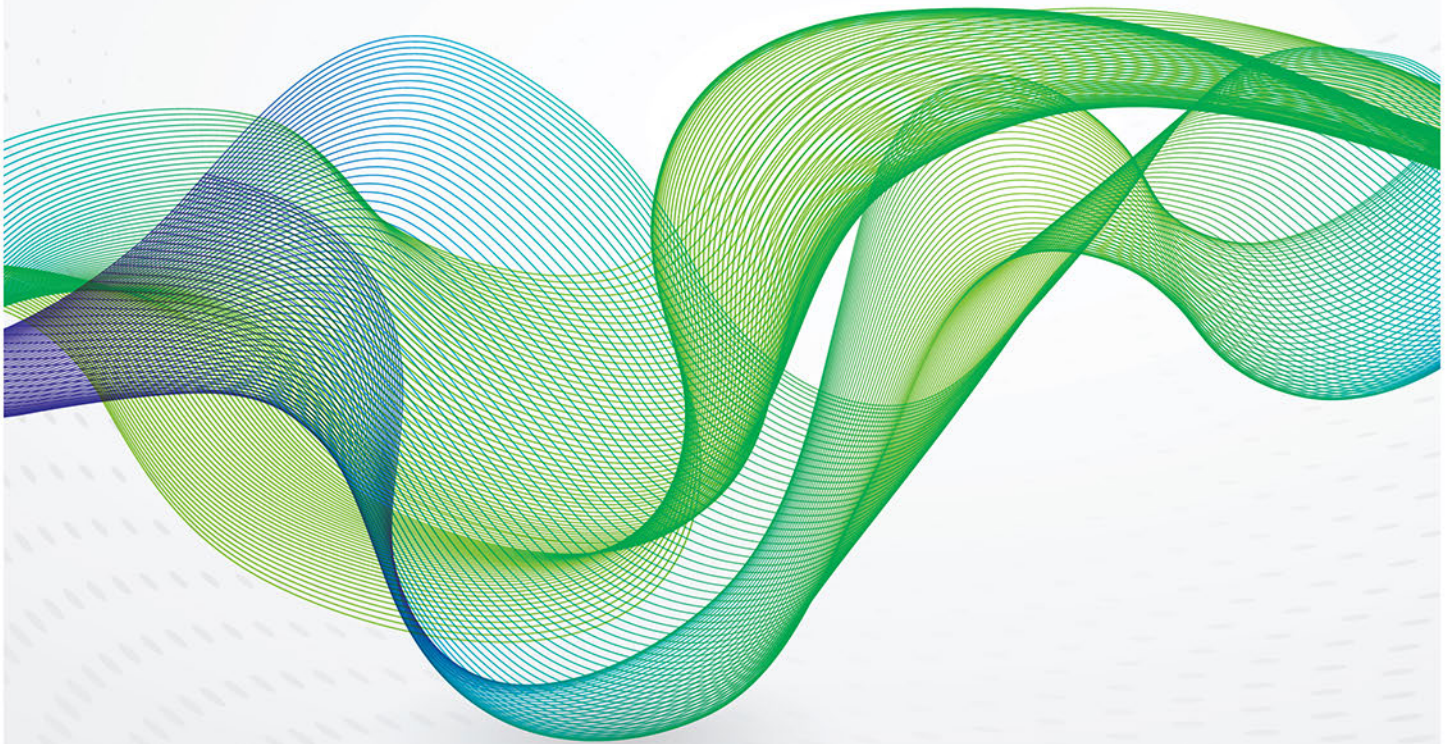


July 2024

Transformations in Oil Markets: Features and Implications



Key forces continue to drive structural transformations in the global oil market, reshaping trade flows, the strategic relationships between buyers and sellers, while reducing market transparency in an increasingly segmented market. First, over the last decade, the progressive use of international sanctions against several oil producers focused on the sale of crude oil and products has reshaped regional and long-haul oil markets in terms of shipping, insurance and payment arrangements. Sanction measures have however had limited impact on global traded volumes, as sellers find new buyers in a market that has proven complex, multi-layered, mature and adept at transformation.

Second, proactive supply decisions by a reinvigorated OPEC+ have helped balance the market. This has been achieved amid a raft of short and medium-long term uncertainty, such as the pace of energy transition and the profound geopolitical fragmentation that threatens some of the basic tenets of globalized trade and global security itself.

US oil policy has become more overtly interventionist with US shale continuing to transform non-OPEC supply and trade flows. Also, China's role as a key oil importer, refiner and oil producer cannot be overlooked. Beijing's energy security strategy remains dominant despite its success in building out renewables and its global leadership in the electric vehicles space. Chinese oil demand, along with that of its Asian neighbors, increasingly sets the tone for global oil market balances in a period where demand in OECD countries is either showing only marginal growth, flatlining or declining.

Oil prices have largely shrugged off these key forces and the transformations they have wrought on oil market structure. After the price spike above \$100/b sparked by the Russia-Ukraine war, Brent has mostly traded in a relatively narrow range between \$75/b and \$85/b in the last two years, defying uncertainty and shocks (**Figure 1**).

Fig. 1: Daily Brent price and geopolitical events since 2022



Source: S&P Global Commodity Insights, Bloomberg, Reuters, OIES

This Energy Comment highlights some key trends currently shaping the oil market and their implications in terms of oil price behaviour, oil pricing, trade flows, and players' responses. A few trends particularly stand out:

- **Low price volatility despite the raft of uncertainties:** Despite the rise in uncertainty, geopolitical tensions and the various geopolitical shocks hitting the oil market, volatility in oil prices has been low and oil prices remain range bound, with the oil market exhibiting strong resiliency.
- **Bifurcated markets, stretched logistics, segmentation:** Though sanctions and geopolitical shocks did not result in large oil supply losses, they have transformed oil and products trade flows, reduced transparency, created more segmented markets, lengthened trade routes and supply

chains, increased costs and logistical complexity and resulted in more constrained optimization for the various players.

- **Changes in players' behaviours and relations between them:** The impacts of these shocks have also shaped and transformed the behaviour of key players in the oil market and their relations. US oil policy has become more overtly interventionist, while US shale supply continues to transform non-OPEC supply and trade flows. The evolution of US shale has important implications not only in terms of balances and prices but also on the structure of the oil market. OPEC has shown its willingness to act in a proactive manner to address market imbalances. Russia is no longer seen as a reliable supplier and has become heavily dependent on a smaller collection of buyers with important implications on pricing, competition, and its trade and geopolitical relations. China, now the world's largest crude importer, has been a main beneficiary of these shifts arbitraging between different sanctioned crudes and its import/export products quota policy has grown in strategic importance.
- **The pivot east for refining:** The changes in the refining scene have been profound over the last two decades, which kick-started some of the above trends including the reconfiguration in trade flows and the rise of China as a swing refiner. With the end of high refining margins, rationalization in the refining sector is inevitable, particularly in Europe, which will reinforce some of the shifts in trade flows.
- **Fundamental shifts in crude pricing systems:** The crude oil pricing system has already seen key structural transformations especially with the inclusion of WTI Midland into the Brent basket. As WTI increasingly sets the price of Brent, larger volumes of oil traded globally priced off Brent are now linked to trading activities and the various physical and financial layers around WTI. This shift will only accelerate as US crude exports continue to break record levels. Also, the availability of higher volumes of spot barrels, increases in the Middle Eastern refining capacity and complexity, and the diversity of players are having important implications for crude pricing in the East of Suez.
- **Increased uncertainty on oil demand growth:** These transformations are happening against a background of wide uncertainty over oil demand growth prospects, with the divergence not only limited to projections over the medium- and long-term demand trajectory, but also the short-term one.

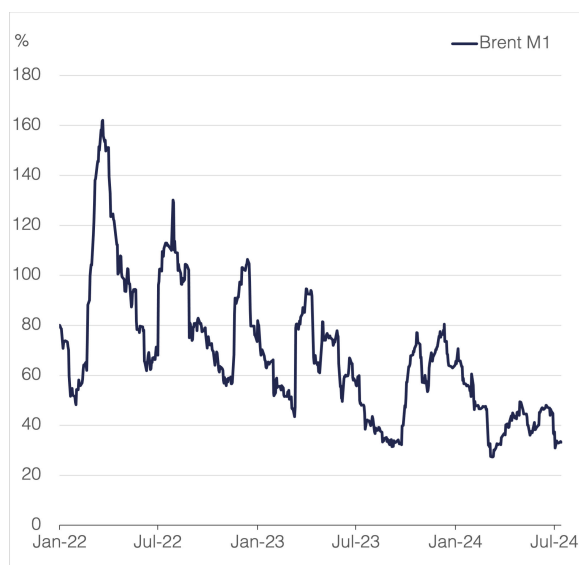
Low volatility, range bound oil prices despite large geopolitical shocks

Since 2022 the oil market has been subject to large numbers of geopolitical shocks including the Russia-Ukraine war, regular attacks on Russian refining infrastructure, the Israel-Gaza war and the diversion of oil trade routes away from the Red Sea due to the Houthi attacks (see **Figure 1**, p.2). Also, some of the world's key oil producers, namely Iran, Venezuela and Russia, have been subject to various forms of sanctions and embargoes and in the case of Russia to price caps on its crude and products exports. Such shocks were expected to result in higher volatility and large risk-premiums¹, but these have thus far failed to materialize. In fact, oil price volatility in the past few months fell to multi-year low levels (**Figure 2**), with the Brent price trading in a very narrow range between \$75/b to \$85/b for most of 2023 and so far in 2024 (**Figure 3**).²

¹ For instance, in a recent interview, Chevron chief executive Mike Wirth argued that "traditionally, when risks elevate in the Middle East, you see it reflected in markets. We have not really seen that yet, and so I am a little surprised." Argus Global Markets, Volume LIV, 3, 19 January 2024.

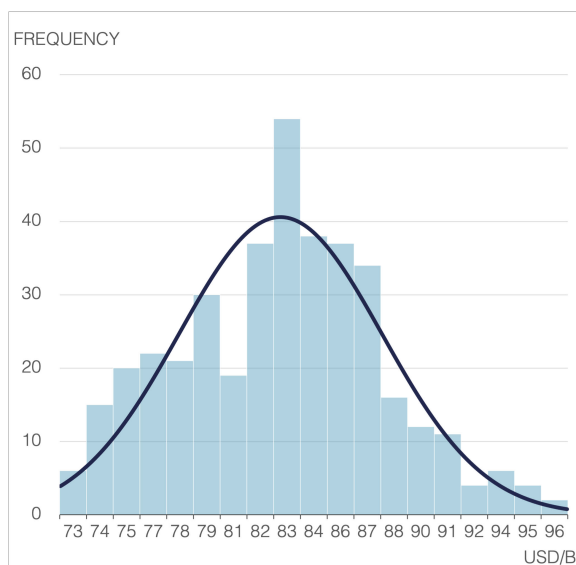
² We estimate that between 3 January 2023 and 16 July 2024 the daily Brent price settled within the \$75/b and \$85/b range 72% of total trading days (388 days).

Fig. 2: Brent M1 21-day realized volatility



Notes: Annualized. Source: OIES

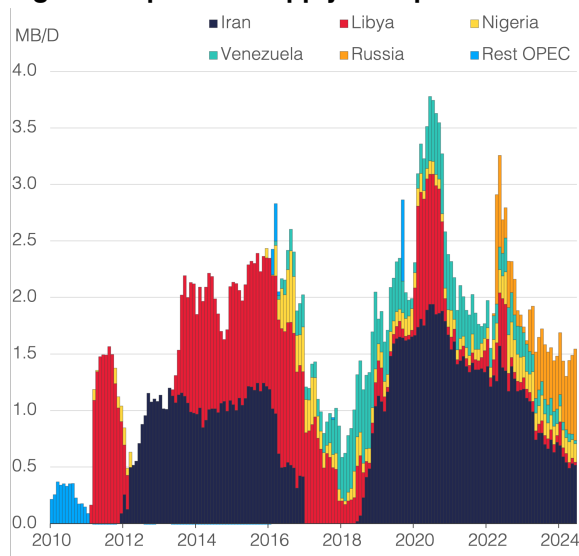
Fig. 3: Distribution of Brent prices



Notes: 3 January 2023 to 16 July 2024. Source: OIES

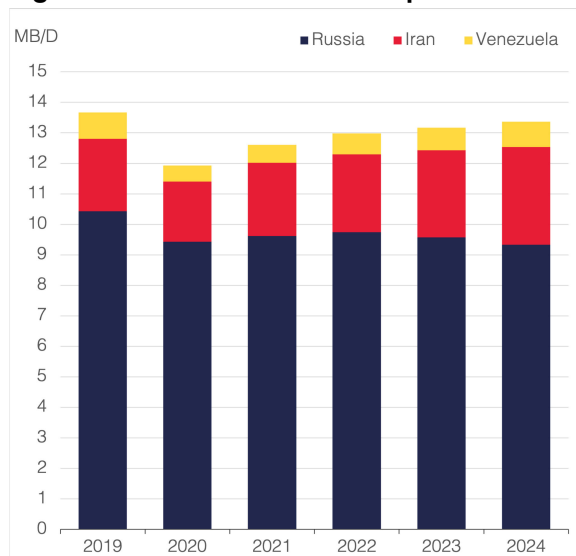
The fact that oil markets appear to be looking beyond the risk of oil disruptions may suggest that security of oil supplies and oil shocks are no longer dominant in the era of the transition. But there are fundamental factors that could explain this observed decline in volatility and the lower-than-expected geopolitical risk premium. First, geopolitical shocks have had so far little impact on physical oil supplies (**Figure 4**). Second, despite the sanctions on Iran, Venezuela and Russia, oil continues to flow out of these countries (**Figure 5**). In H1 2024, output from these three countries combined stood only 300 kb/d below 2019 levels. Iranian and Venezuelan output more than offset the loss of Russian crude compared to H1 2022, up by 660 kb/d and 130 kb/d, respectively, versus a loss of only 330 kb/d from Russia, showing its resilience as an oil supplier. Third, OPEC has been adjusting its supply to counter various shocks, thereby preventing large oil market imbalances. These factors may have contributed towards market participants discounting the impact of geopolitics on oil prices. In fact, our analysis shows that despite the rise in geopolitical tensions, the geopolitical risk premium has been relatively low and declining, especially when compared to demand and supply factors (**Figure 6**).

Fig. 4: Geopolitical supply disruptions



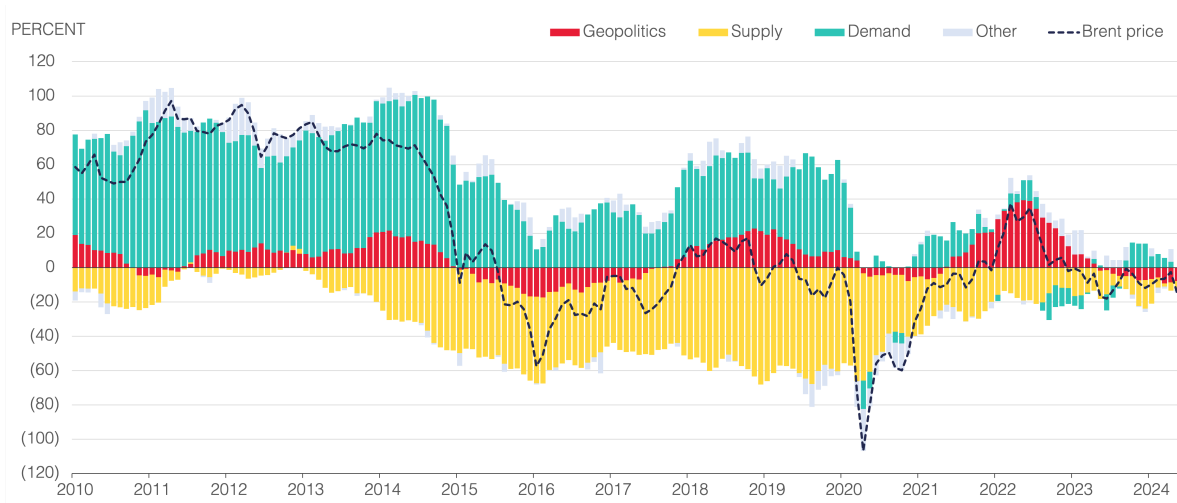
Notes: OPEC plus Russia. Source: OIES

Fig. 5: Sanctioned crude oil output



Notes: 2024 is up to June. Source: OPEC, OIES

Fig. 6: Cumulative effect of oil price drivers on Brent price evolution



Notes: Historical decomposition for Feb 1992 to May 2024 of the real Brent price in May 2024USD, in percent deviations from the sample mean. Source: OIES

Structural shift in crude and products trade flows

Although the oil market was not subject to large output disruptions (unlike the gas market which witnessed a massive loss in Russian pipeline gas)³, crude oil and products have witnessed one of the most significant transformations in terms of crude and products trade flows in the history of the oil market (see **Figure 7**). Perhaps this is best illustrated in the changing composition of EU-27 imports of crude and products. While EU-27 seaborne imports of Russian crude constituted around 20% of the total in 2019 (or 1.9 mb/d out of 9.3 mb/d), in 1H24 this has fallen to zero. In contrast, the share of Middle East, the US and Brazil combined has nearly doubled from 15% in 2019 to 28% in 1H24. Also, the EU has managed to increase its intake from domestic sources with the share of North Sea crude rising from 12% in 2019 to 18% in 1H24. In fact, despite the significant loss of nearly 2 mb/d of Russian crude in Europe, in the first half of 2024, EU-27 imports of crude oil surpassed their 2019 levels.

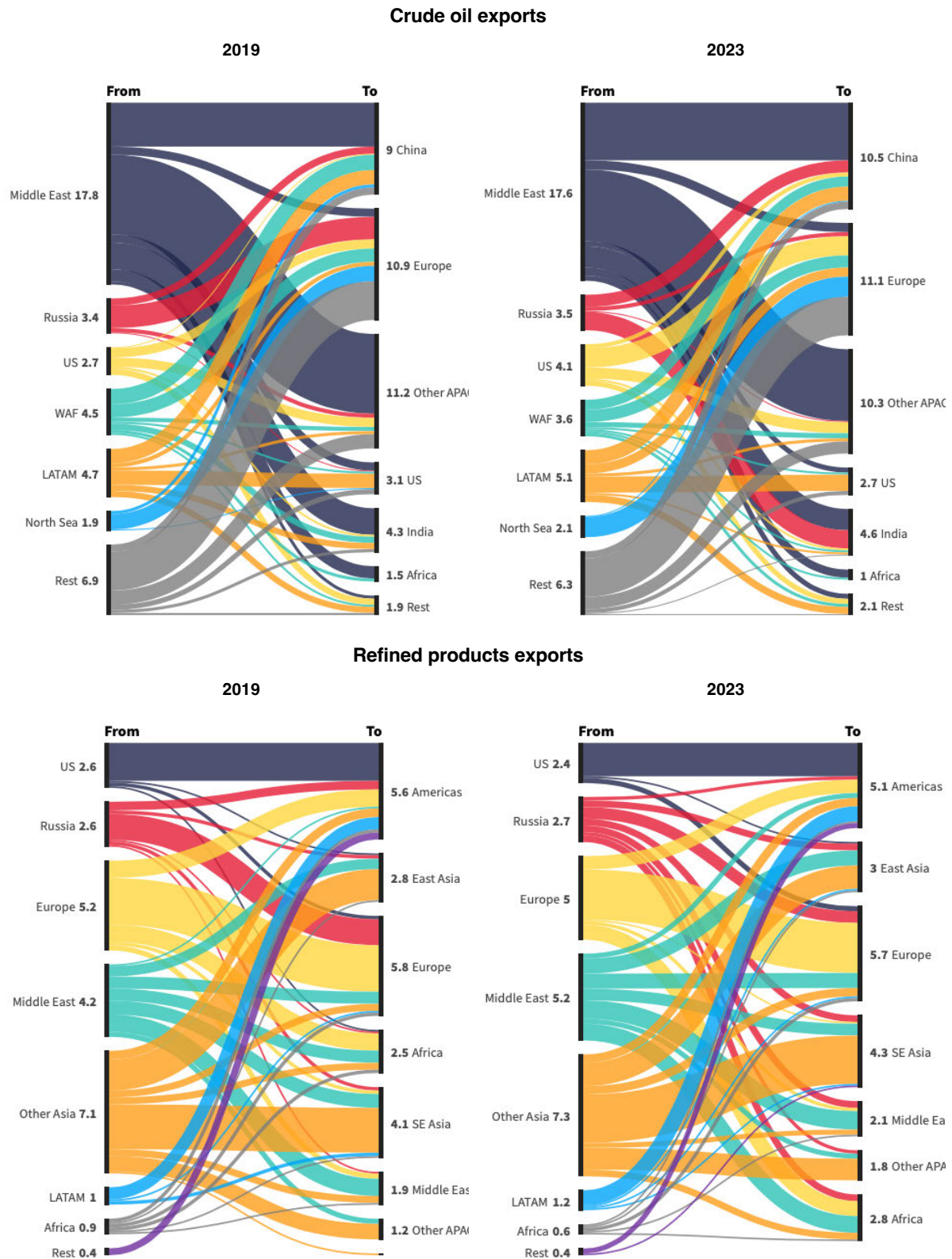
A similar picture emerges in terms of products imports. In 2019, EU-27 imports of Russian products constituted around 27% of its total imports (or 1.2 mb/d out of 4.6 mb/d). By 1H24, this has fallen to 3%. The gap is being replaced by imports from further away places such as the GCC (+5%) mainly Saudi Arabia, the UAE and Kuwait, the Americas (+4%) particularly the US and Brazil and other Asia (+3%) such as India and China. At the same time, European intra-region flows including Turkey in 1H24 rose by 11% to nearly 60% of the total, from 47% in 2019.

This structural transformation could also be illustrated by looking at the shift of Russian crude exports from west to east (see **Figure 7**). In 2019, more than half of Russian crude exports were destined to EU-27 (58%) and exports to Asia accounted for 34% heading mainly to China (21%), while exports to India accounted no more than 1% of the total. In 1H24, Russian crude exports to China, India, and Turkey accounted for 93% of the total, with India and China accounting for the lion's share at 48% and 34%, respectively. Particularly for India, the transformation has been phenomenal as prior to the 2022 sanctions on Russian oil, India's largest annual intake of Russian crude was 52 kb/d in 2017. In 2023, India's imports of Russian crude averaged nearly 1.8 mb/d accounting for nearly 40% of the country's total imports, while on a monthly basis they reached as high as 2.2 mb/d. There are reports that India's state-owned refineries are considering entering into long-term oil supply agreements with Russia.⁴ But this has not been without its challenges. For instance, payment issues have caused the diversion of

³ In 2019, EU imported 179 bcm from Russia through pipelines. By 2023, this has fallen to less than 26 bcm, a decline of 153 bcm.

⁴ <https://www.reuters.com/markets/commodities/indian-state-refiners-talks-long-term-oil-import-deal-with-russia-government/>

Fig. 7: Shifts in global crude and products trade flows, mb/d



Notes: Seaborne only. Source: Kpler, OIES

some Russian cargoes away from India. Russia has recently announced that it has accumulated billions of rupees that it hasn't yet found a use for.⁵ Also, the US and its allies have stepped up the enforcement of sanctions creating difficulties for buyers of Russian oil and idling many tankers used in the transport of Russian oil.⁶

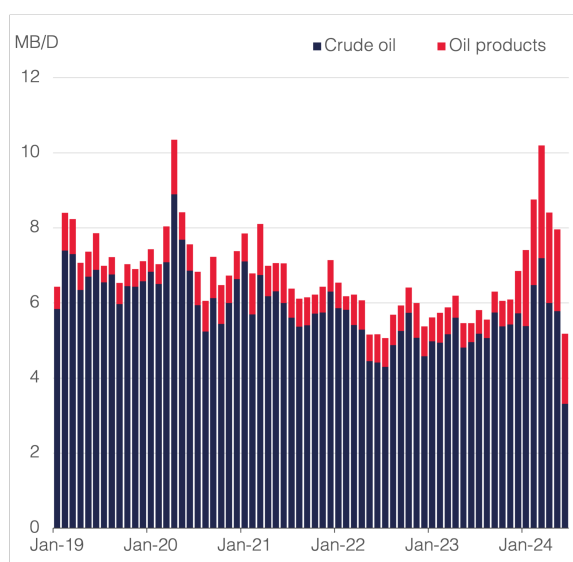
In terms of products, Russia has managed to divert more than half of its total products exports that were traditionally destined to EU-27 and the US (accounting for 52% of the total in 2019) to numerous buyers mainly in Asia (+22%), Northern Africa (+13%), as well as to further away places such as Latin America (+7%; see **Figure 7**).

While it has been successful in diverting its crude and products exports to the fastest growing markets, Russia is no longer seen as a reliable long-term supplier even in Asia. Also, Russia's heavy dependence on a smaller pool of buyers has important implications in terms of its pricing power, its financing/payment conditions, the discounts on offer, and its wider geopolitical relations. That said, with Russia redirecting its exports, the competition among oil exporters to Asia has intensified impacting pricing and marketing strategies.

Longer trade routes and impact on supply chains

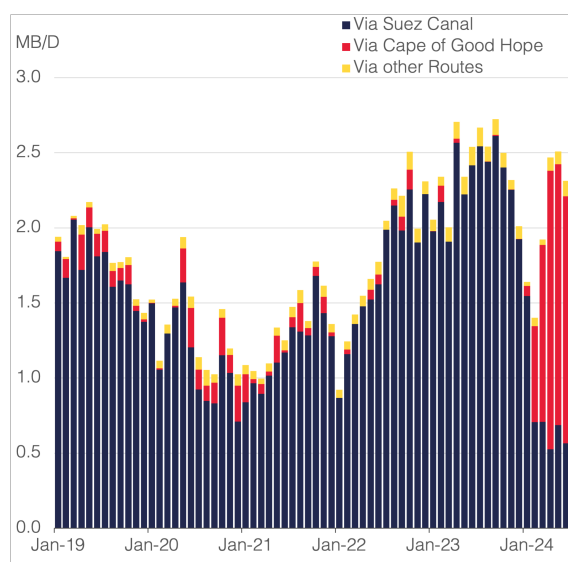
The reshuffling in trade flows means that oil trade routes have become longer, oil trade logistics more complex and costly and refinery optimization more constrained. Refineries have been changing their crude slates resulting at times in the sub-optimal use of crudes and supply of products. The Houthi attacks on shipping in the Red Sea causing the diversion of trade flows to Asia around the Cape of Good Hope rather than through the Suez Canal has only amplified these trends. Crude oil and oil products trade flows around the Cape rose by 2.1 mb/d to 8 mb/d in 1H24 compared to an average of 5.9 mb/d in 2023 with oil products accounting for nearly 80% of the rise (**Figure 8**). The situation is more profound for Europe, which saw oil imports via the Suez Canal decline by 1.5 mb/d in 1H24 compared to their 2023 average, while rerouted flows via the Cape increased by 1.2 mb/d (**Figure 9**). This has increased shipping time, costs, insurance premiums, and demand for bunker fuels.

Fig. 8: Global oil flows via Cape of Good Hope



Source: Kpler, OIES

Fig. 9: Europe oil imports from East of Suez

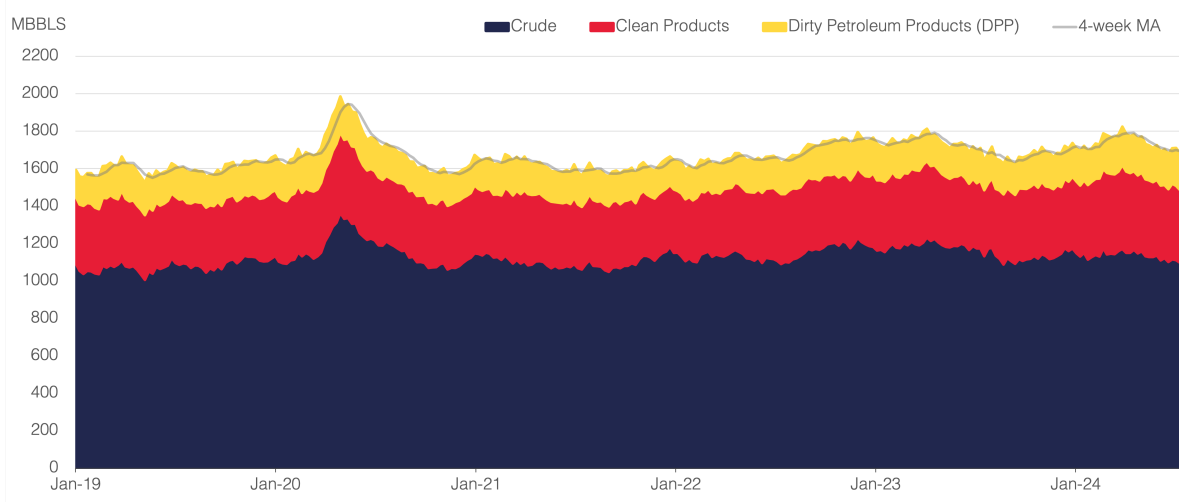


Source: Kpler, OIES

⁵ <https://www.politico.eu/article/india-has-russia-kremlin-over-crude-oil-barrel/>

⁶ <https://oilprice.com/Energy/Crude-Oil/Sanctions-Strand-Over-50-Russian-Oil-Tankers.html#:~:text=While%20the%20dark%20fleet%20is,oil%20cargoes%20since%20being%20designated.>

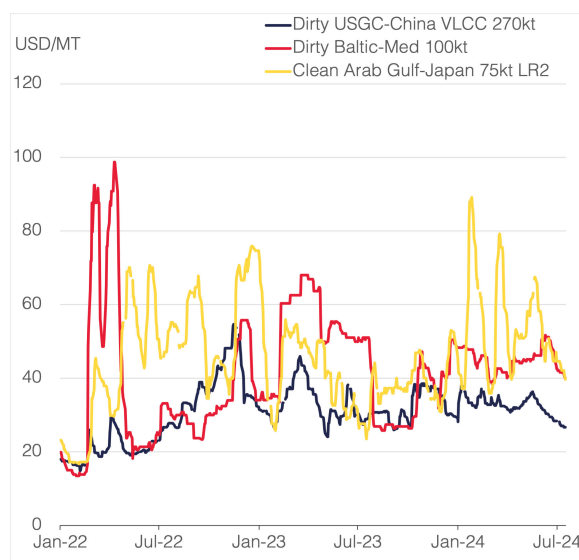
Fig. 10: Commodities on water



Source: Kpler, OIES

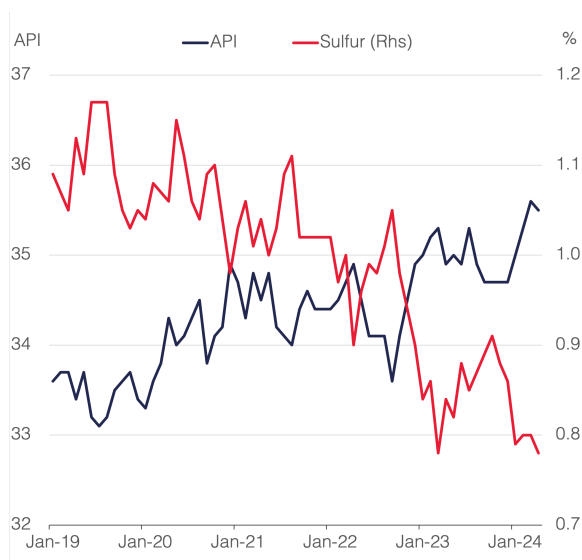
One of the most visible impacts has been the increase in volumes of crude and products on water (**Figure 10**). In 1H24, total crude and products on water surpassed both 2020 and 2023 by 23.6 mbbls and 11.3 mbbls, respectively, averaging 1,550 mbbls versus 1,526 mbbls in 2020 and 1,539 mbbls in 2023. The increase in volumes of products on the water was particularly sharp. Product supply chains are longer than crude, where refineries have more choices in procuring crude. In contracts, products are often produced to meet specific market requirements, which differ across regions. Compared to 2023, products on the water increased by nearly 35 mbbls in 1H24, with fuel oils constituting the biggest category up by nearly 20 mbbls, followed by diesel which rose 14.4 mbbls. LPG is another fuel that saw an important rise mainly due to the diversion of shipments to Asia Pacific away from the Panama Canal.

Fig. 11: Select tanker freight rates



Source: S&P Global Commodity Insights, OIES

Fig. 12: EU-27 refinery runs by crude quality



Source: Kpler, OIES

These trends have important implications on key aspects of the oil market including freight rates, storage patterns, inventory behaviour and investment decisions. For instance, freight rates (particularly clean tankers freight rates) have reached high levels in the past few months impacting arbitrage between markets (**Figure 11**). This has also induced a switch among tankers from carrying dirty to

clean cargoes.⁷ Storage-on-land, a key indicator for oil markets, has also been impacted with stocks exhibiting more volatile patterns in some hubs and for some products (for instance diesel stocks in Europe). This has been reflected in the volatility of time spreads and margins for products. Also, regular refinery switches between sour and sweet crudes have resulted in more volatile spreads. This was seen particularly in the change of European refineries' diet between 2022 and 2023 (see **Figure 12**), as sour crudes became relatively more costly, inducing a shift towards sweet barrels. Commodity trading companies have been expanding their downstream assets in the EU, positioning themselves to accommodate a more volatile products' market, longer supply chains and more robust margins.⁸

Oil markets have become more segmented and less transparent

As a result of embargoes and sanctions and the introduction of price caps, the oil market has become more segmented with sanctioned crudes and sanctioned refined products trading alongside non-sanctioned oil, with prices differing widely for similar qualities of crude and products (**Figure 13**). At the start of the Russia-Ukraine war, the discounts on Russian crude and products were large, but these have narrowed significantly. Also, price discovery for sanctioned crudes has become increasingly challenging if not impossible. For instance, the change in pricing practices from FOB to CIF basis has made the process of price discovery for Russian barrels, particularly Urals in Asia, extremely difficult and dependent on assumptions made about insurance premiums and tanker rates which are not transparent, and which is conducive to capturing margins through transfer pricing. With the G7, the EU and Australia prohibiting the financing, shipping and insurance of crude and products of Russian origin, these services are being carried by 'unknown' entities and have shifted to less transparent jurisdictions. Also, the practice of blending and ship-to-ship transfers have flourished, as has the reliance on shadow fleets, all of which have made it more challenging to track oil flows, especially those destined to China. It is estimated that Russia's shadow fleet is currently comprised of 435 vessels, 185 transporting crude oil and 250 transporting petroleum products, three-quarters of which fall into the age group of 15-20 years with no clear ownership structure and the type of insurance they carry (**Figure 14**).⁹

Fig. 13: Urals and select crude grades



Notes: The price cap took effect on 5 December 2022. Source: S&P Global Commodity Insights, OIES

⁷ <https://www.vortexa.com/insights/freight/dirty-to-clean-switches-on-larger-tankers-help-tame-volatile-lr-freight-rates/>.

⁸ <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/052324-infographic-refining-reshuffle-european-industry-evolves>

⁹ Hilgenstock, B., Hrybanovskii, O. and Kratsev, A. 2024. Assessing Russia's Shadow Fleet: Initial Build-Up, Links to the Global Shadow Fleet, and Future Prospects. KSE Institute, June.

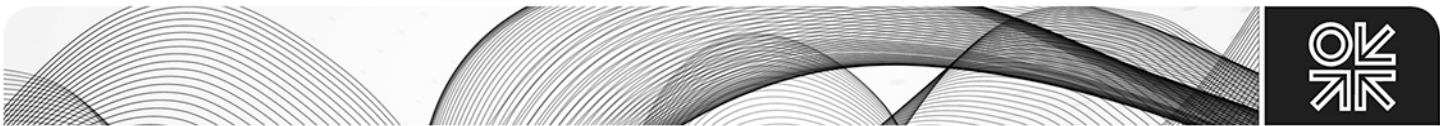
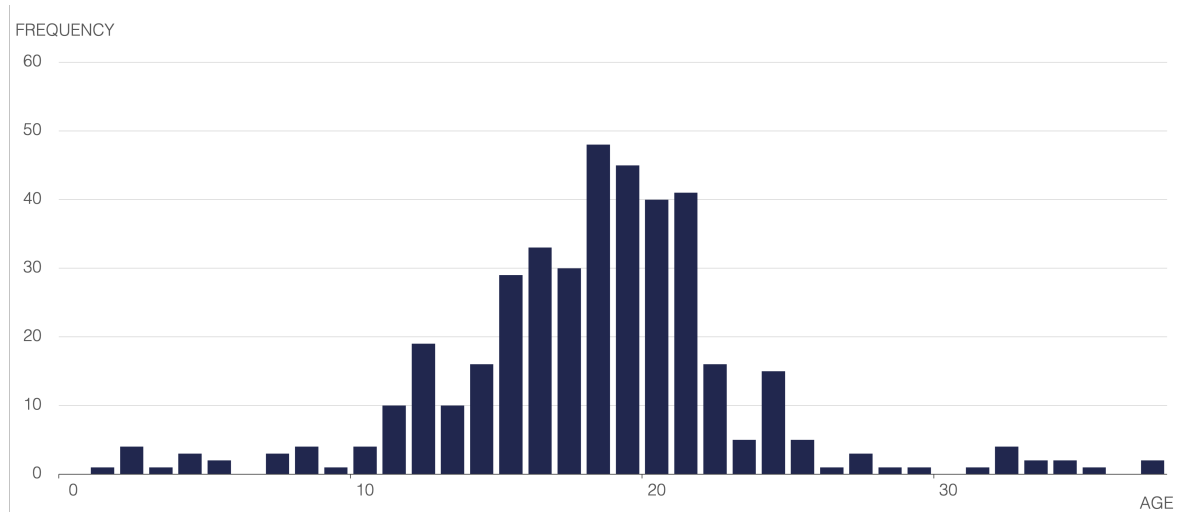


Fig. 14: Distribution of tankers of the Russian shadow fleet by age

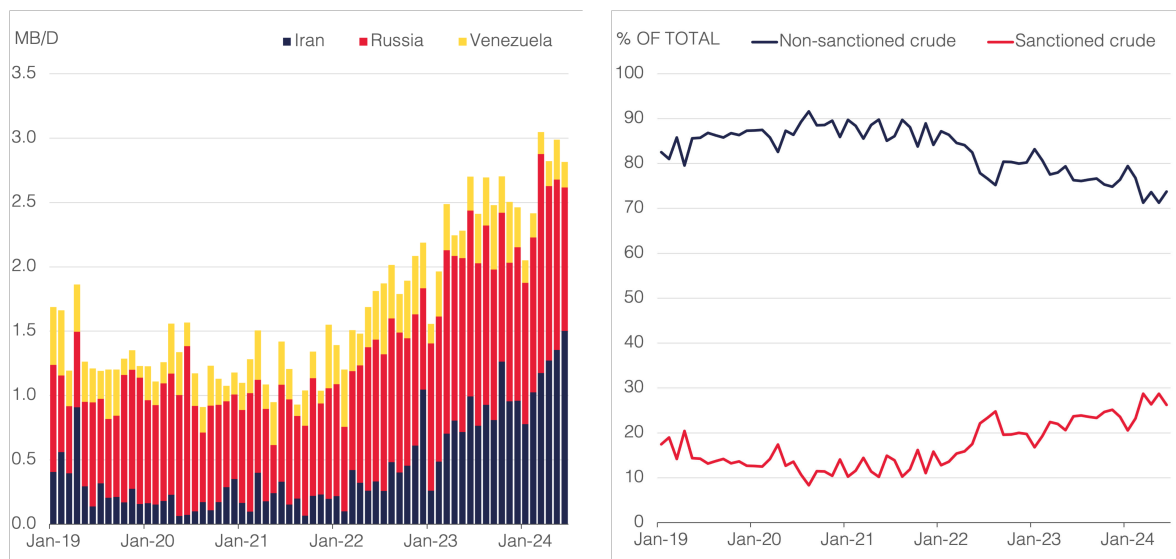


Source: Reconstructed from Hilgenstock et al. 2024. Assessing Russia’s Shadow Fleet: Initial Build-Up, Links to the Global Shadow Fleet, and Future Prospects, Figure 5, p.15.

China’s influence on oil markets on the rise

China, the world’s largest crude oil importer (11.35 mb/d in 2023), has been one of the biggest beneficiaries of reshuffled oil trade flows. China has increased its imports of sanctioned crudes from Russia, Iran and Venezuela (**Figure 15**). In 2019, China’s seaborne crude imports from these three countries amounted to 1.4 mb/d constituting 15% of its total imports of 9.1 mb/d. By 1H24, these increased to 2.7 mb/d constituting on average 26% of China’s total crude imports. These crudes are usually traded at a discount as sanctioned countries are constrained in terms of outlets and compete among each other for access to the Chinese market. This allows Chinese refineries to arbitrage between these crudes based on cost and shifts in perceived risk. For instance, when the US imposes stricter sanctions on vessels carrying Russian crude and when Chinese banks limit the financing of Russian cargoes, Iranian and Venezuelan crude become relatively more attractive and imports from these countries tend to increase.

Fig. 15: China imports of sanctioned crude



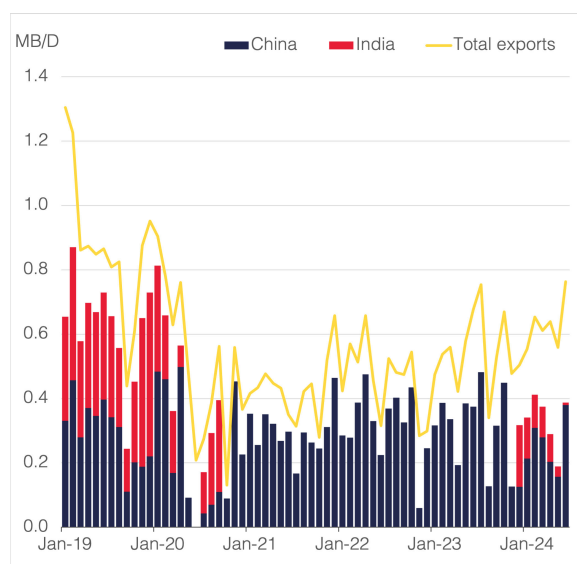
Source: Kpler, OIES

The temporary suspension of US sanctions on Venezuela is another case in point. The temporary sanctions waiver issued in October 2023 caused China’s independent refineries to slow their purchases from Venezuela as the discounts on its main crude grade (Merey) narrowed and Venezuela’s export outlets increased. As a result, Venezuela’s crude exports to China (often classified as diluted bitumen) declined sharply from the 2023 high of nearly 500 kb/d in September to 120 kb/d in December, which was offset by an increase in exports to other countries mainly India (**Figure 16**). But with the expiry of the US sanctions waiver in April 2024 and with the widening of the discounts on Merey, China’s imports of Venezuela’s crude have been on the rise again, a clear indication of the ability of China’s independent refineries to arbitrage changes in the sanctions’ regime and the strictness of their application.

In the case of China’s imports of Iranian crude (mainly appearing in the data as imports from Malaysia), these are usually loaded from storage facilities in Southeast Asia. This shortens the delivery time to China’s refineries allowing them to respond quicker to changes in refining margins. The structure of China’s refining industry which consists of ‘state-owned majors’ and ‘independents’ facilitates this arbitrage. State-owned refineries usually avoid importing Iranian barrels given the risk of secondary sanctions. Instead, most of these barrels are purchased by independent refineries in Shandong (**Figure 17**). The decisions to purchase sanctioned crudes tend to vary depending on market factors such as refining margins, but also on the tightness of US sanctions and banks’ scrutiny about the origin of the imported crude¹⁰.

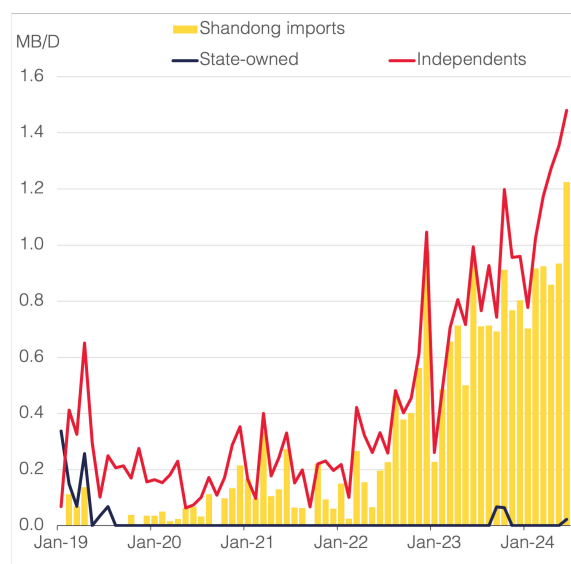
China’s large crude oil storage capacity (both commercial and strategic) facilitates this arbitrage as discounted crude can find its way into storage. China’s total crude oil storage capacity has expanded rapidly, currently estimated by Kpler at 1670 mbbbls, up by 240 mbbbls since 2017 and holding 950 mbbbls ending-1H24 (**Figure 18**). This does not only enhance China’s energy security, but the management of stocks alongside heightened energy security concerns¹¹ is a clear sign of China’s increasing pricing power.

Fig. 16: Venezuela crude exports



Source: Kpler, OIES

Fig. 17: China crude imports from Iran

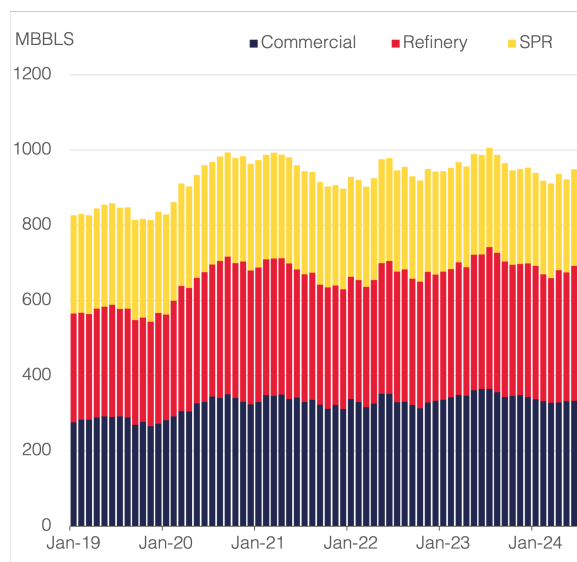


Source: Kpler, OIES

¹⁰ There has been a perception that China buys discounted sanctioned crudes which allows it to export cheap products. However, it is not that straightforward. Teapots buy sanctioned crudes and produce discounted products, which they also sell to the majors. Only the majors can export products so it’s a slightly segmented market.

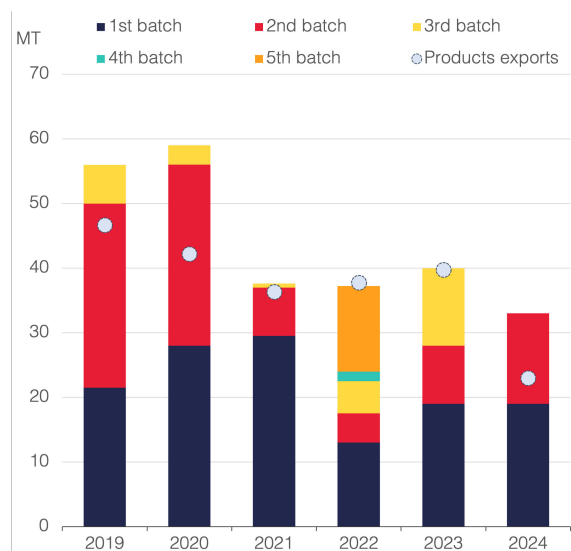
¹¹ <https://www.reuters.com/business/energy/china-asks-state-firms-add-60-mln-barrels-oil-reserves-vortexa-sources-say-2024-07-04/#:~:text=Vortexa%20estimates%20China’s%20strategic%20petroleum,the%20U.S.%20Energy%20Information%20Administration.>

Fig. 18: China crude oil inventories by type



Source: Kpler, OIES

Fig. 19: China products export quotas



Notes: Jan to Jun 24 avg. Source: Argus, Kpler, OIES

China's decision to issue quotas for products exports has also emerged as a key dynamic impacting market outcomes and refining margins in Asia and beyond, highlighting China's role as a global swing refiner (**Figure 19**). When China's domestic demand for refined products such as gasoline and diesel weakens, higher exports become one of the means of relieving pressure on refineries. Higher products exports usually weaken regional refining margins, driving crude purchase decisions, refining runs and crude and products prices. These decisions are compounded by the fact that export decisions in China are based both on export arbitrage economics and on government quota policies, making them harder to predict.

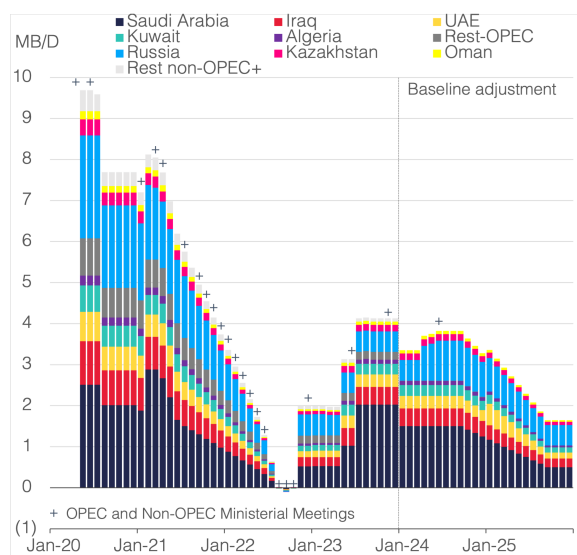
Also, China's massive investment in integrated refining-petrochemical complexes have driven major reorganization of trade flows. Expansion in chemicals capacity has weighed on operating rates and margins. The expansion of Chinese chemicals also highlights the policy of closing inefficient teapots and promoting other independent producers (e.g. Hengli/Rongsheng), now candidates for JV/partnership with Middle East energy companies such as Saudi Aramco, which has itself made a major pivot into China's downstream sector.

More proactive, cohesive and transparent OPEC

In a clear departure from previous cycles, OPEC has become more proactive showing its willingness to act in a pre-emptive manner to support market balances when faced with uncertain fundamentals (**Figure 20**). In the past, such pro-active moves were not always feasible as the cohesion within OPEC was not strong enough and OPEC's reaction to market imbalances was often delayed. Also, in previous cycles, it took months or even years for OPEC to negotiate output agreements, which further delayed responses and reduced the effectiveness of the organization's decisions.

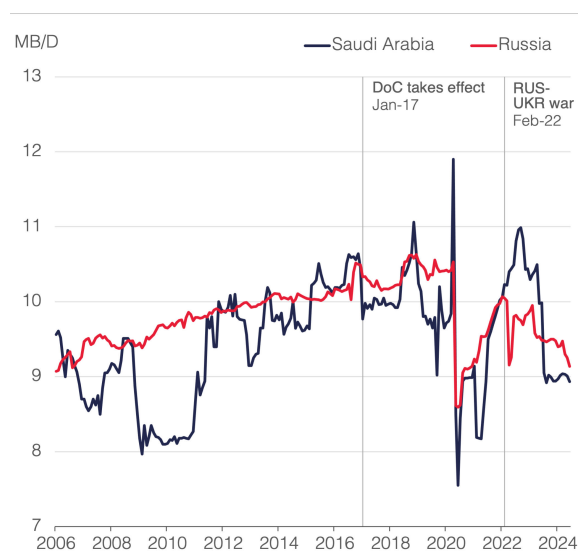
Also, OPEC has been successful in extending its collaboration with other producers via the Declaration of Cooperation (DoC – the larger group is often referred to as OPEC+). This constituted a key milestone in Russia–Saudi oil relations two of the world's largest producers (**Figure 21**). Against expectations, the oil relations between these two countries continued to strengthen following the COVID shock and the Russia Ukraine war.

Fig. 20: OPEC+ output cuts



Notes: Includes voluntary cuts. Source: OPEC, OIES

Fig. 21: Saudi Arabia and Russia output



Notes: Ex-condensate. Source: OPEC, IEA, OIES

Also, some of the large players within OPEC particularly Saudi Arabia have shown willingness at times to take additional unilateral actions to balance the market. This contributed to further flexibility and strengthening the cohesion within the Group. In addition, OPEC has become more transparent, providing guidance to the market about its output policy while retaining flexibility. For instance, in the last OPEC+ meeting in June 2024, key OPEC+ countries announced that they will gradually reverse 2.2 million b/d of their voluntary cuts from the end of September 2024 till September 2025, while retaining flexibility to pause or reverse these increments if market conditions change (see **Figure 20**).

Compliance with quotas has always posed a challenge to OPEC, but there have been efforts to address this challenge through regular monitoring and introducing compensation schemes for those countries that have not met their quotas in certain months to make up the shortfall in subsequent months.

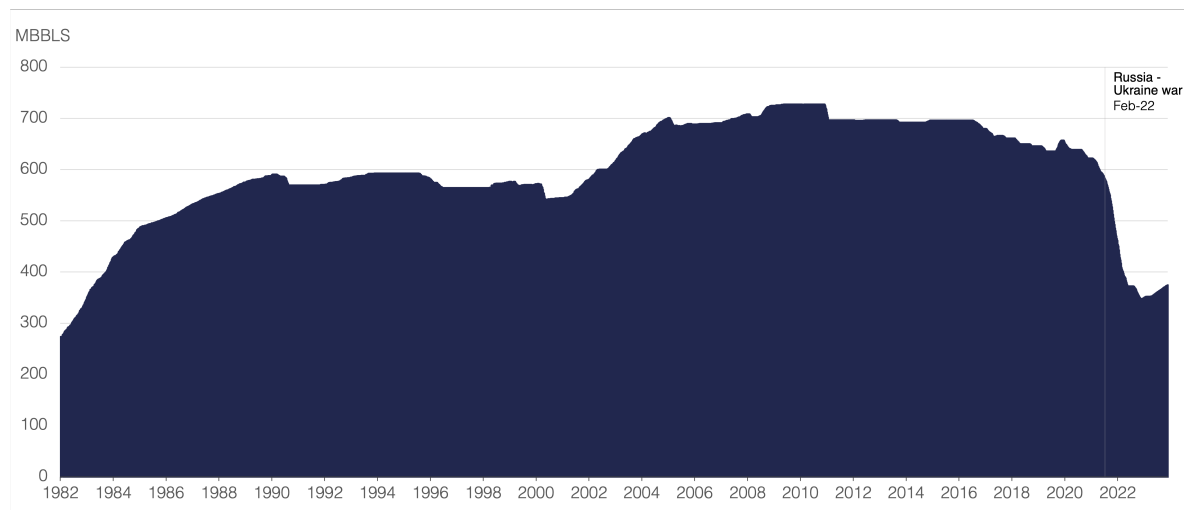
In short, while OPEC has always been a key force shaping market dynamics, it has become more effective and proactive in managing the price cycles, keeping the market balanced, crude stocks below the five-year average and time structures mostly in backwardation.

More interventionist US oil policy

US energy policy has become more overtly interventionist, especially with the introduction of the Inflation Reduction Act (IRA). Green policies have become closely intertwined with industrial policies to achieve leadership in new energies. In the oil market, the interventionist approach has been manifested in the imposition of sanctions on key oil producing countries such as Venezuela, Iran and Russia. The US and its allies have also introduced a price cap on Russian oil to limit revenues flowing to Russia impacting the operation of crude and products markets. The interventionist approach has also been evident in the use of the Strategic Petroleum Reserve (SPR) to manage prices rather than offset supply disruptions. In response to the Russia-Ukraine war, the US released large volume of crude from the SPR, capping the oil price. Ending-July 2023, US stocks of crude oil in the SPR were down by nearly 250 mbbls compared to the start of 2022, falling to their lowest level since the week-ending 19 August 1983 (**Figure 22**). That decision was made, even though disruptions to Russian oil were limited with supply falling by around 1 mb/d to 10.4 mb/d in April 2022, compared to pre-war Jan/Feb levels (11.4 mb/d) but Russian supply swiftly made a near full recovery by 1Q23 (11.2 mb/d). This new approach applies both to rising and declining markets. As oil prices retreated in recent months below \$80, the US started replenishing its SPR. Between July 2023 and July 2024, US strategic reserves slowly increased

by 26 mbbls to 370 mbbls, but still remained well below the 600 mbbls level seen prior to the Russia-Ukraine war. Recently, the US Department of Energy announced the sale of 1 mbbls of gasoline in the Northeast Gasoline Supply Reserve ‘in an effort to reduce gasoline prices ahead of the summer driving season’ and ahead of the US presidential elections in November.¹²

Fig. 22: Weekly US ending stocks of crude oil in SPR



Source: US EIA, OIES

US shale resilient but large divergence on supply outlook

The US has been the main driver of non-OPEC supply, growing at an annual average 530 kb/d between 2009 and 2023 (crude/condensate only; if NGLs are included, this would rise to 830 kb/d). After a sharp fall in 2020 following COVID (-980 kb/d y/y), crude oil production in H2 2023 recovered above its 2019 peak of 13 mb/d despite the decline in rig count (**Figure 23**). Reaching pre-COVID levels of production has been possible due to productivity gains derived from drilling longer horizontal wells, cube drilling, better knowledge of the resource base and drawing down the inventory of drilled but uncompleted (DUCs) wells. In 2023, the US was by far the largest source of oil supply growth, adding 1.5 mb/d y/y.

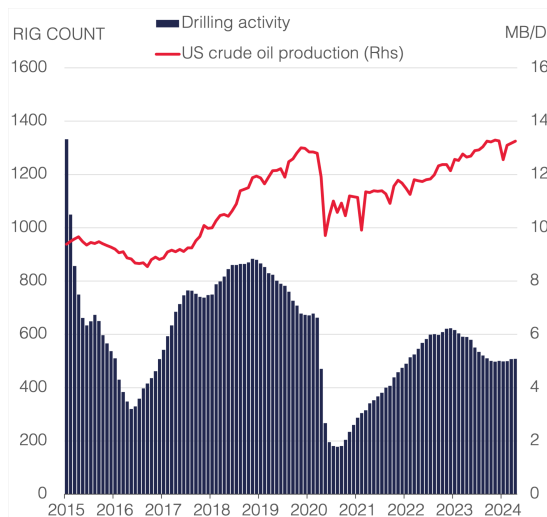
Looking forward, there is however a wide divergence in views on the future prospect for US shale oil. The divergence is related to different views about the persistence of productivity gains and the ability to increase production from current levels without increasing rig count; the behaviour of shale producers particularly the role of privately owned firms; whether the focus on maximizing shareholder return (rather than maximizing output) will continue; the impact of industry consolidation on investment decisions; and the size and quality of the resource base. This has been in part reflected in the revisions in forecasts about US shale. At the start of 2023, EIA projected US shale growth of 470 kb/d for 2023. By the end of 2023, this was revised upward to 860 kb/d. For 2024, the growth projections vary widely, but generally are expected to slow down from 2023 as rig count declined. Beyond 2024, US shale oil production growth is expected to slow down further and even peak before the end of this decade in some projections (see **Figure 24**).

If US shale growth does indeed continue to fall, this will imply a shift in the structure of the market and its role as the ‘marginal’ supplier. The US shale sector not only produced a supply shock, but it remains the most elastic source of supply given its short investment cycle, the diversity of the US shale players and their hedging strategies. A decline in US shale will have important implications on the oil market structure and OPEC policy. Also, with the US shale industry focused on maximizing returns to

¹² US DOE. U.S. Department of Energy Announces Sale of Northeast Gasoline Supply Reserve as Americans Hit the Road for Summer Driving Season. 21 May 2024.

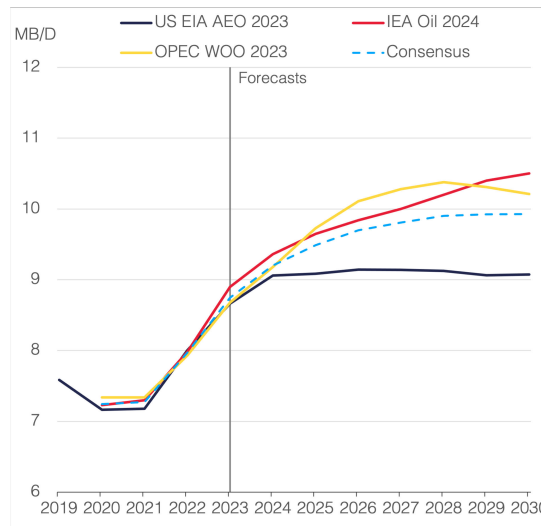
shareholders (not output growth) and OPEC maximizing revenues to its governments, the behaviour of the two have become more aligned.

Fig. 23: US crude oil production



Source: US EIA, OIES

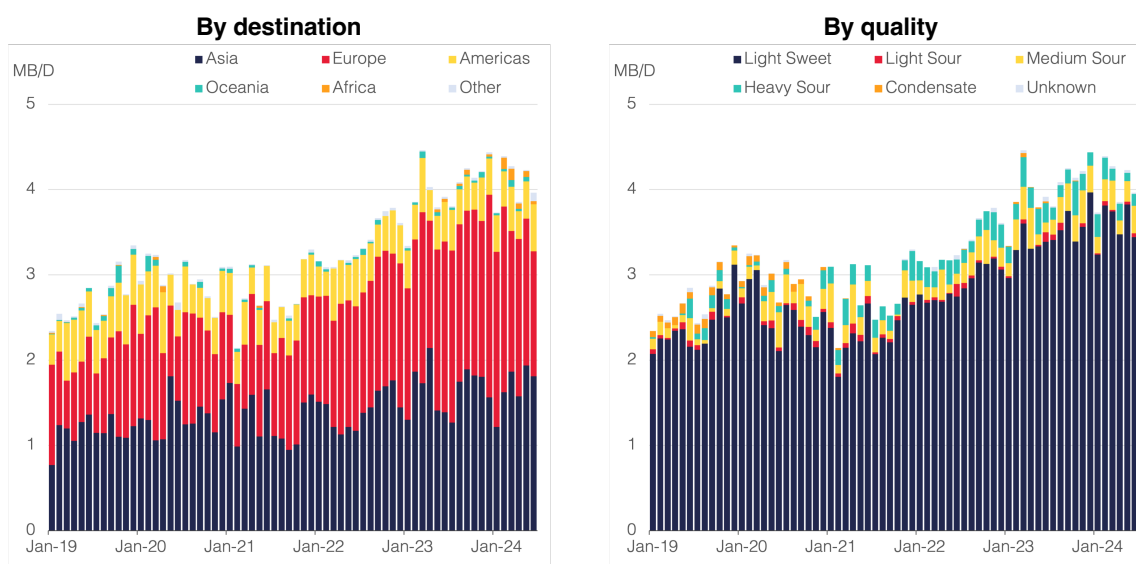
Fig. 24: US LTO forecasts



Source: US EIA, IEA, OPEC, OIES

Against a backdrop of the rapid increase in US production, US crude exports have risen sharply in recent years reaching record levels in 2023 (**Figure 25**). The US has become one of the world's biggest oil exporters with its crude flowing mainly to Europe and Asia, and less to the rest of Americas and Africa. Between 2019 and 1H24, average US crude exports rose by nearly 1.4 mb/d surpassing 4 mb/d. Most of this crude is of the light sweet variety (WTI Midland). During the Russia-Ukraine war, US crude exports played an important role in filling the gap in Europe and by 2023 accounted for nearly half of the total versus 36% in 2019, becoming a mainstay for refineries seeking to replace Russian Urals. But this growth is not only confined to crude. Although in 2023, US petroleum products exports averaged 2.5 mb/d, 260 kb/d below the 2019 average (2.7 mb/d), in December they rose to their highest level since December 2018 at 3 mb/d. Propane, increasingly being used as a feedstock in the Asian petrochemical sector, has become the largest product export category, surpassing that of distillates.

Fig. 25: US crude oil exports

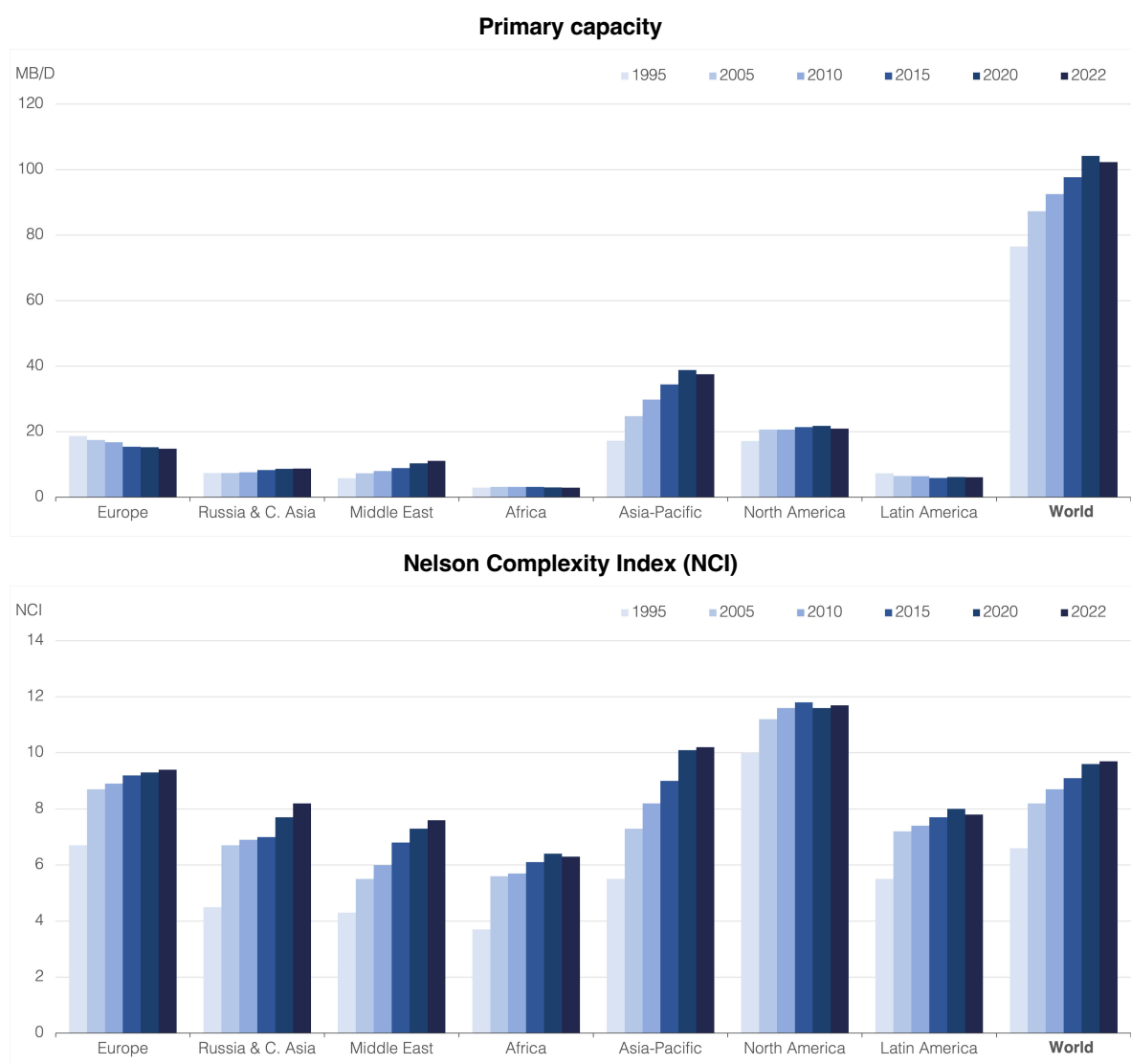


Source: Kpler, OIES

Refining expansions East of Suez reinforce the shifts in trade flows

The global refining scene has also witnessed some fundamental changes. Between 2010-2022, primary refining capacity in Asia-Pacific increased by 7.8 mb/d, accounting for 80% of global increases (**Figure 26**). The Middle East (particularly the Gulf) was the second largest contributor adding 3.1 mb/d of new capacity, followed by Russia and Central Asia which added 1.1 mb/d. Despite the refinery closures in North America, particularly less complex refineries, more complex refineries managed to increase capacity by 280 kb/d between 2010 and 2022. European refinery capacity on the other hand declined by nearly 2 mb/d in the same period, following another decline by 1.9 mb/d between 1995-2010.

Fig. 26: Global refining capacity and complexity



Source: Eni World Energy Review, OIES

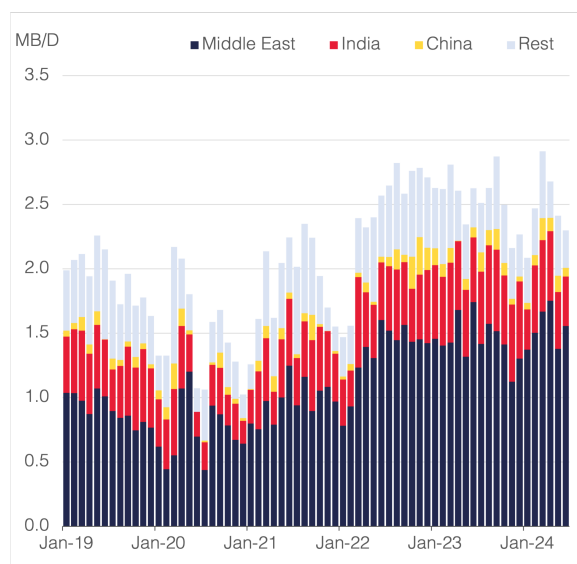
Nearly all new refining capacity built globally since 1995 is made up of more complex refining (see **Figure 26**). North American refineries have historically ranked highest in complexity, averaging 11.3 historically based on the NCI and this is the only region above the global average of 8.7. Europe has historically ranked second averaging 8.7 in line with the global average, followed by Asia-Pacific averaging 8.4 and 7.9 for Latin America. Interestingly, the rate of complexity development in Asia-Pacific has been remarkable, mainly led by China. By 2020 it became only the second other region to

exceed the global average together with North America. A similar trend is observed for the Middle East with the development of more complex refinery projects accelerating over the past decade. The trend of higher complexity in Asia allowed for increased diversification across sources of supply and across types of crude, and for higher yields of light and clean products meeting the most advanced specifications.

The increase in more complex and export-oriented refineries in Asia and the Gulf squeezed out the less complex and less efficient refineries in Europe and some parts of the US. Further rationalization of refining capacity will be required throughout this decade. This will mainly occur in Europe, amid weaker demand, pressure on margins including from higher carbon taxes on emissions, companies' strategies to close/convert refining assets into biorefineries amid strong incentives to shift to low carbon products such as renewable diesel.

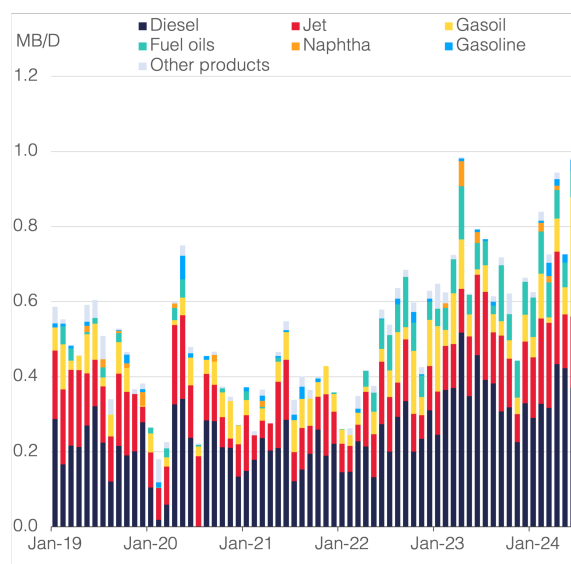
The increase in refining capacity to the east of Suez and its decline to the west of Suez meant larger outflows of refined products from east to west and therefore longer trade routes. The Russia-Ukraine war reinforced this trend with products exports from the Gulf, China and India increasing sharply in recent years to fill part of the gap left behind by Russian refineries. Between 2021 and 1H24, products exports from Asia to West of Suez rose by 600 kb/d, with higher exports from the Middle East accounting for 97% of the total increase (**Figure 27**). GCC product exports to Europe, mainly of middle distillates, have also been on the rise reaching a record level of near 1 mb/d in June 2024 (**Figure 28**). The current long-haul products trade 2.5 times greater than in 2000.¹³

Fig. 27: Asia products exports West of Suez



Source: Kpler, OIES

Fig. 28: GCC + Iraq products exports to EU-27



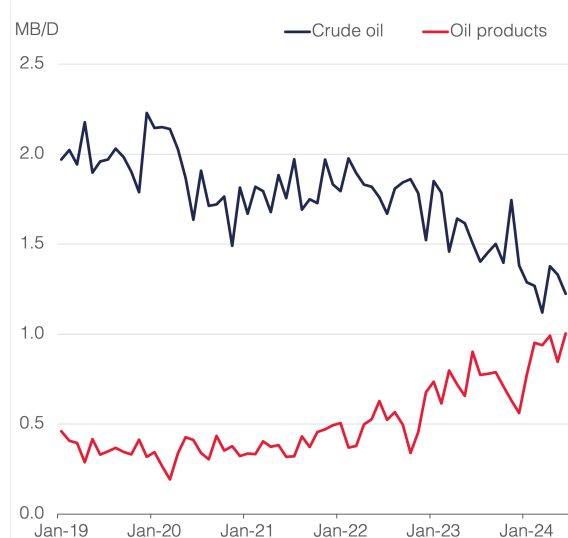
Source: Kpler, OIES

The increase in refining capacity has also changed the export profile of some countries. With the start of the 615,000 b/d Al-Zour refinery, Kuwait's products exports have been on the rise causing its crude exports to fall from 1.8 mb/d in 2022 to 1.3 mb/d in H124, down by 530 kb/d (**Figure 29**). At the same time, products exports from Kuwait rose by 420 kb/d to close to 1 mb/d from 500 kb/d in 2022. The 650,000 b/d Dangote refinery in Nigeria is expected to pull away some of the Nigerian crude from the export markets, while EU gasoline exports to Nigeria are expected to fall sharply. In its first four months of operations, processing nearly 200 kb/d of crude, nearly 90% of total refinery inputs consisted of Nigerian crude (see **Figure 30**). Overall, availability of gasoline to the US is set to increase at times when gasoline demand is expected to slow down, though US gasoline demand could be stronger than expected over the medium-to-long term, given slower growth seen in full battery electric vehicles sales.

¹³ Argus Global Markets, Volume LIV, 27, 12 July 2024

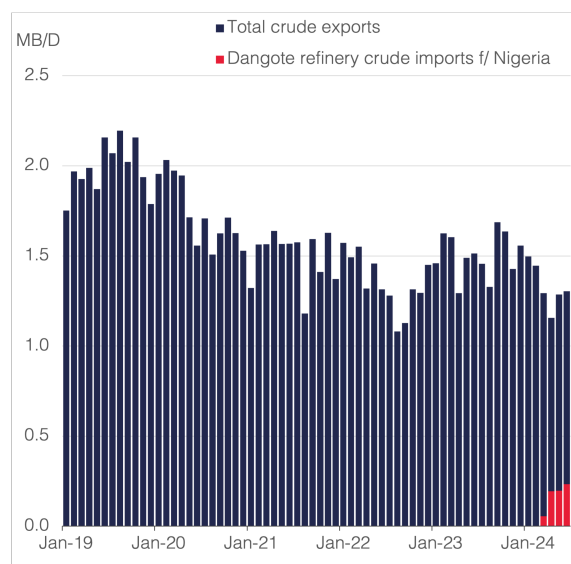
Mexico’s plan to achieve self-sufficiency in products through heavy investments in its refining sector (as well as the decline in the country’s oil production) is already impacting its crude exports and the heavy and medium sour balances. These impacts will only be amplified with Canada having completed its Trans Mountain Expansion (TMX) pipeline, diverting larger volumes of Canadian heavy crudes such as Cold Lake and Access Western Blend (AWB) to the Asia-Pacific away from the US Gulf Coast.

Fig. 29: Kuwait exports of crude vs products



Source: Kpler, OIES

Fig. 30: Nigeria crude exports



Source: Kpler, OIES

Share of light sweet in global crude mix rising

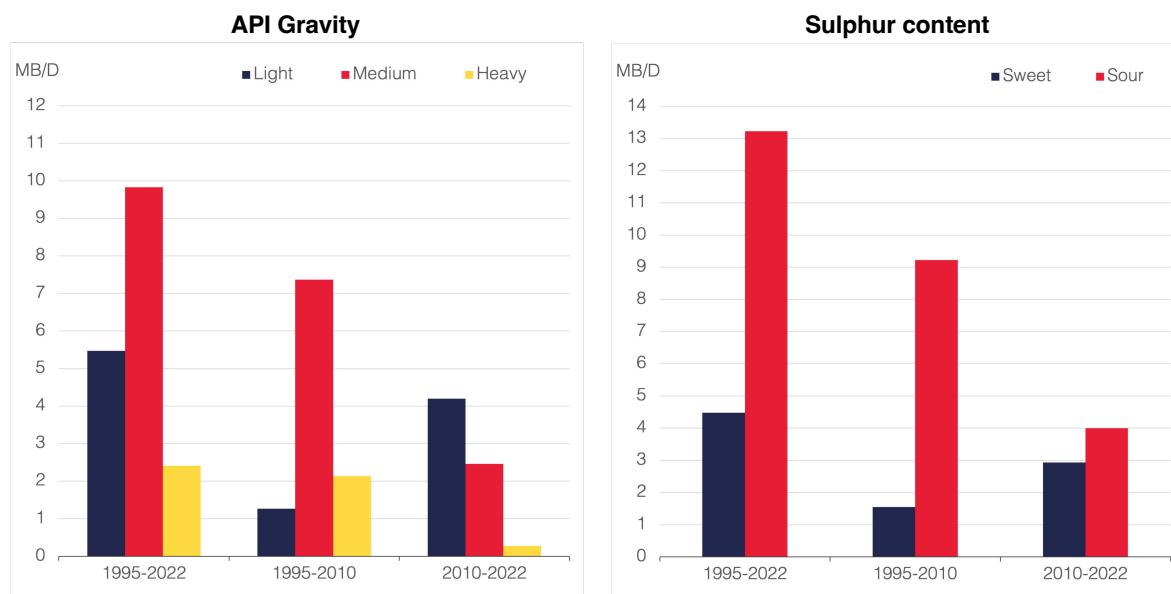
The change in the quality of the marginal barrel is also impacting the refining scene. Over the past decade, the proportion of light sweet barrels compared to the historically dominant medium heavy sour grades have increased rapidly. The rise in US shale production in the early 2010s exacerbated by disruptions in the crude oil production of key OPEC producers –namely Iran, Libya, and Venezuela– as well as OPEC policy caused a surge in supplies of light sweet crude. This transformed the quality of the marginal barrel coming into the market. Incremental global supply of light crude oil between 1995-2010 was 1.3 mb/d compared to 9.5 mb/d of medium-heavy crude oils combined (**Figure 31**). But between 2010-2022 cumulative global light crude production surpassed that of medium-heavy crude oils combined, having reached 4.2 mb/d versus 2.7 mb/d. At the same time, the global share of sweet crude oils production rose to 42% compared to 14% in 1995-2010 and compared to the global share of sour crude production which declined to 58% versus 86% in 1995-2010 (see **Figure 31**). This shift in composition of the incremental barrels has wide range implication for crude pricing and refining output especially at times when the composition of demand is expected to drastically change (for instance, higher adoption of EVs will induce a shift away from gasoline while the rise in petrochemical demand will induce a shift towards naphtha and LPG)¹⁴.

A related trend relates to Natural Gas Liquids (NGLs) which have been growing fast as crude production has shifted to regions with lighter and gassier qualities, such as US shale oil production, while the natural gas market has expanded. Since 2010, NGLs supply has risen by 5.5 mb/d to 15.1 mb/d from 9.6 mb/d with their share in overall oil production now accounting for 15%. Comparatively between 2000 and 2010 NGLs rose only by 2.6 mb/d accounting for 10% in total supply. OPEC forecasts that the composition of US shale supply growth by the end of this decade will be driven solely by NGLs rather

¹⁴ Also, lower gasoline demand will limit the ability to absorb naphtha for blending which could imply that more naphtha will need to be diverted as feedstock for petrochemicals.

than crude, with NGLs output growing by another 1.5 mb/d between 2023 and 2031, from 5.1 mb/d to 6.6 mb/d (Figure 32).

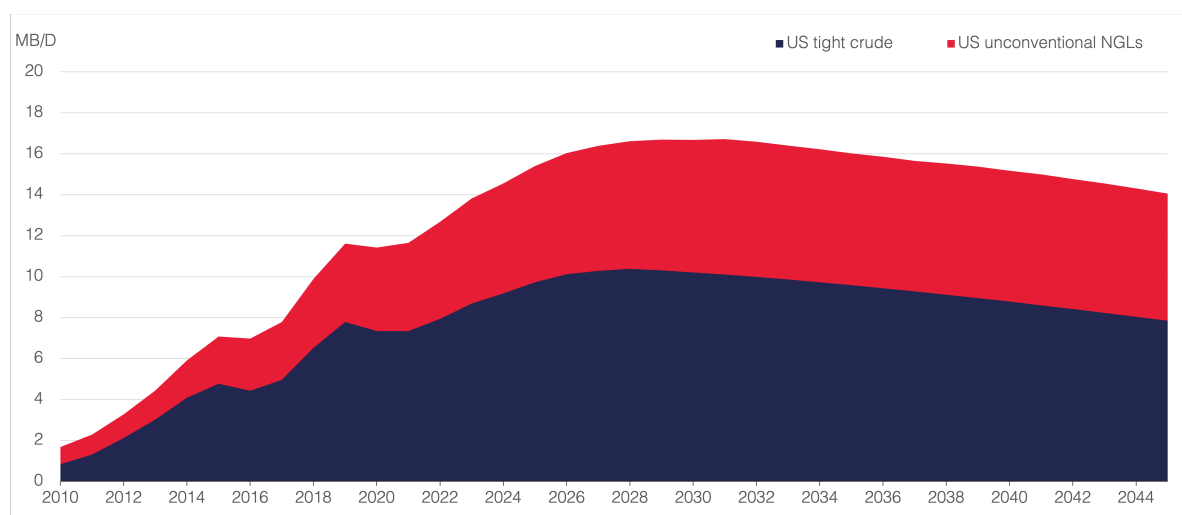
Fig. 31: Global cumulative crude oil production growth by quality



Source: OIES

Rapidly rising NGL supply will weaken the need for growth in refinery throughputs and the demand for crude oil. Also, the nature of global NGLs production means that demand must adapt to growing supply, driving continued expansion in the liquified petroleum gas (LPG) and ethane markets. US LPG and ethane exports have risen fast. Interestingly, China now constitutes the biggest market for US ethane exports which is used as a feedstock in the petrochemical industry.

Fig. 32: US shale oil breakdown



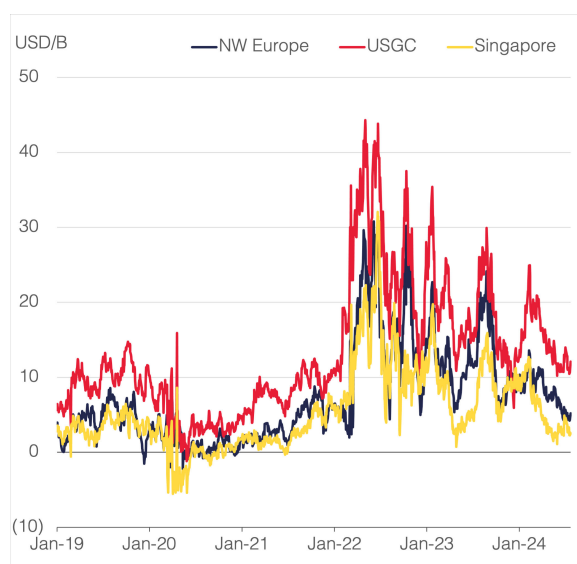
Source: OPEC WOO 2023 (Figure 4.23), OIES

The end of supercharged refinery margins

Refining margins reached record levels in 2022 and 2023, far exceeding pre-COVID levels (**Figure 33**). Perhaps, this is most evident in European markets and particularly for diesel. Several factors account for this massive increase in refining margins: the sharp rebound in demand following the pandemic; the EU embargo on Russia which restricted the export of Russian products to Europe; the closure of refineries in Europe; unplanned outages partly due to delayed maintenance as refineries run hard to exploit the large margins; the longer import routes to Europe; China restricting its exports of products during the lockdown in 2022; and refineries' more constrained optimization impacting products supplies. The high diesel margins in Europe persisted despite the weakness in demand.

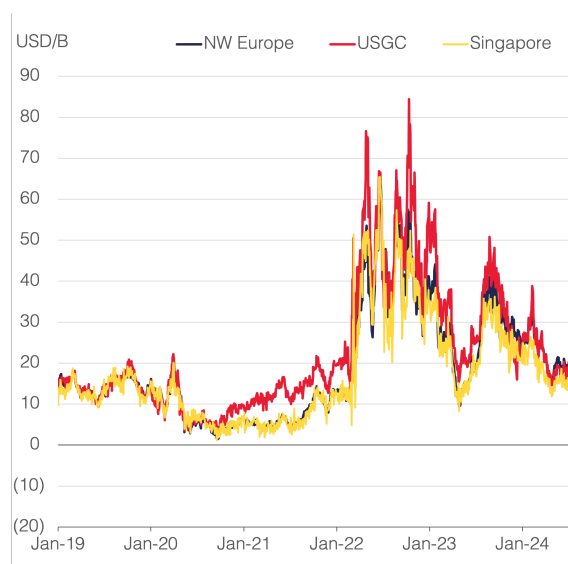
Refining margins however have now fallen as some of these constraints started to ease and some new refineries have ramped up their production while demand for diesel remains subdued (see **Figure 33**). Also, products exports from China have been growing. Diesel margins are now back close to their 2019 levels across all regions, as for example NW Europe diesel cracks in July 2024 (as of 22 July) average \$17.3/b versus a \$14.5/b average in 2019, down by -\$47.2/b from their 2022 high of \$64.5/b (see **Figure 34**). At the same time, USGC and Singapore diesel cracks are down by -\$68.1/b and -\$51.9/b from their 2019 highs, respectively, as diesel stocks are at relatively healthy levels. Gasoline margins are no different and have also fallen from their high levels as supplies and stocks remain healthy amidst subdued gasoline demand in the US and China.

Fig. 33: Refinery margins



Source: S&P Global Commodity Insights, OIES

Fig. 34: Gasoil/Diesel cracks



Source: S&P Global Commodity Insights, OIES

Fundamental shifts in crude pricing systems

Brent and WTI have always been connected through arbitrage, but recent changes in oil pricing mechanisms mean that WTI has become more dominant in setting the oil price following the inclusion of WTI in the Brent basket. WTI Midland, produced in the US, now sets the price of the dated Brent basket more than 50% of the time (**Figure 35**). This dominant position is expected to further increase, as the production in the North Sea particularly the grades that make the Brent benchmark (Brent, Forties, Oseberg, Ekofisk, and Troll) continue their structural decline while US crude exports are projected to increase. With the production of West African (WAF) in decline in recent years and as more Nigerian crude is directed to the Dangote refinery, the position of WTI in the pricing system and its role as the swing barrel between Asia and Europe will only be reinforced.¹⁵

¹⁵ <https://www.bloomberg.com/news/articles/2024-07-26/us-replaces-africa-as-global-oil-swing-supplier-consultant-says>

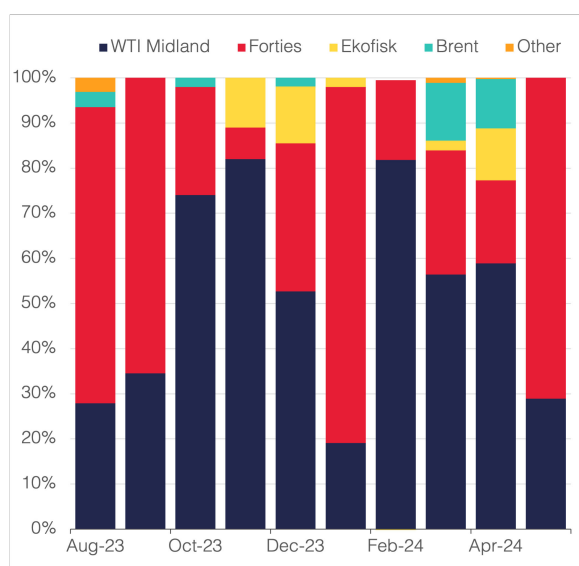
As WTI increasingly sets the price of Brent, larger volumes of oil traded globally priced off Brent are now linked to trading activities and the various physical and financial layers around WTI increasing the exposure of players to the US crude pricing system and its layers. The higher volumes of production, the rise in exports, the diversity of sellers and buyers of US crude, the development of financial layers and OTC markets and the large infrastructure in terms of pipelines, storage hubs, and ports all indicate the crude oil pricing system with its key functions of price discovery and risk management will continue to shift towards the US and within the US, to the US Gulf Coast (USGC).

While light sweet WTI has increased its dominance in crude pricing, Europe has lost a de-facto sour crude benchmark with the loss of Russian Urals. Previously, Russian Urals versus Dated Brent used to be an important indicator for producers outside the region to price accurately their crude in Europe and the Mediterranean. The problem has been compounded by the loss of Kurdish crude exports to Europe. While WTI Midland into Brent addresses liquidity challenge of Brent, there remains pricing challenges with European sour crude pricing visibility, where Norway's Johan Sverdrup as a heavier sour grade is growing in strategic importance as an informal sour index marker.

At the same time, the Brent-Dubai EFS remains a key west-east market signal. The narrowing/widening of EFS has been an effective signal to either encourage Atlantic supplies to Asia or trap them west of Suez, even as attacks on Red Sea shipping lanes have accelerated.

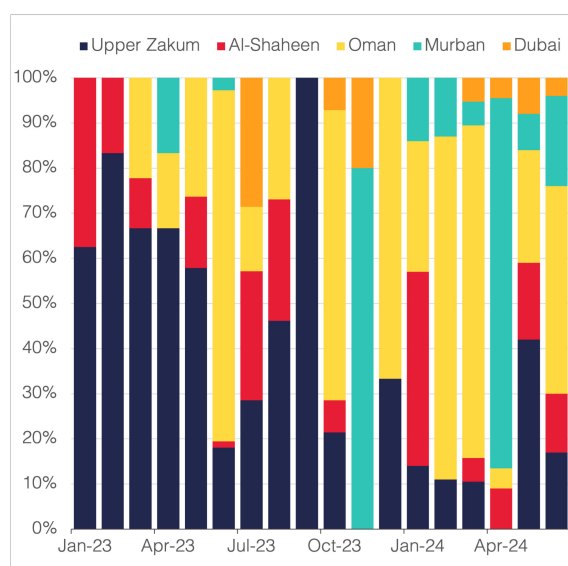
Crude pricing in the East of Suez also continues to evolve. Projects such as ADNOC's Crude Flexibility Project (CFP) at Ruwais West refinery has increased the refining of medium sour crudes such as Upper Zakum and Iraqi Basra Heavy resulting in sharp increase of Murban crude exports, a light sour grade deliverable into the Platts Dubai Basket. The price of the Dubai basket is set by the lowest priced crude in the basket, traditionally Upper Zakum and Qatar's Al-Shaheen that are heavier grades than Murban. But with the higher availability of Murban, the Dubai price is being frequently set by the higher quality Murban (**Figure 36**). Also, from Asian players' perspective, larger volumes of crude are available on the spot market, especially with Russia directing its exports to Europe and some of the large Gulf producers such as the UAE no longer impose destination restrictions on their crudes.¹⁶ This has increased the pricing power of Asian players and their use of risk management tools.

Fig. 35: Brent window convergence by grade



Source: Argus, OIES

Fig. 36: Dubai window convergence by grade



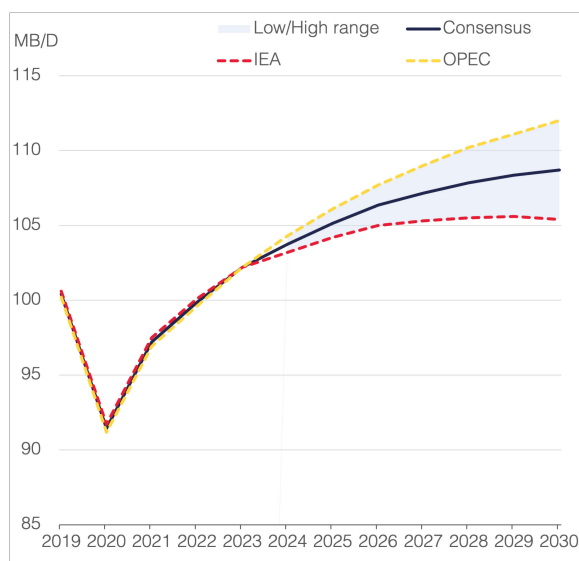
Source: Renaissance Energy Advisors (REA)

¹⁶ Renaissance Energy Advisors, East of Suez Monthly Oil Intelligence, July 26, 2024.

Large divergence on oil demand prospects both in the short- and long-term

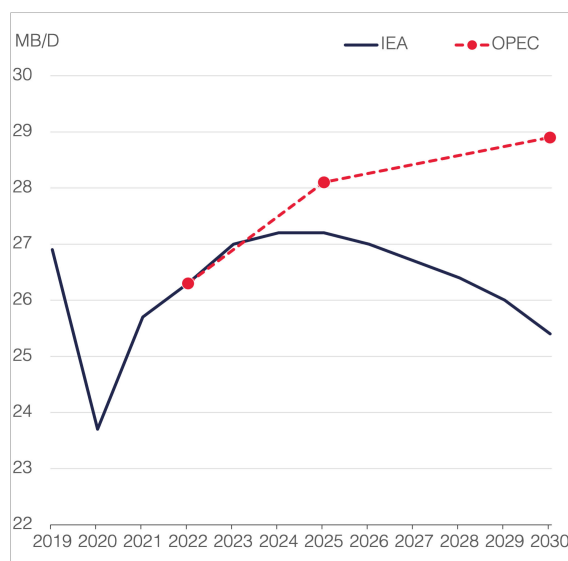
All these transformations are taking place against a more uncertain oil demand outlook. Different views about the speed of the energy transition and governments' decarbonization policies are causing wide divergence in oil demand projections. The divergence is not only limited to the medium and long-term, but also to short-term projections. And this is not due to a fundamental difference in views about growth rates in these economies, but rather to different assumptions made about the relationship between GDP and oil demand, the improvements in efficiency, and the adoption of electric vehicles. The difference between IEA and OPEC global demand growth projections is 1.2 mb/d for 2024 (1 mb/d vs 2.2 mb/d, respectively) and 900 kb/d for 2025 (900 kb/d vs 1.8 mb/d, respectively). For the medium-term outlook, the divergence is even wider exceeding 6 mb/d for cumulative global demand growth between 2023 and 2030 (**Figure 37**). In terms of gasoline, OPEC projects cumulative global gasoline demand growth of 2.6 mb/d between 2022 and 2030 (see **Figure 38**). The IEA expects gasoline demand growth to turn negative from 2026-onwards estimating cumulative growth of -900 kb/d over the same period and for NEVs to displace around 6 mb/d of road fuels demand by 2030.¹⁷ Such large divergence adds another layer of uncertainty with important implications on oil investment decisions.

Fig. 37: Global oil demand forecasts to 2030



Source: IEA Oil 2024, OPEC WOO 2023, OIES

Fig. 38: Gasoline demand forecasts to 2030

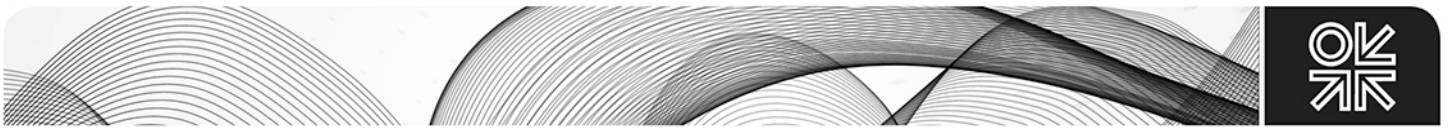


Source: IEA Oil 2024, OPEC WOO 2023, OIES

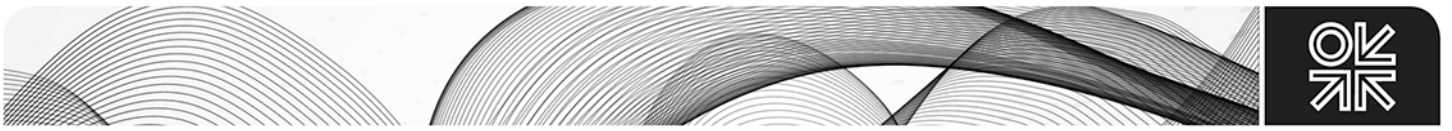
Conclusion

In recent years, the oil market has seen some structural transformations that are shaping market dynamics, trade flows, and players' behaviors and relations between them. Some of the drivers underlying these transformations such as the energy transition and the uncertainties surrounding its speed, the heightened geopolitical fragmentation, and shifts in governments' priorities and policies are shaping the entire energy complex, though their impacts on oil market dynamics are distinctive. This is to be expected as oil markets are global, liquid, highly interconnected through an extensive physical infrastructure and financial layers, have buffers to offset shocks, and are generally more mature than other energy vectors. Other drivers are more oil-market specific intrinsically linked to the market structure, the evolving role of oil in the energy mix, technological shocks impacting the oil sector, the nature of the players and the relations between them, and the important role that oil revenues play in the political economy of oil exporting economies.

¹⁷ IEA. 2024. Oil 2024: Analysis and forecasts to 2030. June



These transformations are taking place at a critical juncture when decarbonization efforts to reduce reliance on oil are accelerating and the geopolitical landscape has become more fragmented, increasing the focus on energy security. So far, the oil market has shown great resiliency in the face of some extreme shocks with prices trading at a narrow range and trade flows undergoing a massive reshuffling, enabled by mature supply chains, extensive infrastructure built over decades, and extensive network of physical and financial layers. Also, players' strategies and the structure of the market continue to evolve in response to various types of shocks and transitions in the energy system and the heightened uncertainty. Equally important, these transformations in the market structure, trade flows, and players' strategies will also shape the energy transition and the role of oil in the global energy system, a theme to be discussed in a follow up paper.



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