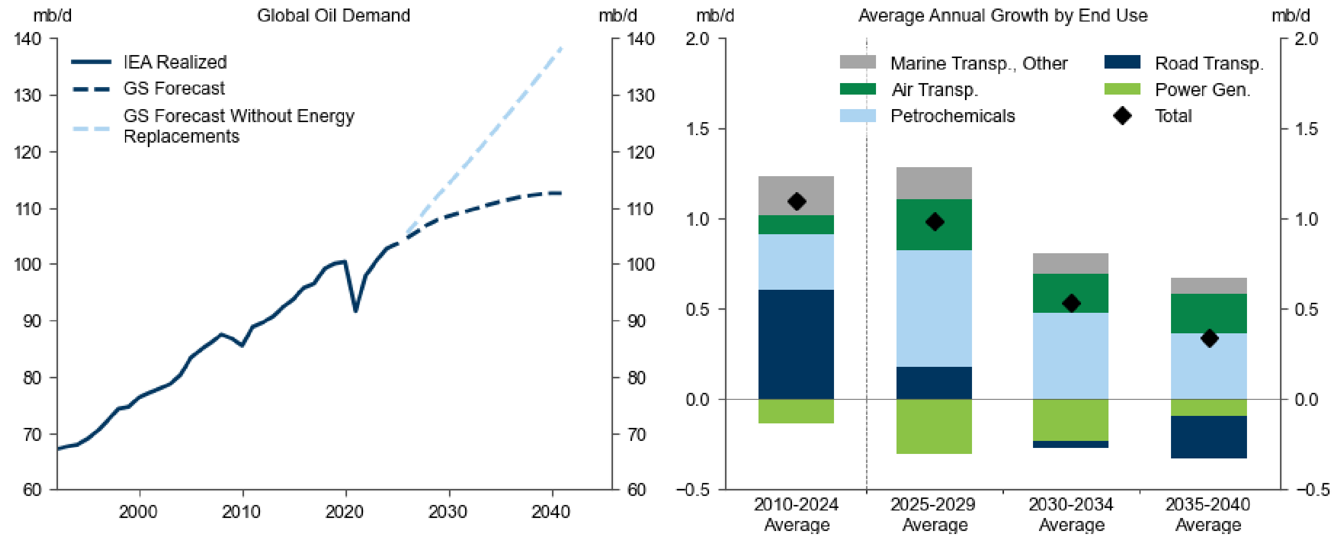
- We forecast **global oil demand to grow further from 103.5mb/d in 2024 to 113.0mb/d in 2040** at an annual average pace of 0.6mb/d (0.5% CAGR) as global energy demand rises and low-carbon technology and infrastructure bottlenecks persist. We expect solid annual average demand growth of 0.9mb/d in 2025-2030, before slowing to 0.1mb/d by 2040.
- We expect **road transportation** oil demand to edge up till 2030 as we incorporate our equity analysts' projections for sales of EV passenger vehicles and of LNG and EV trucks in China. The long plateau in road oil demand reflects an offset between the 58% rise in the global number of total vehicles by 2040 and the rise in the EV share in the passenger fleet to 30%.
- We expect **air transportation** oil demand to grow through 2040 at a solid annual average pace of 2.4% (or 0.2mb/d) as non-OECD incomes rise.
- As road demand peaks, **petrochemicals** become the key driver of global oil demand growth, with petrochemical oil demand (naphtha, ethane, LPG) growing at an average annual pace of 0.5mb/d or 2.1%.
- Three drivers support our above-consensus long-run oil demand view:
  - **Limited alternatives for jet fuel and petchem:** Technology bottlenecks limit scaling of sustainable aviation fuels (SAFs) and plastics recycling.
  - **Energy demand growth outpaces oil displacement by low-carbon alternatives:** Even for peaking road oil demand, we expect a long plateau after 2030 as the rise in the number of vehicles nearly offsets the decline in oil use per vehicle.
  - **Indirect AI boost to oil demand:** We incorporate a 3mb/d indirect boost from AI to global oil demand by 2040 via higher global GDP.
- We see **downside risks to our long-run oil demand forecast** from faster progress in low-carbon tech and lingering impact from potential recessions.
- **High refined product margins.** Our demand outlook supports our call that product margins will remain higher than before Covid. Increased uncertainty about long-term demand from the rise in low-carbon technology has depressed refining capex, while demand growth forces stretched refineries to run hard.

We Expect Global Oil Demand to Grow Through 2040 as Global Energy Demand Rises and as Oil Demand Growth Remains Solid in Petrochemicals and Aviation Given Limited Scalable Alternatives

Global Total Oil Demand



We estimate the replacement of oil demand with other energy sources since 2015.

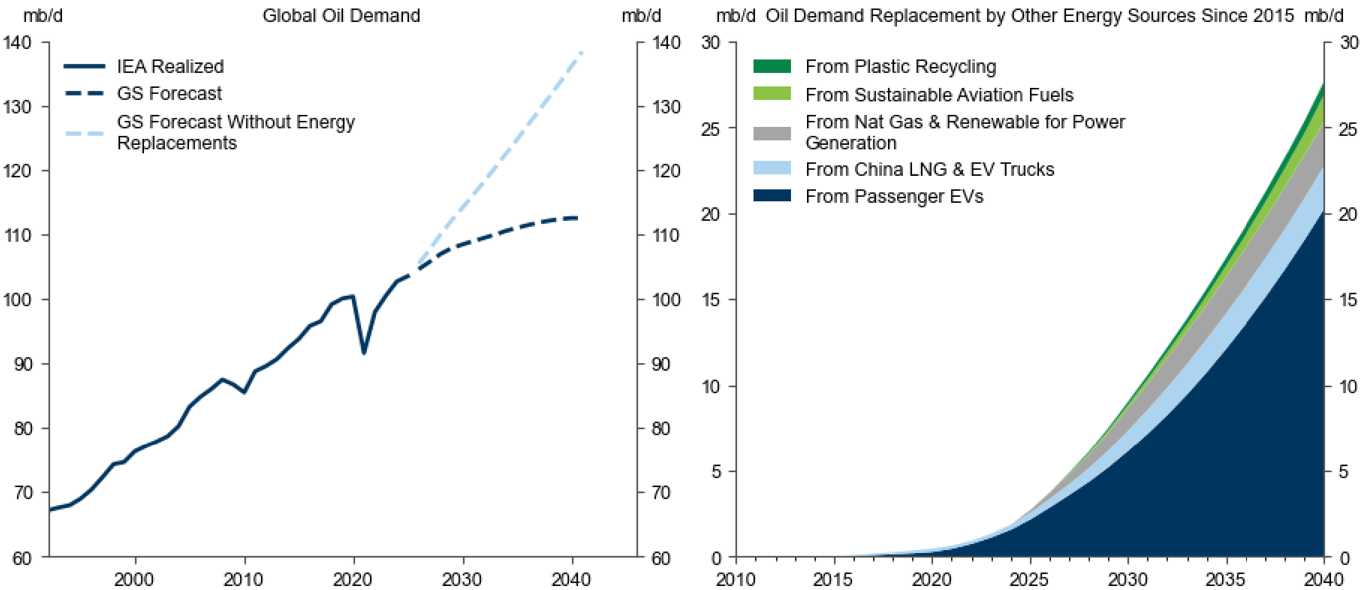
Source: IEA, Goldman Sachs Global Investment Research

Global Oil Demand to Grow Through 2040

We continue our *Energy Tomorrow* series with forecasts of global oil demand through 2040.

We see oil demand growing through 2040 (Exhibit 1, left panel) as global energy demand continues to grow and low-carbon technology and infrastructure bottlenecks persist. We forecast that global oil demand will grow from 103.5mb/d in 2024 to 113.0mb/d in 2040, at an annual average pace of 0.6mb/d (0.5% CAGR).[1] We expect annual average oil demand growth to remain solid around 0.9mb/d in 2025-2030, before gradually moderating to 0.1mb/d by 2040, with a likely long plateau in the early 2040s.

Exhibit 1: We Expect Oil Demand to Grow Through 2040 Despite Rising Oil Replacement



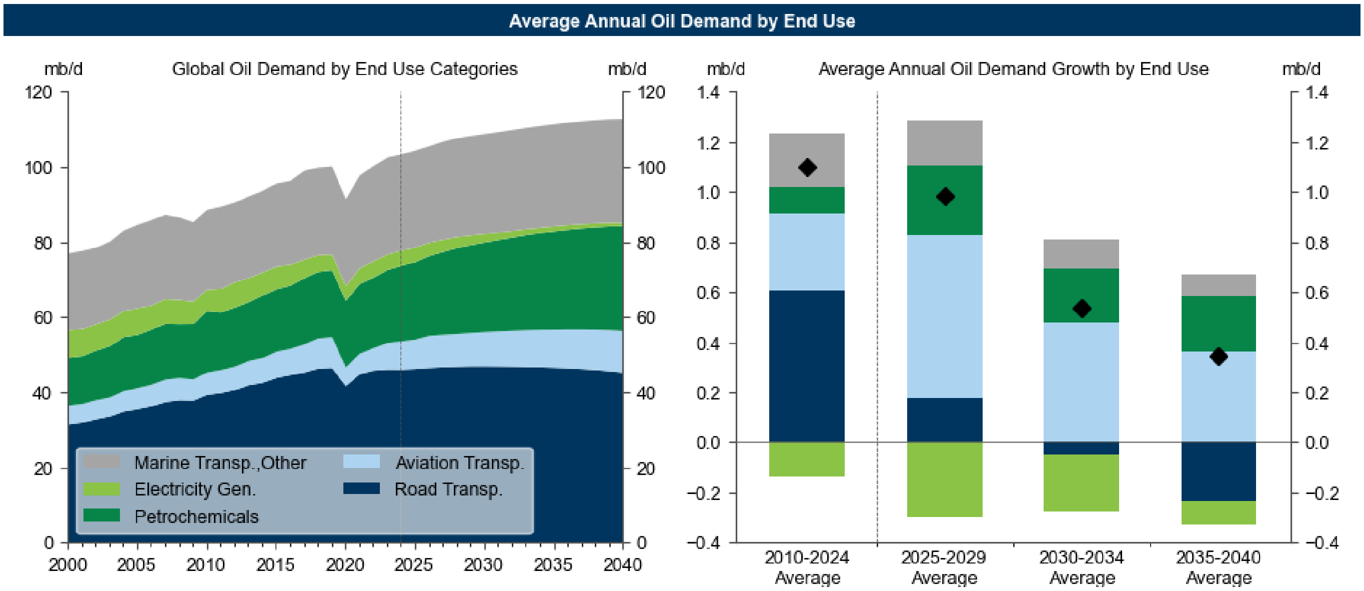
Source: IEA, Goldman Sachs Global Investment Research

Our model integrates our views on oil demand for road and air transportation, petrochemical, and electricity generation and the rising role of alternatives to oil. We see low-carbon technologies replacing 28mb/d or nearly 20% of global oil demand in 2015-2040 (Exhibit 1, right panel).[2] Road fuel oil alternatives — passenger electric vehicles (EVs), electric and LNG trucks — drive 3/4 of our estimated 2040 oil demand replacement. As a result, we expect road transportation fuels to pass the baton to petrochemical feedstocks in driving oil demand growth. (Exhibit 2).

1 The 4.4mbd difference between our 113.0mb/d global demand estimate in 2040 and the 108.6mb/d demand estimate from our global oil equity research team in early 2024 reflects contributions from higher petrochemical demand of 1.8mb/d (explained by a reduction in the assumed drag on annual growth from plastics recycling to 20bp from 70bp) and from higher road oil demand of 2.6mb/d (explained by a reduction in the assumed hydrogen oil replacement assumption worth 1mb/d and downgraded EV assumptions from our global auto equity analysts, including in the US).

2 Our economists' constructive view on long-run economic growth and our finding that oil demand growth (net off energy replacements) moves one-to-one with GDP growth suggest continuing strength in demand for oil-related fuels.

Exhibit 2: Global Oil Demand Growth Slows Down to 0.1mb/d by 2040 as Petrochemicals Replace Road Transportation as the Main Driver of Oil Demand Growth



Source: IEA, Goldman Sachs Global Investment Research

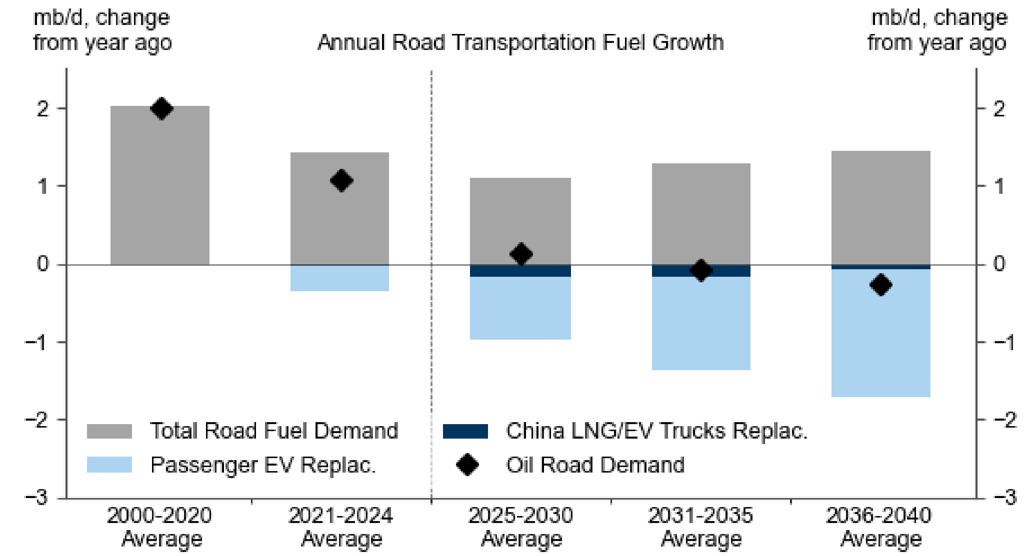
We next update our long-run forecasts for road transportation oil demand and jet fuel demand, and introduce models of long-run petrochemical and power generation oil demand.

Road Oil Demand: Peak in 2030, Long Plateau Later

We expect road transportation oil demand to edge up 0.9mb/d (or 2%) from 2024 to a 2030 peak as we incorporate our equity analysts' projections for sales of EV passenger vehicles and of LNG and EV trucks in China. We see global road oil demand slowly edging down after 2030 along a long plateau, declining by 1.7mb/d from its peak by 2040 (Exhibit 3).

Looking across regions, road oil demand has likely already peaked in the OECD in 2018 and in China in 2021, but we expect further growth through 2040 in the non-OECD ex China region given rapid vehicles growth and a slower rise in the EV share.

Exhibit 3: Road Transportation Oil Demand Is Likely to Rise Till 2030 and Edge Down After



Source: IEA, Goldman Sachs Global Investment Research

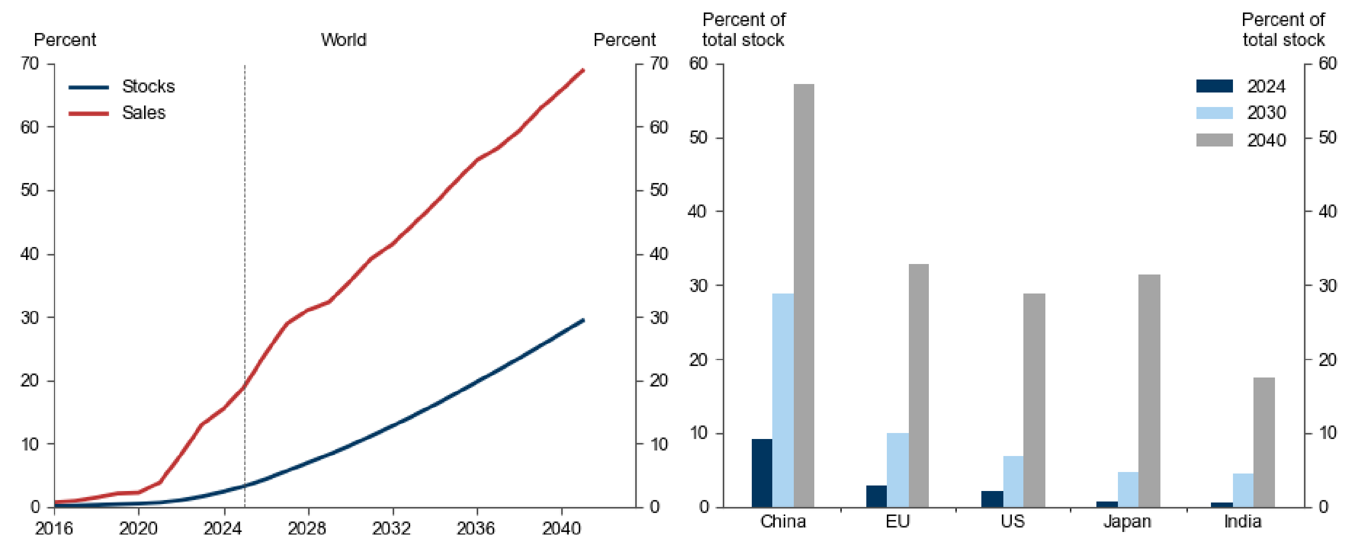
The long plateau in road oil demand reflects an offset between the rise in the global number of vehicles and the decline in oil consumption per vehicle.

We expect a 58% rise in the global number of total vehicles (including EVs and trucks) by 2040 from 2024 given a similar rise in global real GDP our economists forecast. Non-OECD will drive nearly 90% of vehicles fleet growth given increasing car ownership.

On the other hand, we expect a 35% reduction in oil fuel use per vehicle by 2040 from 2024 on both increasing fuel efficiency of traditional ICE vehicles and faster EVs and LNG trucks replacement. Our auto analysts expect EV sales to account for nearly 70% of global total vehicles sales by 2040, which we estimate would raise the EV share in the passenger fleet to 30% (Exhibit 4).

Exhibit 4: We Expect EVs to Account for 70% of Global Passenger Vehicles Sales and 30% of Vehicles Stocks by 2040

Share of EVs in Total Passenger Vehicles Sales (GS Equity Forecast) and Stock



Source: Goldman Sachs Global Investment Research

Besides the EV replacement in passenger vehicles, we also expect increased fuel switching for China's heavy duty trucks (HDT). HDT diesel demand accounted for 16% or 2.2mb/d of total China demand before the pandemic. Our equity analysts expect LNG- and EV trucks to drive 35% and 39% of 2030 HDT sales. Although low-carbon alternatives are more recent for HDTs, a shorter HDT average lifespan vs. a passenger car implies a faster fleet replacement. We expect 2.5mb/d of China HDT oil demand replacement by 2040 as EV and LNG trucks reach shares in China's HDT fleet of 50% and 29%, respectively (Exhibit 14).[3]

Jet Fuel Demand: Steep Passenger Growth and Limited Green Alternatives

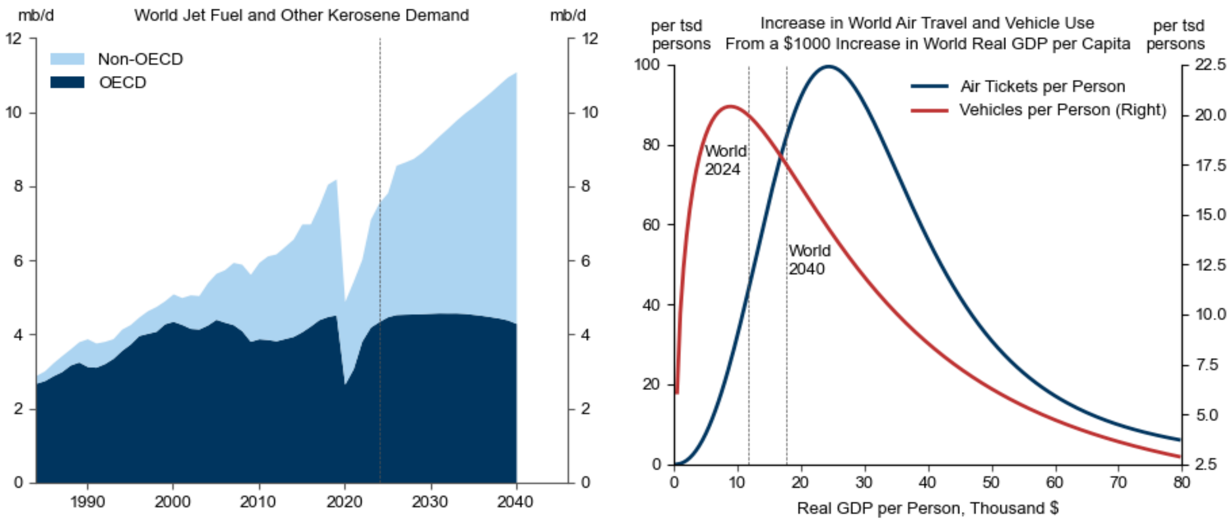
We expect air transportation oil demand to grow through 2040 at a solid pace of 2.4% CAGR (or 0.2mb/d), reaching 11.1mb/d by 2040 as non-OECD incomes rise (Exhibit 5, left panel) and low-carbon alternatives remain scarce.[4]

In percentage terms, we expect non-OECD jet fuel demand to grow at a 3-4 times faster rate than road oil demand because air traveling is much more sensitive to income changes than road transportation at the current level of global GDP (Exhibit 5, right panel).

[3] We do not assume low-carbon HDT adoption outside of China because this would require large-scale investments in refueling infrastructure and hence substantial government coordination and financing.

[4] Air transportation demand includes kerosene.

Exhibit 5: The Air Transportation Boost From Increasing non-OECD Income Will Support Jet Fuel Demand



Source: Haver, CEIC, OICA, Wards, Goldman Sachs Global Investment Research

The only low-carbon alternative to jet fuel currently used in commercial aviation is sustainable aviation fuel (SAF), which accounts for less than 1% of aviation fuel. Scarce SAF inputs, binding technological constraints, and the high fuel cost share in airfares pose challenges to scaling up SAF. We assume SAF's share in aviation fuel reaches 10% by the late 2030s (or nearly 1mb/d).

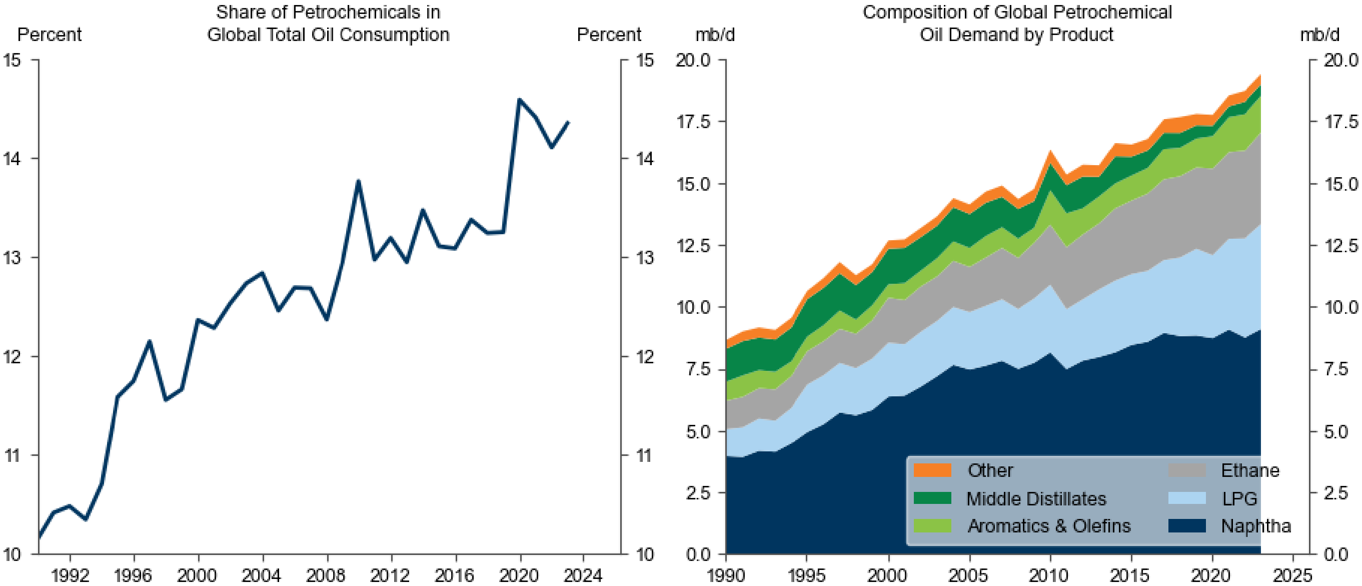
Petrochemical Demand: the New Driver of Global Oil Demand Growth

As road oil demand peaks, petrochemicals become the key driver of global oil demand growth. We expect petrochemical oil demand (naphtha, LPG, and ethane) to grow at an average annual pace of 0.5mb/d, 2.1% CAGR (vs. 1.9% in 2000-2024).

The petrochemical share in global oil demand stood at 14% in 2024 (Exhibit 6, left panel). While road and air transportation use oil products refined from crude oil, petrochemical plants mainly rely on natural gas liquids (NGLs), with naphtha, LPG, and ethane accounting for nearly 90% of petchem demand (Exhibit 6, right panel).[5]

[5] See Yulia Grigsby, Daan Struyven, and team, "Commodity Comment: Tariffs Disruptions to Natural Gas Liquids", April 24, 2025 for a more detailed discussion about NGLs end use market.

Exhibit 6: The Share of Petrochemicals in Total Oil Demand Has Trended Up, With Naphtha, Ethane, and LPG Accounting for 90% of Petchem Demand

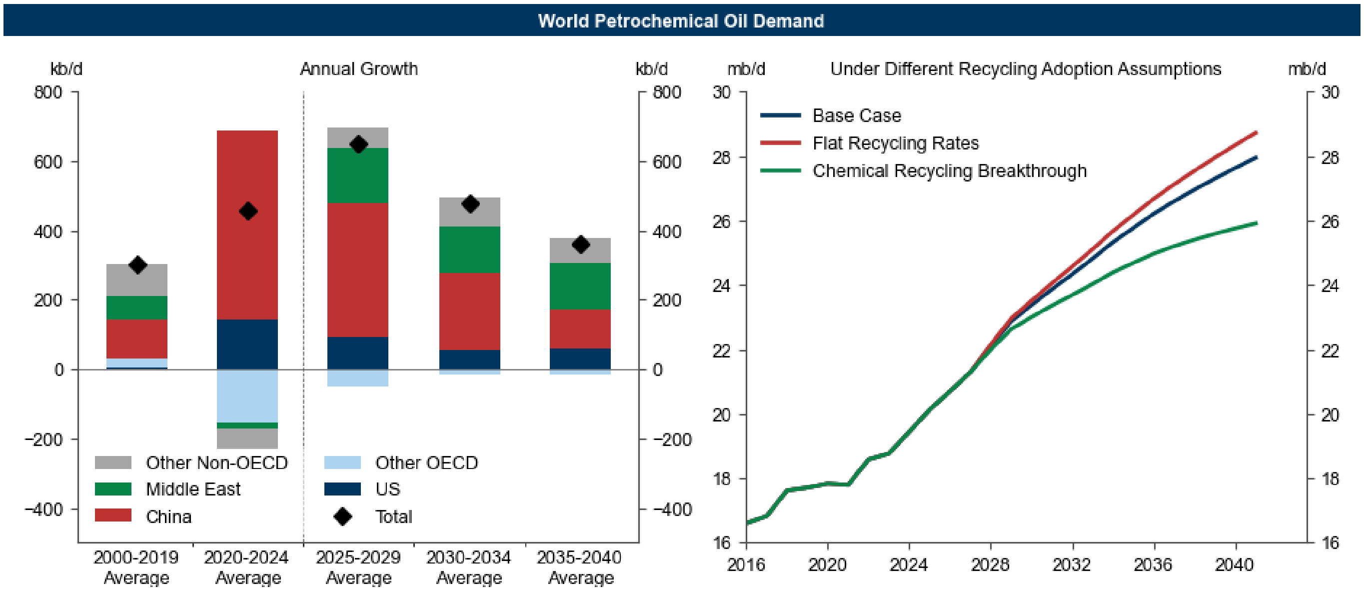


Source: IEA, Goldman Sachs Global Investment Research

Looking across regions, we expect non-OECD countries to continue to drive over 90% of petchem oil demand growth over the next 15 years (Exhibit 7, left panel). OECD petchem consumption has underperformed income growth as the OECD pivoted away from petchem (and refining) plants on increasing costs and ESG concerns (Exhibit 15). But we see petchem consumption ramping up steeply with GDP per capita outside the OECD, especially China and the Middle East, mirroring the petchem- and plastics plants locations.[6] In particular, China petchem capacity additions have boomed over the last five years, putting it in the center of petchem oil demand growth this decade.

[6] Unlike gasoline or jet fuel that directly fuel the transportation services industry, petrochemical feedstocks are an intermediate good for plastics and manufacturing production.

Exhibit 7: We Expect World Petrochemical Oil Demand to Grow at an Average Annual Pace of 0.5mb/d (or 2.1%) Over the Next 15 Years, Barring Breakthroughs in Chemical Recycling



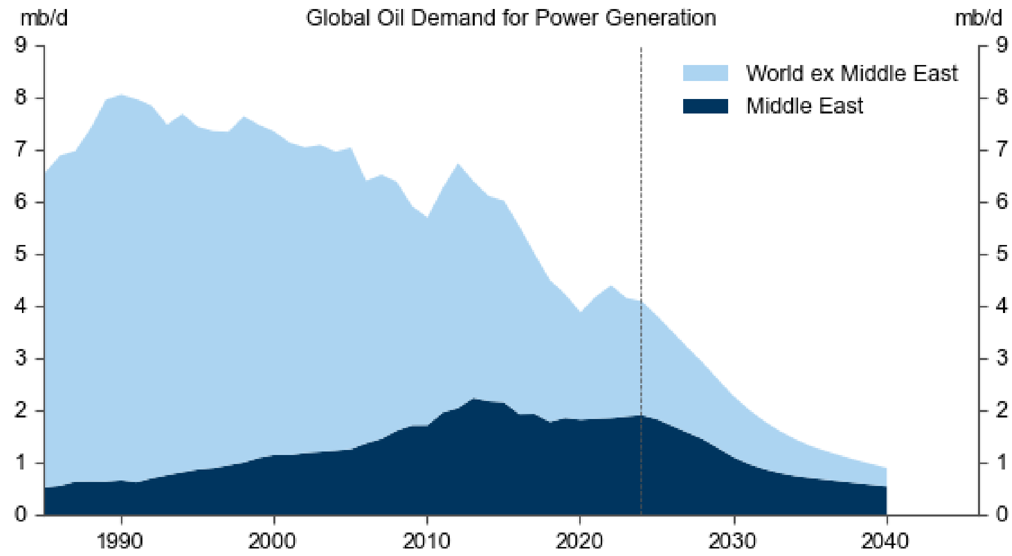
Source: IEA, Goldman Sachs Global Investment Research

Similar to jet fuel, we see limited low-carbon alternatives for petchem oil demand. Barring significant technological breakthroughs, we expect the labor intensity of mechanical plastic recycling and the high costs of chemical recycling to limit petchem oil demand replacement. We assume that recycling subtracts 20bp from petchem oil demand CAGR (Exhibit 7, right panel).

Power Oil Demand: Downward Pressure From a Shift in the Middle East

We expect oil demand for power generation and heating to decline at a faster average annual pace of -9.0% through 2040 (vs. -3.7% in 2015-2024), led by a rapid transition the Middle East. This would result in an 80% drop in global oil use for power generation by 2040, to just below 1mb/d (Exhibit 8).

Exhibit 8: We Expect Oil Demand for Power Generation to Decrease by 80% From 2024 by 2040, to Just Below 1mb/d

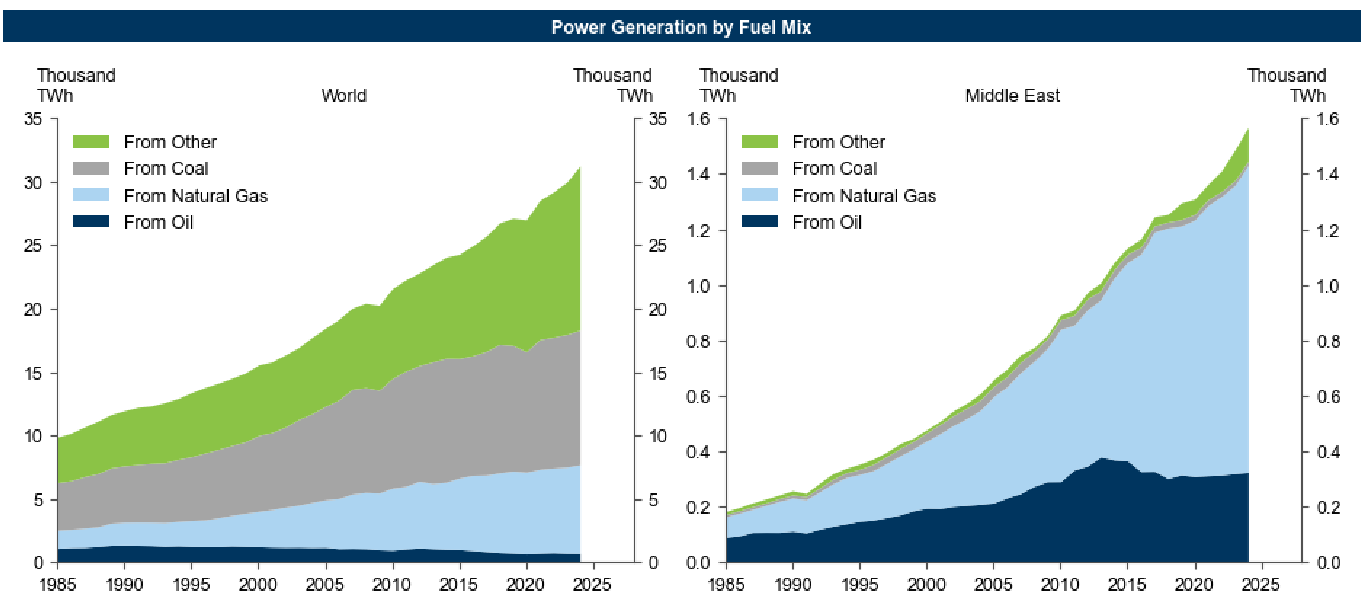


Source: IEA, Goldman Sachs Global Investment Research

Globally, oil use in power generation has declined since the early 1990s. As a result of the shifts to natural gas, solar, and wind energy, oil's share in global power generation has decreased from 12% in the late 1980s to only 2% in 2024 (Exhibit 9, left panel).

Oil still accounts for 20% of power generation in the Middle East but recent policies (e.g. Vision 2030 in Saudi Arabia) aim to ramp up power generation from natural gas. Based on conversations with our MENA analysts, we assume oil demand for power generation in the Middle East decreases to 1.4mb/d by 2040.

Exhibit 9: Oil Still Acccounts for 20% of Power Generation in the Middle East



Source: IEA, Goldman Sachs Global Investment Research

This diminishing role of oil in power generation suggests that any AI-driven global power demand boom will not have a large direct effect on oil demand, in contrast to natural gas. However, we incorporate a 3mb/d indirect boost from AI to global oil demand by 2040 via higher global GDP, with a 6mb/d boost in the upside full adoption scenario.

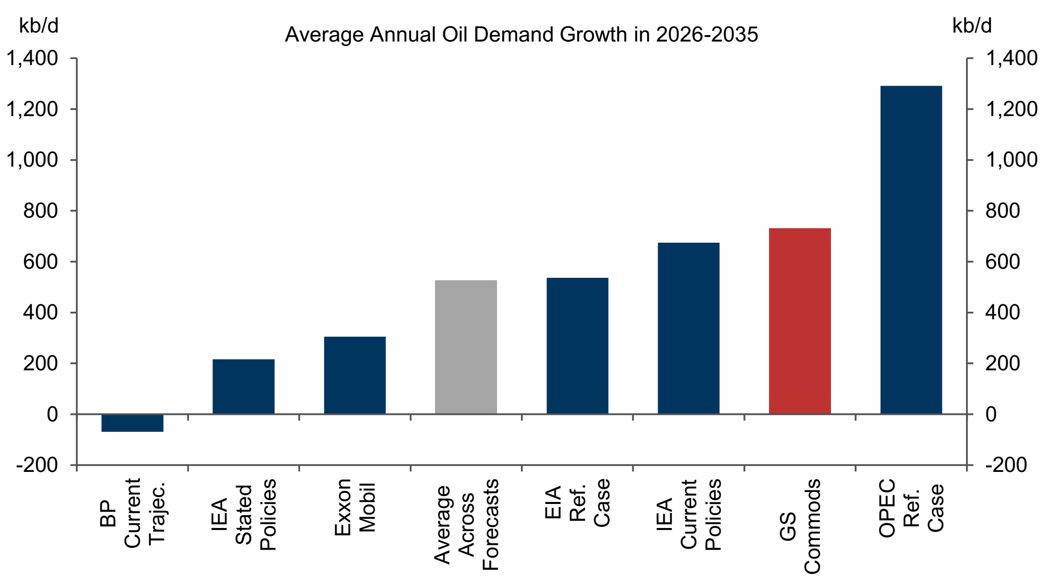
Marine Transportation, Agriculture, and Industrial Use: Non-OECD Tailwinds Dominate

Road and air transportation, petchem, and power and heat oil demand account for nearly 4/5 of oil demand. We see little room for expansion in low-carbon oil alternatives in the remaining 1/5 of demand — mainly, marine transportation, agriculture and industrial use — and assume these segments will grow at a 0.5% CAGR through 2040.

Bottom-line: Solid and Above-Consensus Oil Demand Growth For the Next 10 Years But Downside Risks

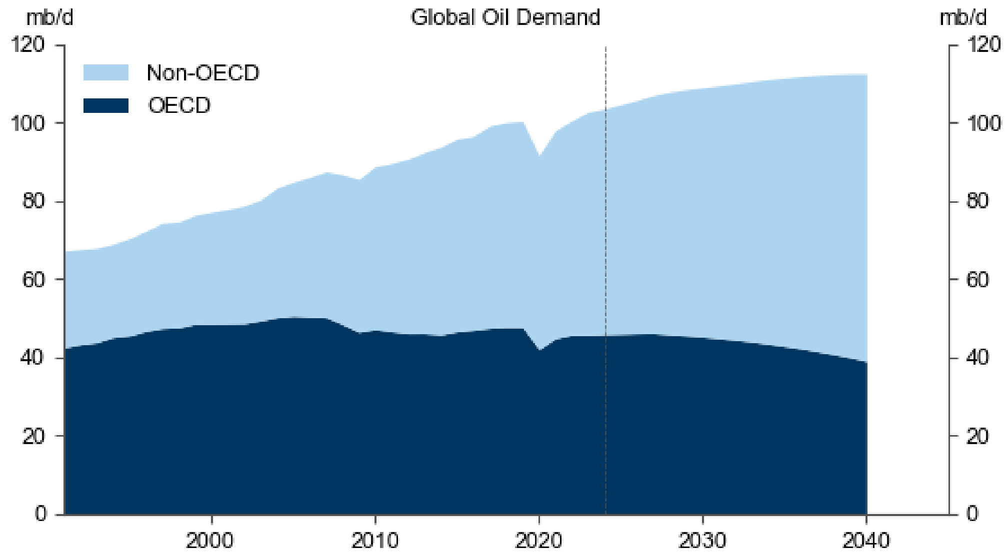
Our forecast that global oil demand grows at an average annual pace of 0.7mb/d between 2026-2035 is above the average across other forecasters, but similar to recent IEA projections under current policies (Exhibit 10). Our constructive demand forecast reflects that we expect non-OECD demand to grow at a relatively stable annual pace of 0.9-1.0mb/d through 2040 (Exhibit 11), outweighing OECD declines from 2028.

Exhibit 10: We Expect Oil Demand to Grow at an Average Annual Pace of 0.7mb/d Over the Next 10 Years – Moderately Above Most Other Forecasters...



Source: Goldman Sachs Global Investment Research

Exhibit 11: .. As Non-OECD Oil Demand Growth Exceeds OECD Declines

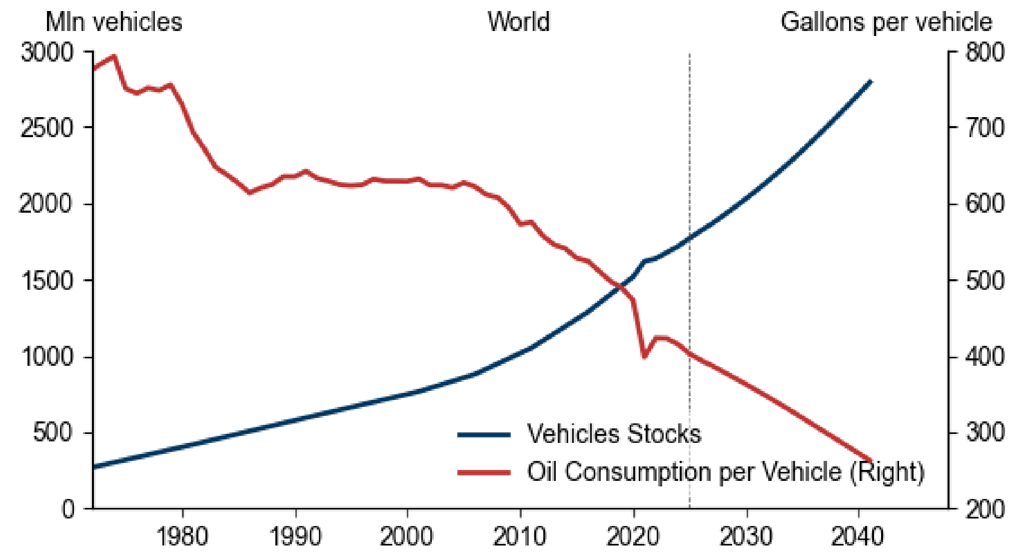


Source: IEA, Goldman Sachs Global Investment Research

Our base case above-consensus view on long-run oil demand relies on two key assumptions:

1. **Limited low-carbon alternatives:** We do not assume major breakthroughs in low-carbon technology. This implies modest growth in SAFs, plastics recycling, and hydrogen adoption. We also assume that LNG trucks won't take off outside of China given infrastructure and policy coordination challenges.
2. **Energy demand growth outpaces oil displacement by low-carbon alternatives:** Even for peaking road oil demand, we expect a long plateau after 2030 as the rise in the number of vehicles and underlying demand for all sources of road fuels nearly offsets the decline in oil use per vehicle (Exhibit 12).

Exhibit 12: The Decline in Oil Consumption per Vehicle Nearly Offsets Increases in Total Vehicles Demand



Source: IEA, Haver, CEIC, OICA, Wards, Goldman Sachs Global Investment Research

However, forecasts of long-run oil demand are highly uncertain and tend to be revised significantly. Moreover, the uncertainty around oil demand rises with the horizon (Exhibit 16) and with ongoing decarbonization efforts and hard-to-predict low-carbon technological innovations. Given our relatively conservative assumption on technology over the next 15 years (and the potential for China to accelerate the rise of EVs and LNG vehicles with competitive exports and with infrastructure investments outside of China) and our no-recession assumption, we see risks to our base case long-run oil demand growth as skewed to the downside and consider three risk scenarios.

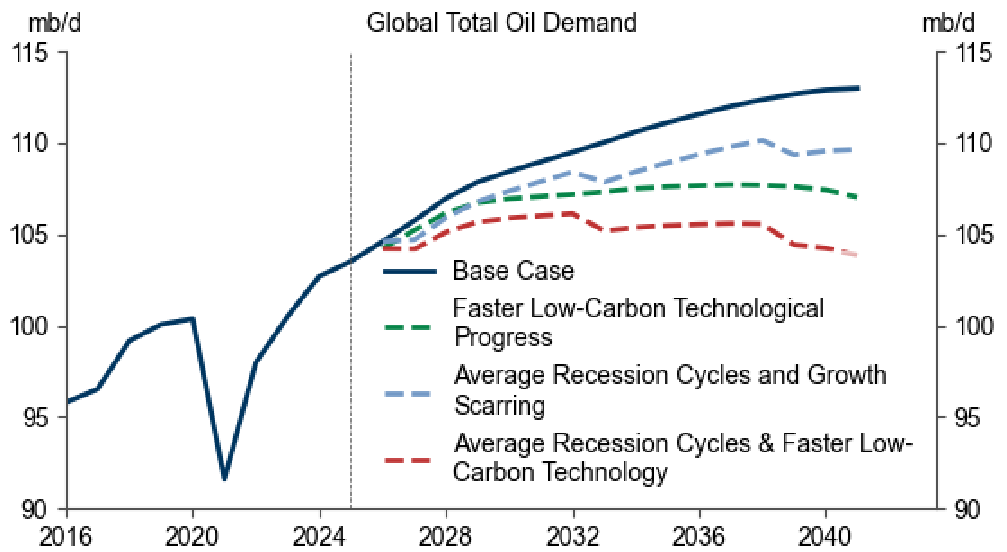
1. **Faster low-carbon technological progress:** The dashed green line in Exhibit 13 assumes:
   - LNG and EV HDT adoption outside China (with a similar hit to oil demand as in China);
   - Twice as fast a pace of SAF adoption as in our base case;[7]
   - A breakthrough in chemical recycling that would subtract 75bp from petchem oil demand CAGR (vs. 20bp in our base case).

   In this scenario, global oil demand grows at a slower CAGR of 0.2% (vs. our baseline CAGR of 0.5%) till it peaks in 2036 at 108mb/d (4.3mb/d below our base case).
2. **Lingering recessions effect:** The dashed blue line assumes a typical business cycle where recessions occur every 6 years, last for 4 quarters, and leave 50% of "scarring" to the underlying GDP and oil demand trends. In this scenario, global oil demand peaks in 2037 at 110mb/d.
3. **Faster technological progress + recessions scarring:** The dashed red line combines scenarios #1 and #2. In this extreme scenario, global oil demand peaks as soon as

[7] Reaching the Net Zero target by 2050 and fully decarbonizing the aviation industry requires a 4 times faster pace of SAF adoption than in our base case.

2031 at 106mb/d.

Exhibit 13: We See Risks to Our Oil Demand Forecast as Skewed to the Downside From Faster Low-Carbon Technological Progress and Potential Recessions



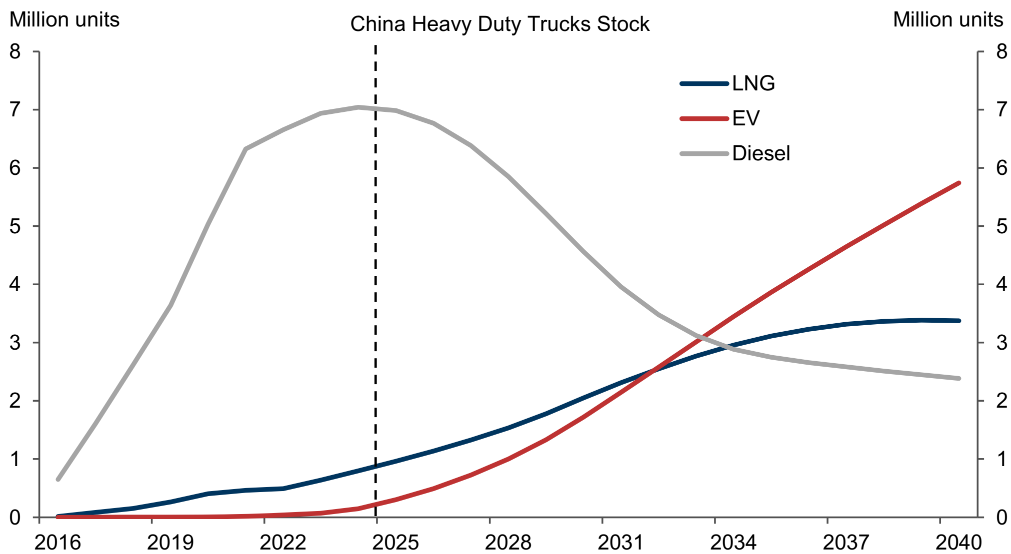
Source: Goldman Sachs Global Investment Research

Structurally Higher Refining Margins

Our constructive long-run oil demand outlook supports our view that refined product margins will likely remain structurally higher than before the pandemic. The post-pandemic rise in refined margins shows that decarbonization efforts don't necessarily imply lower prices for traditional fuels. In fact, the increase in uncertainty about long-term oil demand from the rise in low-carbon alternatives and ESG considerations have not only depressed investment in new refineries—which are long-cycle assets—but also led to refinery closures in the OECD, while solid global demand growth is forcing stretched refineries to run hard.

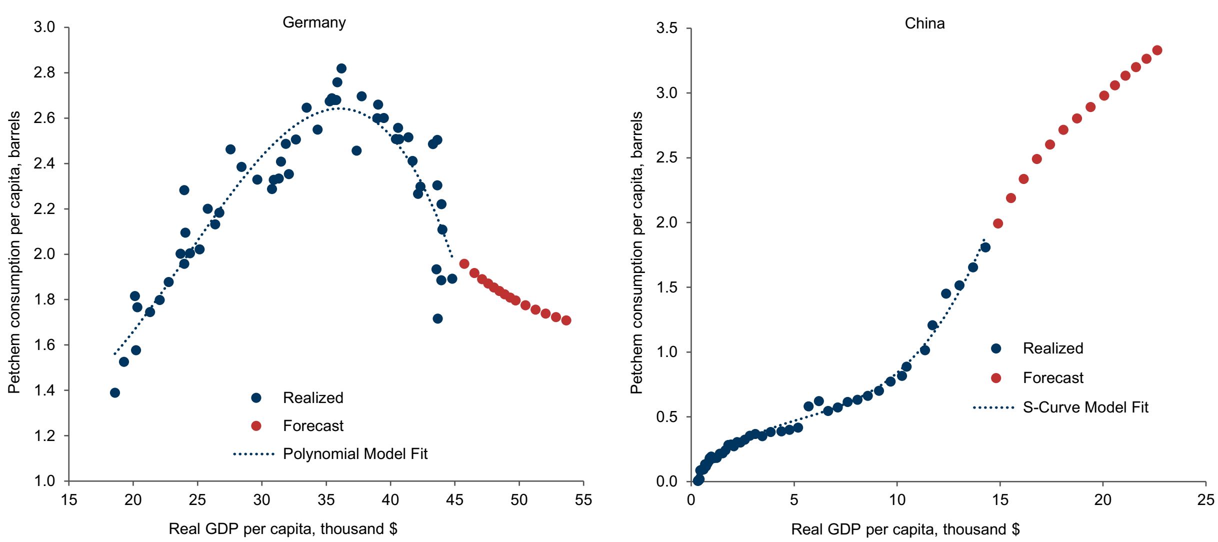
Appendix Charts

Exhibit 14: A Rapid Increase in LNG and EV Trucks Fleet in China May Replace 2.5mb/d of Diesel Demand by 2040



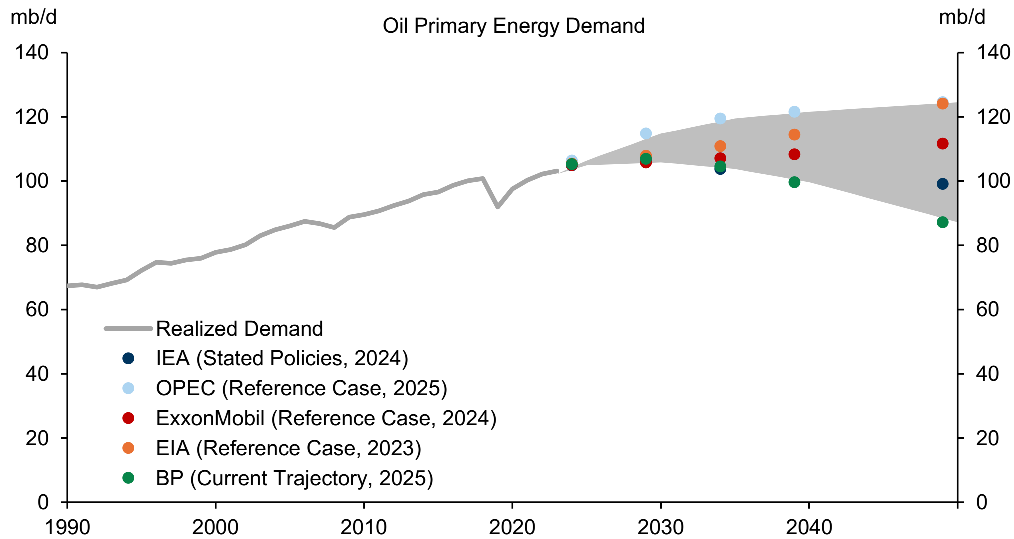
Source: Goldman Sachs Global Investment Research

Exhibit 15: Petchem Consumption Is Decoupling from Income Growth in the OECD, but Ramping Up Steeply with GDP per Capita in Non-OECD and Especially China



Source: Haver, IEA, Goldman Sachs Global Investment Research

Exhibit 16: The Uncertainty Over Long-Term Oil Demand Is High and Increases With the Forecasting Horizon



We rescale all the agencies' projections to start at the same 2023 level of realized oil demand.

Source: IEA, OPEC, ExxonMobil, EIA, BP, Goldman Sachs Global Investment Research

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Disclosure Appendix

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We, Yulia Zhestkova Grigsby and Daan Struyven, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

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