

Refining margins review

September 2026

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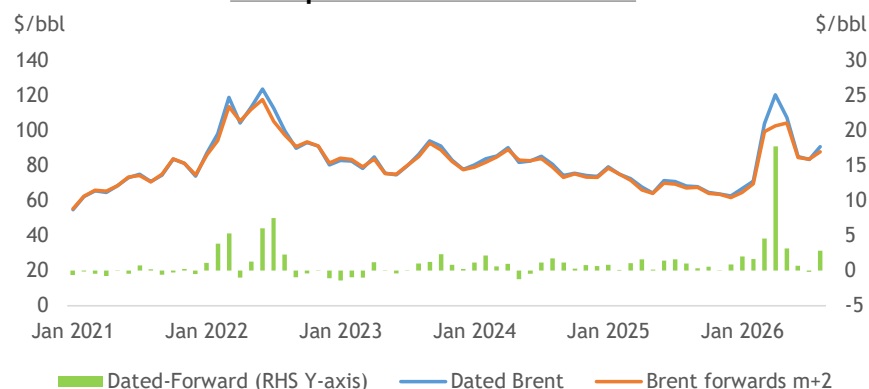
Introduction and disclaimer

- The purpose of this document is to provide an analysis of certain aspects that are shaping European refining margins currently. The market is currently disrupted by the Hormuz crisis. Market prices and refining fundamentals are currently influenced by several temporary factors. The trajectory of prices and margins in the short and medium term is inherently unpredictable, since it can be modified by one or all of several factors. For example:
- Release of emergency stock by IEA countries
- Refining margins are being affected by the IEA decision to release crude and products and by the crude/product ratio. In the release approved in March, crude accounted for 72% of the volume.
- The Chinese Government controls product exports. Its policies have often been erratic also in normal circumstances and have become more erratic with the Hormuz crisis. Between January 202 and December 2025, China had been exporting an average of ~600kbd of middle distillate. With the Hormuz crisis, the government initially banned export, then allowed it to resume on reduced quotas. Export of middle distillate is currently reported at ~70% of the historical level, making the shortage caused by China quite low. This could change.
- China has reduced its import of crude oil substantially and is processing crude oil from storage. This had a powerful effect in keeping Brent prices low, while the price of middle distillate went up and the differentials to Brent reached unprecedented levels.
- Before the Hormuz crisis, the petrochemicals industry was going through a period of low margins, with large overcapacity and Asia and expected rationalization forthcoming. The industry has reacted to the shortage of feed by reducing utilization. In the long term this is not sustainable. Meanwhile, there has been an evident reduction of refinery utilization in South Korea, where a lot of the refining capacity supply petrochemicals.
- Inventories are still being drawn at a rate that the IEA estimates to be 2.8mn b/d. This cannot go on forever.
- Having regard for this, forward looking statements made in this analysis should not be taken as forecasts because of the high degree of uncertainty. There is no certainty that the market will move in any particular direction and, in any event, it is very unlikely that market trends will be linear.
- Forward looking statement regarding what may happen if the Strait of Hormuz remains closed for a long period of time are "what if" speculations and do not indicate any opinion that this might be the case. At the time of writing, partial flow through Hormuz has been restored, which is evident from the crude oil production of countries such as Iraq and Kuwait. However, diplomatic activities towards a full resolution seem to have stalled.
- Ukraine's campaign of drone attacks on Russian refineries is causing lasting damage. Crude throughput and product export from Russia reduced significantly, then the government put a ban of export of all products on the 8th of July. The ban will stay in place until at least October. If and when the ban is lifted, it is difficult to see how Russia can return to exporting diesel at the historical rates of close to 1mn b/d (even higher at the historical peak). This is a supply disruption of global significance that will continue to have consequences going forward. In the decade to 2020, the Russian refineries had undertaken large investments to increase diesel yields, aimed at the export market.
- In addition to the factors of uncertainty that are known and have been discussed above, forecasts are inherently uncertain because of events or combinations of events that cannot reasonably be foreseen including the actions of government, individuals, third parties and competitors. No fitness for a particular purpose shall apply.

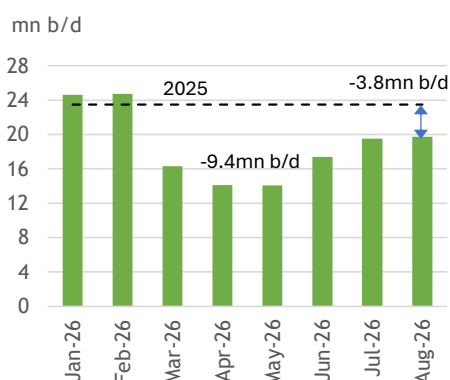
1. - Oil and energy prices

Oil prices

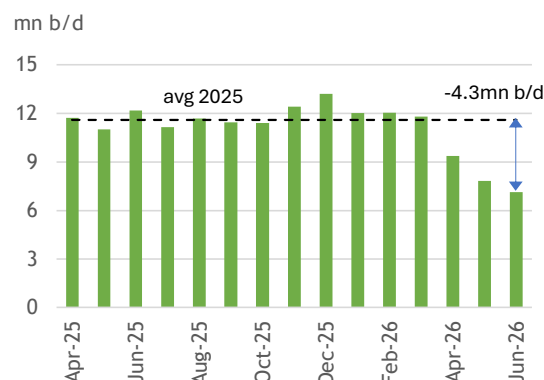
Brent prices and backwardation



Crude oil production in AG countries



China crude oil import

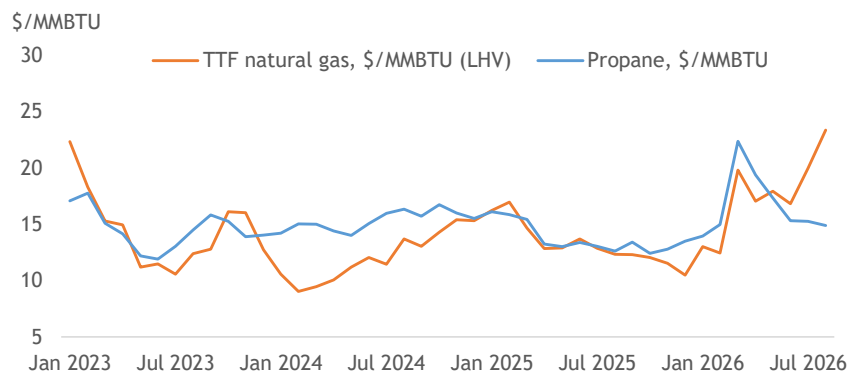


- Brent prices fell to a low of \$68/bbl on the 2nd of July and averaged \$91/bbl in August. At the time of writing, Dated Brent is back to \$125/bbl on renewed tensions around Hormuz and recent attacks on Saudi Arabia. Flow on the Saudi Arabian East-West pipeline has stopped, with reported damage to three pumping stations and a clear possibility that the pipeline will restart at lower capacity.
- At the peak of the crisis, in April and May, the shortage of crude oil as measured from the collective reduction of production in the AG countries, was 9.4mn b/d relative to the 2025 average. The shortage has now reduced to ~4mn b/d with the increase of flow through Hormuz. After leaving OPEC, the UAE has increased production to 3.8mn b/d, higher than its previous OPEC quota of 3.4mn b/d. In August, the OPEC big-4 (Saudi Arabia, Kuwait, Iran and Iraq) produced 14.9mn b/d, i.e. 75% of their 2025 average. However, it is likely that the September data will show a drop of aggregate production because of Saudi Arabia.
- China has single handedly kept the global market in balance by reducing crude oil import by ~4 mn b/d relative to the 2025 average. This was partly achieved by curbing export of products, which are subject to government quotas, and by drawing from inventories, reportedly at a rate of ~500kbd.
- The OECD countries have released approximately 300mn bbls of emergency stocks, 72% of which as crude and 28% as products (based on the plan). The volume of crude released equates to ~1.6mn b/d over the period (the volume of products is ~650kbd).
- According to the IEA, the reduction of global inventories has been 2.8mn b/d since February.
- The data show quite clearly that, due to the actions of China and the release of strategic stocks, the crude oil market was adequately supplied between July and August, hence the temporary fall in prices.
- June saw the end of the steep backwardation that had characterized the market in April. There was even a brief period of contango. The market is backwardated again because tensions in Saudi Arabia have caused Dated Brent to raise to \$125/bbl. Backwardation is an indication that the market believes the spike is temporary.

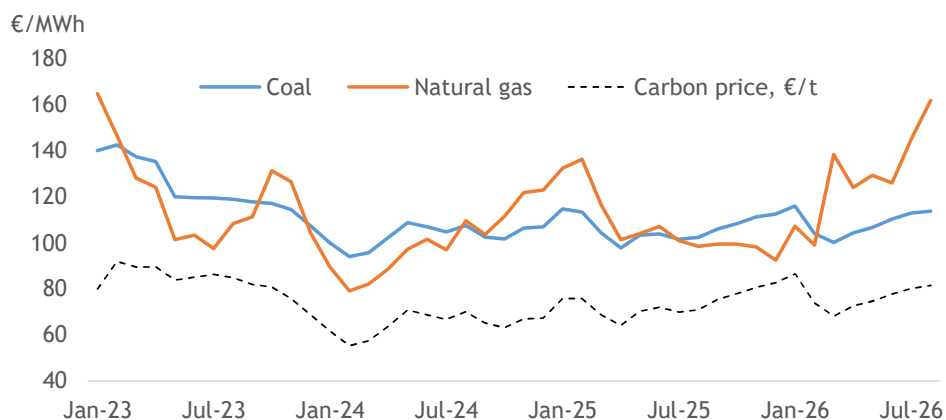
1. - Oil and energy prices

Natural gas and carbon costs

Natural gas and interfuel competition



Cost of power (fuel + carbon) and Carbon price

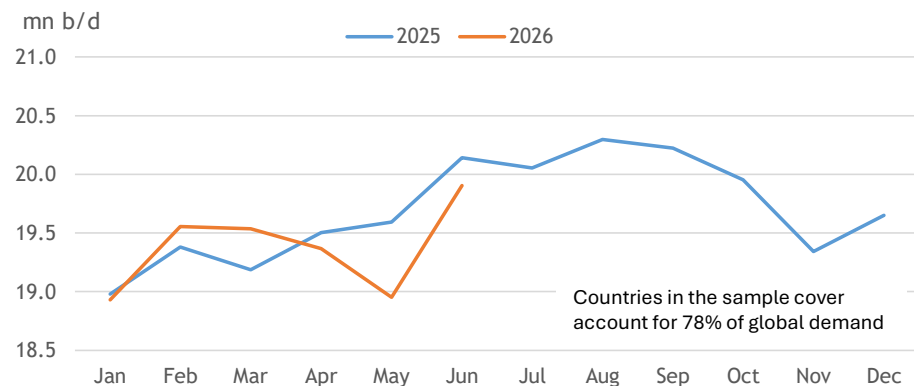


- The TTF natural gas price has reached \$21/MMBTU of HHV, the highest price since December 2022. In 2022, very high gas prices had crossed the boundary that made it cheaper for refineries to burn propane and use LPG or naphtha to make hydrogen. The consequence was that many European refineries started using LPG internally and cut LPG production. That boundary is being crossed again.
- In a more normal refining margin environment, the gas price in Europe is key to refineries' ability to compete internationally. The gas price at Henry Hub is still below \$3/MMBTU, which gives a very large competitive advantage to refineries in the USGC. The price in Japan is also well below TTF, having average \$14/MMBTU in August.
- Europe is entering the winter with lower than normal stocks of natural gas, so there will be a few months of uncertainty until we start seeing whether it will be a mild or a cold winter. Normally, net draws from stock at an EU aggregate level start between late October and early November.
- High gas prices have also pulled carbon prices slightly higher at €82/tonne (\$95/tonne). Gas-to-coal competition in the power sector is one of the factors the impact to fundamentals of the carbon market. High gas prices cause a switch to fuel, which increases demand for emission allowances.
- Since 2023, the carbon price has been quite close to the level that would have been expected based on gas-to-coal competition. Falling gas since the peak of 2022 caused carbon prices to reduce from a high of €92/tonne in February 2023, to a low of €55/tonne in February 2024. Currently, carbon prices are creeping up again. The fact that coal is now a significantly cheaper fuel than gas suggests that further increases of carbon prices are possible, unless other factors intervene.
- At August 2026 prices, natural gas accounted for \$2.0/bbl of the operating costs of the Forties FCC benchmark. Carbon costs account for \$2.1/bbl of the variable operating costs (or \$0.7/bbl of the cash costs, making the assumption the refinery receives 65% of its needs as free allocations).

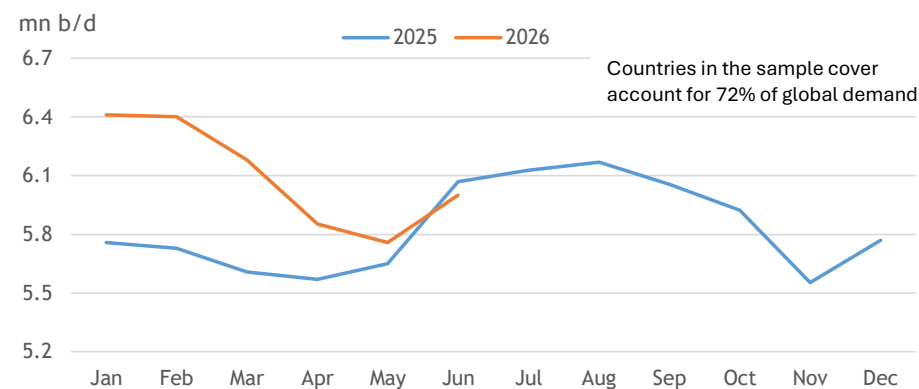
2. - Demand for refined products

Global demand for light fuels: tracking demand reductions vs 2025

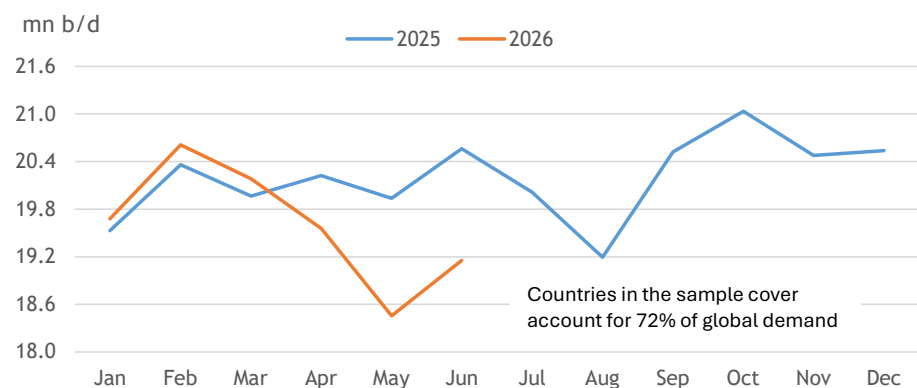
Gasoline demand



Jet fuel/kerosene demand



Gasoi/Diesel demand



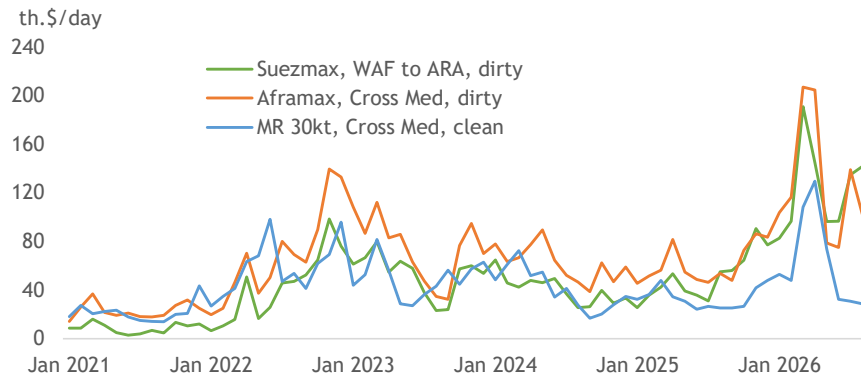
- High prices are still not producing a very large impact on gasoline demand. However, global demand seemed set to grow 1-2% this year, but is instead declining by 1-2% (250-500kbd).
- Jet/kerosene demand is currently aligned to last year. This means that expected year-on-year growth of ~500kbd has been wiped out by reduced flying activity.
- Gasoi/diesel has seen the largest supply disruptions, a much larger impact than other products on prices and a significant contraction of demand since April. As of June 2026, demand in the sample countries was 1.4-1.5mn b/d lower than in 2026.
- In many countries May-June demand has been lower than in the corresponding months of 2025 by 5-20%. China, Europe and the US have all seen large reductions of gasoi/diesel demand.
- China has resumed product export. July export has been estimated at 700-800kbd, of which ~500kbd was jet fuel. The August quotas envisaged total export at ~700kbd, with jet fuel at ~400kbd. These figures are ~70% of what has been the normal level of export since 2023.

Sources: Eurostat, JODI and OPEC MOMR

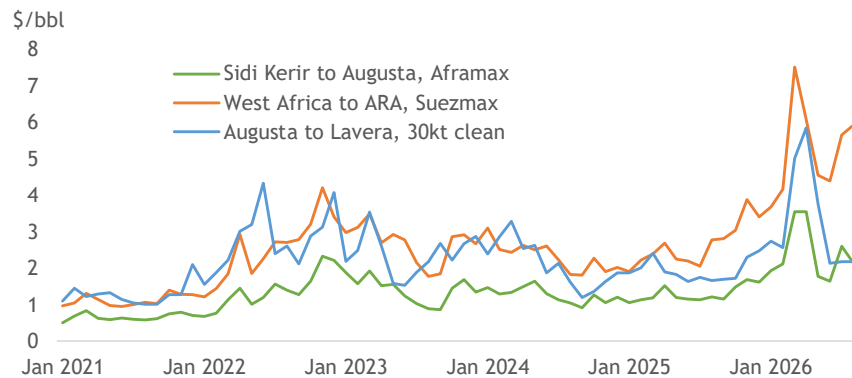
3. - Freight rates

Representative Time Charter Equivalents and voyage costs

Time Charter Equivalent at 13knots



Voyage costs

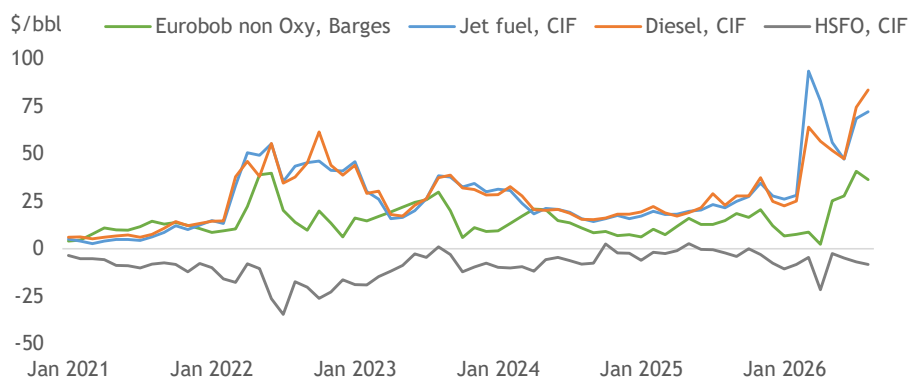


- Freight rates as measured through the TCE of some representative tankers reached unprecedented levels in March and April with a large number of tankers trapped inside the Strait of Hormuz and the call by other regions on tanker capacity as needed to rearrange trade flows and plug supply gaps.
- TCEs and voyage costs have now reduced somewhat but remain very high by historical standards.
- The cost of delivery of Suezmax-borne crude from West Africa to Europe was \$3.7/bbl in January 2026 and \$5.9/bbl in August.
- The tanker rates for clean products have been affected less by the Hormuz crisis and have returned to pre-crisis level.
- Tanker rates for crude oil rebounded in July partly because of higher traffic through Hormuz. Aramco resumed loadings at Ras Tanura in late June.
- Growth of crude oil export from the US that is replacing Middle East crude traded to Asia (in no small part from strategic reserves) is adding to the tonne-miles sailed.
- Renewed difficulty in sailing through Bab El Mandeb is causing some Asian refineries to lift Saudi crude at Port Said (Egypt) and sail Round Cape. The interruption of flow on the Saudi Arabian East-West pipeline will likely impact this trade route.
- In the short term, the supply disruptions in the crude oil market are causing the need to sail longer distances. In the long term, a continued restriction of flow through the Strait of Hormuz is more likely to create overcapacity in the industry because of the impact of demand destruction on the tonne-miles to be sailed.

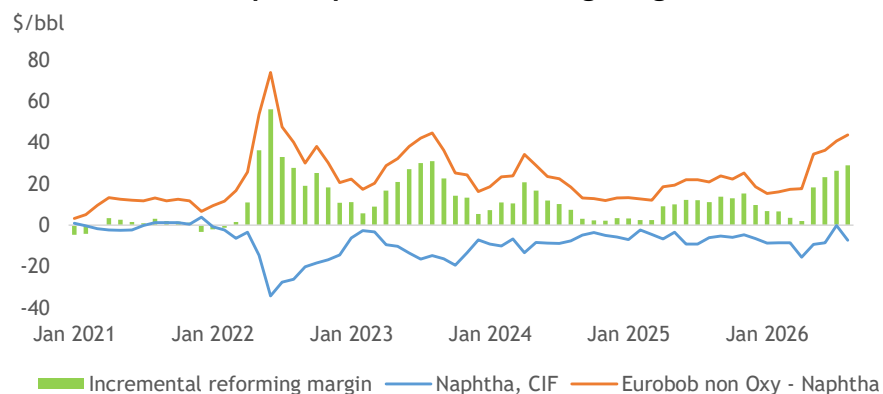
3. - Product prices

Price differentials relative to Forties delivered to Rotterdam

Price differentials to Dated Brent in Northwest Europe



Naphtha prices and reforming margins

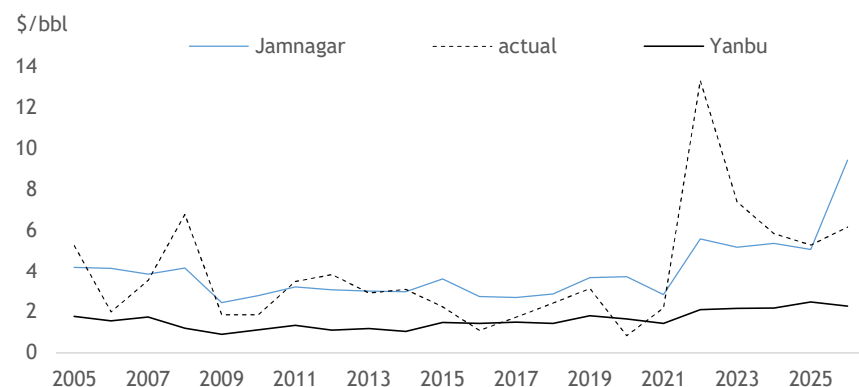


- Jet fuel and diesel continue to be the products most impacted by the Hormuz crisis. The total flow of these two products via Hormuz used to be ~1.4mn b/d before the crisis and Europe was the largest destination. The IEA writes that flow in August was 390kbd, so a loss of 1mn b/d.
- Russia banned diesel export on the 8th of July. Export had started falling earlier this year because of the damaged caused by the Ukrainian attacks on the refineries. Compared with 2025, the loss of supply to the global market has been ~800kbd.
- The combined loss of supply from Russia and the Middle East is approximately 1.8 mn b/d of middle distillate, which is not too different from the amount by which demand has fallen so far. This would imply that the market was heading towards a new equilibrium with diesel prices at ~\$175/bbl.
- The year had started with weak gasoline differentials at Rotterdam. The differential to Brent of Eurobob non-oxy averaged \$7.2/bbl in January/ February, vs a 2025 annual average of \$13.4/bbl. The Hormuz crisis did not lift the gasoline differentials, which initially fell because of higher crude oil prices. Gasoline prices have strengthen significantly since May.
- Strong gasoline has dragged naphtha higher because of increased demand for blending. For a brief period the price of CIF naphtha was above Dated Brent. Despite the stronger price of naphtha, reforming margins increased, which shows that the gasoline pull certainly played a role in the higher prices of naphtha.
- Export of High Sulphur Fuel Oil from Hormuz is much more limited. However, lower supply of medium gravity crude from the Arabian Gulf to the global market directionally reduces HSFO supply. Fuel oil prices have been strong relative to crude in recent years and the differential has not been affected much by the Hormuz crisis.
- The Arabian Gulf used to export large quantities LPG, to supply households and petrochemicals plants in Asia, as well naphtha used as petrochemicals feed. The petrochemicals industry was going through a rough patch and has reacted by cutting utilization. It is reasonable to think that naphtha prices could see some upward pressure once the market for petrochemicals has tightened again.

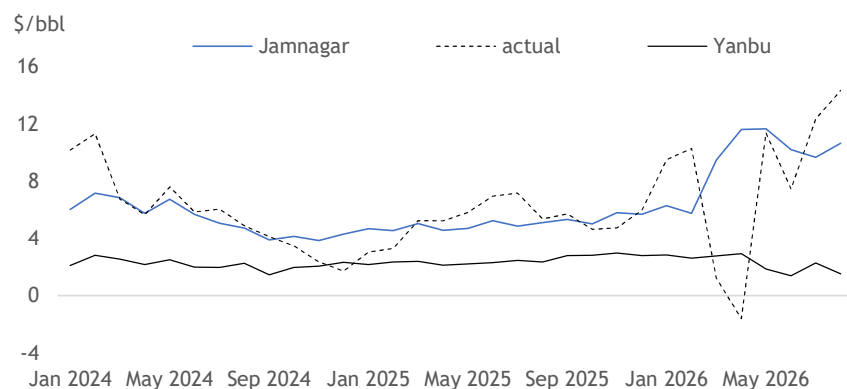
3. - Product prices

Arbitrage economics

Long-term, annual average prices



Last three years at month average prices

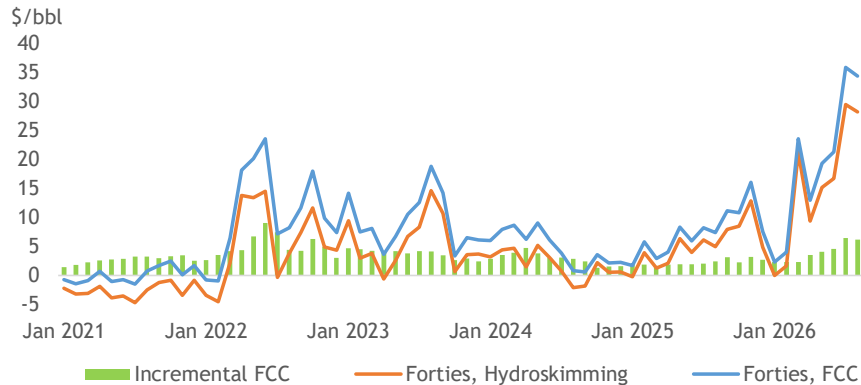


- Europe imports middle distillate from India and the Arabian Gulf in competition with other locations East of Suez that are short and rely on imports, for example Indonesia or Australia. European prices must stay above Singapore prices as needed to attract sufficient supply. The Arabian Gulf and India are regular suppliers to Europe. When the European market is short, supply from as far as South Korea can become feasible.
- These charts plot the CIF Rotterdam - FOB Singapore price under the hypotheses that the two markets are in equilibrium when the netback from Asia/Pacific or Europe are identical at Yanbu or at Jamnagar. When the actual price differential is higher, the European market gives a higher netback to the location. The Yanbu refinery is closer to Europe and need lower European prices to find supply to Europe advantageous. The actual price is that of jet fuel, to remove distortions related to different diesel specifications in different geographies.
- The long term chart shows that at times of market weakness, the difference in prices between Rotterdam and Singapore aligns to the freight costs from Yanbu. However, most of the time it is closer to India or somewhere in the range. At times of extreme tightness (2008, 2022 and 2026), the differential was higher, which means trade to Europe from further afield is viable.
- The chart also shows that high higher prices in Europe relative to Asia in 2024 and 2025 are aligned with what would be normal to expect with those freight costs.
- The month average prices shows that the two markets have remained strongly linked through freight costs, with prices dropping to Yanbu parity during a spell of oversupply at the end of 2024. In March and April 2026, Singapore prices went briefly to a premium because market shortage hit Asia first. In May and June the two markets had returned to the normal relationship.
- The prices in July and August implies that the European market has gotten shorter and needs more import, which seems to be a consequence of the stop to Russian export. It could also be the resumption of Chinese export depressing Singapore prices to the point where some products has to be traded to Europe or that freight costs are higher than estimated because of new tensions around Bab El Mandeb. Freight costs are somewhat theoretical in the fact they assume unhindered passage through the Red Sea and the Suez Canal with no additional insurance premium.

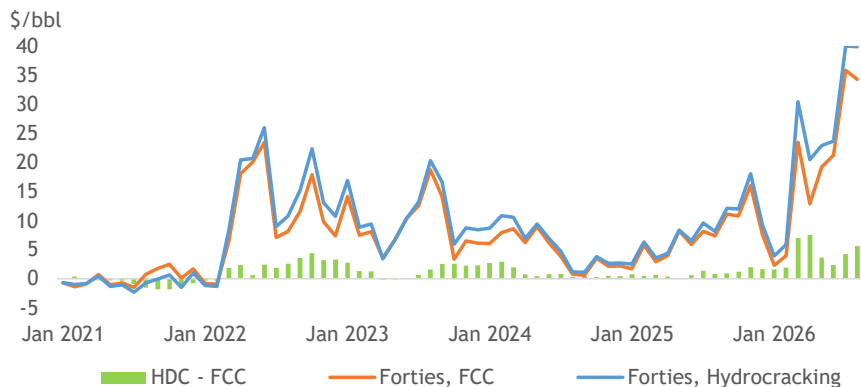
4. - Refining margins

Refining margins at Rotterdam with Forties crude oil

Refining margins at Rotterdam after variable costs



Refining margins at Rotterdam after variable costs



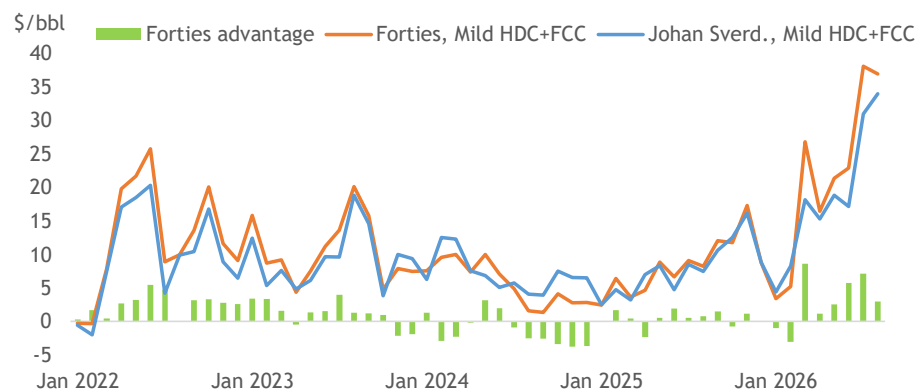
Carbon costs are included on the basis of 65% free allocations

- Refining margins keep breaking records. In July and August, margins were supported by a relatively well supplied crude oil market that kept Brent prices well below \$100/bbl, while product prices remained very high.
- Margins after variable costs remain above \$25/bbl even with hydroskimming yields and with 100% carbon cost, which is the carbon cost applicable to one barrel of marginal capacity. This is an indication that all technical operable refining capacity in Europe is currently called to supply the market.
- The incremental margin earned by FCC capacity over hydroskimming is high, but remains below the peak of the summer 2022.
- The advantage of hydrocracking capacity over FCC has increased again in July and August, a consequence of high middle distillate prices.
- The July/August fundamentals were particularly favourable for refining, because there was no real shortage of crude in the international market. With China, Russia and the Arabian Gulf disconnected from the global market for refined products, the rest of the world had adequate supply of crude oil and not enough refining capacity.
- In September, the market has entered a new disrupted phase with the possible loss of more crude oil supply from Saudi Arabia. Brent prices have shot up by ~\$30/bbl. Based on partial until half September, product prices have also gone up, so not much has changed so far for margins. However, a possible further loss of crude oil supply from Saudi Arabia (or anywhere else for that matter) is not positive for refining because the resulting destruction of demand can create overcapacity.

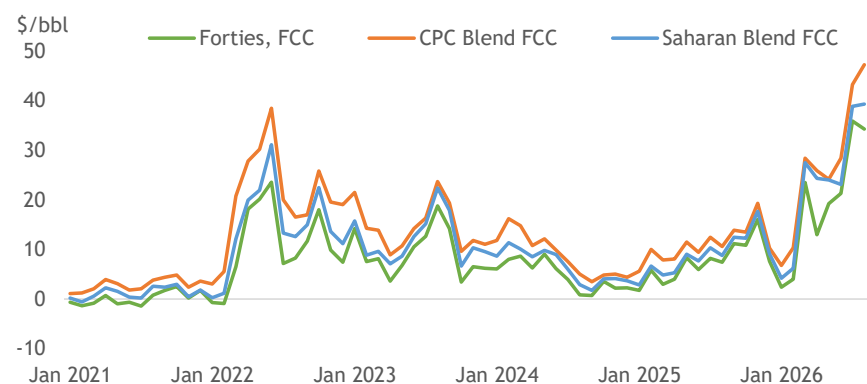
4. - Refining margins

Refining margins at Rotterdam with lighter and heavier crude oils

Refining margins at Rotterdam after variable costs



Refining margins at Rotterdam after variable costs



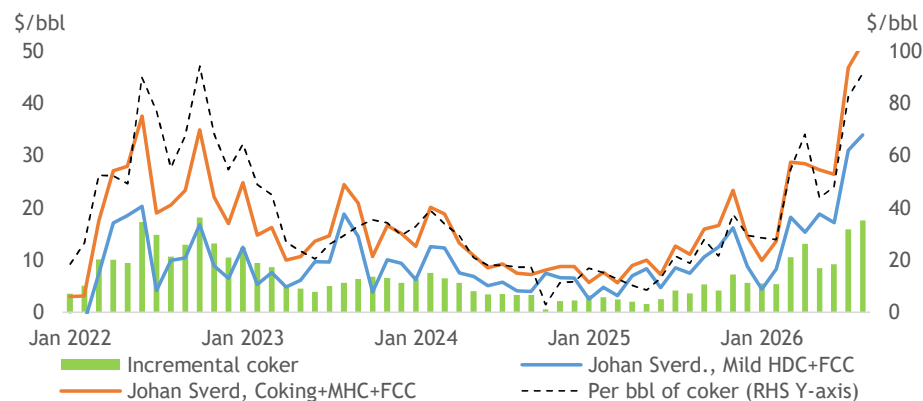
Carbon costs are included on the basis of 65% free allocations

- In the European market there has been for quite some time an advantage in processing lighter crudes at simpler refineries. The origin of this situation is oversupply of light crudes in the Mediterranean. More recently, the loss of supply of Russian crude has produced scarcity of medium gravity crude.
- Johan Sverdrup is the North Sea crude that can be considered the most direct substitute of Urals. Johan Sverdrup margins in a medium complexity refinery, such as the Mild Hydrocracker+FCC benchmark, are often lower than Forties and only occasionally higher. This is despite the fact that at constant distillation capacity the John Sverdrup refinery uses more conversion capacity, so it converts more VGO into distillates.
- The gap between these two crudes in the Mild Hydrocracking/FCC benchmark, which is well representative of core European refining capacity, has increased in recent months.
- The fact margins are lower with Johan Sverdrup is a simple reflection of the scarcity of heavy crude. The prices of heavier crudes are presumably being bid up by refineries with residue cracking capacity, to the point that heavier crudes are priced out of the pocket of simpler refineries.
- High middle distillate prices have increased the coking value of a crude like Johan Sverdrup and lifted its prices to the point that by switching to Forties a VGO cracking refinery makes a substantially higher margin (see slide 13 for more analysis of this).
- The significant increase of freight costs has not changed the fact that it is possible to trade very light Mediterranean crude to North Europe and obtain margins that are aligned to Forties, actually slightly better.

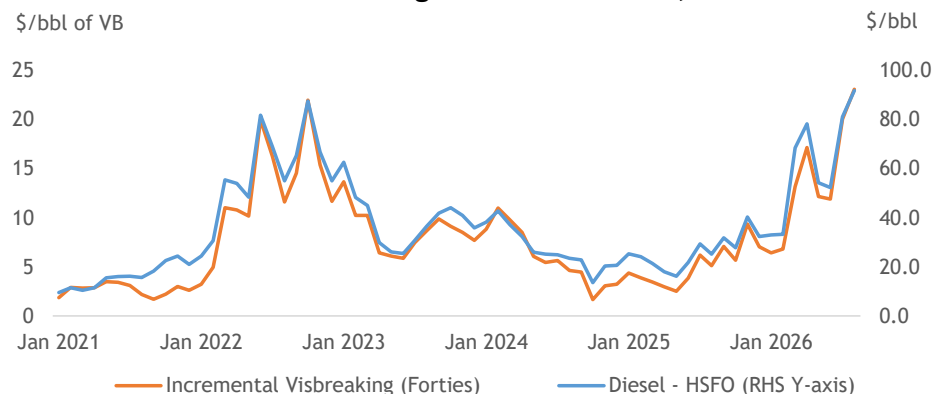
4. - Refining margins

Residue conversion margins at Rotterdam

Incremental coking after variable costs, Johan Sverdrup



Incremental Visbreaking after variable costs, Forties



Carbon costs are included on the basis of 65% free allocations

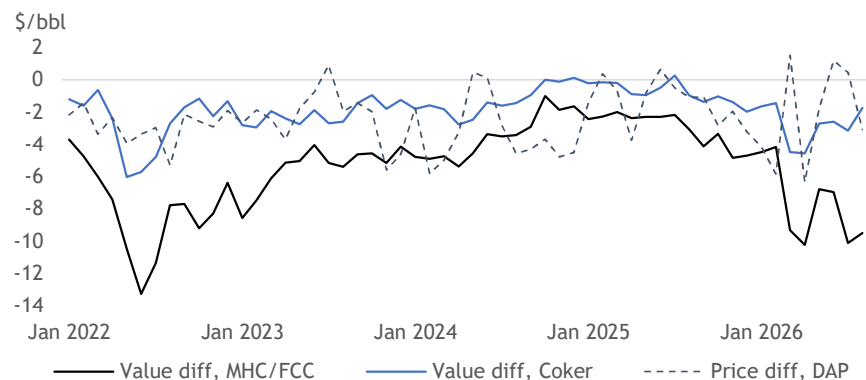
- Incremental coking and visbreaking margins are specific to the crude oil that is being processed because without the coker or the visbreaker the refinery would blend vacuum residue to fuel oil and because the cracking yields are different with feed of different quality.
- Incremental coking and visbreaking margins are very directly correlated to the price differential between middle distillates and fuel oil, as evidenced by the figure in the lower half of the slide.
- Between January 2023 and December 2025, coking Johan Sverdrup residue would have added \$4.8/bbl to the margin of the Mild Hydrocracking+FCC benchmark, which is equivalent to \$25.1/bbl of coker capacity utilized. This is below historical norms, when adjusted for inflation, which is the consequence of high fuel oil prices and high hydroskimming margins. By contrast, peaks of \$90-95/bbl as recorded in 2022 should be considered abnormal, since at that level a coker would pay back in about 1 year.
- The Hormuz crisis has brought the incremental coker margin back above \$90/bbl.
- The incremental coking margin measures the opportunity cost of leaving one barrel of coker capacity unutilized, for example if scarcity of heavy crude does not allow the refinery to fill the coker. This is also the marginal value that would be seen by the refinery LP models, when calculating the economics of substituting a lighter crude with a heavier one and deciding what price to pay for the heavier crude.
- The incremental visbreaking margin has also spiked to reach \$23/bbl of visbreaking capacity, which exceeds the June 2022 record of \$20/bbl.
- Incremental residue cracking margins at these levels cannot be supported by long term fundamentals and should be considered the result of market disruption. However, incremental cracking margins could still go up temporarily higher as a result of monthly price volatility, especially if fuel oil prices happened to fall.

5. - Crude oil price differentials

Johan Sverdrup - Forties price differential

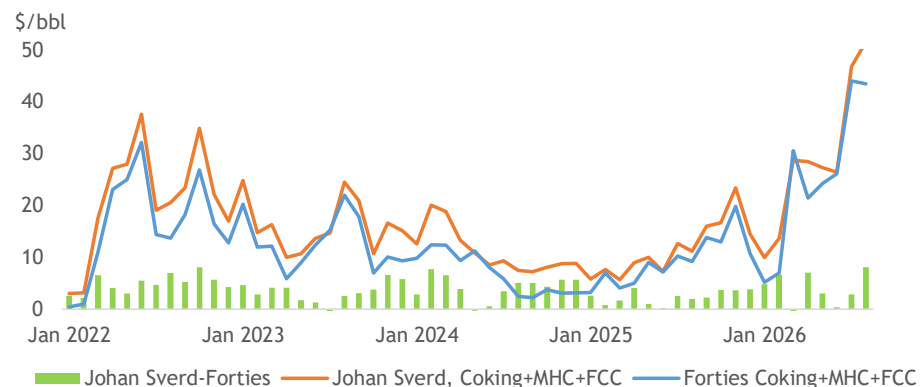
Johan Sverdrup - Forties, price vs value analysis

Substitution economics with 100% of carbon costs



Johan Sverdrup vs Forties coking margins after variable costs

Carbon costs are included on the basis of 65% free allocations



- Crude oils derive their value from the refined products that are made from them. The price differentials between any two crudes reflect the differentials that refineries are willing to pay to substitute one crude for another, while maintaining an equal margin after variable costs. These considerations shape the bidding activities of refineries every day and influence price differentials.
- The economics of substituting a cargo for another plays out based on the marginal capacity of each refinery. The economics of substituting a light crude for another light crude are better explained with hydroskimming economics or simple FCC economics. However, with heavy crudes getting scarcer, the price differentials between light and heavy crudes align with the hypothesis that refineries need heavy crude to fill up residue conversion capacity and are prepared to pay higher prices for this.
- The value differential between Johan Sverdrup and Forties is calculated with substitution economics at two refineries:
 - Mild Hydrocracker+FCC refinery with production of fuel oil
 - Mild Hydrocracking + FCC + Coking refinery with the coker underutilized
- The price of Johan Sverdrup is normally found in the range between the two. However, it is more often aligned to the economics of the coking refinery, probably reflecting a desire by these refineries to secure heavier crude.
- The gaps between the two valuations is wider when the incremental coking margin is higher, so it is in these situations that simpler refineries are more likely to find heavier crudes too expensive (as is currently the case).
- Occasionally, the price of John Sverdrup has reached parity with Forties on a delivered basis, at which points the two crudes have a nearly identical coking margin.

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