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Geoeconomic Fragmentation: Risks to Renewable Energy Supply Chains

Sustainability Research Paper

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Geoeconomic fragmentation — the progressive realignment of trade, investment and technology flows along strategic rather than purely economic lines — has, in recent years, moved from a scenario to a standing feature of the energy transition. As strategic blocs reshape supply chains and redirect capital flows, the policy outcomes first identified from 2022 – higher-for-longer interest rates, tighter credit standards and reduced fiscal headroom in developing economies – have become defining characteristics of a fragmented global economy rather than forward-looking risks.

This paper examines the nature and impact of geoeconomic fragmentation across five sections, following the industrial chain on which the energy transition depends: supply chain concentration, renewables technology, the financing of the transition, governance and trade, and a specific focus on MENA and the Global South.

SUSTAINABILITY RESEARCH PAPER

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03 EXECUTIVE SUMMARY

- Geoeconomic fragmentation has become a fixture of the energy transition rather than a peripheral scenario. Evidence shows simultaneous impacts across mineral refining, capital markets, shipping routes and regulatory systems, with direct consequences for the speed, cost and distribution of renewable deployment.
- The midstream stage of the critical minerals value chain has grown more concentrated, with China predominant across the principal energy-related minerals and Indonesia commanding nickel. The International Energy Agency's (IEA) stress test, which notionally removes the largest single supplier, finds that residual global capacity would be insufficient to cover projected 2035 demand for battery metals and rare earth elements.
- Policy has compounded these structural conditions. Two waves of Chinese rare-earth export controls in 2025, the second suspended but not withdrawn, have lifted European prices several-fold and introduced extraterritorial licensing covering foreign goods containing Chinese-origin material.
- Parallel US tariff action and the sequenced implementation of the EU Critical Raw Materials Act, European Sustainability Reporting Standards, amendments to IFRS S2 and the high-risk obligations of the EU AI Act have produced a complex compliance environment, particularly for resource-constrained firms.
- The near-closure of the Strait of Hormuz from late February 2026 added a physical shock. Cost transmission through freight, insurance and energy channels has been

uneven, falling hardest on smaller importers and debt-stressed economies. Disruption extended beyond crude oil to sulphur, petroleum coke and aluminium, feeding directly into the manufacture of renewable hardware.

- The transition has nevertheless continued. Global solar deployment reached record levels and renewables overtook coal as the leading source of generation in 2025. Yet the IEA now expects capacity to double rather than triple by 2030, with the shortfall attributable to grid, permitting and capital constraints.
- Offshore wind costs have risen by 30-40% since 2022; the renewables insurance protection gap has widened; and the cost of capital for utility-scale solar in emerging markets and developing economies remains more than twice the advanced-economy level.
- Capital markets have begun to recognise the issue. The Network for Greening the Financial System published a Fragmented World Scenario in November 2025, and the International Monetary Fund (IMF) has identified fragmentation as the dominant downside risk to its revised growth projections.
- The joint IMF-World Bank USD 150 billion pledge at the April 2026 Spring Meetings, alongside continued Gulf debt-market access, supports a material multilateral response, though not yet at the scale needed to close the financing gap in Emerging Market and Developing Economies (EMDE).
- The MENA region sits at the centre of these dynamics. Contracted pipelines, cross-border interconnection and green hydrogen export plans remain in place, but execution capacity, not procurement or target-setting, is now the binding constraint.
- Whether the Global South secures sufficient blended finance and operates an integrated assurance framework spanning sanctions screening, sustainability disclosure and supply-chain due diligence will largely determine delivery on the 2030 tripling pledge.

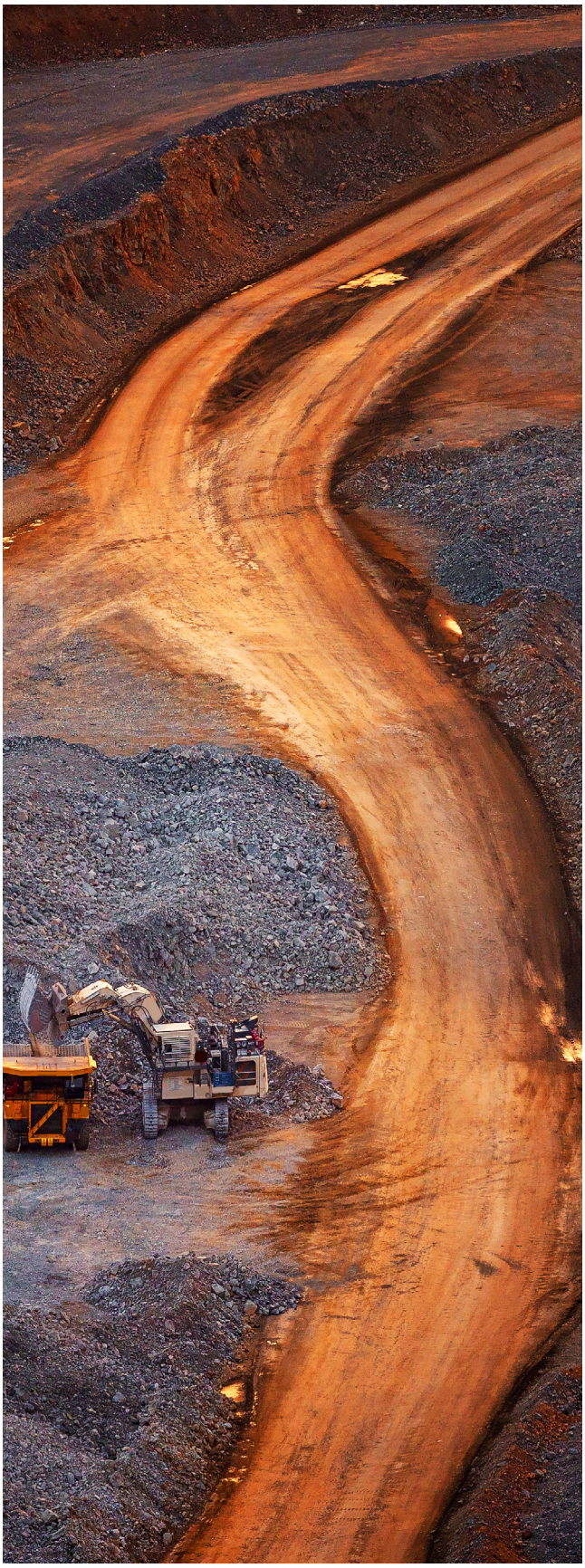
05 SUPPLY CHAIN CONCENTRATION

Refining of critical minerals — the midstream step between extraction and manufacturing — has grown more concentrated rather than less. The IEA's Global Critical Minerals Outlook 2025 reported that the average market share of the top three refining nations has risen to 86% by 2024, with roughly 90% of supply growth in each mineral attributable to the single largest producer: Indonesia for nickel and China for cobalt, graphite, and rare earth elements.[1]

The IEA's research suggests the top three share will decline only marginally, to 82% by 2035, effectively reverting to 2020 levels. China is the dominant refiner for 19 of the 20 energy-related minerals tracked by the IEA, with an average market share of approximately 70% and more than 90% of rare-earth separation capacity. [1]

The N-1 resilience test, which models the exclusion of the largest single supplier, indicates that residual global capacity would meet only about half of the projected 2035 demand for battery metals and rare earth elements. A sustained supply shock could raise average battery pack costs by 40-50%, eroding the cost declines on which transition economics have so far depended. [1]

Mineral-specific exposure has differed materially. Indonesia accounts for more than 60% of global mined nickel and over half of refined (Class 1) nickel. In comparison, the Democratic Republic of Congo supplies roughly 70% of mined cobalt, with downstream refining controlled by China. Graphite anode material has remained over 90% Chinese-refined, the single most concentrated input in the renewables value chain. [12]



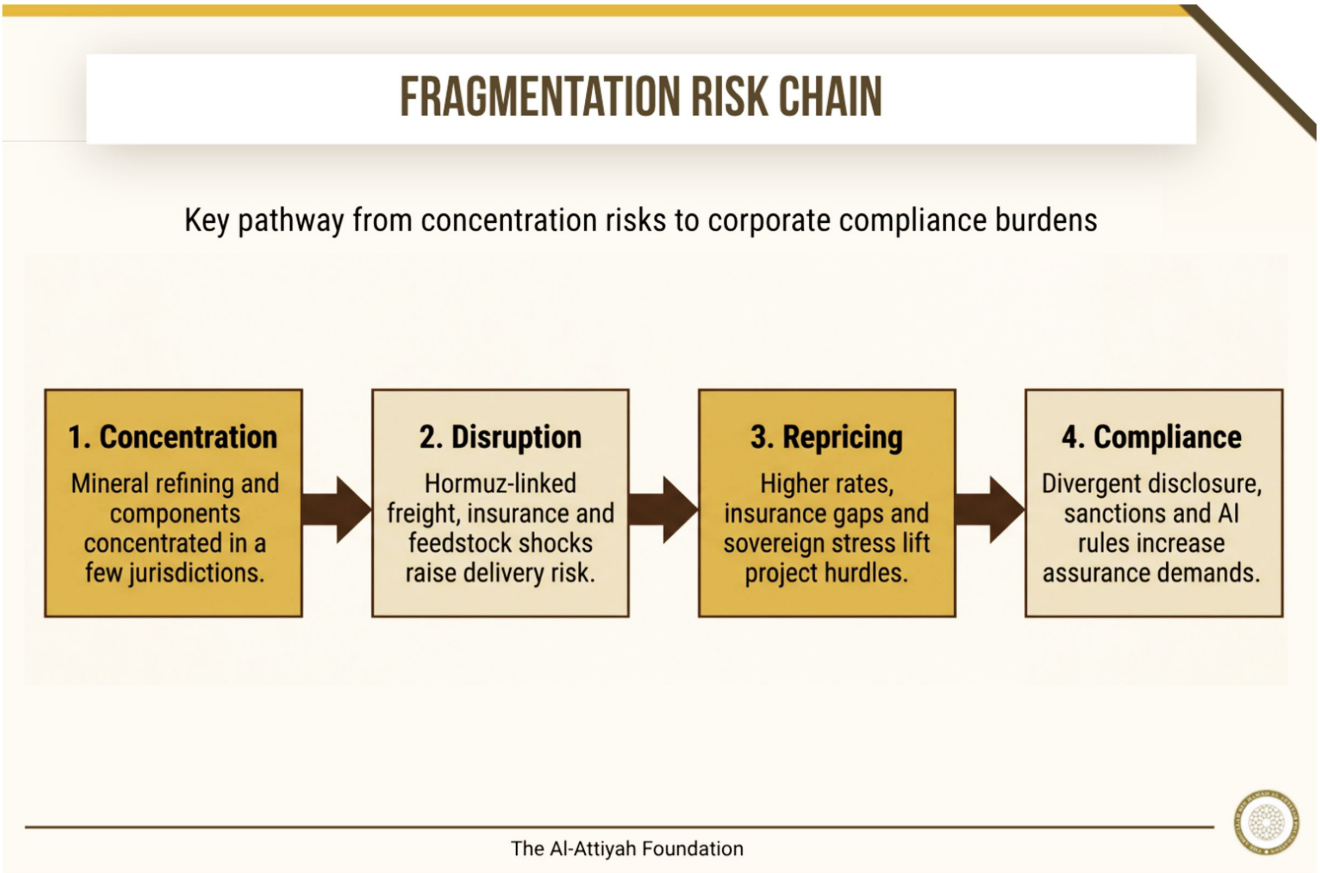
Peer-reviewed modelling of hard-bloc fragmentation, which reflects mineral trade split along geopolitical lines, has estimated material declines in global renewables investment and in electric vehicle production under restrictive scenarios relative to "cooperative" net-zero pathways. The same literature links hard-fragmentation outcomes to permanent global output losses of up to 7%, indicating that mineral concentration could entail broader macroeconomic penalties rather than being a narrow supply-chain problem.[12,14]

The academic literature provides a useful macro-financial context. The IMF finds that tariff and subsidy measures designed to reduce strategic dependencies often increase global welfare costs without meaningfully lowering concentration, because trading partners respond with counter-measures that impede any intended diversification.[14]

One option for MENA project developers has been to base their future battery-storage cost assumptions on scenario ranges derived from the IEA N-1 resilience test and peer-reviewed geoeconomic fragmentation studies, rather than simply extrapolating the 2020-24 cost-decline trend forward.[1]

Policy actions through 2025 have compounded geoeconomic fragmentation. China's Ministry of Commerce introduced rare-earth export controls in two waves, in April and October 2025. The April wave-imposed licensing upon seven heavy rare earth elements and all related compounds, metals and magnets. The October wave added five further rare earth elements, related equipment, technologies and personnel expertise, with extraterritorial provisions covering foreign-made products containing trace amounts of Chinese-origin material.[2]

Figure 1: Fragmentation Risk Chain



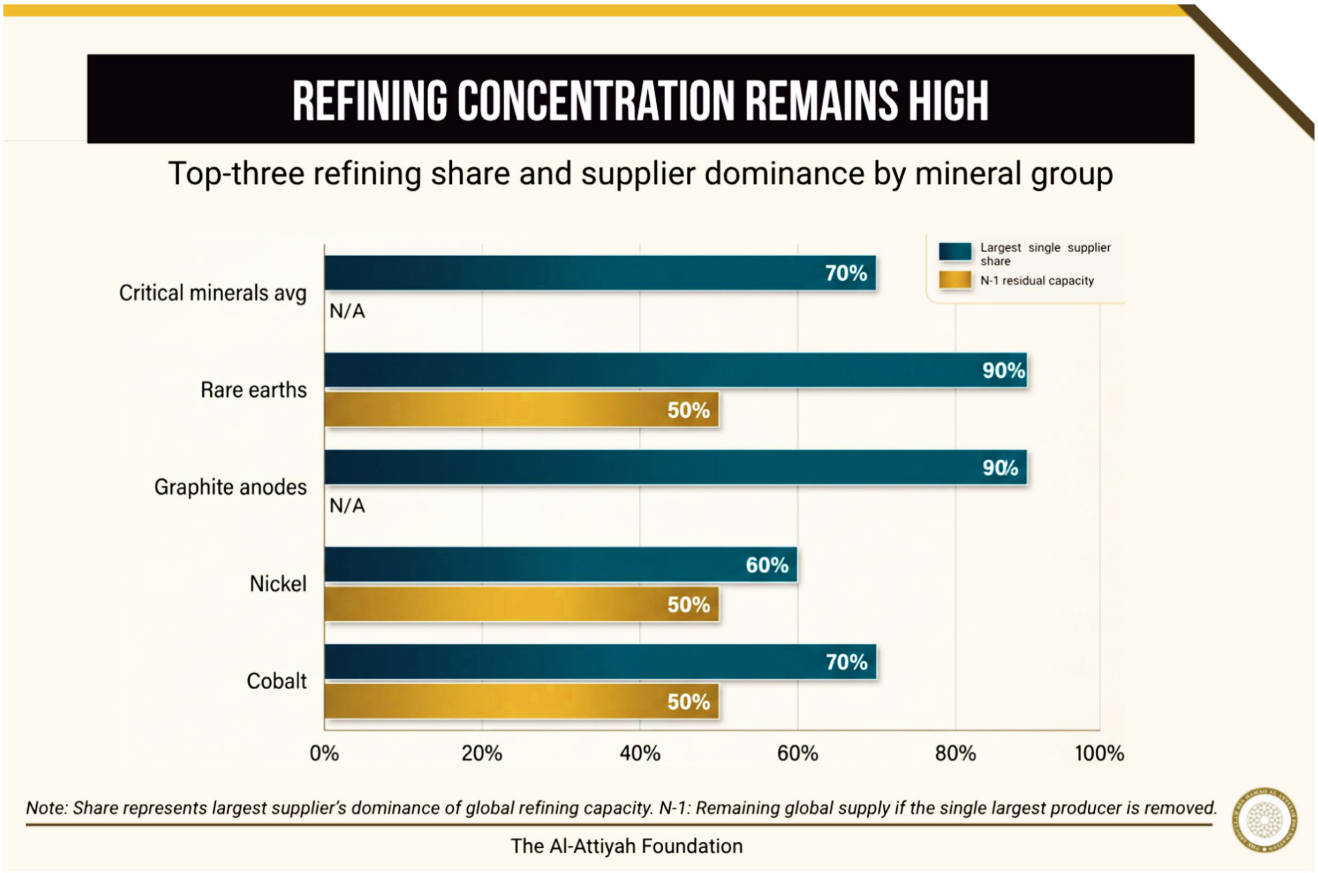
In November 2025, the second wave was suspended until November 2026, creating a one-year window but not rescinding the licensing legislation. Licences have been applied selectively by end-user and end-use, preserving the capacity to reimpose controls at short notice. The European Parliament has assessed that controls expose major supply chain vulnerabilities, and the European Central Bank has estimated that over 80% of large European firms are no more than three intermediaries away from a Chinese rare-earth producer.[2]

The US has pursued parallel tariff escalation, imposing 50% levies on Chinese solar cells alongside rising duties on critical minerals and batteries, while advancing related procurement frameworks with the EU and Japan.

Local-content mandates have risked tension with World Trade Organization non-discrimination rules, with the Energy Transitions Commission distinguishing between resilience targets, likely to survive dispute-settlement scrutiny and industrial-policy targets, less likely to do so.[15]

Since late February 2026, events in the Strait of Hormuz have added physical disruption on top of these regulatory barriers. The United Nations Conference on Trade and Development (UNCTAD) has reported that higher energy, freight and insurance costs have propagated across interconnected markets, reducing fiscal space in developing economies already under debt-service strain.[3]

Figure 2: Concentration of Global Refining Capacity



Freight channels have transmitted the disruption unevenly. Tanker rerouting via the Cape of Good Hope has added 14 to 21 days of voyage time per round trip, affecting smaller importers that cannot easily absorb longer cash-conversion cycles. The effect on importers of renewable-energy equipment has been second order but still significant, because many wind and solar support components - such as mounting structures, inverters and cabling - move as containerised cargo along the same routes.[3]

The disruption has extended well beyond crude oil to other commodities used in renewable-energy supply chains, including sulfur, petroleum coke, aluminium and iron-ore pellets.

Sulfur is used in the processing of nickel and cobalt and in the production of key chemicals for lithium iron phosphate batteries. Petroleum coke is used to make graphite and aluminium anodes. Shocks to these inputs feed directly into the cost of renewable-energy equipment.[16]

Firms that depend on the Gulf transit corridor are beginning to treat stock levels of critical minerals and key processing materials as key risk metrics, tracking inventory days at the board level and updating benchmarks each quarter against UNCTAD and World Economic Forum commodity indicators.[16]

Global solar photovoltaic installations exceeded 600 GW in 2025, a 12% year-on-year increase which lifted cumulative installed capacity to approximately 2.8 terawatts and rendered solar the largest installed power-generation technology in the world by capacity.[4]

The IEA expects global renewable capacity to more than double, but not triple, by 2030. Constraints are mainly due to permitting delays, grid-connection queues, and higher financing costs, rather than a lack of equipment. To reach the tripling goal, annual additions would need to be about 45% higher than today and that increase would have to be sustained for five years.[4]

Peer-reviewed literature has offered complementary evidence. Bogdanov and co-authors (2025) show that, in cost-optimal transition pathways, most new power comes from a combination of solar generation and battery storage, but that rigid grids and limited cross-border transmission are the main factors holding these scenarios back. This result aligns with the IEA's findings.[17]

Cost pressure has concentrated in offshore wind. Project costs have risen by 30 to 40% between 2022 and 2025, with several European developers cancelling or renegotiating power purchase agreements during 2025 amid tighter capital markets and supply chain friction. Escalation has persisted into 2026, with working capital and hedging costs remaining elevated.[5]

Onshore wind has been more cost-resilient, with turbine manufacturers absorbing a greater share of input cost pressures rather than passing them all on to project developers. They have partly done this by setting aside more budget to cover future repair and performance obligations under their long-term warranties.

Supply chains for blades and towers remain concentrated among a small group of European and Chinese original equipment manufacturers. Sponsors diversifying across onshore and offshore wind have retained greater negotiating flexibility than single-technology developers.[5]

Boston Consulting Group has identified steel, copper, cabling and other heavy industrial inputs as major cost drivers in offshore wind, supporting the conclusion that the energy-price shock has pushed up the underlying cost of turbines and related hardware, not just wholesale power prices.[5]

One reporting option has been to disclose the levelised cost of energy (LCOE - the lifetime average cost per unit of electricity), both at the point when a contract is awarded and again once a project is operating, with the difference between the two used as an early warning of how far higher input costs are being passed through into power purchase agreements. In the absence of such a distinction, the profitability that is signalled to shareholders is likely to be overstated.[4]

Next-generation solar cells have made clear progress. A new class of perovskite–silicon tandem panels, which add a thin perovskite layer on top of a conventional silicon cell to capture more sunlight, has exceeded 34% efficiency in 2025 laboratory tests, surpassing the theoretical ceiling for standard silicon panels and, over time, helping to ease dependence on the high-purity polysilicon currently concentrated in Chinese refining.[6]

Commercial deployment has remained constrained by durability and content concerns. There are open questions about how long they will last in real-world conditions and about the small amounts of lead they contain.

Regulators in the EU have not yet given clear long-term guidance on how such materials will be treated under existing product-safety and waste rules.[6]

Grid-scale battery storage economics have improved in parallel, but this has exposed a complementary risk of concentration. Lithium iron phosphate cell costs fell below USD 90 per kilowatt-hour in 2025, underscoring the doubling of announced storage pipelines in MENA and South Asia. Cell supply has nonetheless remained over 80% Chinese.[4]

Distributed energy resources such as rooftop solar, on-site batteries and smart inverters have, in several advanced economies, grown faster than large, utility-scale projects in 2025. In the MENA region, these smaller, customer-side systems have provided a practical route to residential and commercial uptake, broadening deployment patterns and reducing reliance on lengthy approval cycles for very large projects.[4]

Pathways that connect electricity with heat, transport and industrial energy use have gained importance in system planning. Studies by Bogdanov and others suggest that linking electricity and heat through technologies such as power-to-heat and thermal storage can reduce overall system costs by around 5 to 15% in regional scenarios, with clear relevance for district cooling and industrial heat applications in the MENA region.[17]

AI-based grid tools are now widely used by transmission system operators in advanced economies to keep supply and demand in balance in real time as wind and solar have grown. The high-performance chips that power these systems are manufactured on very small semiconductor "nodes" of around 5 nanometres, which only a few firms - currently including TSMC, Samsung and Intel - can produce at scale.[4]

The IEA has highlighted grid integration and storage as the main constraints on meeting the 2030 goal of tripling global renewable capacity, noting that transmission permitting in OECD countries typically takes 2 to 10 years and has become a key bottleneck. At the project level, long waits for a grid-connection slot have therefore become a useful early signal that deployment is likely to fall behind headline targets.[4]

The volatility of energy prices following the Gulf disruption has, paradoxically, reinforced the strategic case for renewables. The United Nations Framework Convention on Climate Change (UNFCCC) has noted that 2025 was the first year in which renewables overtook coal as the foremost source of electricity, with clean energy investment in excess of USD 2 trillion, double the fossil-fuel total. The milestone has reframed renewables from a climate-policy instrument to an energy-security instrument, a shift similar to the European response to the 2022 gas shock.[18]

The near-term impact has also been significant. Independent analysis suggests that repair and restoration of damaged Gulf energy infrastructure could cost at least USD 25 billion, with work on liquefied natural gas facilities expected to run over several years, drawing on the same engineering capacity needed for scaling up renewables.[19]

The analytical implication is a widening divergence between long-run acceleration scenarios and the deployment pace expected over 2026-28. Sponsors can reflect this in project business cases by treating short-term disruption and long-term policy support as separate scenario dimensions, rather than blending them into a single average trajectory.[18]

A persistent gap in financing costs has carried over into 2026. The IEA finds that developers of large-scale solar projects in emerging market and developing economies (EMDEs) typically face borrowing costs more than twice those in advanced economies, so that interest and other financing charges make up more than half of the levelised cost of electricity in many such markets.[7]

Capital allocation has remained uneven. EMDEs excluding China received about USD 300 billion of the roughly USD 3.3 trillion invested in global energy in 2025 - around 15% of total flows, despite accounting for about half of projected growth in global energy demand - and the IEA highlights first-loss guarantees, concessional debt and local-currency facilities as the main tools for closing this gap.[7]

The IMF has modelled bloc-based trade restrictions and has found permanent global output losses of up to 7% in hard-fragmentation scenarios, with EMDEs disproportionately affected through terms-of-trade and capital-flow channels.[14]

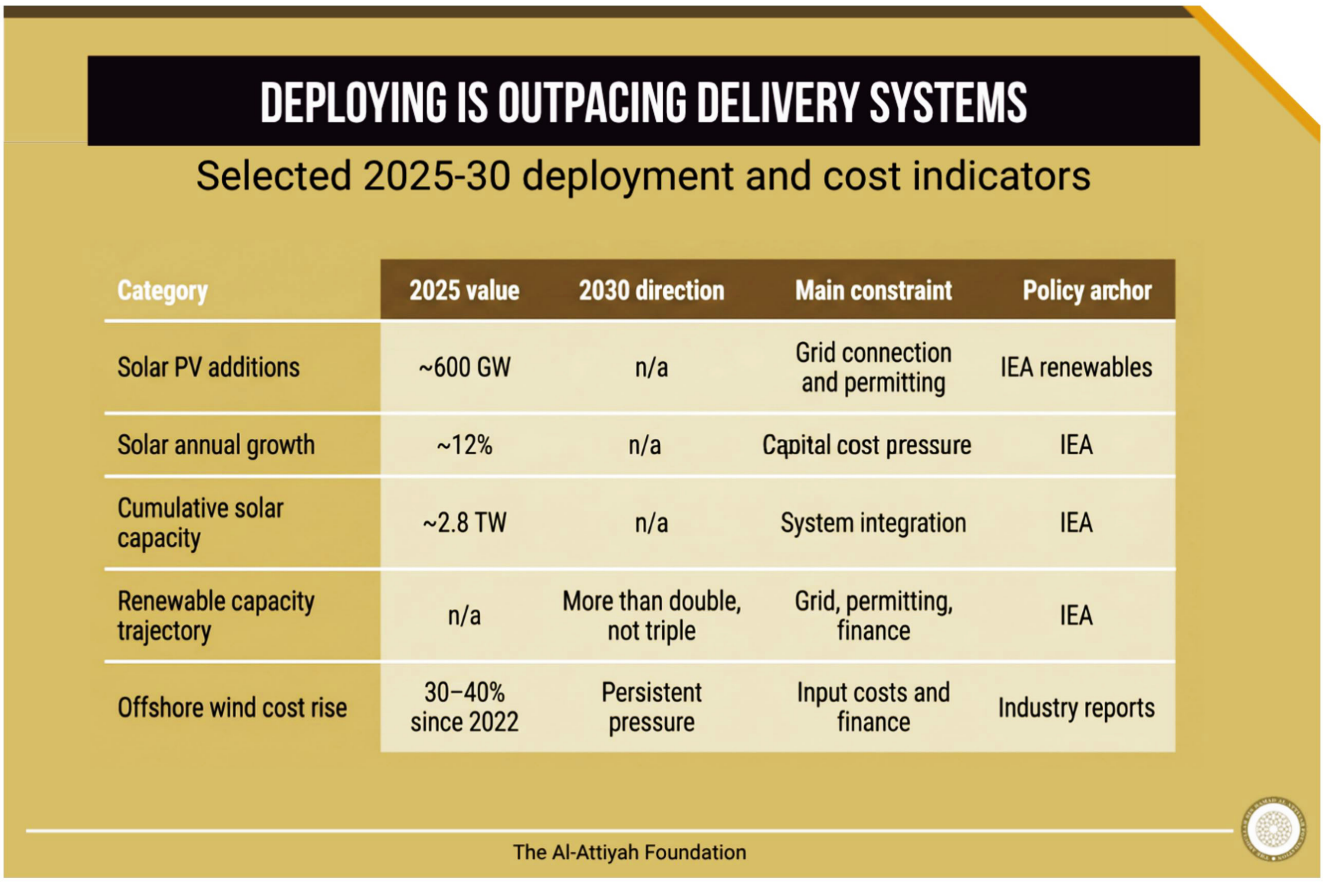
Lender underwriting has repriced since late February 2026. The IMF Global Financial Stability Report of April 2026 found that emerging-market assets and currencies were strongly affected after the Middle East conflict intensified, especially in commodity-importing and more vulnerable economies, with financial conditions tightening the longer the conflict persisted. That environment has raised minimum viable (hurdle) rates for Gulf-linked renewables project finance and lengthened credit committee timelines.[20]

The gap between the risks renewable projects face and the insurance available to cover them widened further in 2025, as reinsurers reduced their exposure to projects facing intertwined geopolitical, economic and climate risks, slowing financial close and increasing the cost of protection against extreme losses. One practical measure of this for board risk committees has been the share of project capital expenditure that is actually insured, tracked each quarter and compared with the market price of sovereign credit default swaps for the host country as a proxy for wider risk conditions.[21]

Local-currency and Islamic-finance instruments have partially offset hard-currency pricing pressure. Green sukuk issuance from Gulf sovereigns and quasi-sovereigns reached approximately USD 18 billion in 2025, with Saudi, Emirati and Qatari entities accounting for the majority, thereby providing a Shariah-compliant channel that has reduced exposure to conventional CDS-based repricing pressures.[7]

The Network for Greening the Financial System Phase V long-term scenarios have introduced the Fragmented World pathway alongside Net Zero 2050 and Current Policies, projecting a material cumulative global investment shortfall by 2050, with EMDEs bearing a disproportionate share of it. The accompanying short-term scenario documentation has incorporated compound events - including simultaneous mineral disruption, maritime chokepoint closure and tighter financing conditions - directly applicable to the present situation in the Strait of Hormuz.[8]

Figure 3: Overview of renewables deployment and delivery



The International Monetary Fund's 2023 Climate Note is the main reference point for modelling climate and fragmentation risks and recommends that scenarios build in persistently higher policy rates, tighter lending standards and reduced fiscal space in EMDEs. Where treasuries have continued to plan multi-year renewables programmes using pre-2022 assumptions about interest rates and borrowing conditions, they have significantly understated the ongoing financing cost of holding these commitments on balance sheet.[13]

The multilateral response has accelerated. The IMF and World Bank have jointly pledged up to USD 150 billion at the April 2026 Spring Meetings to support the countries most affected by the energy shock, reframing renewables investment as a form of resilience insurance rather than a climate obligation.[11]

Gulf sovereigns have retained access to finance despite infrastructure damage. Abu Dhabi, Qatar and Kuwait are reported to have raised around USD 10 billion through privately placed US dollar bonds during the March-April 2026 ceasefire window, helping to offset lower hydrocarbon revenues and higher defence spending. Analytically, these transactions differ from green sukuk: the latter signal that transition-themed funding channels remain active, whereas the private placements show that high-grade Gulf issuers can still secure hard-currency liquidity under stress.[20]

The IMF World Economic Outlook for April 2026 has revised global growth down to approximately 3.1%, identifying the duration of conflict and deepening fragmentation as the dominant downside risks.

Sovereign stress has concentrated in energy-importing EMDEs, amplifying the case for concessional blended facilities over pure market instruments.[22]

Capital markets show early signs of structural fragmentation. The IMF's April 2026 assessment finds that foreign investors in EMDEs now react more sharply to swings in global risk appetite and that lower-rated borrowers in these markets face greater refinancing risk at a time of higher funding needs. This does not yet amount to clear evidence of a permanent "two-pool" bond market. Still, it supports the narrower conclusion that investors are differentiating more strongly between countries, depending on their exposure to conflict, inflation pressures, and debt vulnerabilities.[20]

Blended-finance structures have remained the primary means of unlocking stalled renewables project pipelines in EMDEs. By taking a first-loss position, multilateral development banks absorb the earliest potential losses and so attract private investors into junior capital at programme-level mobilisation ratios often targeted at around 1:3, enabling solar and wind projects in sub-Saharan Africa and South Asia that would not have passed conventional project finance committees on their own.[11]

Transition-financing plans calibrated to benign multilateral and reinsurance backdrops have required recalibration amid elevated sovereign spreads, reduced donor fiscal headroom, and the persistent withdrawal of insurance capacity currently observable.[22]

The EU Critical Raw Materials Act (Regulation 1252/2024) has established binding 2030 benchmarks of 10% domestic extraction, 40% processing and 25% recycling of the EU's annual needs for each strategic raw material, with a cap limiting any single third country to 65% of annual needs at any stage of processing.[23]

The European Commission has estimated that, at the time of adoption, 97% of the EU's magnesium supply originated in China and that 100% of rare earth elements used in permanent magnets were refined there. The European Court of Auditors (Special Report 04/2026) concluded in March 2026 that the implementation of the Critical Raw Materials Act (CRMA) has been hampered by financial, legal and administrative bottlenecks, with permitting timelines, financing of strategic projects and coordinated demand aggregation identified as priority areas for remediation.[9] The governance problem is therefore not confined to the setting of targets. It lies in the widening gap between legislative intent and administrative delivery. That same gap recurs in sustainability reporting, where frameworks have converged in direction but not in legal burden or timing.

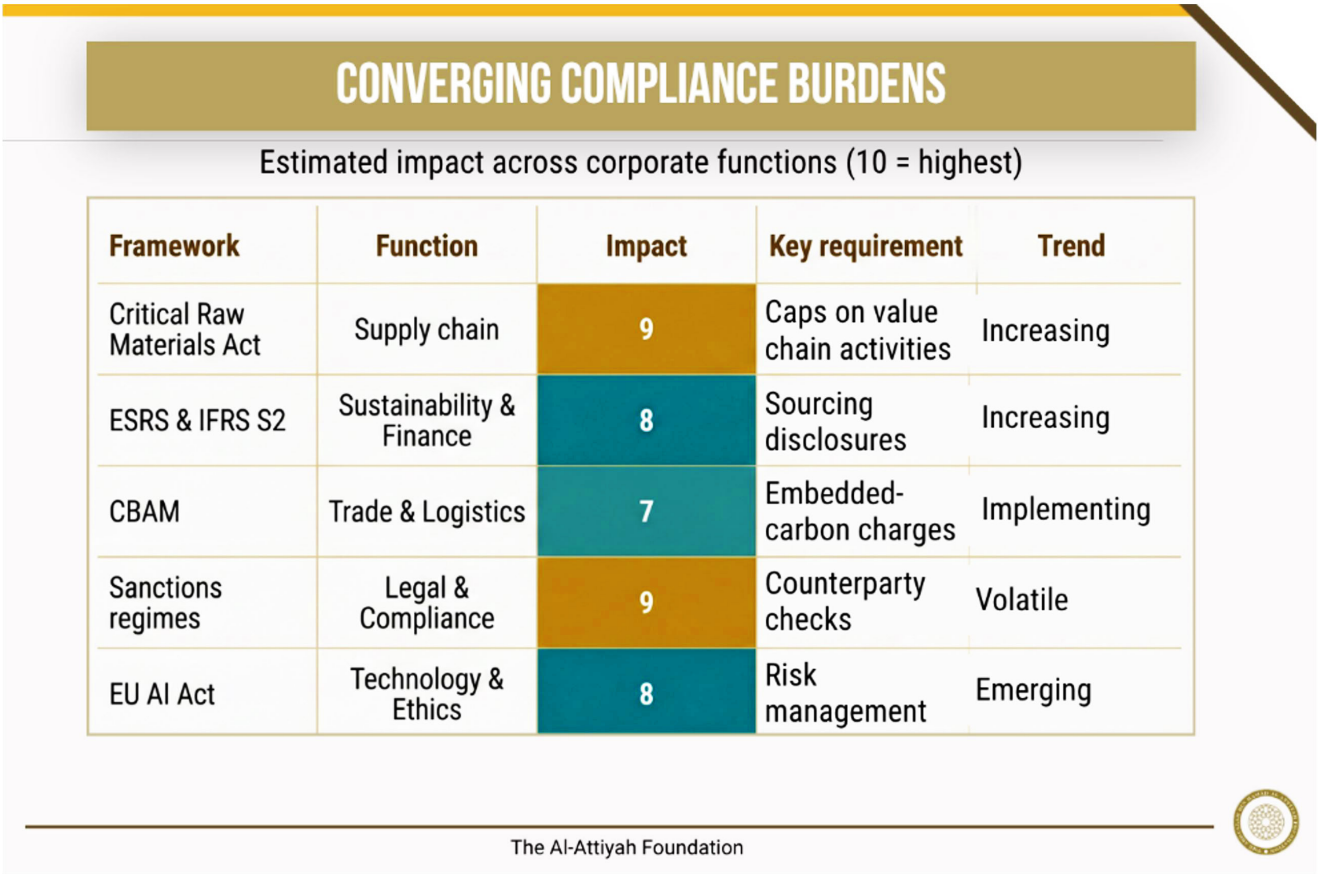
Disclosure frameworks have partially converged but remained divergent in detail. The EU Omnibus I provisional agreement of December 2025 and the European Financial Reporting Advisory Group's simplified European Sustainability Reporting Standards exposure draft have reduced the data burden by approximately two-thirds while retaining the principle of double materiality (finance and broader impact).[24]

In parallel, the International Sustainability Standards Board amended IFRS S2 in December 2025 to reduce the complexity of greenhouse-gas disclosure without diluting mineral-sourcing or concentration-risk requirements. The amendments have narrowed the quantitative gap between ISSB and ESRS reporters without dissolving it, leaving dual-listed renewables sponsors with a residual reconciliation task.[25]

The Organisation for Economic Co-operation and Development's (OECD's) five-step due diligence framework has remained the global anchor for cobalt, lithium and rare-earth traceability, providing the reference methodology against which corporate compliance reports have been benchmarked.[26]

Trade policy has reinforced disclosure pressures. The EU Carbon Border Adjustment Mechanism (CBAM) has entered its definitive phase from January 2026, applying embedded-carbon charges to imports.

Figure 4: Converging Compliance Burdens

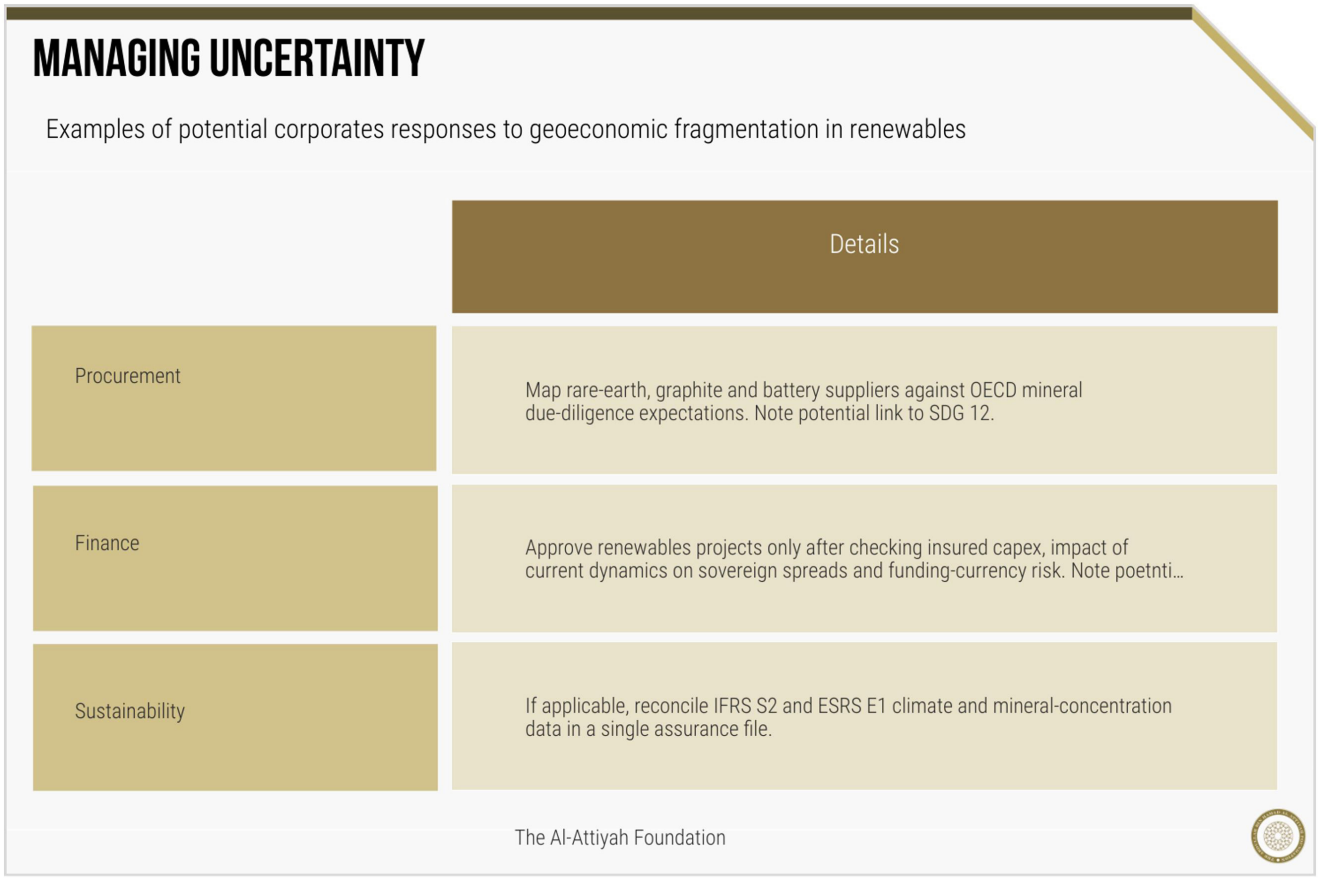


For renewables hardware, the mechanism has primarily affected steel towers, aluminium frames and electrical infrastructure, raising landed costs for non-EU suppliers that are not subject to equivalent domestic carbon pricing.[23]

The EU Corporate Sustainability Due Diligence Directive (CSDDD) has imposed a binding duty of human rights and environmental due diligence on in-scope firms, extending OECD-style traceability to direct and indirect business relationships. Transposition into member-state law has proceeded unevenly through 2025 and 2026, with enforcement architectures and civil-liability thresholds differing materially.[26] This widening compliance field then intersected with sanctions law. The result has not been a simple accumulation, but an interaction between regimes whose definitions of exposure and permissibility do not fully coincide.

Sanctions regimes have diverged structurally. EU sanctions against Iran were expanded in January 2026 and further extended by Commission Implementing Regulation (EU 2026/648) in March 2026, which added listed entities and tightened restrictions on drone and missile technology. In March 2026, the US Office of Foreign Assets Control (OFAC) authorised only the limited delivery and sale of Iranian-origin crude oil and petroleum products already loaded on vessels as of that date, while also designating additional Iran-linked shipping entities and authorities in the UAE took strong action against illicit financial operations connected to Iran. The practical consequence is a multiple-regime environment for firms with MENA exposure, in which compliance with one regime does not guarantee compliance with the others.[27]

Figure 5: Example Responses to Geoeconomic Uncertainty by Corporate Function



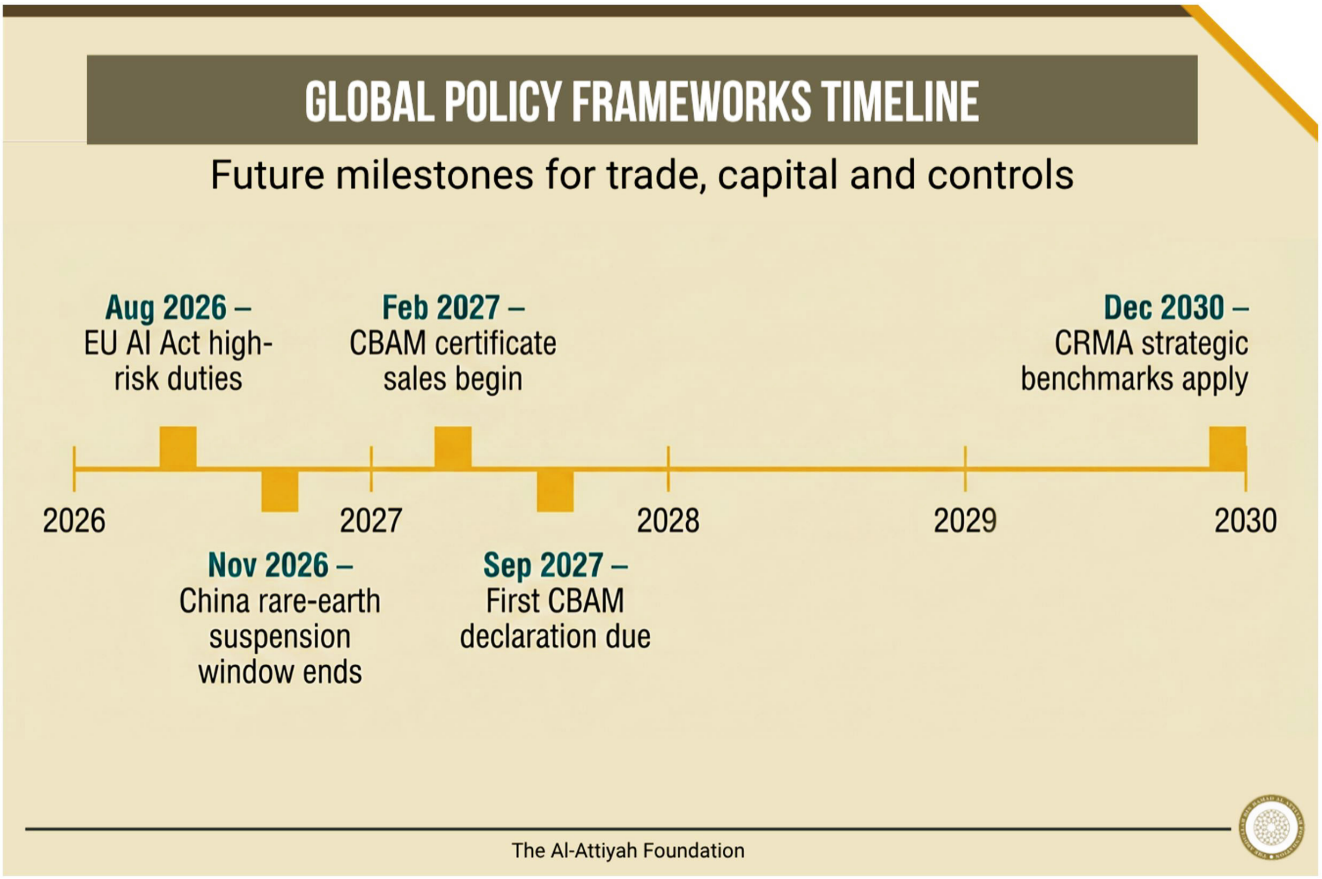
Inbound investment screening in the US under the Committee on Foreign Investment in the United States has tightened in parallel, with closer scrutiny of clean-energy and critical-mineral deals involving ultimate beneficial ownership in China or Iran. Outbound controls (under Executive Order 14105) now also require US persons to screen investments in the covered Chinese semiconductor, AI, and quantum sectors; as a result, dual-listed renewables firms must manage both inbound and outbound US reviews when structuring transactions.[27]

The next layer of governance complexity is digital rather than geographic. The EU AI Act's high-risk system obligations take effect on 2 August 2026.

Artificial-intelligence-enabled grid management, load forecasting and real-time dispatch systems for renewable generation fall within Annex III high-risk categories, triggering risk management, logging, human-oversight and conformity-assessment duties under the Act. Non-compliance penalties reach EUR 15 million or 3% of global annual turnover.[28]

One implication is that firms able to show a clear inventory of their AI systems mapped to the EU AI Act's Annex III high-risk categories (the EU list of high-risk AI uses), with documented human-oversight arrangements built into their existing enterprise risk management frameworks rather than left in separate silos, are likely to be seen as more ready for compliance.[28]

Figure 6: Global Policy Frameworks Timeline (2026-2030)



IFRS S2 (the global baseline for climate-related financial disclosures) and ESRS E1 (the EU climate-change reporting standard) require companies to quantify where key minerals originate and how concentrated their supplies are, and these requirements now intersect with sanctions-screening obligations. Feeding sanctions-compliance data directly into climate-risk disclosure processes, instead of running the two in parallel, is one way for firms to capture both financial-materiality and counterparty-risk dimensions within a single assurance framework.[25]

The planned UK Sustainability Reporting Standards, which are based on IFRS S1 (general sustainability) and IFRS S2 (climate), are scheduled for endorsement in 2026 and will allow flexibility on scope 3 emissions reporting and on how prescriptive transition plans need to be. For renewables sponsors with listings in more than one jurisdiction, this creates a complex reconciliation task between major international baseline requirements.[25]

Academic work on regulatory divergence offers a complementary perspective for boards. Peer-reviewed studies find that unilateral, trade-linked climate measures such as border carbon adjustments can face legal challenge under World Trade Organization (WTO) rules and may shift emissions abroad - so-called carbon leakage - if other countries do not move in step, which underlines the value of multilateral coordination mechanisms and "climate club" approaches.[15]

Deployment of renewables in the MENA region has moved into a clear acceleration phase. Recent analysis indicates that regional operational renewable capacity has grown rapidly, with a large solar project pipeline now covering a substantial share of stated 2030 targets and a significant volume of projects already under construction or in advanced development. Within this, the Gulf Cooperation Council (GCC) has emerged as a core hub, with sizeable grid-connected capacity already online and a further wave of large-scale projects progressing through execution.[10]

Gulf states have continued to diversify their energy systems at scale. Saudi Arabia is pursuing a major expansion of solar and wind under its National Renewable Energy Programme; the UAE has committed to a material increase in renewable capacity as part of its updated National Energy Strategy; and Qatar is building a solar portfolio aligned with its national liquefied natural gas decarbonisation objectives.[31]

The February 2026 Gulf disruption has introduced new physical-security constraints on the pace of deployment. Fiscal redirection towards liquefied natural gas infrastructure repair has drawn engineering capacity away from the execution of renewables, confirming that implementation, rather than equipment procurement, is now the binding constraint on a renewable energy project pipeline that is largely already contracted. The near-term trade-off between LNG repair and renewables build-out is therefore material, and the precise sequencing adopted by individual Gulf operators should be treated as a priority human follow-up item, to be confirmed, rather than assumed, against investor-relations disclosures in the next reporting cycle.[19]

Regional electricity interconnection has expanded significantly. The GCC Interconnection Authority grid and the planned Saudi Arabia-Egypt electricity link increase flexibility across national systems and allow countries to share back-up capacity, so that cross-border transmission acts as a resilience tool alongside domestic generation build-out.[10]

Gulf green hydrogen ambitions remain prominent, but projects are now facing tougher cost and customer-contract conditions. Flagship schemes such as NEOM Green Hydrogen, Oman's national green hydrogen programme and Masdar-led projects have announced export routes to Japan, South Korea and northern Europe. Yet, final investment decisions still depend on meeting the detailed EU certification rules for renewable hydrogen and other "renewable fuels of non-biological origin" under RED III, which determine whether exports can count towards EU targets and earn premium pricing.[32]

Peer-reviewed modelling of fully renewable energy systems suggests that MENA has a structural advantage in producing low-cost solar-based green hydrogen, provided grid and desalination infrastructure scale up in parallel. Studies indicate that, even in a "Fragmented World" scenario with differentiated regional energy prices, MENA hydrogen exports can remain competitive, but business cases now need to be adjusted for the higher sovereign-risk premiums observed after the February 2026 Gulf disruption.[17]

The IEA State of Energy Policy 2026 has identified blended finance, concessional guarantees and technology-transfer conditions as the evidence-based instruments most likely to attract private capital for EMDE beyond the Gulf, given the limited fiscal space for tax-credit programmes and other policy instruments under current macroeconomic conditions.[11]

The Sustainable Energy for All Council for Critical Minerals in the Global South has advanced a framework by which resource-holding EMDE may capture higher value-chain positions through domestic processing partnerships, concessional finance and technology-transfer conditions, so positioning African and South Asian mineral-holding economies as structural counterparts to Gulf capital.[33]

African and South Asian energy-importing economies have faced the sharpest compound exposure. UNCTAD has documented that the 2026 Hormuz-linked energy-price transmission has reduced fiscal space in economies already under debt-service strain, with sovereign debt-service-to-revenue ratios in several sub-Saharan African countries exceeding public-investment allocations for renewables by a material margin.[3]

Differential impacts have been observed between hydrocarbon-exporting and hydrocarbon-importing Global South economies. For exporters, windfall revenue has partially offset deployment constraints. For importers, the compound shock has tightened both hard-currency liquidity and import cover for renewable energy equipment, reinforcing the case for multilateral concessional facilities as the binding condition for maintaining deployment pace.[11]

Current evidence indicates that geoeconomic fragmentation is no longer one scenario among many but a fixed feature of the global energy transition. Its effects are not occasional or confined to one segment - they now operate simultaneously across mineral processing, the project economics of renewables, the capital markets that finance the transition and the regulatory regimes to which participants must respond. The 2026 Strait of Hormuz disruption has not created this condition. Instead, it has compressed and made more visible forces that were already in motion.

A central tension runs through the analysis. The long-run case for renewables, as tools for both decarbonisation and energy security, has strengthened precisely in the period when delivering near-term projects has become more difficult and more expensive. The milestone of renewables overtaking coal in 2025, together with record-level clean-energy investment that year, points to structural momentum. Yet the IEA judges that capacity is on track to double, not triple, by 2030 and attributes the gap not to a shortage of panels or turbines but to constraints in grids, permitting and capital, all of which have been intensified by fragmentation.

Three conditions may be offered by way of conclusion. First, compound scenario planning has become a necessary analytical discipline. Analysts can no longer test for a single shock in isolation when mineral-supply disruption, the closure of a maritime chokepoint and a "higher-for-longer" interest-rate environment are now present together. Assumptions carried over from before 2022 need a systematic review in the context of geoeconomic fragmentation, and in particular, the updated parameters in the IMF's April 2026 outlook.

Second, the main regulatory obligations now in force - including the Critical Raw Materials Act, the simplified European Sustainability Reporting Standards, the amended IFRS S2 and the high-risk provisions of the EU AI Act – have taken effect at roughly the same time, even though they address different risks. For resource-constrained organisations, an integrated compliance architecture that connects these disclosure regimes offers a more defensible audit position than managing each in isolation.

Third, and most important for the immediate horizon, MENA and wider Global South positioning are critical long-term factors. In the Gulf, the renewables project pipeline is largely contracted and the main bottleneck has shifted from securing equipment to executing projects. Beyond the Gulf, the adequacy of the blended-finance architecture - first-loss guarantees, concessional debt, local-currency facilities and technology-transfer conditions - has become the single factor on which the 2030 tripling ambition now most directly depends. The way in which blended finance matures and the speed at which it does so will determine whether the long-term case for energy transition is converted into capacity built on the ground.

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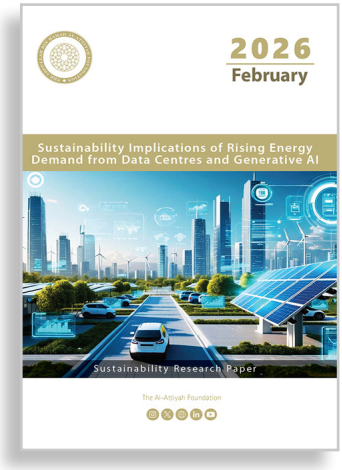
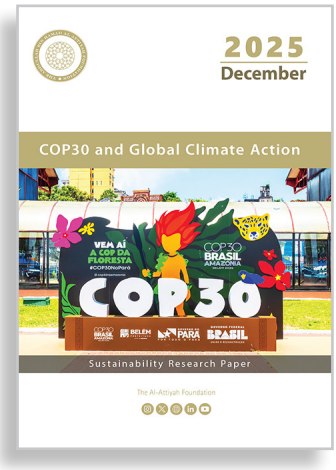


February- 2026

Sustainability Implications of Rising Energy Demand from Data Centres and Generative AI

Global data centre electricity demand has roughly doubled since 2020 and the International Energy Agency (IEA) has projected it will more than double again by 2030, driven primarily by generative Artificial Intelligence (AI) model-building and deployment activities.

(QRCO.DE)

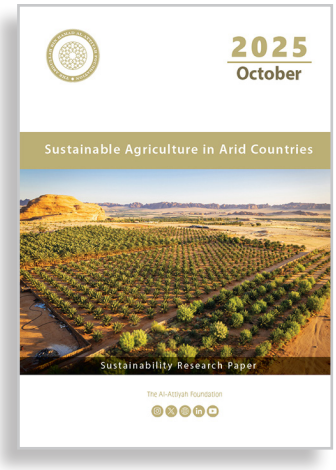


December - 2025

COP30 and global climate action

The 2025 United Nations Climate Change Conference (COP30) in Belém concluded with outcomes that underscored a structural shift in climate governance: non-state actors such as cities, businesses, and civil society brought forward implementation pipelines while national government commitments lagged.

(QRCO.DE)



October - 2025

Sustainable agriculture in arid countries

MENA holds 1% of global freshwater yet sustains 6% of the global population, with most of the world's water-stressed countries located in the region.

(QRCO.DE)

Our partners collaborate with The Al-Attiyah Foundation on various projects and research within the themes of energy and sustainable development.

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