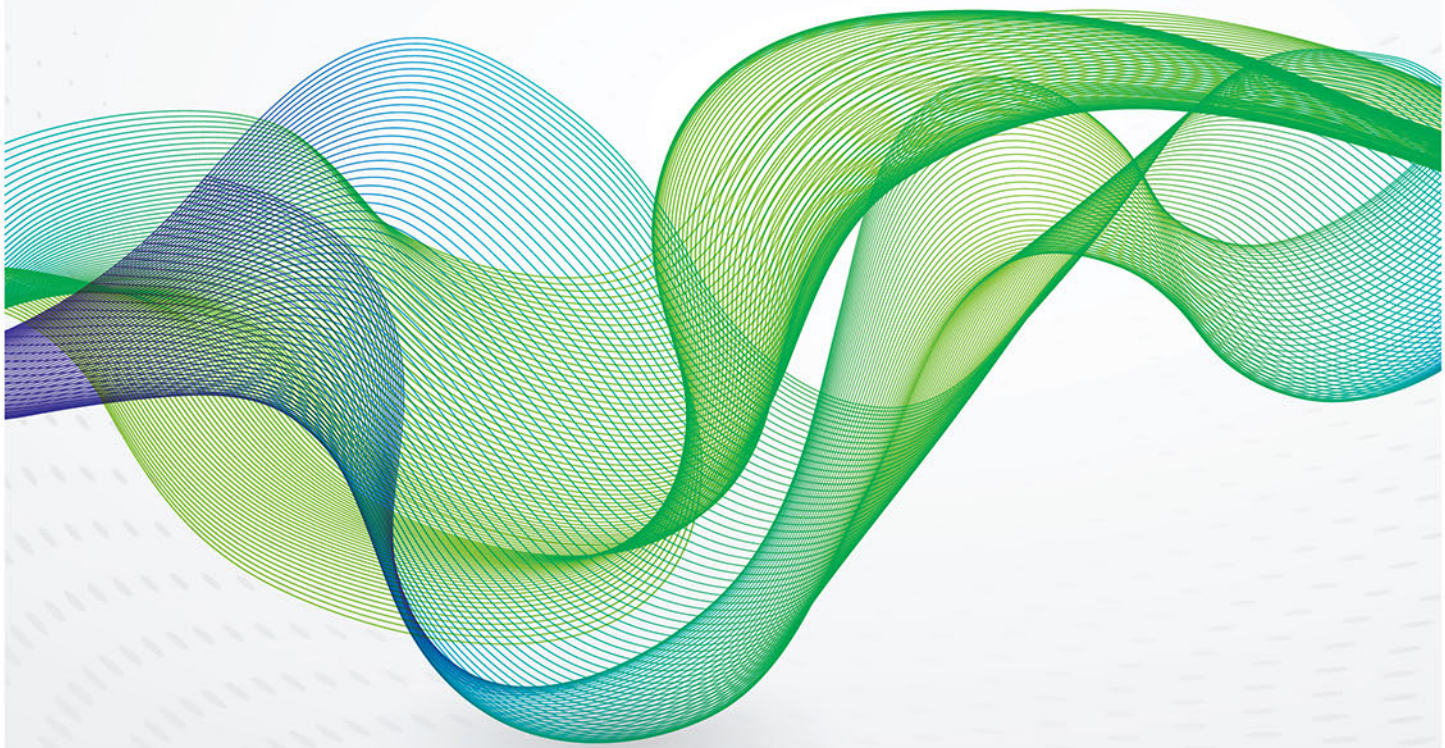
THE OXFORD INSTITUTE FOR ENERGY STUDIES

April 2024

# Russian Oil Refining: in the Crosshairs



OIES ENERGY COMMENT

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Ukraine intensified its drone attacks on mainland Russian energy infrastructure in Q1 2024, striking oil refinery and storage targets located more than 1,000km from the Russia-Ukraine border. Between January and March, Ukraine launched more than 20 drone attacks on Russian oil facilities, of which 14 attacks were launched in March alone (see **Table 1**). According to S&P Global Commodity Insights, 3.7 mb/d, or more than half of Russia's total refining capacity of 6.5 mb/d, is within the range of Ukrainian drones, of which 3.15 mb/d of capacity has been targeted as of 2 April.[1]

**Table 1. Drone attacks on Russian oil facilities**

| Date | Location / Name | Facility | Status | Distance from Ukraine border |
|---|---|---|---|---|
| Jan-24 | St. Petersburg | Oil terminal | No impact | 850 km |
| Jan-24 | Bryansk | Oil depot | Impact | 100 km |
| Jan-24 | Ust Luga | Refinery | Impact | 870 km |
| Jan-24 | Tuapse | Refinery | Impact | 400 km |
| Jan-24 | Yaroslavl | Refinery | No impact | 700 km |
| Feb-24 | Nevsky Mazut | Oil terminal | Impact | 870 km |
| Feb-24 | Volgograd | Refinery | Impact | 350 km |
| Feb-24 | Ilskiy | Refinery | Impact | 340 km |
| Mar-24 | Polevaya (Kursk) | Oil terminal | Impact | 100 km |
| Mar-24 | St. Petersburg | Oil terminal | No impact | 850 km |
| Mar-24 | Gubkin (Belgorod) | Oil depot | Impact | 90 km |
| Mar-24 | Voronezh | Oil tank farm | No impact | 180 km |
| Mar-24 | Kursk | Oil depot | Impact | 100 km |
| Mar-24 | Nizhny Novgorod (NORSI) | Refinery | Impact | 800 km |
| Mar-24 | Oryol | Oil depot | Impact | 220 km |
| Mar-24 | Ryazan | Refinery | Impact | 460 km |
| Mar-24 | Kirishi | Refinery | No impact | 300 km |
| Mar-24 | Novoshakhtinskiy | Refinery | Impact | 15 km |
| Mar-24 | Syzran | Refinery | Impact | 700 km |
| Mar-24 | Novokuibyshevsk | Refinery | No impact | 900 km |
| Mar-24 | Slavyansk | Refinery | Impact | 350 km |
| Mar-24 | Kuibyshev | Refinery | Impact | 1000 km |
| Apr-24 | Nizhnekamsk (TANECO) | Refinery | Impact | 1200 km |

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

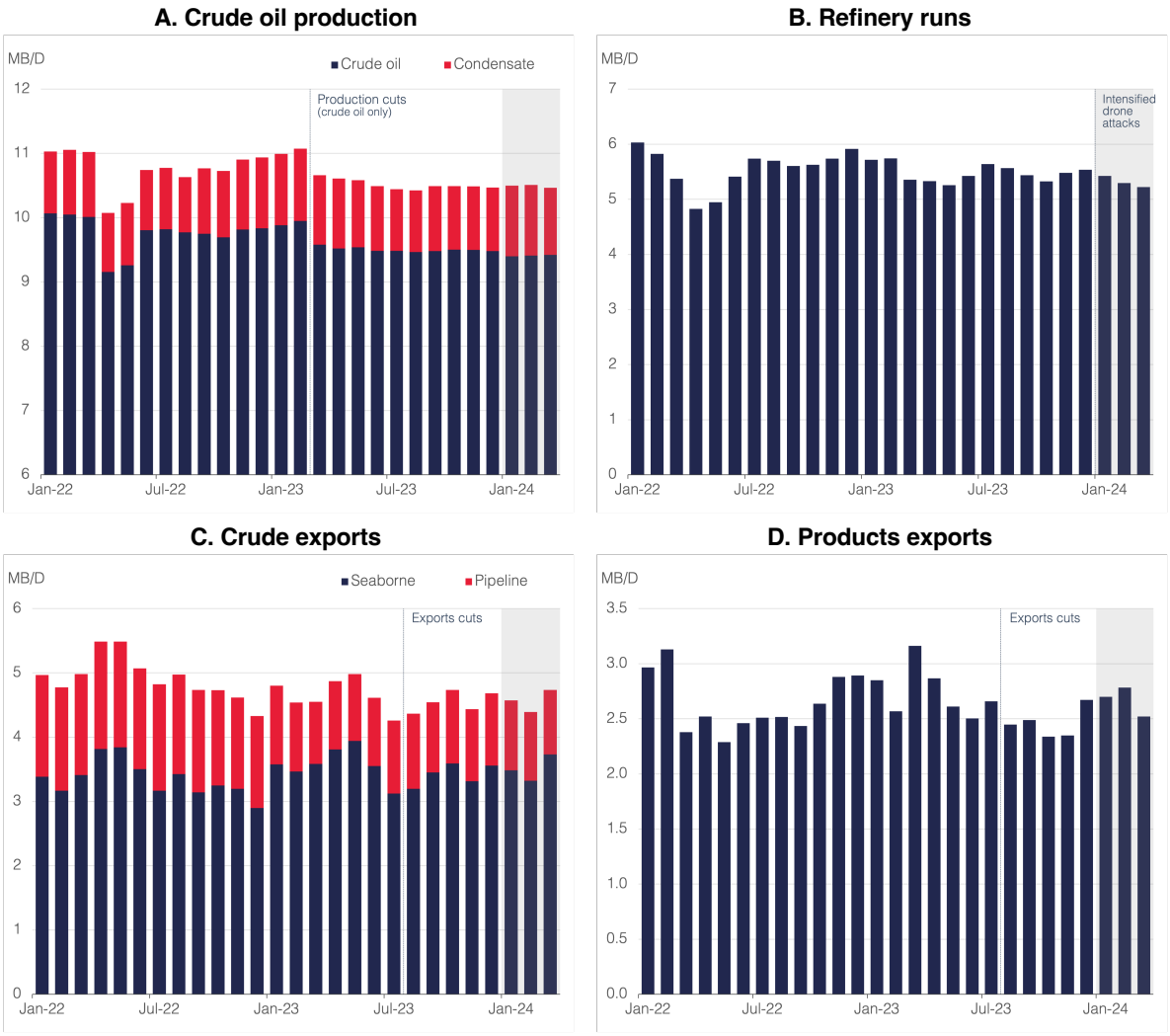
This Energy Comment attempts to assess the impact of Q1 drone attacks on Russian oil refineries and to give some guidance for Q2 2024. We estimate that some 300 kb/d of crude processing was lost in 1Q24 on a gross basis, assuming unaffected refineries did not increase runs to offset losses at damaged sites (**Figure 3-A**). On a monthly basis, the disruptions rose to 450 kb/d in March, partially offset by increased runs from non-affected plants (e.g., Kirishi refinery) and by planned maintenance being adjusted (e.g., Volgograd refinery). On a net basis, the crude processing disruptions in March averaged 380 kb/d, or 12% of total refining capacity in the targeted area in 1Q24 and 6% of total Russian refining capacity.

[1] S&P Global. 2024. FACTBOX: Russian refining outages mount under surge of Ukrainian drone attacks. 18 Mar.

Other third-party impact estimates are significantly higher. The IEA estimates that roughly 500-600 kb/d of Russia's crude processing could have been lost in 1Q24 on a gross basis (not accounting for any offsets) as a result of the attacks,[2] while other reports suggest that around 800-900 kb/d of primary oil refining capacity could have been knocked out by end-March.[3] These estimates, however, are not reconciled with Russia's March supply data (see **Figure 1**).

Russian refinery runs in March declined for a third consecutive month by 70 kb/d to 5.2 mb/d but stood just 300 kb/d lower y/y. Crude production remained relatively unchanged in Q1 near 10.5 mb/d (or 9.4 mb/d ex-condensate), with crude exports rising m/m only in March by 400 kb/d but remaining unchanged y/y at 3.5 mb/d. Product exports declined m/m by 260 kb/d to 2.5 mb/d in March and fell by 190 kb/d y/y in the quarter as a whole.

**Figure 1: Overview of Russian oil supply since start of Russia-Ukraine war**




Source: IEA, Kpler, OPEC, OIES

[2] IEA. 2024. Oil Market Report. 12 April.
[3] Reuters. 2024. Russian refineries targeted by Ukraine's drones. 2 April.

Our analysis utilizes a generic vector-autoregression forecasting model of Russian refinery runs following EIA's *STEO Petroleum Refining Forecasts* methodology.[4] The model is designed to forecast Russian refinery runs (crude oil inputs) using as main predictors current and past observations of domestic crude oil production and consumption of petroleum products, net imports of crude oil, as well as average gross margins as a proxy of the incentive to process crude oil. The main input variables for the forecasting model rely on Kpler *Refineries Intelligence* data and the forecasts also incorporate estimates of scheduled refinery maintenance in Q1 and Q2 2024 reported by Argus. The estimates of Q1 disruptions in Russian refinery runs as a result of the drone attacks are derived by comparing the forecast estimates starting from the month prior to a reported drone attack against actual throughputs in the same period. The sample includes the 14 Russian oil refineries associated with the Ukrainian drone attacks in the period 21 January to 2 April 2024.

We acknowledge that refinery operations are complex, no two refineries are the same, and refineries' location, technical configuration, optimization, profitability and policy compliance are all important determinants in refinery models that may not be captured by our generic modelling. That said, considering the data limitations and lack of a clear baseline, the main objective of our analysis is to test third party assessments of the impact of drone attacks and whether they can be reconciled with Russian supply data and other market indicators.

## Impact of drone attacks on Russian oil refineries

Between January and March 2024, 14 Russian oil refineries of a total of 44 were targeted by Ukrainian drone attacks. In March alone, Ukraine targeted eight oil refineries in a significant escalation of its attacks. Of those, 11 refineries were reported to have suffered damage. The Ust Luga gas condensate plant and Rosneft's Tuapse, Syzran, Ryazan and more recently Kuibyshev refineries were worst hit with operations fully or partially suspended. In the case of Ust Luga, runs were restored following a three-week suspension, but the Tuapse plant remains offline after being hit in January and is not expected to restart before early-May. This highlights that the duration of the outages differs across affected refineries and very much depends on the units affected. There is little official information on these details or access to available equipment for repairs. In April there were two major drone attacks on Russian refineries. First, against the TANECO complex refinery on April 2, which is the third largest oil refinery in Russia with nameplate capacity of 324 kb/d and one of the largest producers of diesel in the country, but production at the refinery was reportedly not disrupted. More recently, on April 27, 20 drones targeted again the Ilskiy and Slavyansk oil refineries reportedly causing fires at the facilities.[5] While there are no disruptions reported at the Ilskiy refinery, the 90 kb/d Slavyansk refinery reportedly partly halted operations again, having completed previous repairs to a crude distillation unit and vacuum unit damaged in the March 17 attack and resumed operations on April 4.[6]

Our assessments have used Kpler's monthly refinery data with information on the attacks derived from S&P Global Commodity Insights, Argus, Energy Intelligence and other industry sources. **Table 2** summarizes the analysis and depicts the results for each of the 14 refineries that were impacted by a Ukrainian drone attack in 1Q24.

[4] US EIA. 2024. Short-Term Energy Outlook: Petroleum Refining Forecasts. January.
[5] On April 24, media reported a suspected hit by drones on Western Russia energy facilities in two districts of the Smolensk region involving a fuel storage and transshipment causing fires, without any further details.
[6] Reuters. 2024. Oil refinery in Russia's Krasnodar suspends operations after Ukraine drone attack, says TASS. 27 April.

**Table 2. Impact assessment of the drone attacks on Russian oil refineries**

| | | | |
|---|---|---|---|
| **Date:** | January 21 | | |
| **Ust Luga** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 150 | Simple (Condensate splitter) | 870 |
| **Domestic / Export focus** | Baltic Sea naphtha export hub | | |

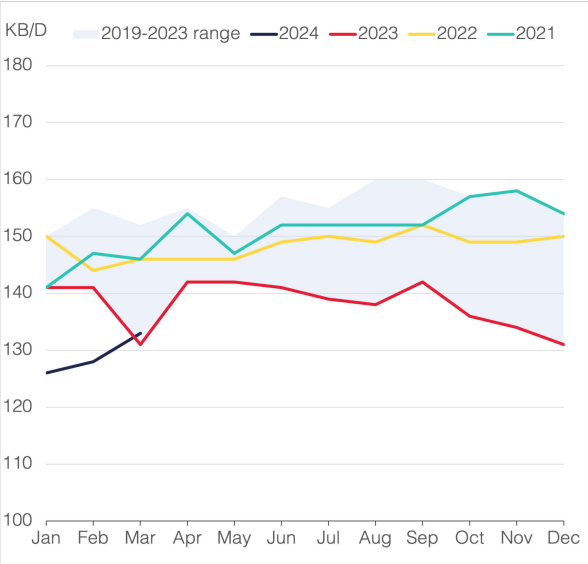
**Reported impact**

- Processing affected; loadings suspended.

**Reported status**

- Outage lasted 3-weeks.
- Resumed loadings mid-Feb.

**Refinery runs**




| | | | |
|---|---|---|---|
| **Date:** | January 25 | | |
| **Tuapse** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 240 | Simple (Hydroskimming) | 400 |
| **Domestic / Export focus** | Baltic Sea export hub for refinery feedstocks | | |

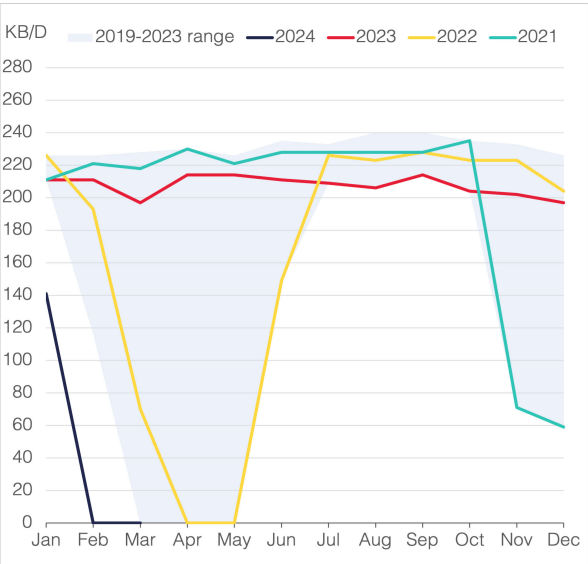
**Reported impact**

- Fire in VDU, suspected damage.

**Reported status**

- Planned February maintenance brought forward.
- 100% capacity offline.
- Expected restart in early-May.

**Refinery runs**



## Table 2 (cont.). Drone attacks on Russian refineries

| Date: | January 29 | | |
|---|---|---|---|
| **Yaroslavl** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 301 | Complex | 700 |

**Domestic / Export focus** Domestic supply, diesel exports via Primorsk

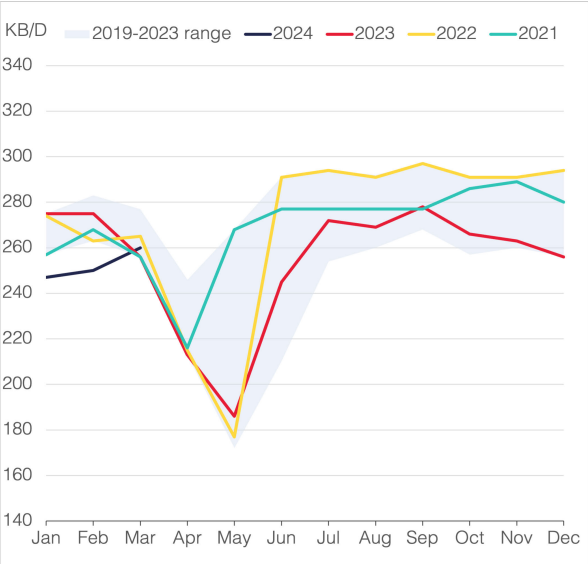
**Reported impact**

- No impact, strike averted.

**Reported status**

- Fully operational.

**Refinery runs**




| Date: | February 03 | | |
|---|---|---|---|
| **Volgograd** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 314 | Medium (Cracking) | 350 |

**Domestic / Export focus** Domestic supply, diesel exports via Novorossiisk

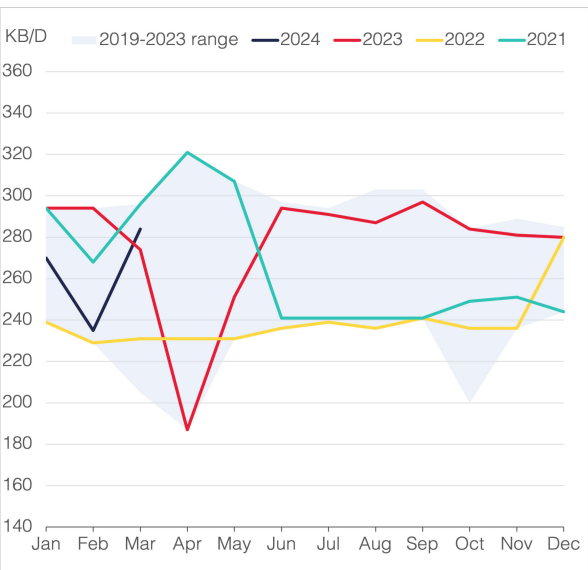
**Reported impact**

- Internal pipeline fire on CDU VDU-5.

**Reported status**

- Unit offline, restarted on 21 February.

**Refinery runs**



## Table 2 (cont.). Drone attacks on Russian refineries

| Date: | February 09 | | |
|---|---|---|---|
| **Ilskiy** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 132 | Simple (Hydroskimming) | 340 |
| **Domestic / Export focus** | Baltic Sea export hub | | |

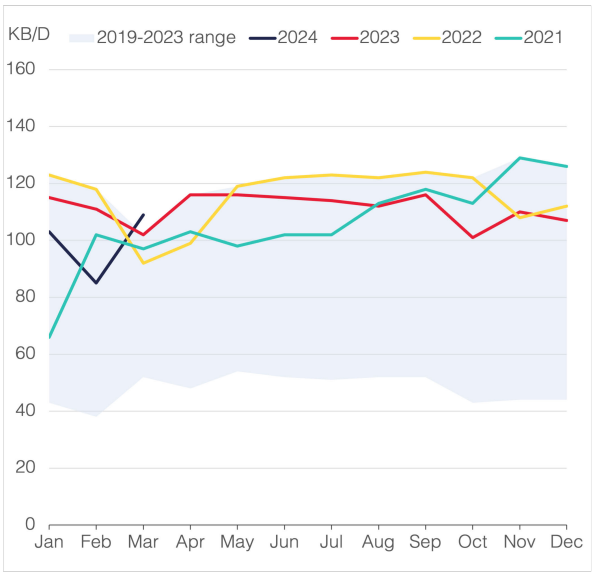
**Reported impact**

- Suspected damage to 72 kb/d CDU.

**Reported status**

- Restarted after maintenance on 16 February.

**Refinery runs**




| Date: | March 12 | | |
|---|---|---|---|
| **Nizhny Novgorod (NORSI)** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 340 | Medium (Cracking) | 800 |
| **Domestic / Export focus** | Domestic supply, key gasoline supply source | | |

**Reported impact**

- Fire on main CDU (AVT-6).
- 50% capacity offline.

**Reported status**

- Partly operational.
- Estimated restart 29 March.

**Refinery runs**

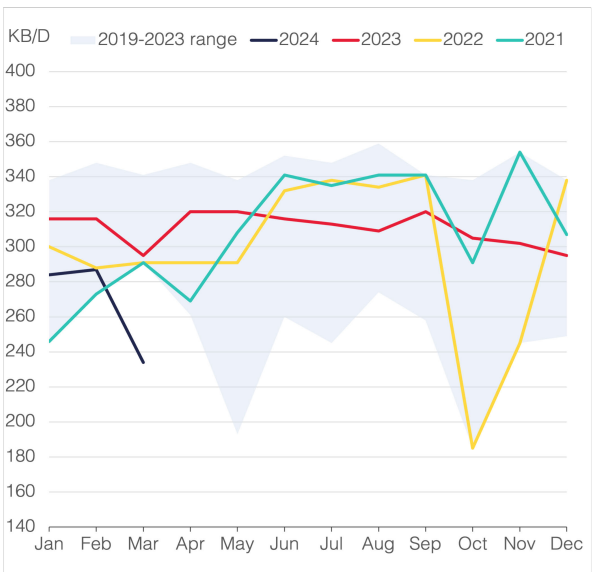


**Table 2 (cont.). Drone attacks on Russian refineries**

| **Date:** | March 13 | | |
|---|---|---|---|
| **Kirishi** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 355 | Medium (Cracking) | 300 |

**Domestic / Export focus** Domestic supply, exports excess diesel/FO via Primorsk and Ust Luga

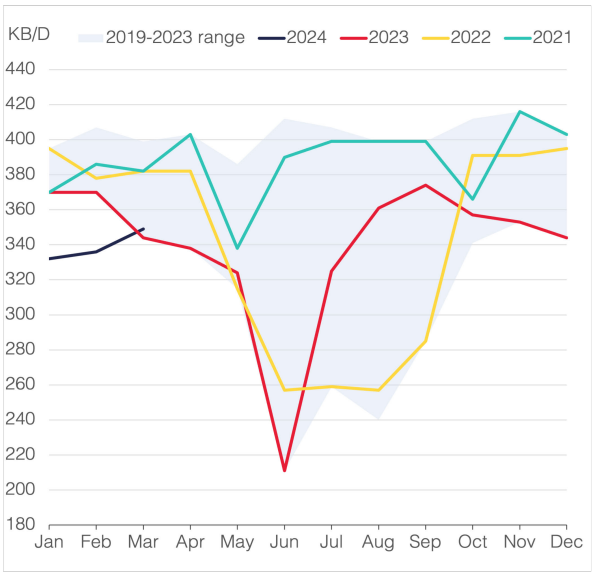
**Reported impact**

- No impact, strike averted.

**Reported status**

- Fully operational.

**Refinery runs**




| **Date:** | March 13 | | |
|---|---|---|---|
| **Ryazan** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 342 | Medium (Cracking) | 460 |

**Domestic / Export focus** Domestic supply, connection to Primorsk for diesel exports

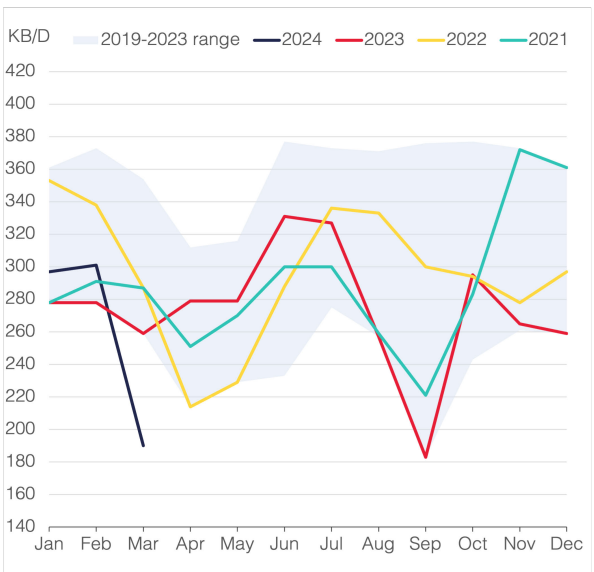
**Reported impact**

- Two CDUs damaged.
- Shut-down two primary oil refining units, halted main CDU (AVT-6 of 170 kb/d capacity) and smaller CDU (AVT-4 of 84 kb/d capacity).
- 70% capacity offline.

**Reported status**

- Estimated restart 3 April.

**Refinery runs**



## Table 2 (cont.). Drone attacks on Russian refineries

| Date: | March 13 | | |
|---|---|---|---|
| **Novoshakhtinskiy** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 112 | Simple (Hydroskimming) | 15 |
| **Domestic / Export focus** | Domestic feedstock hub | | |

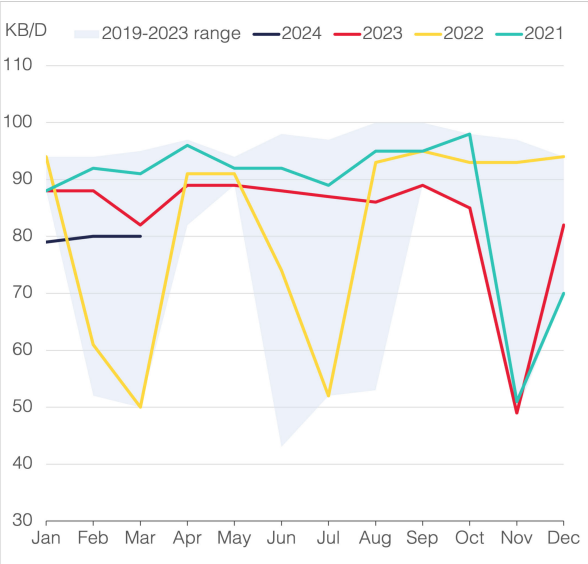
**Reported impact**

- Downed drones crashed on-site.

**Reported status**

- Operations suspended.
- Gradual restart.

**Refinery runs**




| Date: | March 16 | | |
|---|---|---|---|
| **Syzran** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 178 | Medium (Cracking) | 700 |
| **Domestic / Export focus** | Domestic supply, diesel exporter to Eastern Europe | | |

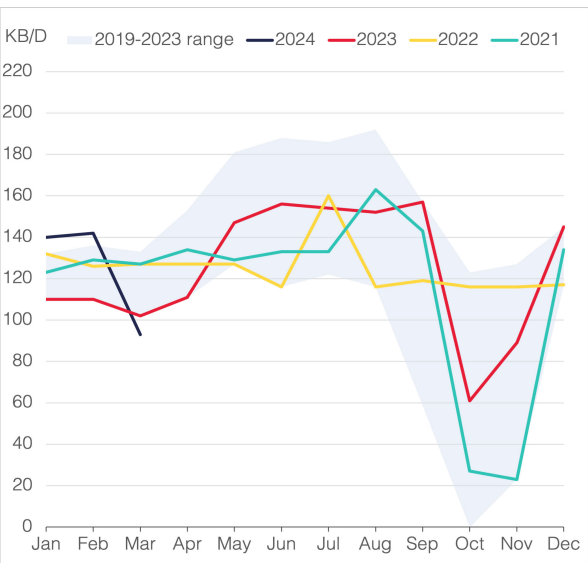
**Reported impact**

- Fire at processing unit, CDU-5 offline.
- CDU-5 and CDU-6 (due to maintenance).

**Reported status**

- Estimated restart May-14.
- Restart brought forward, reportedly putting back both CDU-5 and CDU-6 in the w/c 15 April.

**Refinery runs**



## Table 2 (cont.). Drone attacks on Russian refineries

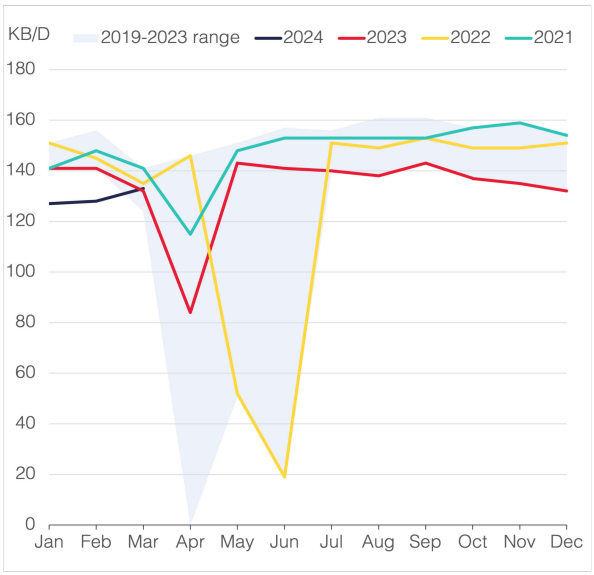
| Date: | March 16 | | |
|---|---|---|---|
| **Novokuibyshevsk** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 166 | Complex | 900 |

**Domestic / Export focus** Domestic diesel source, heavy fuel exporter

**Reported impact**

- No impact, strike averted.

**Refinery runs**




**Reported status**

- Fully operational.

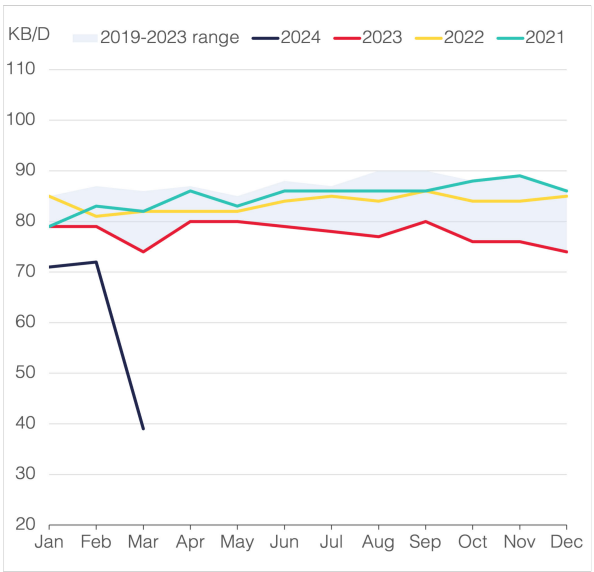
| Date: | March 17 | | |
|---|---|---|---|
| **Slavyansk** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 90 | Simple (Hydroskimming) | 350 |

**Domestic / Export focus** Private plant, exporter

**Reported impact**

- Downed drones crashed on-site, suspected CDU and VDU damage.

**Refinery runs**




**Reported status**

- Partly operational, gradual restart.
- Completed repairs on 4 April.

## Table 2 (cont.). Drone attacks on Russian refineries

| Date: | March 24 | | |
|---|---|---|---|
| **Kuibyshev** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 140 | Medium (Cracking) | 1000 |
| **Domestic / Export focus** | Exporter, producer of gasoline, diesel and residual fuel | | |

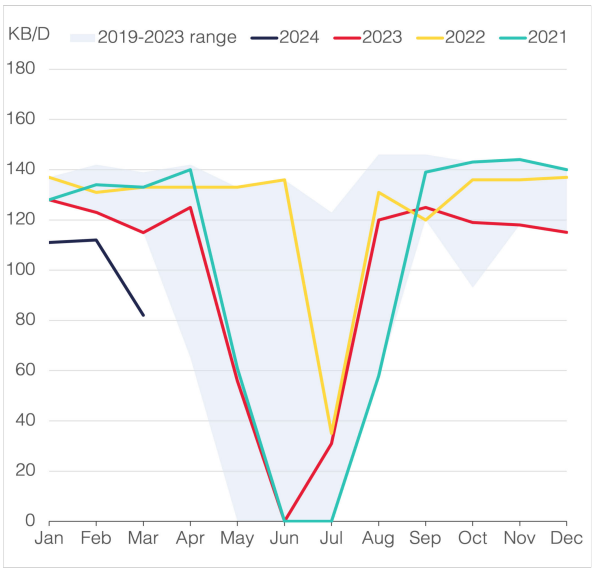
**Reported impact**

- Fire on main CDU (CDU-5).

**Reported status**

- Suspended.

**Refinery runs**




| Date: | April 2 | | |
|---|---|---|---|
| **Nizhnekamsk (TANECO)** | **Capacity (kb/d)** | **Configuration** | **Distance f/ border (km)** |
| | 324 | Complex | 1115 |
| **Domestic / Export focus** | Domestic supply, key diesel supply source | | |

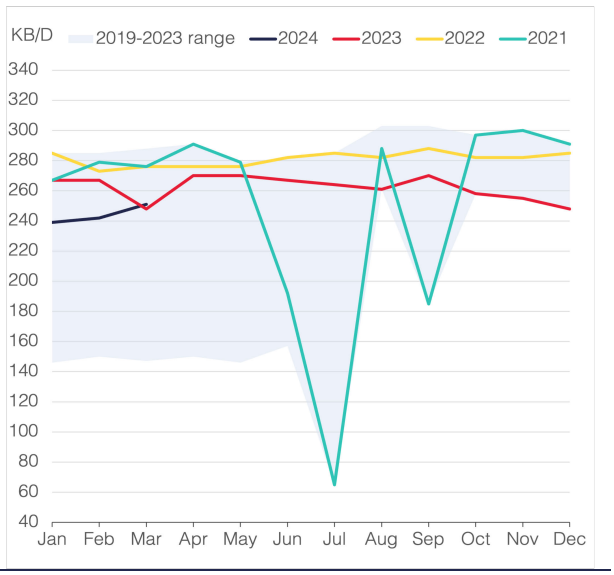
**Reported impact**

- Fire on CDU-7 (one of two), damage unclear.

**Reported status**

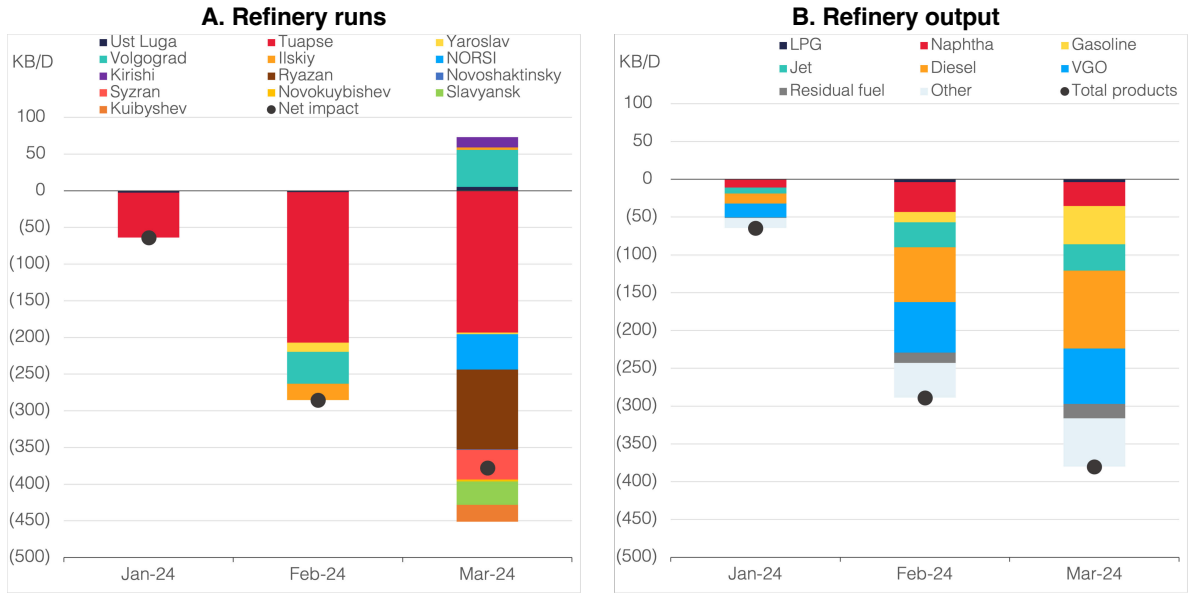
- Operational.

**Refinery runs**




Reports: S&P Global Commodity Insights, Argus, Energy Intelligence, Reuters. Data: Kpler. Source: OIES analysis

**Figure 3: Impact of drone attacks on Russian oil refineries**




Source: OIES analysis

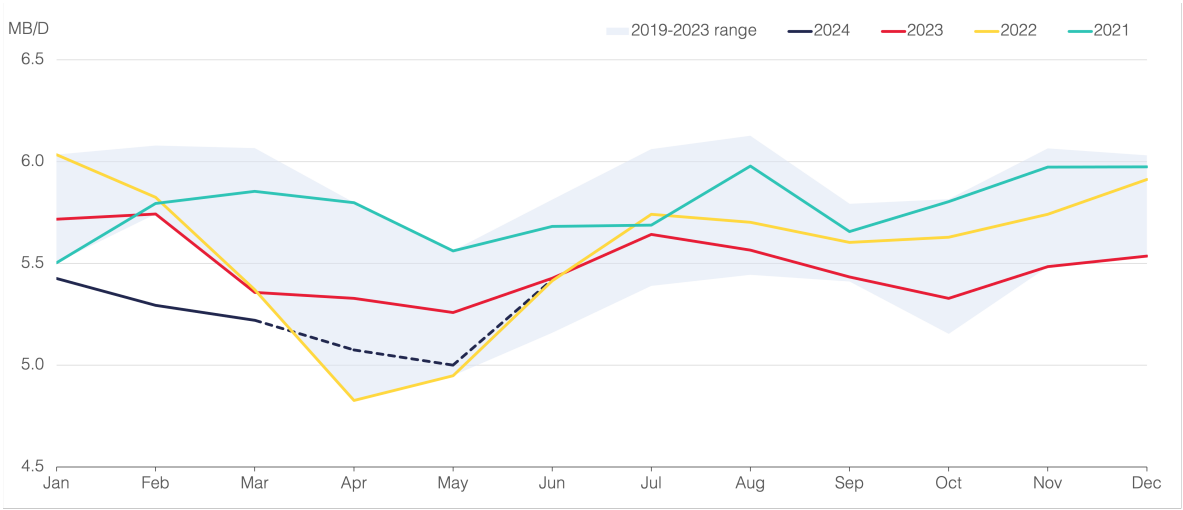
We estimate that roughly 300 kb/d of crude processing was lost in 1Q24 on a gross basis, assuming other not targeted refineries did not increase runs to offset losses (**Figure 3-A**). On a monthly basis, the disruptions rose to 450 kb/d in March, partially offset by increased runs from non-affected plants (e.g., Kirishi refinery) and by planned maintenance being brought forward or deferred (e.g., Volgograd refinery). On a net basis, the crude processing disruptions in March averaged 380 kb/d, or 10% of total refining capacity in the targeted area of 3.7 mb/d in 1Q24 and 6% of total Russian refining capacity of 6.5 mb/d.

Our impact estimate for Q1 is half of the estimate from IEA (500-600 kb/d),[7] whereas a net 380 kb/d disruption in Russian crude runs in March correlates with the m/m rise in Russian crude exports of 410 kb/d. While we take our absolute estimate with a grain of salt, our analysis suggests that the Russian refinery disruptions due to the drone attacks in Q1 could have been less severe than other third-party estimates. This could be the case because critical equipment avoided the worst of the damage; Russia was swift to repair damage;[8] affected refineries adjusted timings for scheduled maintenance; refineries were able to increase runs through secondary units or kick-start reserve capacity;[9] or undamaged refineries ramped-up runs.

In terms of products, we find that diesel output was the most severely hit in 1Q24 accounting for 26% of total disruptions on average, with output losses building through March and reaching 100 kb/d or 5% of total Russian diesel supply (**Figure 3-B**). This was followed by residual fuel oil (25%), naphtha (11%), jet (10%) and gasoline (9%). Notably, gasoline impacts accelerated in March, with gasoline output losses rising to 13% of the total, from 5% the month before, owing to the disruptions from the Kuibyshev and Syzran refineries. Diesel output losses also increased to 27% of the total. On the other hand, naphtha output losses narrowed slightly in March, falling below 10% of the total, from 16% in January. These refinery output losses were somewhat reflected on Russian products exports that between December 2023 and March 2024 fell by 150 kb/d, with diesel exports accounting for roughly half the total losses in the same period (48%), followed by naphtha (20%), gasoline (19%), jet fuel (14%) and fuel oil (8%).

[7] IEA. 2024. Oil Market Report. 12 April.
[8] Reuters. 2024. Exclusive: Russia restoring oil refining capacity knocked out by drones. 15 April.
[9] Energy Intelligence. 2024. How Serious Are Russian Refinery Outages for Oil Markets? 22 March.

**Figure 4: Russian refinery runs outlook in 2Q24**




Source: Kpler, Argus, OIES

Looking ahead to 2Q24, our forecast (incorporating Q2 scheduled maintenance as reported by Argus) suggests that, all other things equal, Russian refinery runs will bottom in April/May close to 5 mb/d from 5.2 mb/d in March and roughly 300 kb/d below year ago levels, before recovering again near 2023 levels of 5.4 mb/d in June (**Figure 4**). This forecast suggests that if Russia meets its Q2 maintenance schedule that involves some 360 kb/d of nameplate capacity from refineries not associated with the drone attacks entering into maintenance in April, 80% of which is scheduled to be completed by June, and continues to manage to limit downtime of damaged refineries such as in the case of the Syzran refinery that it was brought back online in early-April (estimated restart was mid-May), then crude runs could recover close to a year ago levels ending-Q2 in-line with official statements that all damaged refineries will be re-commissioned by June.[10] If drone attacks however resume at the intensity seen in March, then the Russian refinery system could remain under pressure, albeit Russia might be more prepared to offset the effects of drone attacks and technical outages.[11]

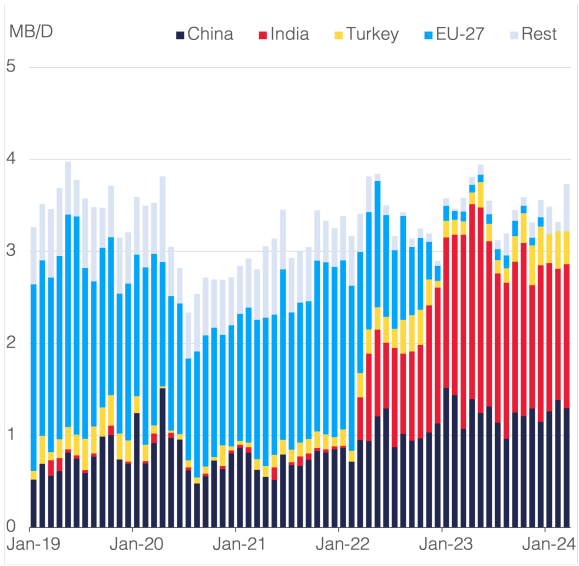
## Implications for Russian crude and products exports

Russian crude exports in March rose m/m by 410 kb/d to 3.7 mb/d, as reduced refinery runs made more crude available for export (**Figure 5**). Whether this continues into April will depend upon the intensity of ongoing drone attacks, scheduled maintenance and the pace of repairs to damaged plant. Moreover, with Russia set to deepen its voluntary crude oil production cuts in Q2 (by 350 kb/d in April, 50 kb/d in May and 71 kb/d in June), the ability to allocate unprocessed crude to export streams will be curtailed in any case.[12]

Russian product exports in March saw a m/m decline of roughly 250 kb/d to 2.5 mb/d, with diesel exports accounting for nearly half the decline since the start of the year (**Figure 6**). The most significant impact for exports markets involved diesel, naphtha and fuel oil, while Russia's six-month ban on gasoline exports is designed to limit domestic price pressures. This is not expected to have much impact on international markets, as gasoline exports last year averaged just 140 kb/d, a small fraction of total Russian products exports (5%).

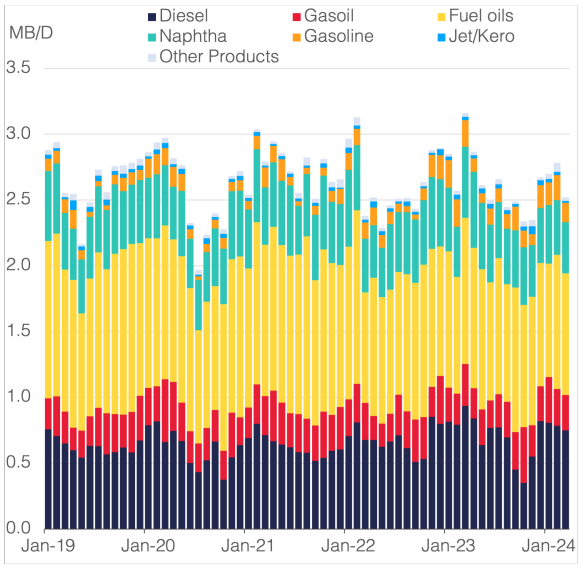
[10] Interfax. 2024. All damaged refineries will be re-commissioned before start of June – Energy Minister Shulginov. 3 April.
[11] Energy Intelligence. 2024. Russia to Repair Refineries by June, Step Up Protection. 10 April.
[12] Reuters. 2024. Exclusive: Russia orders companies to cut oil output to meet OPEC+ target. 25 March.

**Figure 5: Russia crude exports**




Notes: Seaborne only. Source: Kpler, OIES

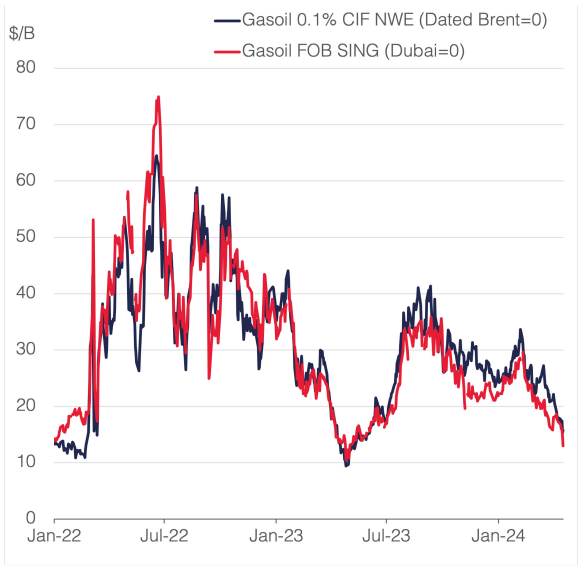
**Figure 6: Russia products exports**




Notes: Seaborne only. Source: Kpler, OIES

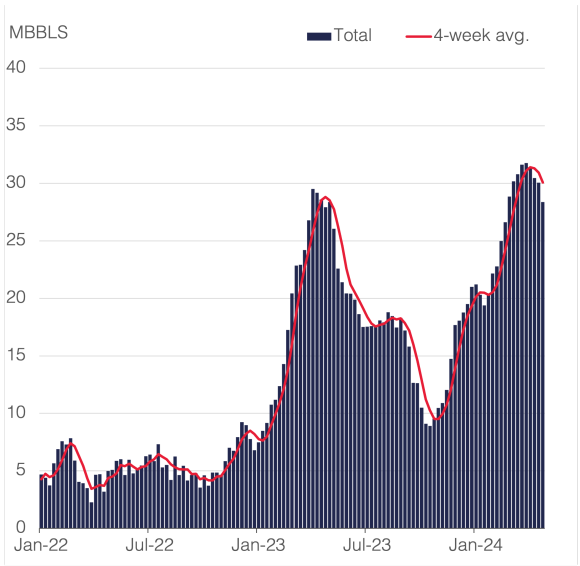
A final question is whether a sustained decline in Russian products exports in Q2 could have a significant impact on global middle distillate markets. So far in Q1, the impact on crack spreads has been minimal and the picture in Asian distillate markets is one of easing supply tightness (see **Figure 7**). Moreover, volumes of Russian diesel at sea have been on the rise, exceeding last year's high amid the full enforcement of the EU ban on Russian products (**Figure 8**). This suggests that the market could weather a 10-12% decline in Russian product exports in Q2 with minimal impact on global middle distillate market, but with diesel output being the most impacted by the drone attacks as witnessed in Q1, renewed attacks could sustain concerns over global middle distillate markets.

**Figure 7: Diesel cracks**




Source: S&P Global Commodity Insights, OIES

**Figure 8: Russian diesel at sea**




Source: Kpler, OIES