Oil Analyst

Demand Uncertainty and Long-Run Prices

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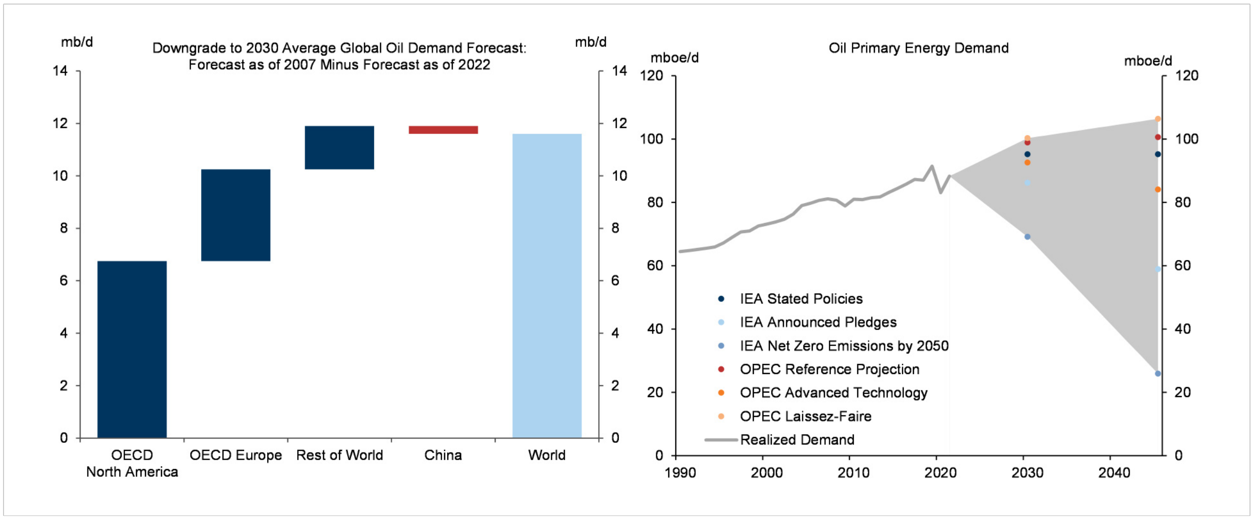
- As the start of the summer is the hottest on record, investors ask what decarbonization efforts imply for the long-run outlook for oil demand and prices.
- While the direct price impact from falling oil demand would be negative, we think that decarbonization is not necessarily bearish for oil prices. For one thing, geological decline rates—the reduction in the rate of production of oil fields after the peak—imply that oil supply would fall in the absence of investment. Moreover, investors may require a premium in long-dated prices to compensate for the increased investment risk from high demand uncertainty, mirroring the rise in long-dated prices on supply uncertainty in the 2000s bull market.
- To assess the level of uncertainty about long-run oil demand, we analyze long-run demand forecasts. Energy organizations and energy majors with a baseline long-run demand forecast—the EIA, OPEC, and ExxonMobil—expect oil demand to grow by 800kb/d per year on average in 2024-2030. The bulk of oil demand growth through 2030 is expected to come from Asia-Pacific (a 75% share in growth) regionally, and from jet fuel (30%) and petrochemical (30%) products.
- However, these similar baseline forecasts through 2030 understate the uncertainty about long-run oil demand for two reasons. First, forecasts of long-run oil demand have been revised significantly in the past. The typical forecast of the level of global oil demand in 2030 came down by nearly 12mb/d during the financial crisis, with misses concentrated in the OECD region and in diesel products, but has stayed broadly stable since.
- Second, decarbonization efforts imply that the uncertainty about long-run oil demand is now greater than in the past. When including alternative scenarios, the projections range from "has already peaked" to "will not peak through 2050" with a median peak in 2035. Extending the horizon from 2030 to 2045 triples the range of demand projections to 80mb/d.
- We also document that long-run oil demand forecasts tend to be higher for energy agencies and energy majors with a relatively greater exposure to oil production (e.g. OPEC) than for organizations with a greater exposure to consumption (e.g. IEA) or alternatives to oil (e.g. European majors).
- While the direct impact on oil demand and oil prices from decarbonization or any renewed demand misses would be negative, the boost from the unusually high level of demand uncertainty to the investment hurdle rate and to oil prices is a

critical empirical question for the future of oil.

Large Historical Revisions and a Wide Range of Projections Illustate How Uncertain Long Run Oil Demand is



The 2030 average global demand forecast on the left panel corresponds to the average of OPEC and IEA WEO Stated Policies forecasts.

Source: IEA, OPEC, Goldman Sachs Global Investment Research

Demand Uncertainty and Long-Run Prices

As the start of the summer is the hottest on record according to the World Meteorological Organization (WMO), investors increasingly ask what decarbonization efforts imply for the long-run outlook for oil demand and for oil prices.

While the direct oil price impact from falling oil demand would be negative, we think that decarbonization is not necessarily bearish for oil prices.

For one thing, geological decline rates—the reduction in the annual rate of production of oil fields after the peak—imply that global oil supply would fall by around 5% each year in the absence of investment in existing or new projects.

Moreover, investors may require a premium in long-dated prices to compensate for the increased investment risk from high uncertainty about demand. Indeed, the large uncertainty about long-run demand incentivizes investors to delay investment, especially for long-cycle projects. The related fear of "stranded assets" raises the real option value of waiting for clarity on demand and of delaying investment.

A rise in long-dated prices on increased demand uncertainty would mirror the rise in long-dated prices on supply uncertainty in the 2000s bull market. Going back to 2005, we raised our long-dated oil price forecast on rising supply-side uncertainty about costs, as the market shifted from the exploitation phase, with the depletion of excess capacity, to the investment phase. The increased uncertainty around costs arose from increased uncertainty surrounding host-government policy on taxation and reserve access in oil-rich nations, the rise in project complexity, and inadequate infrastructure and refining capacity.

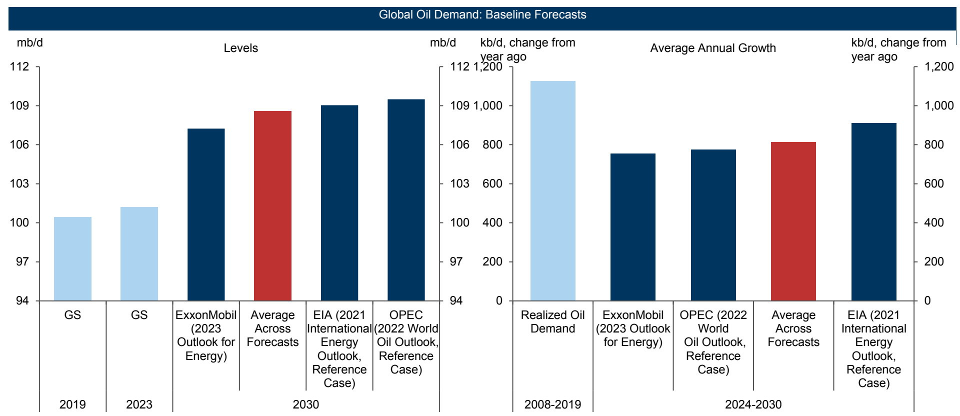
To assess the level of demand uncertainty and to explore the long-run outlook for demand, this *Oil Analyst* analyzes long-run demand forecasts from leading energy organizations.

Baseline Forecasts Show Moderate Demand Growth Through 2030

We first review forecasts of global oil demand in 2030 from the most widely followed energy agencies and the supermajors, which publish baseline forecasts (as opposed to alternative scenarios), namely EIA, OPEC, and ExxonMobil.

As Exhibit 1 shows, the three organizations share similar baseline forecasts, with oil demand rising to an average level of 108-109mb/d by 2030.[1] These forecasts suggest that oil demand will grow by around 800kb/d on average per year, somewhat slower than the 1.1mb/d annual growth of the 2008-2019 cycle (Exhibit 1, right panel).[2]

Exhibit 1: Baseline Forecasts Suggest That Oil Demand Will Rise Around 800kb/d Per Year on Average in 2024-2030



We rescale the EIA, OPEC, and ExxonMobil oil demand levels such that all 2021 levels match our GS 2021 estimate.

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

Which regions and refined products are expected to drive oil demand growth through 2030?

Regionally, Asia-Pacific drives the bulk of projected oil demand growth. The share of Asia-Pacific in global demand growth through 2030 (averaged across EIA, OPEC, and IEA forecasts) stands at 75%. India is projected to drive 25% of global demand growth, surpassing China's share of 20%.[3] In contrast, predicted oil demand is roughly flat through 2030 in North America, but falls further in Europe, which is consistent with our view that OECD oil demand peaked in 2005.[4]

Turning to refined products, we average the OPEC and IEA (Stated Policies) projections, which have product details. Jet fuel/kerosene and the petrochemical-oriented products—ethane/LPG and naphtha—are predicted to each fuel just over 30% of oil

1 To ease comparison, we rescale the EIA, OPEC, and ExxonMobil oil demand levels such that all 2021 levels match our GS 2021 estimate of 98.0mb/d.

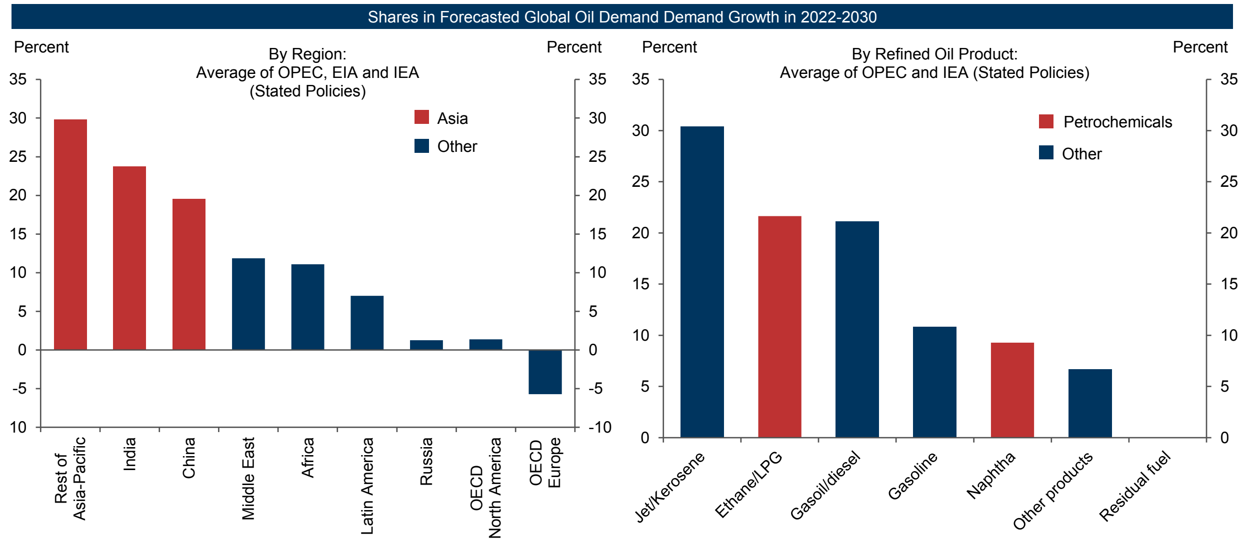
2 We estimate the 2023 ExxonMobil projection by applying the average of GS and EIA 2022-2023 growth rates to the 2021 ExxonMobil level.

3 Exhibit 2 focuses on 2022-2030 growth as the EIA, IEA, and OPEC all have estimates for 2021 and 2030. While the IEA Stated Policies scenario is not exactly a baseline forecast, we follow the 2018 study by Henrik Wachtmeister, Petter Henke, and Mikael Höök. Their Applied Energy article includes this scenario as a central projection, because it "might be seen as more probable than the more goal oriented" other scenarios.

4 We estimate trend OECD annual oil demand growth—when GDP grows at its potential 1.5% rate, and when oil prices, the dollar, and jet fuel demand are stable—of -0.2mb/d, with over 2/3 of the negative contribution from Europe

demand growth through 2030 (Exhibit 2, right panel).[5]

Exhibit 2: The Asian Region and the Jet Fuel and Petrochemical Products Are Predicted to Drive Much of Oil Demand Growth



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

While the baseline forecasts of oil demand through 2030 from the major energy organizations are similar (Exhibit 1), they understate the uncertainty about long-run oil demand, because forecasts have been revised significantly in the past, and because decarbonization efforts imply even greater uncertainty in the future.

[5] Steam crackers crack naphtha (derived from crude oil) and ethane (prevalent in natural gas and natural gas liquids (NGLs)) in purified "olefins" components, including ethylene and propylene, which are processed into polymers, i.e. plastics. Catalytic reforming converts naphtha in high octane gasoline. The IEA and OPEC forecasts report ethane together with LPGs, which are both NGLs. LPGs are used as petrochemical feedstock, and as a fuel for space and water heating, cooking, and transportation (propane), gasoline blending, lighters, and stoves (butane), and gasoline octane boosters (isobutane).

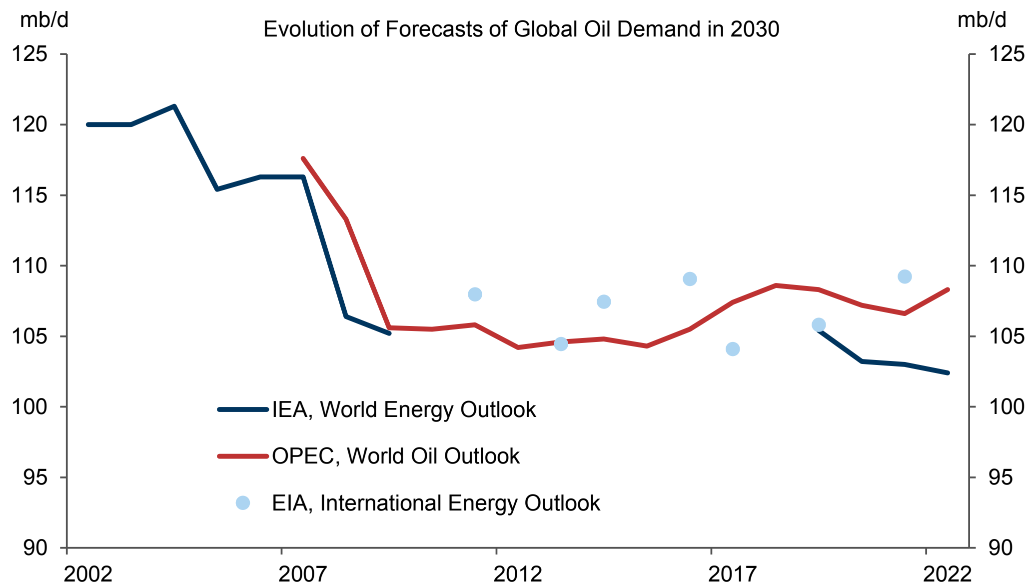
Forecasts of Oil Demand Have Changed Significantly

To illustrate the uncertainty, we first document how forecasts of oil demand in 2030—published by the EIA, OPEC, and the IEA—have evolved over time.

Exhibit 3 shows that the EIA and OPEC sharply revised down their forecasts of demand in 2030 by 11-12mb/d during the 2008-2009 recession. The forecasts of demand 2030 have remained fairly stable thereafter, except for moderate upgrades in 2016-2018 on increased US supply availability.

The sharp IEA downward revision in 2008 reflected "the impact of much higher prices and slightly lower GDP growth", and new government policies to promote fuel-efficient vehicles and biofuels supply in the OECD. Similarly, "greater than previously estimated efficiency improvements", and the global recession drove the sharp OPEC demand downgrade in 2009.

Exhibit 3: The EIA and OPEC Revised Down the Forecasts of Oil Demand in 2030 by 11-12mb/d in 2008-2009…

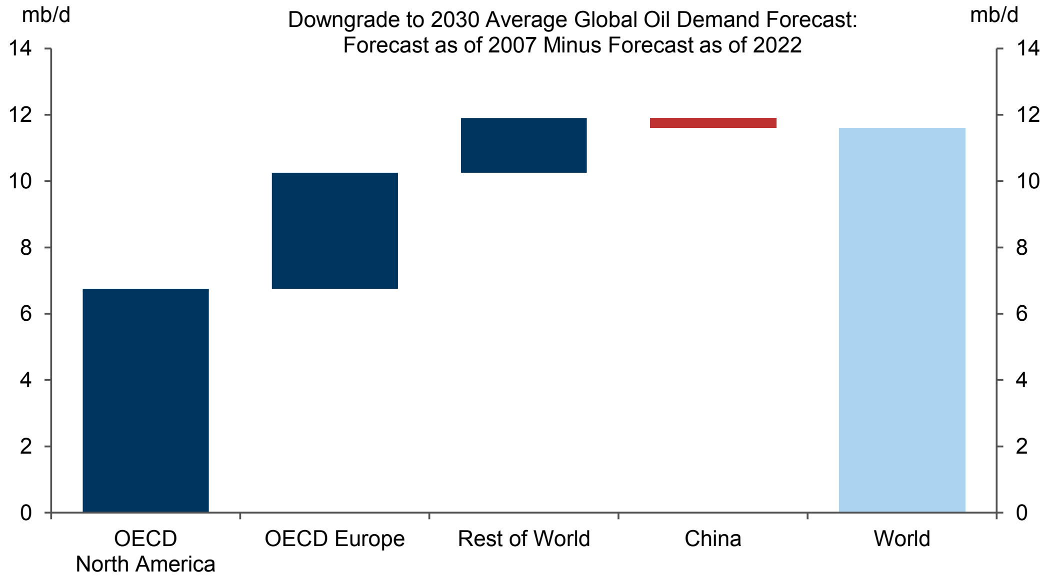


The IEA data are the 2030 total oil forecasts from the Reference Scenario through 2009, the New Policies scenario in 2010, and the Stated Policies scenario thereafter.

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

We next analyze the contribution from various regions and products to the large downgrade to 2030 oil demand since 2007. By region, North America and to a lesser extent Europe drive most of this downgrade (Exhibit 4). This reflects both slower than expected trend GDP growth in the OECD, and larger than expected declines in the oil intensity of GDP.

Exhibit 4: … with Downgrades Since 2008 Concentrated in the OECD Region…

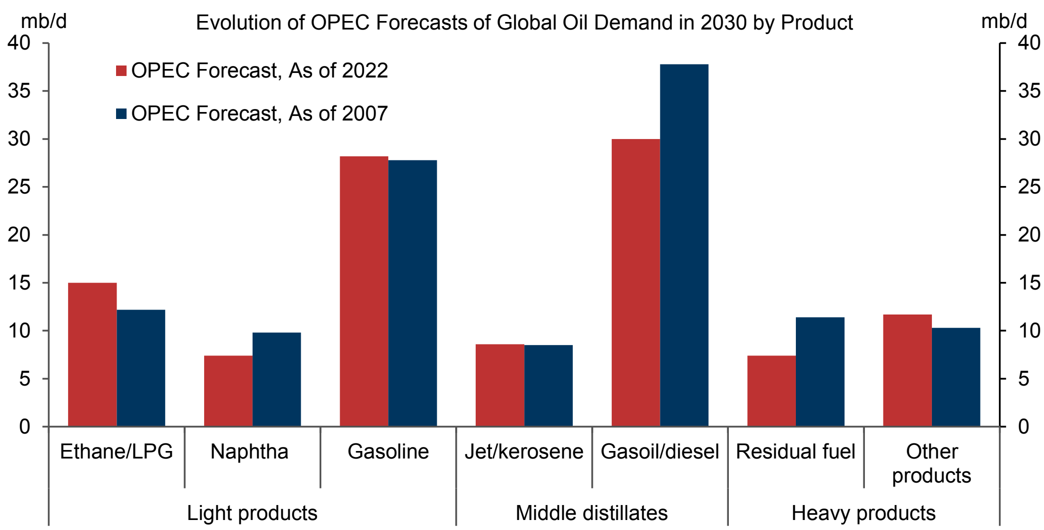


The forecast corresponds to the average of OPEC and IEA WEO Stated Policies forecasts.

Source: IEA, OPEC, Goldman Sachs Global Investment Research

By product, diesel/gasoil and residual fuel together more than fully explain the downgrade since 2008 to the OPEC forecast of oil demand in 2030.[6]

Exhibit 5: … and in Diesel and Residual Fuel Oil Products



Source: OPEC, Goldman Sachs Global Investment Research

6 Potential reasons for the product tilt of the demand downgrades include the de-dieselification of Europe's car fleet since 2015, and substitution from fuel oil to cheaper gas.

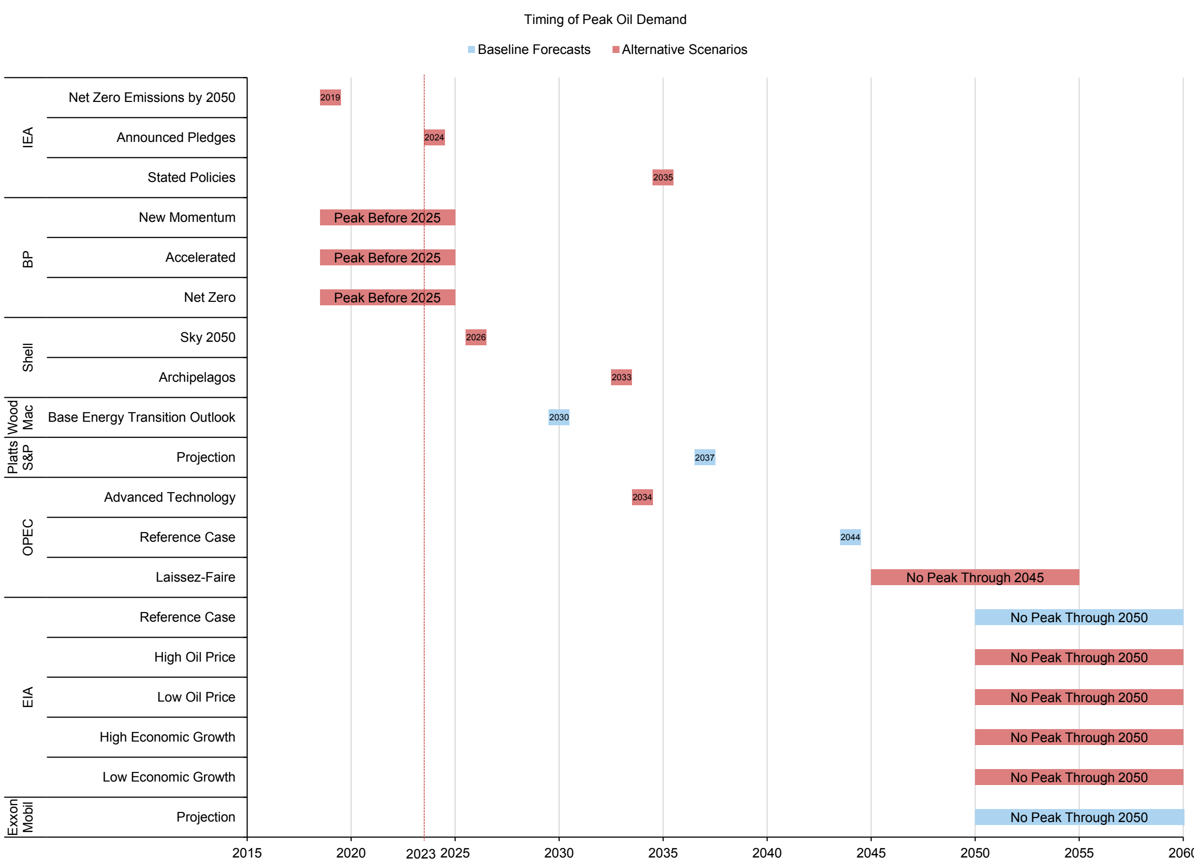
Decarbonization Implies Even Greater Uncertainty in the Future

Although forecasts of oil demand have been revised significantly in the past, decarbonization efforts from policymakers, corporations, entrepreneurs, scientists, and consumers imply even greater demand uncertainty in the future.

As a result, several energy agencies and supermajors, including Shell and BP, now only publish scenarios, as opposed to a baseline forecast, with specific assumptions about emission policies and technology.

Exhibit 6 includes alternative scenarios, and shows the timing of peak oil demand in 19 projections from 8 organizations. The projections range from "has already peaked" for the IEA Net Zero Emissions by 2050 scenario to "no peak through 2045" for the OPEC Laissez-Faire scenario, and "no peak through 2050" for the EIA and ExxonMobil. The median timing for the peak is 2035 across all baseline and alternative projections. Even when looking at baseline forecasts only (light blue), the range remains wide, and spans from 2030 (WoodMac) to "no peak through 2050" (EIA and ExxonMobil).

Exhibit 6: A Wide Range of Peaks for Oil Demand



Source: IEA, BP, Shell, Platts, Wood Mackenzie, OPEC, EIA, ExxonMobil

In their latest installment of the Future of Energy Demand, our energy equity analysts do not forecast peak oil demand this decade. Our colleagues, however, expect oil demand growth beyond 2025 to be anemic, mainly due to electrification, and oil demand to reach 106mb/d in 2030. Leveraging the GS Carbonomics cost curves, our energy equity analysts have also modeled two paths to net zero carbon, which limit global warming to 1.5°C and 2°C, respectively. Oil demand peaks by 2025 in both scenarios.

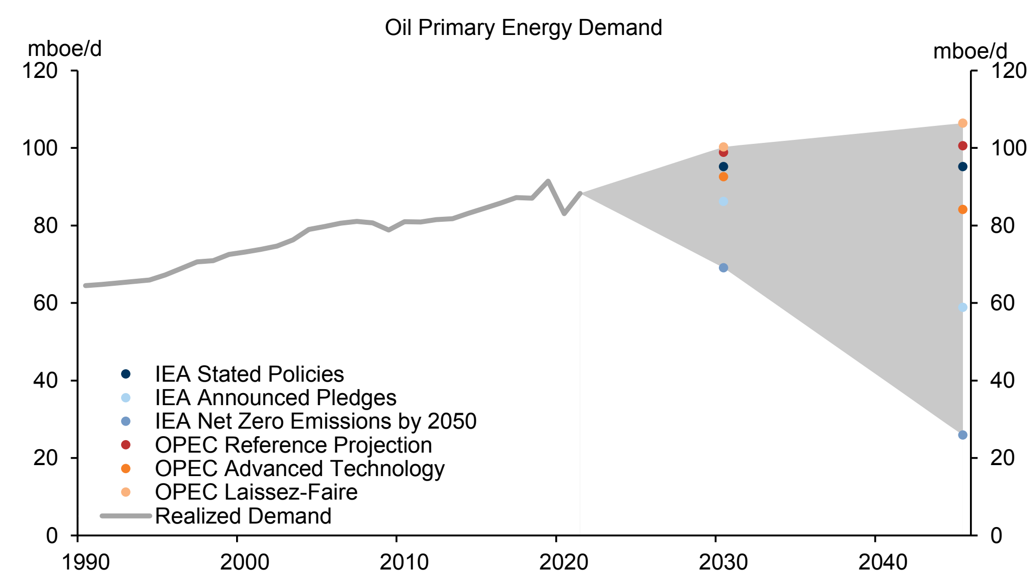
Exhibits 1 and 6 also show that long-run oil demand forecasts tend to be higher for organizations with a relatively greater exposure to oil production than for organizations with a greater exposure to consumption.

Looking across energy agencies, OPEC and the EIA (and the US now runs a petroleum trade surplus) forecast later peaks than the IEA, which represents the net petroleum importing OECD region. Looking across supermajors, ExxonMobil predicts no peak through 2050. In contrast, the scenarios from the European Big Oils—which invest relatively heavily in alternatives to oil—show a peak before 2025 for BP and by 2033 for Shell.

While the uncertainty about the timing of the peak is high, whether demand edges down slowly, or falls sharply once the peak is reached, is very uncertain too. Exhibit 7 therefore shows IEA and OPEC scenarios for oil primary energy demand for 2030 and 2045, harmonized by the International Energy Forum.

The key point is that the uncertainty about long-run oil demand rises sharply with the horizon. Extending the forecast horizon from 2030 to 2045 triples the range between the highest projection (OPEC Laissez-Faire) and the lowest projection (IEA Net Zero Emissions by 2050) to 80mb/d.

Exhibit 7: Uncertainty About Oil Demand Rises With the Forecast Horizon



Source: IEA, OPEC, Goldman Sachs Global Investment Research

Demand Uncertainty and Oil Prices

The direct impact on oil demand and oil prices from decarbonization, any renewed demand misses (as happened following the 2007-2008 oil rally and financial crisis), or a turnout in demand below the relatively higher expectations of organizations with a production exposure, would be negative. That said, the decarbonization boost from the unusually high level of demand uncertainty to the hurdle rate for investment, and therefore to future long-dated oil prices is a critical empirical question for the future of oil markets.

Daan Struyven

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