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ENERGY AND CRITICAL MATERIALS

From production to logistics: how the Hormuz Crisis affects OPEC's market power

The Hormuz closure shows that OPEC's market power now rests on the ability to export spare capacity, not merely to hold it.

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As the conflict broke out between the United States, Israel, and Iran on 28 February 2026, the closure of the Strait of Hormuz halted the transit of roughly 20 million barrels per day (mb/d), nearly one-fifth of global oil supply, that normally flows through the Strait (EIA). In March 2026, the IEA's Executive Director, Fatih Birol, described the closure as 'the largest supply disruption in the history of the global oil market' (IEA, Oil Market Report, May 2026). According to Wood Mackenzie (May 2026), more than 11 mb/d of Gulf crude and condensate production remained curtailed, putting sustained upward pressure on oil prices. The response combined several levers at once: coordinated releases from strategic reserves, higher output from non-Gulf producers, rerouted exports through the limited bypass infrastructure available, and demand-side measures in importing countries, especially in Asia (IEA, 2026 Energy Crisis Policy Response Tracker). Even combined, these measures could not fully offset the loss of maritime access to the Gulf.

Paradoxically, this disruption occurred just as OPEC and OPEC+ had begun an opposite strategic shift: after several years of voluntary output restraint, the group had engaged in a progressive unwinding of its cuts from April onward, bringing cumulative increases to nearly 2.9 mb/d over the year, in an explicit bid to reclaim market share. The paradox is therefore twofold: at the very moment OPEC+ were reasserting its willingness to act on volumes, the Hormuz crisis demonstrated that nominal availability of that capacity does not necessarily mean its effective availability to the global market. This is not simply a matter of scale. In prior major disruptions (the 1973 Arab oil embargo and the 1956–57 Suez Crisis, which removed just under 10% of global supply) the spare capacity that absorbed the shock sat outside the disrupted region: during Suez, the United States alone held reserve capacity equal to roughly 35% of world supply (Rapidan Energy Group, 2026). The 2026 Hormuz closure disrupts roughly twice the share of global supply that Suez did, and it did so by directly incapacitating supplies from Saudi Arabia and the UAE, the two producers that together held the overwhelming majority of the world's remaining buffer. Yet this has not, so far, produced a price response of the scale seen in 1973, when a considerably smaller disruption (roughly 7% of global supply) drove prices to nearly quadruple.

Spare capacity has long been treated as an essential layer of energy security: the buffer that lets the market absorb unexpected disruptions without a price spike or a scramble for alternative supply. This apparent unavailability mattered during the Hormuz crisis precisely because the buffer was expected to function automatically - an expectation the crisis did not bear out. This exposes a core assumption in the literature: that spare capacity, on its own, is a sufficient measure of OPEC's market power. Pierru, Smith and Zamrik (2018) exemplify this, quantifying the stabilizing value of OPEC's buffer capacity while implicitly assuming its immediate activation and unimpeded

access to international markets. This assumption of automatic exportability had, until Hormuz, never been seriously tested.

The implications reach beyond the crisis itself. If spare capacity's value depends on exportability rather than volume alone, OPEC+'s quota-based approach to managing it may itself need rethinking. The UAE's withdrawal from OPEC+ in May 2026, driven partly by its ambition to expand export capacity, offers an early signal. As deliverability becomes as important as volume, producers may increasingly compete on infrastructure rather than accept limits on output they are not permitted to use.

This paper proposes to relax this assumption by introducing two successive adjustments to the nominal measure of spare capacity. The first, a deliverability adjustment (Deliverability Adjusted Spare Capacity, DASC), distinguishes spare capacity that remains effectively exportable from capacity that, while physically available, is stranded behind the chokepoint. The second, an adaptability adjustment, assesses each producer's ability to restore, over a medium-term horizon of investment and infrastructure expansion, supply that is effectively deliverable to the global market.

OPEC, founded in 1960, is the intergovernmental organisation coordinating petroleum policy among its member states (eleven as of May 2026, following the UAE's withdrawal). OPEC+, established in 2016, extends this coordination to a wider group of non-OPEC producers, notably Russia, Kazakhstan, Oman, and Azerbaijan, together accounting for roughly half of global oil production.

Spare capacity is production that can be brought online within 30–90 days and sustained over time (IEA, EIA) - a concept applicable to any oil producer, including non-OPEC+ countries such as the United States. As of today, most of the world's readily available spare capacity is concentrated within OPEC+, largely as the deliberate result of coordinated supply restraint aimed at balancing markets and supporting price stability.

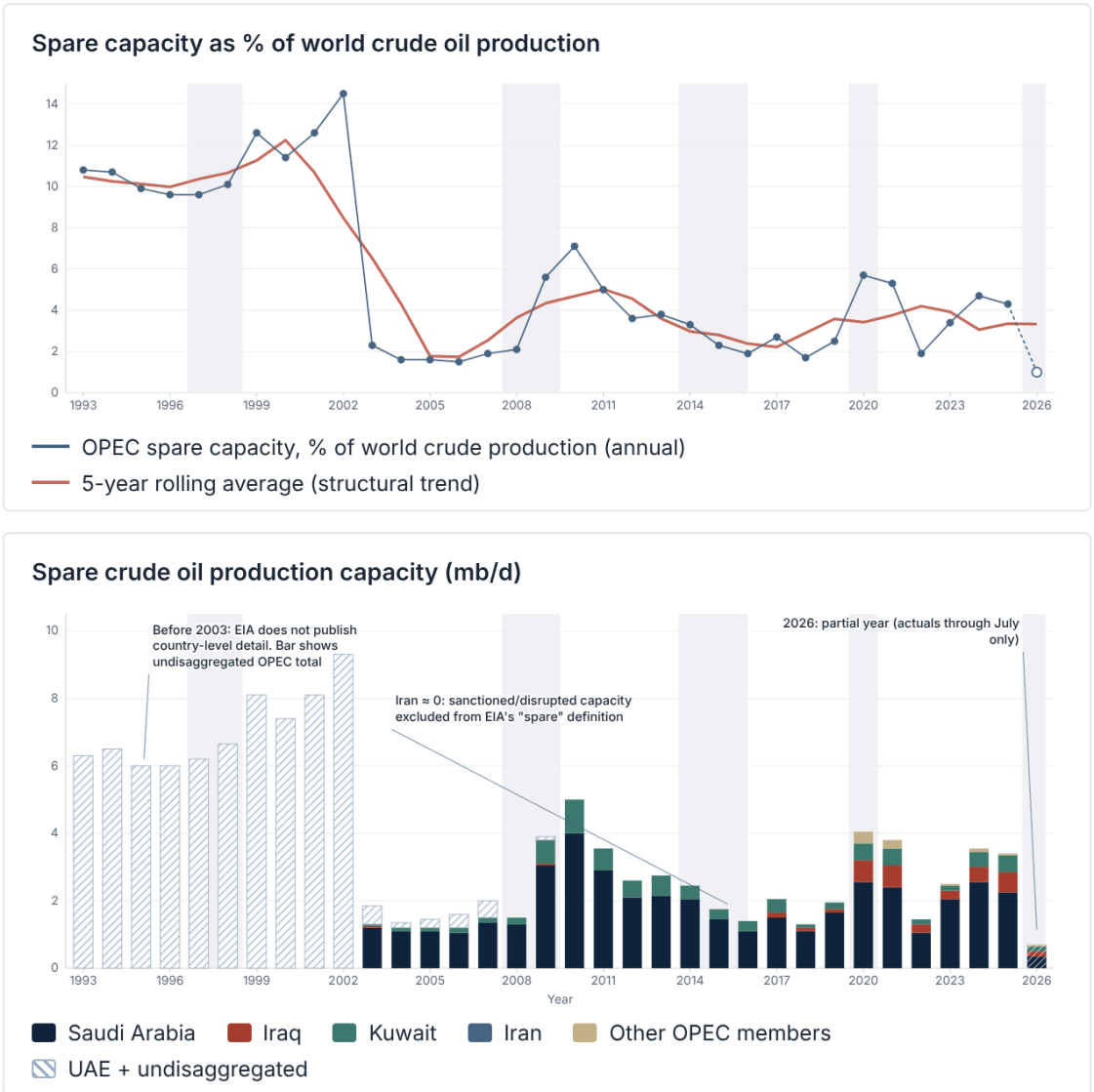
1. Deliverability adjustment (current availability)

If spare capacity has long been treated as the oil market's ultimate insurance against disruption, what does that insurance actually protect against once the buffer itself can no longer reach the market? Before the Strait of Hormuz closed, OPEC+'s spare capacity was already a shrinking and increasingly concentrated resource. After it closed, most of that capacity turned out to be unreachable altogether. How much of nominal spare capacity can genuinely be considered available once both structural erosion and physical exportability are taken into account? And how that "effective" capacity can be measured?

The first adjustment addresses a structural transformation of the global oil market. Since the early 2000s, OPEC's spare production capacity has become an increasingly small share of global crude oil production (**Figure 1**): from a peak of 14.5% in 2002 to a persistent plateau of roughly 2–7% since, and just 1.0% in the partial-year 2026 data (7 months of actuals). This structural break was triggered, not gradual: spare capacity collapsed from 14.5% in 2002 to 2.3% in 2003 (a 12.2 percentage-point drop in a single year) as the Venezuelan oil strike and the invasion of Iraq forced other producers, principally Saudi Arabia, to draw down their buffer. It never rebuilt to its earlier level, aside from temporary, crisis-driven upticks to 7.1% in 2010 (financial crisis) and 5.7% in 2020 (COVID demand collapse), both fading within a few years. In 2025, it stood at 4.3%. The remaining buffer is also highly concentrated (**Figure 1**, top panel): Saudi Arabia alone has accounted for roughly 70–75% of tracked OPEC spare capacity in most years since 2003, with Iraq and Kuwait the only other consistently material contributors, while Iran, Libya, and Venezuela contribute close to zero - their nominal capacity excluded from EIA's "spare" definition due to sanctions or disrupted output.

FIGURE 1

OPEC spare capacity is concentrated in a few producers, and matters less to the world market each year



UAE is not tracked as an individual series by EIA STEO and is folded into "UAE + undisaggregated" below; it cannot be shown separately in this chart.

Source: EIA, Short-Term Energy Outlook (STEO), August 2026 vintage. Window: 1993–2026, the longest range where OPEC total spare capacity (COPS_OPEC) and world crude oil production (COPR_WORLD) both have data; STEO forecast months excluded (cutoff set manually at 2026-07 against the STEO release page). Individually plotted countries (Saudi Arabia, Iraq, Kuwait, Iran) match the spare-capacity treatment used elsewhere in this project. "Other OPEC members" sums Algeria, Nigeria, Libya, Venezuela, Gabon, Congo (Brazzaville), and Equatorial Guinea. "UAE + undisaggregated" = OPEC total minus all individually tracked and minor-OPEC countries; before 2003 (cross-hatched) it equals the full undisaggregated OPEC total, since EIA does not publish country-level detail that far back. Hatched bar / hollow marker = 2026, partial year (actuals through July only). Shaded bands mark major demand or supply shocks for context, not causal attribution.

This erosion of OPEC's individual market weight came to a head in the 2014–2016 price war, when Saudi Arabia abandoned its traditional swing-producer role and flooded the market in an explicit attempt to price U.S. shale producers out of business. Shale drillers cut costs and kept producing instead, and Brent crude fell from over

$115/barrel in mid-2014 to below $30/barrel by January 2016. This failed strategy motivated the December 2016 creation of OPEC+, bringing OPEC members together with non-OPEC producers, notably Russia, to manage supply collectively rather than compete on volume. The new coalition aimed to restore an influence over prices that Saudi Arabia had just demonstrated it could no longer secure by acting alone. Yet broadening the coalition - designed to restore price stability, not to reverse the concentration of spare capacity - did not change that underlying trend: the remaining buffer has become increasingly concentrated within a small number of Gulf producers, with Saudi Arabia, the UAE (prior to its 2026 exit), Iraq and Kuwait together accounting for roughly 90% of OPEC+'s total nominal spare capacity (EIA; OPEC+ market assessments, April 2026). It has since deepened further with UAE's exit from OPEC+ in May 2026.

The economics literature has assumed that having spare capacity is the same as being able to use it. In this perspective, spare capacity acts as an insurance mechanism for global oil markets by allowing producers, to offset unexpected supply disruptions. Pierru, Smith and Zamrik (2018), for instance, show just how much OPEC+'s buffer capacity has stabilized markets, while Nakov and Nuño (2013) trace Saudi Arabia's dominance to its ability to ramp up production quickly. McNally (2017) adds historical depth, tracing how the swing-producer role evolved over time - from Standard Oil's informal market control before 1911, to the Texas Railroad Commission's production quotas that stabilized prices from the 1930s to the 1960s, to OPEC and Saudi Arabia after 1973, with Riyadh absorbing the brunt of the role in the 1980s by cutting its own exports from roughly 10 mb/d to 3 mb/d between 1980 and 1986 to defend prices. These accounts share a common assumption: that spare capacity, once activated, is immediately available to the market.

A second strand focuses on OPEC+ as an institution rather than on its productive assets. Colgan (2014) argues that OPEC+'s influence has often been overstated and that its political coordination matters more than its effective production restraint. More recently, Fattouh and Economou (2025) argue that the unwinding of voluntary production cuts reflects a structural evolution in OPEC+'s reaction function. Yet regardless of whether market power is interpreted as productive capacity or political coordination, both approaches continue to evaluate it through nominal production.

However, under a complete closure of the Strait of Hormuz, nominal spare capacity becomes an inadequate indicator because it ignores a new binding constraint: exportability.

Exposure to the Strait of Hormuz operates through several layers of logistics, not volume alone. Among others, the type of vessel a route can load, the availability of transshipment infrastructure, and the distance to end markets all determine whether a nominal barrel of spare capacity ever becomes a delivered one.

The Automatic Identification System (AIS, ship-tracking transponder data) evidence confirms that the disruption is primarily an export shock rather than a production shock. Both indices collapse from their 2025 baseline to near-zero within days of the 28 February closure and stay there for roughly three months. After the 17 June MoU, they recover only partially, peaking below half of pre-crisis levels before fading again, showing that, due to prolonged attacks and military activity in the Strait, maritime flows have not entirely resumed even after the formal de-escalation. Nominal spare capacity therefore stops being a reliable measure of market flexibility once part of it can no longer reach consuming markets.

Coordinated production policy (the traditional lever through which OPEC+ has exercised market power) remains relevant, but it is no longer sufficient on its own as logistics has become an equally decisive factor. The UAE's withdrawal from OPEC and OPEC+ in May 2026 confirms this: since physical export capacity, rather than coordinated restraint, increasingly determines market influence, remaining bound by a policy-based quota system offers diminishing value.

This shift from policy to logistics motivates the construction of a **Deliverability Adjusted Spare Capacity (DASC)**, which distinguishes between spare production capacity that can still reach international markets and spare capacity that remains physically available but is effectively stranded behind the disruption.

OPEC+ producers vary considerably in their exposure to the Strait of Hormuz, and fall into three categories based on that exposure. The first group holds partial bypass infrastructure (a pipeline capable of rerouting some crude to a coast outside the Gulf) so a portion of their spare capacity remains deliverable, bounded by how much spare throughput that pipeline actually has. The second group has no alternative export route at all: their entire spare capacity depends on maritime transit through the Strait, and is therefore fully stranded once it is closed. The third group's exports never relied on Hormuz to begin with, whether because they ship from Atlantic, Black Sea, or Pacific-facing terminals - for these producers, nominal and deliverable spare capacity are effectively the same.

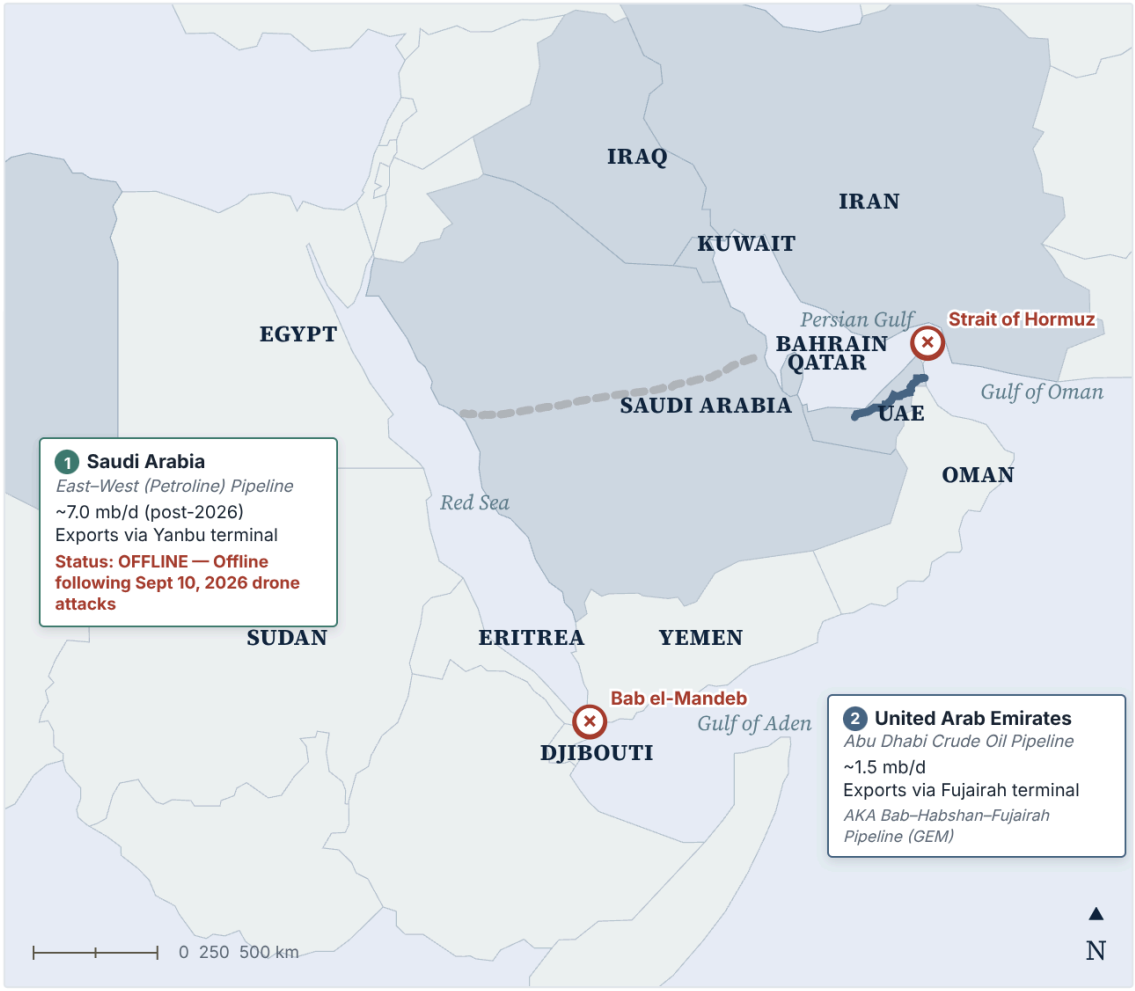
OIL EXPORT BYPASS INFRASTRUCTURE AROUND THE STRAIT OF HORMUZ

Alternative export routes and DASC-adjusted spare-capacity positions among Gulf producers

PIPELINES SHOWN | Bypass only | All pipelines

☑ Operating ☐ Construction ☐ Shelved ☐ Retired | ☐ Petroline operational OFFLINE

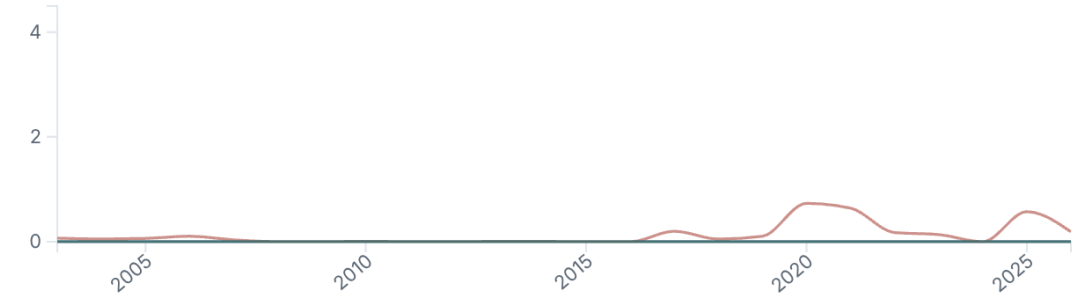
☐ SHOW TERMINALS



Legend

- OPEC member territory
- East–West (Petroline) — Saudi Arabia
- ADCOP — UAE
- Other crude pipelines (colored by status, hidden by default)
- Major export terminal (hidden by default)
- Chokepoint (Hormuz / Bab el-Mandeb)

DASC-Adjusted Spare Capacity (mb/d)



2026: Saudi Arabia 0.00 mb/d (counterfactual: Petroline offline across full series) · Iraq 0.19 mb/d · Kuwait 0.00 mb/d · Iran

Saudi Arabia, the UAE, and Iraq at a smaller scale illustrate the first category. Saudi Arabia's East–West Pipeline runs 1,200 km from the Abqaiq processing complex in the Eastern Province to the Red Sea export terminal at Yanbu. The UAE's Abu Dhabi Crude Oil Pipeline (ADCOP), also known as the Habshan–Fujairah pipeline, runs from onshore fields at Habshan to the export terminal at Fujairah on the Gulf of Oman. Iraq holds a limited route through the Kirkuk–Ceyhan pipeline to the Mediterranean, though this connects only to northern fields and cannot reach the Basra-based bulk of national production. The scale of what each route could actually transport, however, is best understood by comparing pre-conflict usage to what came after, which the paragraphs below take up route by route.

Saudi's East-West Pipeline carries crude only. Before the closure, it typically carried just 0.8 to 1.0 Mb/d, a fraction of even its original 5 mb/d design capacity, because it functioned as contingency infrastructure rather than a primary export route, leaving several million barrels per day of pre-existing headroom (S&P Global, June 2025). Its capacity had already been expanded to 7 mb/d before the closure though that expanded capacity had never actually been run at full. Since the closure, Aramco has pushed flows toward that ceiling: on 10 March 2026, the company stated that around 5 mb/d could be made available for exports, with the remainder supplying domestic refineries (Al Jazeera, March 2026). Even that figure overstated deliverable volumes: Yanbu's berths can load only around 4–4.5 mb/d, and by June 2026 actual loadings stood at just 4.1 mb/d - roughly 64% of what normally transited Hormuz - leaving the terminal handling 92% of Saudi seaborne exports with no public plan to expand its loading capacity (Kpler, June 2026; IEA).

Despite having the largest bypass route of the three producers, Saudi Arabia still faces a further logistics constraint once crude reaches Yanbu: onward delivery to its principal Asian market. Most exports from Yanbu load onto very large crude carriers (VLCCs) that normally transit via Bab al-Mandeb. Houthi threats to shipping in that corridor, however, have periodically put this route at risk, raising the prospect of cargoes rerouting north through Suez instead, a passage these vessels cannot make fully laden, requiring either lightering part of the cargo through Egypt's SUMED pipeline or switching to smaller Suezmax vessels, both of which add time and cost (Al Jazeera, July 2026). This became more than a theoretical constraint in July 2026, when Houthi threats to Red Sea shipping forced some Yanbu-loaded cargoes to divert toward Suez rather than sailing south as usual.

Even worse, what happened on 10 September 2026 perfectly illustrates that fragility. Drone strikes hit pump stations along the East-West Pipeline. Consequently, Saudi Arabia's Ministry of Energy confirmed the following day that the pipeline had been shut down as a precautionary measure. The loss is total, not marginal: a route that had been delivering around 4.1 mb/d to Yanbu since June, already a figure corresponding to two thirds of initial capacities, dropped to zero. With no restoration timeline or partial throughput figure reported for the shutdown period, we set Saudi Arabia's deliverable bypass capacity to zero for the affected window. With interactive Figure 2 we extend this assumption over the full 2003-2026 period. Thus, Figure 2 allows the reader to compare the evolution of our DASC for Saudi Arabia with or without Petroline, isolating exactly how much the country has been dependent on this single, physically undefended 1,200km pipeline and its structural role - rather than on any genuine diversity of export routes. This very recent event embodies Saudi Arabia's fragility. Deliverable capacity only holds if the infrastructure behind it survives - and Petroline's shutdown shows that nothing should be taken as granted.The UAE's ADCOP pipeline had far less headroom to begin with. Before the conflict, it was already carrying roughly 1.5 mb/d, over half of the UAE's daily crude exports, close to its original nameplate capacity, against a reported technical ceiling of 1.8 mb/d (CNBC, March 2026; Global Energy Monitor). That narrow margin explains why ADNOC moved to fast-track a doubling of ADCOP's capacity to 3 mb/d within 12–18 months of the closure, rather than simply running the existing pipeline harder (Seatrade Maritime, May 2026). The UAE's departure from OPEC and OPEC+ was driven only partly by dissatisfaction with the quota-setting process, it also reflected a logistics calculation. Freed from coordinated output ceilings, the UAE could pursue an independent expansion

strategy, targeting 5 mb/d of production (IER, May 2026) alongside this pipeline expansion. Remaining inside OPEC+ would have meant building export capacity it was not permitted to fully use.

Kuwait sits at the other extreme. With no pipeline linking its fields to any coast outside the Gulf, its entire spare capacity, modest but real at roughly 0.4 mb/d, became entirely stranded the moment the Strait closed, with no partial existing workaround available.

Iraq possesses a limited alternative export route through the Iraq–Turkey (Kirkuk–Ceyhan) pipeline, which connects northern oil fields to Turkey though the route has also been intermittently disrupted by governance disputes between Baghdad and the Kurdistan Regional Government over control of exports. Since most Iraqi production originates in the southern Basra region, this corridor evacuates only a fraction of national output. Iraq has partly offset this by trucking crude to Syria, and negotiations, backed by the US administration, are underway to revive a pipeline route through Syrian territory. Even so, most of Iraq's spare capacity remains effectively stranded.

Accordingly, DASC provides a snapshot of immediate deliverability under a given infrastructure configuration, but that snapshot is itself incomplete. Even barrels classified as "deliverable" are not equally valuable: crude that reaches Yanbu still faces a second logistics leg, Suez transshipment and a passage around the Cape of Good Hope, to reach the Asian markets that absorbed most pre-crisis Hormuz volumes, raising freight costs and reducing effective tanker availability. A binary deliverable/stranded classification therefore understates how much resilience really depends on cost, routing, and market access, not just physical throughput. Nor is deliverability static: a disruption may temporarily strand part of global spare capacity, but producers differ substantially in their ability to restore deliverable supply through investment, infrastructure expansion, and operational adaptation. This raises a second question: **beyond the capacity that remains available today, which producers are capable of maintaining, rebuilding and improving the competitiveness of market flexibility over time?**

2. Adaptability: rebuilding deliverable capacity over time

Deliberately conservative, DASC accounts only for operational deliverability. But it leaves a separate question unanswered, one this section takes up: not whether DASC itself should be adjusted upward as new bypass infrastructure comes online, but which producers are best positioned to turn an announced project into confirmed capacity fastest. The cases of Saudi Arabia and the UAE are quite illustrative as both producers have announced or initiated investments to expand alternative export infrastructure. The question is which of them can convert that announcement into deliverable barrels soonest.

As emphasized by Cherp and Jewell (2014), energy security should not be understood solely as the availability of resources, but also as the capacity of energy systems to withstand, adapt to and recover from disruptions. Applied to oil markets, resilience therefore depends not only on existing productive assets but also on the financial and industrial capabilities that allow producers to restore effective supply over time.

Adaptability can be understood as a multidimensional concept reflecting a producer's ability to restore deliverable supply following a prolonged disruption. It depends jointly on a producer's financial capacity, its institutional and governance environment, its existing infrastructure base, its geographic characteristic, and its exposure to chokepoint dependence. These dimensions jointly determine both the feasibility and the speed with which additional deliverable capacity can be brought to market. Accordingly, we operationalize adaptability through a five-pillar index - Financial, Governance, Infrastructure, Geographic, and Chokepoint - described in detail in the

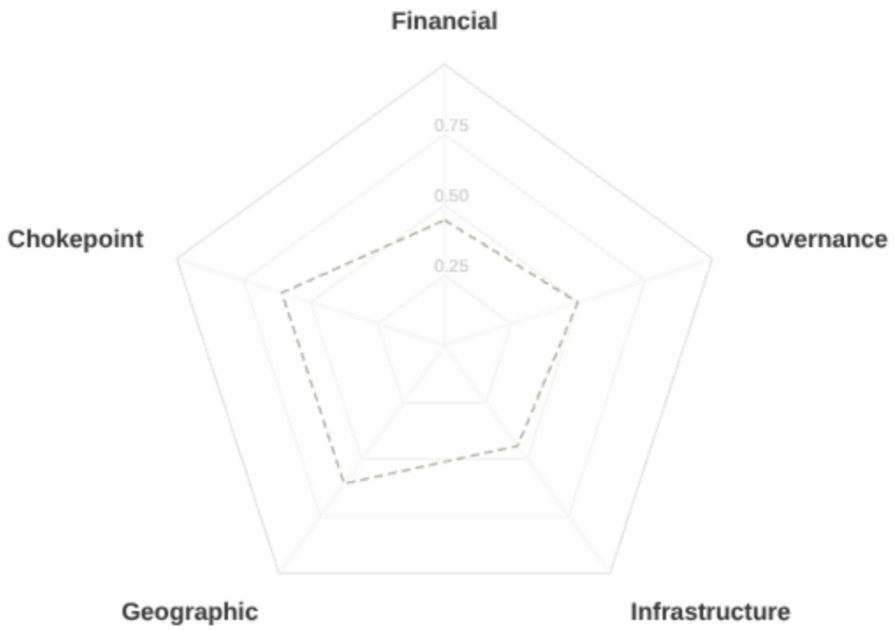
Annex. As such, the proposed framework complements the DASC by shifting the analysis from the immediate availability of supply to the structural conditions under which market resilience is rebuilt over time.

Five-pillar adaptability scores — OPEC & OPEC+

2017–2025 average · select up to 5 countries to compare against the full OPEC+ coalition average · higher = stronger structural position

COUNTRIES (A–Z, UP TO 5)

+ Add a country (0/5)



○ OPEC ● OPEC+ † former member · United Arab Emirates left OPEC+ 1 May 2026 · Qatar left OPEC Jan 2019 · dashed line = 2017–2025 average across the 22-country OPEC+ panel (reference only, no fill)

Among OPEC members with a genuine structural dependence on a maritime chokepoint, Saudi Arabia stands out on two of the five pillars[1]. It leads OPEC+ decisively on the Financial dimension (0.695, vs. 0.558 for Kuwait, the next-highest), anchored by the Public Investment Fund's USD 1,038 billion in assets under management — flat across the panel as a single 2026 snapshot rather than a time series — and comparatively strong foreign exchange reserves, at roughly USD 460–515 billion over 2017–2025. This financial strength has coexisted with a marked rise in gross government debt, however, from 16.0% of GDP in 2017 to 31.7% in 2025 due to economic diversification Saudi Arabia also leads OPEC on Infrastructure (0.540). On Governance, the kingdom trails Kuwait[2]. On Geographic

characteristics, it trails Iran; and on Chokepoint resilience specifically, its score (0.223) remains well below the United Arab Emirates' (0.566) — not because Saudi Arabia fails to route crude through its bypass (Petroline already carries roughly 22–28% of exports away from Hormuz, rising as capacity expanded to 7 mb/d in 2025), but because that bypass route is not itself chokepoint-free: crude reaching Yanbu on the Red Sea must still transit Bab-el-Mandeb — itself exposed to Houthi attacks — or take the longer route around the Cape of Good Hope, to reach the Asian markets that absorb most Saudi exports. The 10 September 2026 drone attack that took Petroline offline entirely underscores the same fragility upstream: the whole route is not only exposed at its downstream endpoint but along its own lengths[3]. By contrast, the UAE's ADCOP route to Fujairah on the Gulf of Oman opens directly onto international waters with no secondary chokepoint. Saudi Arabia's bypass therefore reduces Hormuz-specific exposure without eliminating chokepoint dependence altogether — a distinction the framework's residual bypass-exposure component is designed to capture.That gap between installed capacity and realized resilience is itself informative: it suggests the kingdom's near-term adaptability challenge lies less in building further bypass infrastructure, capacity it largely already possesses, than in the commercial and logistical adjustments needed to route a larger share of existing exports through it.

While Saudi Arabia represents the benchmark case of financial scale, the United Arab Emirates demonstrates a comparable degree of adaptability through a different route - leading the full 22-country sample on composite adaptability (0.786), with the highest Governance score in the sample (0.889) reflecting an institutional environment well suited to delivering large-scale projects, and a Financial score (0.727) that itself edges out Saudi Arabia's. Rather than matching Saudi Arabia's scale of bypass investment, the UAE's Abu Dhabi Crude Oil Pipeline (ADCOP) - connecting inland production to the Fujairah terminal on the Gulf of Oman, and bypassing the Strait of Hormuz entirely - delivers just 1.8 mb/d of capacity against Petroline's 5 mb/d. A further pipeline, West-East 1, is under construction and targets roughly 1.5 mb/d more, with completion planned for 2027 - not yet reflected in this panel's 2017–2025 window. Despite the smaller absolute capacity, the UAE records the highest Chokepoint resilience score among genuinely exposed producers in the sample (0.566, against 0.223 for Saudi Arabia) - because Fujairah opens directly onto the Gulf of Oman with no secondary chokepoint downstream, unlike Yanbu, which still requires transiting Bab-el-Mandeb or rounding the Cape of Good Hope to reach Asian markets. The contrast is therefore not one of effort or utilization, but of route geography: a shorter bypass to genuinely open water outperforms a longer one that trades one chokepoint for another.

However, financial strength alone does not necessarily translate into comparable adaptability. Kuwait illustrates the limits of relying primarily on financial resources. Although the country possesses one of the world's largest sovereign wealth funds (USD 1,011 billion) and therefore faces few constraints in mobilising capital, its ability to convert financial resources into additional deliverable capacity remains comparatively limited: its Infrastructure scores lag those of Saudi Arabia and the UAE, and it has no bypass infrastructure of any kind. Geography compounds the problem: Kuwait's single coastal facade faces the Gulf directly onto the Strait of Hormuz, and the nearest alternative coastline lies some 1,150 km away, reachable only by crossing another country's territory. The entirety of Kuwait's crude exports transits the Strait of Hormuz - 100% throughout 2017–2025, with no alternative route - leaving it, alongside Bahrain, among the most exposed producers in the sample regardless of its financial capacity to eventually build one.

Russia occupies a distinctive position within the adaptability framework. Its Chokepoint resilience score (0.879, among the highest in the sample) reflects genuine structural diversification - the ESPO/Kozmino Pacific corridor, Arctic terminals, and the Druzhba pipeline to Central Europe together keep its primary-chokepoint exposure low (11–13%) and largely chokepoint-free. Its Financial score (0.651) also ranks third in the sample, on paper - but this reflects macro-level buffers (foreign exchange reserves, a low measured risk premium) rather than actual access to capital, which sanctions have constrained since 2022. The clearer constraint is institutional: Russia's Governance

score (0.455) sits below the sample average, driven by a marked deterioration in rule of law and political stability indicators from 2022 onward that persists, unchanged, through 2025. Russia thus illustrates a distinct failure mode: strong physical and geographic diversification does not, on its own, guarantee adaptability when the institutional and financing environment constrains the ability to act on that diversification.

By contrast, the US could show a third way: outside of the 22-country sample analyzed in this note, it does not get a score here. However, it is worth a mention. The US has become the world's largest oil producer. In terms of export, it does not heavily rely on a single chokepoint (except for the Panama Canal) as the largest export basin is located in the Gulf of Mexico. Regarding spare capacity, the US oil sector is dominated by private companies that have the ability to produce more rapidly although with higher production costs compared to Gulf producers. Precisely these different features have put under pressure OPEC spare capacity.

Conclusion

Nominal spare capacity does not necessarily translate into market power. Indeed, the Hormuz crisis shows that what matters is deliverability, not volume per se, since a large share of OPEC+'s buffer proved unreachable once its main export route closed. That gap is uneven and not fixed - producers' capacity to rebuild deliverable supply over time depends on financial, governance, and infrastructure factors that vary sharply across the coalition. This shift is already reshaping producer behavior, as the UAE's 2026 exit from OPEC+ shows once deliverability starts to rival volume as the basis of market power. (Coordinated) production policies remain important; however, export logistics gain relevance as key defining characteristics of market power and geopolitical relevance as the UAE's withdrawal from OPEC illustrates. Consequently, this shift also causes significant changes for energy security in light of the volatile developments. As fixed infrastructure becomes easier to target and harder to fully defend, energy security may no longer mean preventing disruption, but managing how well a system holds up once disruption is unavoidable - and by that standard, a spare-capacity buffer that cannot reach the market is not resilience at all as the attacks to the Saudi East-West Pipeline shows.

Annex: Construction of the Five-Pillar Adaptability Index

The five-pillar index is constructed from a panel of 22 OPEC and OPEC+ countries over 2017–2025. Each pillar aggregates a set of structural indicators into a single normalised score ranging from 0 to 1, where higher values reflect greater structural strength or resilience in that dimension.

- **Normalisation.** Within each year, each raw indicator is rescaled to [0,1] by dividing each country's value by the maximum observed across the group that year (raw share method). Where an indicator is naturally oriented so that lower values reflect better performance — gross government debt, country risk premium, fragile state score — the sign is reversed prior to normalisation. Indicators within each pillar are then averaged with equal weight to produce the pillar score.
- **Financial pillar** combines six indicators: gross government debt as a share of GDP (IMF World Economic Outlook), the country risk premium (Damodaran), the central bank independence index (Romelli et al.), FDI inflows, foreign exchange reserves (World Bank WDI), and sovereign wealth fund assets (SWFI, 2026 snapshot, held constant across all panel years). The first two are inverted prior to normalisation.
- **Governance pillar** combines seven indicators drawn from two sources: the V-Dem/World Bank Worldwide Governance Indicators (control of corruption, rule of law, political stability, government effectiveness), the World Bank Ease of Doing Business score, the Fragile States Index (Fund for Peace), and the diplomacy share index (Pardee Institute FBIC). The fragile states score is inverted prior to normalisation.

- **Infrastructure pillar** combines two indicators: container port traffic in TEUs and the Logistics Performance Index overall score, both from the World Bank. Air freight was excluded as conceptually irrelevant to oil and gas export logistics.
- **Geographic pillar** is represented by a single composite score (GEO_SCORE, 0–100) reflecting the multiplicity of maritime export facades (weight 0.7) and the proximity of an alternative coastline (weight 0.3), constructed from hand-collected data on coastline characteristics, facade typology, and landlocked status.
- **Chokepoint exposure pillar** is represented by a single composite score, CHK_RESILIENCE_SCORE (0–100, higher indicating greater resilience), constructed from hand-collected data as 100 minus CHK_EXPOSURE_SCORE. CHK_EXPOSURE_SCORE itself combines the share of crude exports transiting the primary chokepoint (weight 0.7) and the residual chokepoint exposure of any bypass route (weight 0.3), reflecting that a bypass route is only partially chokepoint-free if it still requires transit through a third country or a secondary chokepoint. An earlier version of this pillar averaged CHK_EXPOSURE_SCORE and CHK_RESILIENCE_SCORE together; because the two are exact complements by construction, this produced an uninformative constant score of 0.5 for every country-year and has been corrected to use CHK_RESILIENCE_SCORE alone. Both underlying scores were developed by O. [surname] and are described in detail in the accompanying technical note.
- **Absolute bypass capacity** (chk_bypass_capacity_mbd, in mb/d) is reported separately alongside the Chokepoint pillar score where relevant in the text, to distinguish the scale of a producer's bypass infrastructure from the share of its exports actually routed through it — a distinction the normalised pillar score alone does not convey.

Notes and references

01 Composite scores for some other OPEC members (e.g., Algeria, Gabon, Nigeria) benefit from very high Chokepoint scores that largely reflect the structural absence of chokepoint dependence rather than built resilience or bypass investment. Comparisons here are restricted to producers with an actual Hormuz (or equivalent) exposure, since the framework's purpose is to assess adaptive response to that exposure specifically.

02 The gap is driven almost entirely by two of the seven Governance sub-indicators — measured political stability and the Fragile States Index — where Kuwait scores meaningfully better (a 0.72-point advantage on political stability, and a 15.5-point lower, i.e. better, fragility score). Saudi Arabia in fact leads Kuwait on the remaining indicators: control of corruption, government effectiveness, and the Ease of Doing Business score. The composite Governance score should therefore be read as capturing perceived political stability and state fragility risk alongside institutional and administrative capacity, not administrative capacity alone — on the latter, narrower dimension, Saudi Arabia would outperform Kuwait.

03 See Figure 2, comparing Saudi Arabia’s DASC-adjusted across 2003-2026 with Petroline operational or not - isolating how much the country’s apparent deliverability depends on this single route.

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