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CADERNO 8

# GEOECONOMICS OF OIL – BETWEEN ENERGY TRANSITION OR ENERGY SECURITY

Vera Thorstensen

FGV EESP
CENTRO DE ESTUDOS DE GEOECONOMIA DO COMÉRCIO E INVESTIMENTOS

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# Geoeconomics of oil – between energy transition or energy security

**Alexandre Coelho e Mauro Arima**[1]

## Abstract

This article analyzes the geoeconomics of oil in the context of an accelerating yet increasingly fragmented global energy transition. It argues that oil has not lost its strategic relevance; instead, it has been reconfigured within a hybrid energy order marked by renewed energy weaponization, industrial policy competition, aspirations for energy security and geopolitical rivalry over supply chains and critical minerals.

The article advances three central arguments. First, oil remains structurally embedded in the global political economy, generating carbon lock-in dynamics that constrain orderly decarbonization pathways. Second, the energy transition has evolved into a domain of geoeconomic competition, distinct from traditional geopolitics. While geopolitics is primarily concerned with territorial control, military power, and strategic security, geoeconomics operates by economic instruments to achieve strategic objectives. In this context, states are increasingly deploying subsidies, export controls, investment screening mechanisms, and industrial policy to shape clean energy value chains, secure access to critical inputs, and consolidate technological leadership. Third, growing geoeconomic fragmentation, reflected in competing regulatory regimes, supply chain reconfiguration, and financial decoupling, combined with macro-financial instability, increases the likelihood of disorderly transition scenarios, with significant implications for inflation dynamics, sovereign risk, corporate strategy, and the future of global economic governance.

The energy transition does not eliminate energy geopolitics – it transforms it. Fossil fuels, renewables, and critical minerals coexist within a competitive and partially fragmented international system in which energy, finance, and trade are increasingly instrumentalized for strategic purposes. Understanding this hybridization is essential for policymakers,

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corporations, and financial institutions navigating the evolving architecture of global energy power.

## 1. Introduction: Oil in an Era of Energy Transition

Despite sustained political commitments to decarbonization and the rapid expansion of renewable energy capacity, oil continues to occupy a central position in global power politics. Forecasts of imminent oil decline have repeatedly underestimated the resilience of petroleum demand and the structural embeddedness of fossil fuels in modern economies. Rather than signaling a linear transition away from oil, current dynamics suggest a more complex and uneven transformation in which fossil fuels coexist with low-carbon technologies for an extended period.

Energy security and decarbonization are often framed as competing objectives, yet they are increasingly interdependent. Short-term supply constraints, geopolitical disruptions, and price volatility have reinforced state reliance on oil even as climate policies tighten. This duality raises the article's central research question: is oil undergoing a structural decline in geoeconomic relevance, or is its role being transformed within a hybrid energy order?

The article is structured as follows. Section 2 outlines the theoretical framework linking geoeconomics, energy, and power. Section 3 examines the return of energy weaponization and the politicization of oil markets. Section 4 analyzes carbon lock-in and the political economy of fossil fuel persistence. Section 5 explores the geoeconomics of the energy transition itself, with emphasis on industrial policy and critical minerals. Section 6 revisits energy security under hybrid energy systems. Section 7 addresses financial stability and transition risk. Section 8 concludes with implications for policy, corporate strategy, and future research.

## 2. Theoretical Framework: Geoeconomics, Energy and Power

### 2.1 Geoeconomics as Statecraft

Geoeconomics can be understood as the strategic deployment of economic instruments by states to pursue geopolitical objectives under conditions of deep interdependence. Rather than assuming that economic integration is inherently welfare-enhancing or peace-promoting, the geoeconomic perspective foregrounds power asymmetries, strategic manipulation, and the latent coercive capacity embedded in global markets. As argued by Robert Blackwill and Jennifer Harris in *War by Other Means* (2016), economic tools have become central instruments of statecraft, increasingly substituting for direct military force in an international system where open conflict among major powers is both costly and politically constrained. Markets, in this view, are not neutral arenas but contested strategic spaces shaped by state intent, regulatory power, and asymmetric leverage.

Building on this insight, geoeconomic statecraft[2] operates through a broad repertoire of policy instruments, including sanctions, export controls, investment screening, industrial

[2] Geoeconomic statecraft is the strategic use of economic instruments, such as sanctions, trade agreements, investments, and foreign aid, by states to achieve geopolitical, national security, and foreign policy objectives. It involves using the economy as a tool of power ("war by other means") to influence, coerce, or attract other countries, either as a substitute for or complement to military force.

policy, and strategic subsidies. These tools allow states to impose costs, reshape incentives, and alter the strategic environment without resorting to armed coercion. Henry Farrell and Abraham Newman (2019) conceptualize this dynamic as *weaponized interdependence*, whereby states occupying central nodes in global financial, trade, and technological networks can exploit chokepoints to exert coercive power over others. Economic openness, therefore, does not displace power politics; rather, it reconfigures it through dense networks that simultaneously generate efficiency gains and systemic vulnerabilities.

Brazilian scholarship has further refined this framework by highlighting how geoeconomics operates in contexts of systemic rivalry and fragmented globalization. The geoeconomic competition redistributes power across regulatory, financial, and technological domains, creating new hierarchies that particularly affect intermediate and late-industrializing states. From this perspective, geoeconomics is not merely coercive but also constitutive: it shapes development trajectories, constrains policy autonomy, and conditions the strategic choices available to countries positioned outside the core of global value chains.

Energy occupies a privileged position within this geoeconomic architecture because it combines material indispensability with structurally concentrated supply chains. Modern economic activity, military capability, and political stability depend fundamentally on secure and affordable access to energy. At the same time, energy systems are characterized by high capital intensity, long investment horizons, and strong path dependency, which lock states into durable relationships of dependence and vulnerability (Goldthau & Sitter, 2015). These features render energy particularly amenable to strategic manipulation through pricing power, supply disruptions, infrastructure control, financing mechanisms, or regulatory leverage.

As Braz Baracuhy (2021) argues, contemporary energy politics must be understood at the intersection of geopolitics and geoeconomics, where markets, regulation, and strategic competition are deeply intertwined. Energy transitions do not eliminate power struggles; instead, they reconfigure them by shifting the loci of control toward technology, finance, standards, and supply chains. In this sense, energy functions not merely as a traded commodity but as a strategic asset embedded in broader relations of power.

States that control energy resources, transit routes, financial channels, or critical technologies can shape the strategic autonomy of others, constraining policy choices and influencing geopolitical alignment. Conversely, large consumer states may leverage market size, regulatory standards, or financial dominance to discipline producers and redirect energy flows. Energy thus exemplifies what Susan Strange (1988) defined as *structural power*: the ability to shape the frameworks within which other actors operate. Within a geoeconomic order marked by fragmentation and rivalry, energy emerges as a central arena where economic interdependence and geopolitical competition intersect and mutually reinforce one another.

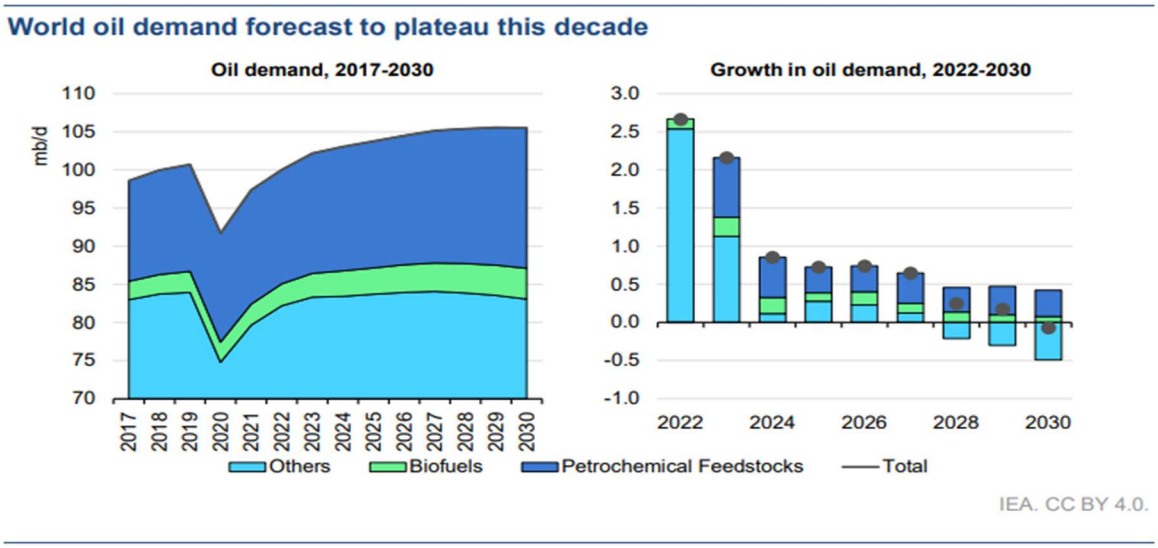
### 2.2 Oil as a Structural Instrument of Power

Historically, oil has operated less as a neutral commodity exchanged in markets than as a structural instrument of power embedded in the foundations of industrial economies and modern statehood. As Yergin demonstrates in *The Prize* (1991), access to oil has been

inseparable from the trajectories of industrialization, military capability, and global influence since the early twentieth century. Control over oil supplies has repeatedly shaped the outcomes of wars, the rise and decline of great powers, and the macroeconomic stability of states. This centrality has generated enduring asymmetries between producers, transit states, and consumers, positioning oil at the core of international political economy rather than at its periphery.

Oil's power derives not only from its indispensability but from the uneven distribution of both resources and vulnerabilities. Consumer states whose economic growth, transportation systems, and armed forces depend heavily on imported oil are structurally exposed to price volatility and supply disruptions.

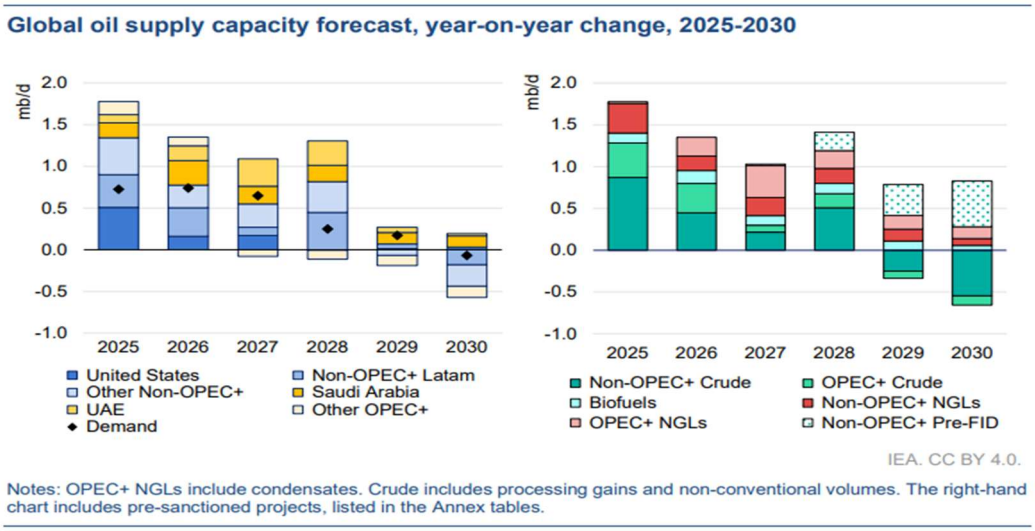
**Figure 1 – Oil Demand Forecast**




*Source: AIE, 2025, p.9. Available at:* https://iea.blob.core.windows.net/assets/c0087308-f434-4284-b5bb-bfaf745c81c3/Oil2025.pdf. *Access 20.03.2026.*

Producer states, by contrast, may leverage their control over extraction and export capacity to influence prices, manipulate supply, or extract political concessions.

**Figure 2 - Oil Supply Forecast**




Source: AIE, 2025, p. 9. Available at: <https://iea.blob.core.windows.net/assets/c0087308-f434-4284-b5bb-bfaf745c81c3/Oil2025.pdf>. Access 20.03.2026.

This dynamic corresponds to what Keohane and Nye (1977) describe as asymmetric interdependence: while all actors are connected through markets, the costs of disruption are distributed unevenly, creating opportunities for coercion. Energy coercion thus operates not through autarky, but through dependence itself.

The oil shocks of the 1970s illustrated this logic vividly. The use of embargoes and production restraints by OPEC transformed oil from a background input into a central instrument of geopolitical leverage, demonstrating that market integration does not neutralize power but can amplify it when supply is concentrated. Subsequent decades of liberalization and financialization did not erase this structural feature. As Mitchell (2011) argues, oil's political power lies not simply in barrels produced, but in the infrastructures, labor systems, and financial mechanisms that govern its circulation. Control over these systems enables states and firms to shape economic outcomes far beyond the energy sector.

Globalization has further transformed, rather than diminished, oil's geoeconomic significance. Deeper market integration has created new transmission channels, financial, logistical, and technological, through which oil-related power can be exercised. Pricing mechanisms denominated in dominant currencies, control over shipping insurance and tanker fleets, access to refining capacity, and restrictions on upstream investment or technology transfer all function as tools of influence. As Goldthau and Sitter (2015) note, energy power increasingly operates through regulatory authority and market governance, not only through physical supply disruptions. In this sense, oil exemplifies structural power in Susan Strange's (1988) formulation: the ability to shape the rules, institutions, and material conditions within which other states must operate.

Consequently, oil remains a central pillar of geoeconomic statecraft even in the era of diversified energy sources and climate transition. While renewable energy may alter the composition of energy dependence over time, the legacy infrastructures, fiscal reliance, and geopolitical entanglements associated with oil ensure its continued relevance. Rather

than fading as a source of power, oil has been re-embedded in global systems of finance, security, and governance, reinforcing its role as a strategic asset capable of shaping both market outcomes and international hierarchies.

### 2.3 Energy Transition in a Fragmented International Order

The energy transition is unfolding within a context of geoeconomic fragmentation, defined as the partial breakdown of global economic integration along geopolitical lines (Farrell & Newman, 2019). Fragmentation heightens the risk of carbon lock-in by encouraging states to prioritize security of supply over efficiency and emissions reduction. It also increases the likelihood of disorderly transitions, in which delayed mitigation is followed by abrupt policy tightening with destabilizing economic effects.

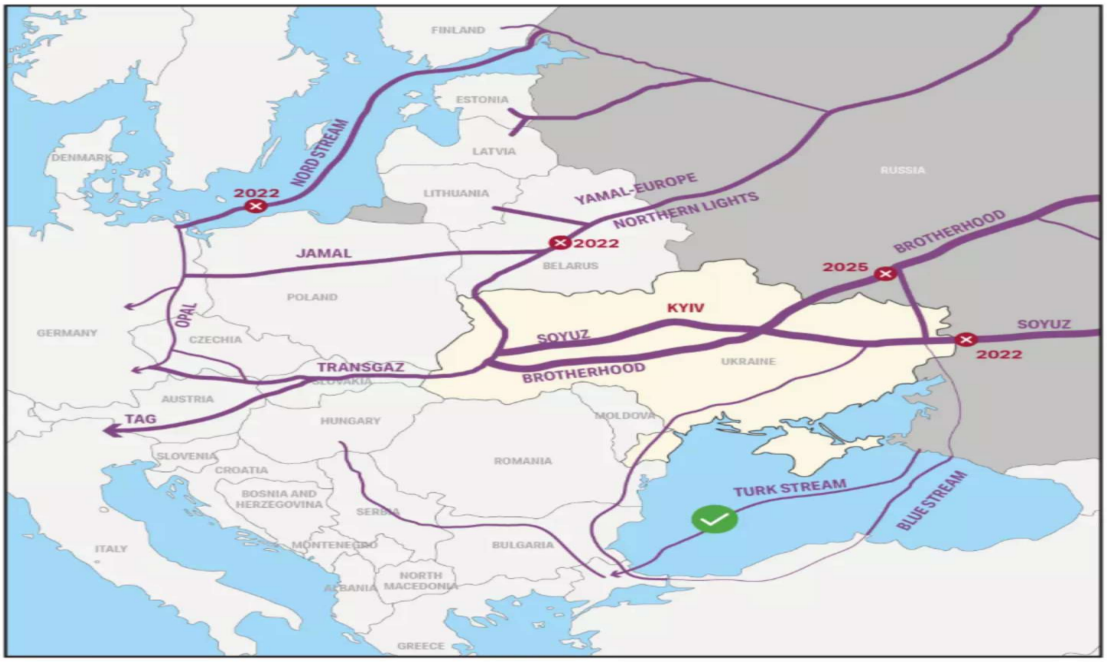
## 3. Oil and the Return of Energy Weaponization

### 3.1 Energy Coercion in the 21st Century

Recent geopolitical crises have underscored the continued relevance of energy coercion as a tool of state power. Far from disappearing with market liberalization or the energy transition, oil has re-emerged as a vector of systemic economic disruption, capable of transmitting shocks across trade, finance, and industrial production. Contemporary energy coercion no longer relies exclusively on physical supply interruptions; it increasingly operates through financial, logistical, and regulatory channels embedded in global markets.

The war in Ukraine provides a paradigmatic example. Russia's reduction of gas flows to Europe and the subsequent reorientation of oil exports following Western sanctions demonstrated how energy can be leveraged to impose macroeconomic costs on adversaries while testing political cohesion.

**Figure 3 - Russian gas pipeline infrastructure in Europe**




**Source:** Keliauskaitė, Tagliapietra e Zachmann (2025), Bruegel Institution – Available at: https://www.bruegel.org/analysis/europe-urgently-needs-common-strategy-russian-gas. Access 20.03.2026.

Although oil markets ultimately adjusted, the initial price spikes and inflationary pressures revealed the enduring capacity of fossil fuels to destabilize advanced economies dependent on imported energy (Yergin 1988; Goldthau and Sitter 2015).

Unlike earlier episodes of energy weaponization, however, coercion today is exercised through a broader infrastructure of control. Financial sanctions restricting access to dollar clearing, shipping insurance constraints imposed by Western insurers, and regulatory pressure on maritime logistics have become as consequential as physical supply cuts. These mechanisms exploit chokepoints in global energy networks, transforming oil into a multidimensional instrument of geoeconomic power rather than a purely material commodity (Farrell and Newman 2019).

### 3.2 Sanctions, Price Mechanisms, and Market Reconfiguration

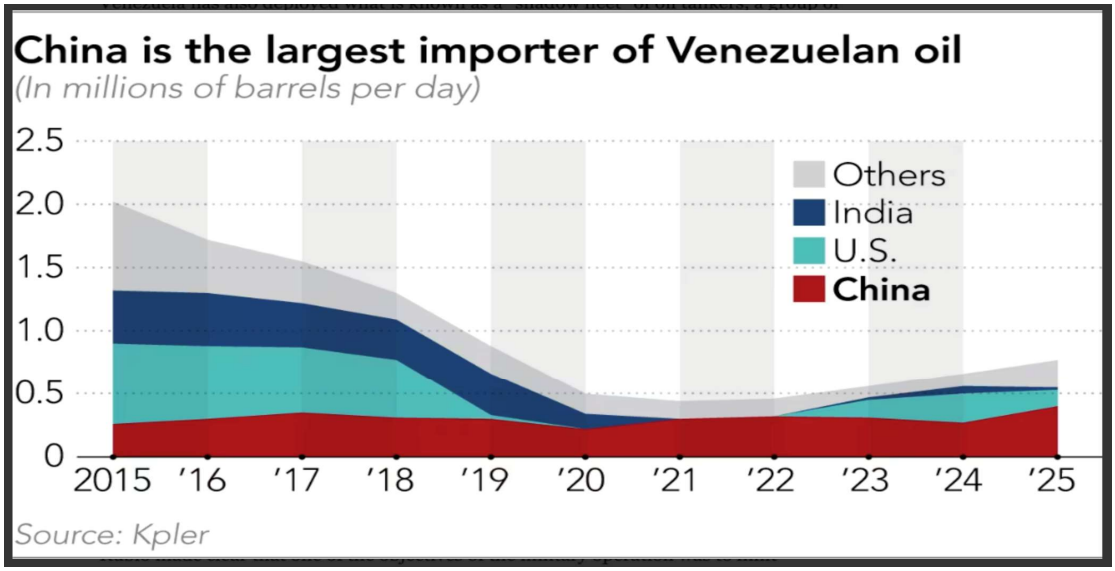
Sanctions regimes targeting major oil producers have reshaped global energy markets rather than eliminating supply. Contemporary sanctions aim less at removing oil from the market than at reconfiguring the terms, destinations, and revenues associated with its trade. The introduction of price caps on Russian oil exports illustrates this logic: instead of a full embargo, G7 countries sought to constrain revenue while preserving global supply to avoid destabilizing price spikes (Goldthau and Hughes 2020).

In practice, these measures have accelerated the emergence of alternative trading infrastructures. Russian crude has been rerouted toward Asia, particularly China and India, using discounted pricing, non-Western payment systems, and a growing "shadow fleet" of tankers operating outside traditional insurance and compliance regimes. This reconfiguration highlights how shipping, insurance, and finance have become central

battlegrounds in energy geopolitics, complementing traditional control over production and transit routes.

Similar dynamics are observable beyond Russia. Sanctions on Iran and Venezuela over the past decade have not removed their oil from global markets but redirected flows through intermediaries, blending practices, and opaque logistics. The result is a more fragmented and politicized oil market, characterized by differentiated prices, segmented trade routes, and parallel infrastructures aligned with geopolitical blocks rather than market efficiency.

**Figure 4 – China – largest importer of Venezuelan oil**




**Source:** Kpler / Nikkei Asia 2026 – Available: <https://asia.nikkei.com/business/energy/venezuelan-oil-and-china-4-things-to-know>. Access 20.03.2026.

These developments reinforce a central insight: energy weaponization today is less about absolute denial and more about selective access, revenue manipulation, and the strategic use of market friction. Oil thus remains embedded in a broader geoeconomic contest over who controls the rules, standards, and infrastructures of global exchange.

### 3.3 The Politicization of Energy Markets

Consequently, energy markets have moved decisively away from liberal assumptions of neutrality and efficiency toward overt strategic competition, where energy security considerations play a central role. State intervention, once framed as a distortion to be minimized, is increasingly normalized as a tool of resilience, risk management, and geopolitical leverage, particularly in response to concerns over supply disruptions, price volatility, and infrastructure vulnerability. Export controls, strategic stockpiling, subsidies for domestic production, and diplomatic coordination among producers have become routine features of energy governance, aimed not only at market stabilization but also at safeguarding national energy security and reducing external dependence.

The behavior of producer coalitions such as OPEC+ illustrates this shift. Production decisions are no longer justified solely on market-balancing grounds but are closely intertwined with geopolitical signaling, fiscal priorities, and strategic alignment, with direct implications for global energy security. Similarly, consumer states have reasserted

influence through coordinated releases from strategic petroleum reserves, diversification strategies, and regulatory intervention in fuel markets during periods of volatility, seeking to buffer domestic economies against external shocks and ensure continuity of supply.

This politicization is not a temporary response to crisis but a structural feature of a fragmented international system in which energy security has become inseparable from economic and geopolitical strategy. As energy transitions unfold unevenly across regions, states increasingly view control over energy flows, both fossil and clean, as integral to national security, technological autonomy, and economic sovereignty. This includes not only access to hydrocarbons but also electricity systems, critical minerals, and clean-energy value chains. In this context, oil remains uniquely powerful: its material indispensability, liquidity, and entrenched infrastructure make it an enduring instrument of coercion and a cornerstone of energy security, even in a decarbonizing world.

Rather than signaling the decline of energy geopolitics and geoeconomics, the clean transition has intensified and broadened them. Oil now operates within a hybrid order where markets, states, and firms continuously negotiate power through energy, finance, and regulation, while new energy security concerns emerge around supply chain resilience, technological dependence, and system flexibility. Understanding the return of energy weaponization, alongside the evolving dimensions of energy security, is therefore essential to grasping the political economy of both fossil persistence and the contested pathways of global decarbonization.

## 4. Carbon Lock-in and the Political Economy of Fossil Persistence

### 4.1 Fossil Investment Amid Decarbonization Commitments

Despite the rapid diffusion of net-zero commitments across governments and corporations, global investment in oil and gas infrastructure remains substantial and, in some regions, has expanded in recent years. This persistence reflects carbon lock-in not as a temporary market anomaly but as a durable political–economic equilibrium embedded in existing energy systems (Unruh 2000; Seto et al. 2016). Long asset lifecycles, sunk capital costs, and fiscal dependence on hydrocarbon revenues continue to anchor expectations of fossil profitability, even as climate commitments intensify rhetorically.

Empirically, this contradiction is visible at the firm level. While publicly reaffirming net-zero ambitions, companies such as ExxonMobil and Chevron have expanded upstream investment in shale, deepwater, and liquefied natural gas (LNG), particularly in the United States, Guyana, and the Permian Basin. These investment decisions are justified internally by assumptions that global oil and gas demand will remain resilient under most transition scenarios and that climate policy enforcement will be gradual, uneven, and politically contested (Smil 2017; Helm 2017).

European majors display a similar duality. Shell and BP have announced reductions in long-term oil output growth targets yet continue to sanction new LNG capacity and upstream projects, framing natural gas as a necessary “transition fuel” for energy security. The post-2022 energy crisis reinforced this logic: governments implicitly signaled tolerance, and in some cases encouragement, for short-to medium-term fossil expansion

in the name of supply security, thereby weakening the credibility of rapid phase-out expectations (Yergin 1988; Goldthau and Sitter 2015).

At the state level, fossil investment persistence is even more pronounced. National oil companies in countries such as Brazil, Saudi Arabia, and the United Arab Emirates continue to expand production capacity, reflecting the centrality of hydrocarbon revenues to fiscal stability, industrial policy, and geopolitical leverage. In these contexts, carbon lock-in operates not only through firm-level incentives but through macro-fiscal structures that render fossil income politically indispensable, reinforcing durable coalitions opposed to rapid decarbonization (Mitchell 2011; Strange 1988).

### 4.2 Oil Companies and the Limits of Diversification

Over the past decade, international oil companies have increasingly embraced diversification narratives centered on energy transition. Firms such as TotalEnergies, Equinor, and BP have invested in offshore wind, solar power, hydrogen, biofuels, and electric mobility infrastructure, reflecting growing awareness of transition risk and rising reputational pressure from regulators, investors, and civil society (Bridge et al. 2018; Meckling et al. 2022).

Yet, closer examination reveals that diversification remains limited in both scale and scope. For most oil majors, hydrocarbons continue to account for most of the capital expenditure and cash flow. Even TotalEnergies, often cited as one of the most proactive European firms in renewables, allocates the bulk of its investment in oil and gas, particularly LNG projects in Africa and the Middle East. Similarly, Equinor's flagship offshore wind investments, such as Dogger Bank in the United Kingdom, coexist with continued expansion of offshore oil and gas production on the Norwegian continental shelf. These patterns underscore the persistence of fossil dominance within ostensibly transitioning portfolios (Bridge et al. 2023).

These outcomes reflect deep structural constraints. First, oil companies' comparative advantage remains firmly rooted in upstream hydrocarbons. Core competencies in subsurface geology, large-scale project execution, complex logistics, and host-government bargaining translate poorly into renewable sectors characterized by standardized technologies, lower margins, and intense competition from utilities and specialized developers (Goldthau and Westphal 2019). Offshore wind represents a partial exception, which helps explain why firms such as Equinor and BP have concentrated renewable investment there rather than in solar or onshore wind.

Second, capital market discipline strongly shapes diversification behavior. Shareholders continue to reward oil companies primarily for free cash flow generation, dividends, and share buybacks. Hydrocarbon assets, especially LNG and low-cost oil, consistently outperform renewable investments on these metrics, particularly in periods of price volatility and supply constraint (Yergin 1988; Pankratz and Zehntner 2021). Diversification strategies are therefore calibrated to remain financially subordinate to fossil operations, ensuring that clean investments do not undermine near-term returns.

Third, internal governance mechanisms reinforce fossil bias. Executive compensation schemes, internal hurdle rates, and capital allocation models remain aligned with fossil fuel economics. Renewable projects often face higher internal discount rates, reflecting

perceived regulatory uncertainty and unfamiliar market structures. Even when climate risk is acknowledged at the strategic level, these internal decision-making frameworks systematically disadvantage low-carbon investments (Meckling and Hughes 2023).

Fourth, policy uncertainty further constrains diversification. Renewable energy, hydrogen, and storage projects depend heavily on subsidies, carbon pricing, and stable regulatory frameworks. For globally operating oil companies, fragmented and politically reversible climate policies increase perceived risk, discouraging deep capital commitments to clean assets that could become stranded if policy priorities shift (Helm 2017; Goldthau and Sitter 2015).

Finally, much diversification reinforces carbon lock-in rather than dismantling it. Investments in carbon capture and storage, such as ExxonMobil's CCS hubs in the United States, or in blue hydrogen linked to natural gas production extend the economic life of fossil assets while presenting these projects as climate solutions. Such strategies manage transition risk without fundamentally transforming fossil-centered business models, thereby reproducing lock-in dynamics under a green veneer (Unruh 2000; Seto et al. 2016).

Taken together, these dynamics suggest that the limits of diversification among oil majors are structural and systemic rather than merely strategic. Absent stronger policy coordination, credible carbon pricing, and a realignment of financial incentives, oil companies are likely to remain hybrid actors—selectively participating in the energy transition while continuing to rely on hydrocarbons as the core source of revenue, power, and strategic relevance (Bridge et al. 2023).

### 4.3 The Risk of Disorderly Transition

Delayed climate mitigation significantly elevates the risk of a disorderly transition, characterized by abrupt, unanticipated, and poorly coordinated policy adjustments. When governments defer climate action, the accumulation of physical risks, mounting social and political pressures, or sudden technological and geopolitical shocks can precipitate rapid regulatory tightening. Such responses may include the sudden introduction of carbon pricing mechanisms, accelerated phase-outs of fossil-fuel-based assets, stricter emissions standards, or enhanced prudential and disclosure requirements for financial institutions (Battiston et al., 2017; NGFS, 2023).

These abrupt policy shifts substantially increase the likelihood of asset stranding, understood as the premature loss of economic value of assets due to structural changes in regulation, technology, or market conditions. This dynamic is particularly acute in carbon-intensive sectors such as fossil fuels, heavy industry, and energy-intensive infrastructure. Assets whose valuation depends on long-term carbon-intensive cash flows may become economically unviable well before the end of their expected operational lifespans, triggering sharp write-downs, impairments, and financial losses (Caldecott, Howarth & McSharry, 2013; Bolton et al., 2020). The resulting repricing can cascade through equity and debt markets, erode collateral values, and weaken both corporate and sovereign balance sheets.

Crucially, transition risk is not confined to the environmental domain but is inherently macro-financial in nature. Financial institutions with concentrated exposures to climate-

sensitive assets may face heightened credit risk, liquidity stress, and solvency challenges, especially if asset repricing occurs simultaneously across sectors and jurisdictions (Battiston et al., 2021). These dynamics can interact with pre-existing financial vulnerabilities, such as high leverage, maturity mismatches, and cross-border capital flows, thereby amplifying systemic risk and threatening financial stability (FSB, 2020).

Integrated assessment models and climate stress-testing exercises consistently show that delayed and abrupt transitions generate worse economic and financial outcomes than orderly, well-signaled pathways. According to scenario analyses conducted by the Network for Greening the Financial System, disorderly transitions are associated with deeper short-term output losses, sharper increases in risk premium, and greater financial-market volatility compared to scenarios involving early and gradual policy action (NGFS, 2023). These findings reinforce the view that climate policy credibility, predictability, and coordination are central not only to emissions reduction but also to macroeconomic resilience.

In this context, climate transition risk should be understood not only as a policy-induced financial risk arising from the interaction between delayed mitigation, market expectations, and institutional exposure, but also as deeply intertwined with energy security dynamics. Efforts to decarbonize can generate new vulnerabilities related to supply adequacy, price volatility, and dependence on critical energy inputs, particularly in a fragmented geopolitical environment. Disruptions in fossil fuel markets, insufficient investment in reliable low-carbon capacity, or bottlenecks in critical minerals and energy technologies may amplify both economic and financial instability during the transition. Effective management of this risk therefore requires forward-looking regulatory frameworks, credible and well-sequenced transition pathways, and the systematic integration of climate and energy security considerations into monetary policy, financial supervision, and fiscal planning (Bolton et al., 2020; Campiglio et al., 2018). This includes ensuring diversification of energy sources, resilience of infrastructure, and stability of supply chains. Without such measures, the probability of a disorderly transition—marked by simultaneous financial stress and energy insecurity—and its associated systemic consequences will continue to rise.

## 5. The Geoeconomics of Energy Transition

### 5.1 Industrial Policy and Strategic Competition

Industrial policy has re-emerged as a central instrument of statecraft in the energy transition, reflecting intensified strategic competition among major powers. Governments are no longer relying solely on market mechanisms to guide decarbonization but are actively shaping industrial outcomes through subsidies, local-content requirements, public procurement, and state-backed finance (Aiginger & Rodrik, 2020).

The United States' Inflation Reduction Act (partially impaired by the measures of Trump and his "drill, drill policy"), the European Union's Green Deal Industrial Plan, and China's long-standing support for clean-energy manufacturing illustrate how decarbonization strategies are embedded within broader geoeconomic objectives. These policies aim not only to reduce emissions but also to secure technological leadership, domestic employment, and resilient supply chains (Meckling & Hughes, 2023). As a

result, climate policy has become a site of strategic rivalry, with states competing to attract investment, control intellectual property, and dominate future growth sectors.

This resurgence of industrial policy challenges liberal assumptions about comparative advantages and efficiency. Instead, it reflects a shift toward a security-oriented logic in which redundancy, resilience, and national control are prioritized over cost minimization. In this context, clean-energy industries are increasingly treated as strategic sectors akin to defense or telecommunications, reinforcing the geoeconomic nature of the energy transition (Farrell & Newman, 2019).

### 5.2 Strategic Control of Energy Value Chains

Control over energy value chains, spanning manufacturing, processing, logistics, and deployment, has emerged as a strategic priority for states navigating the energy transition. Unlike fossil fuels, where value was concentrated upstream in extraction and transport, low-carbon technologies derive strategic importance from midstream and downstream segments, particularly manufacturing capacity, processing know-how, and infrastructure integration (Helveston et al., 2022).

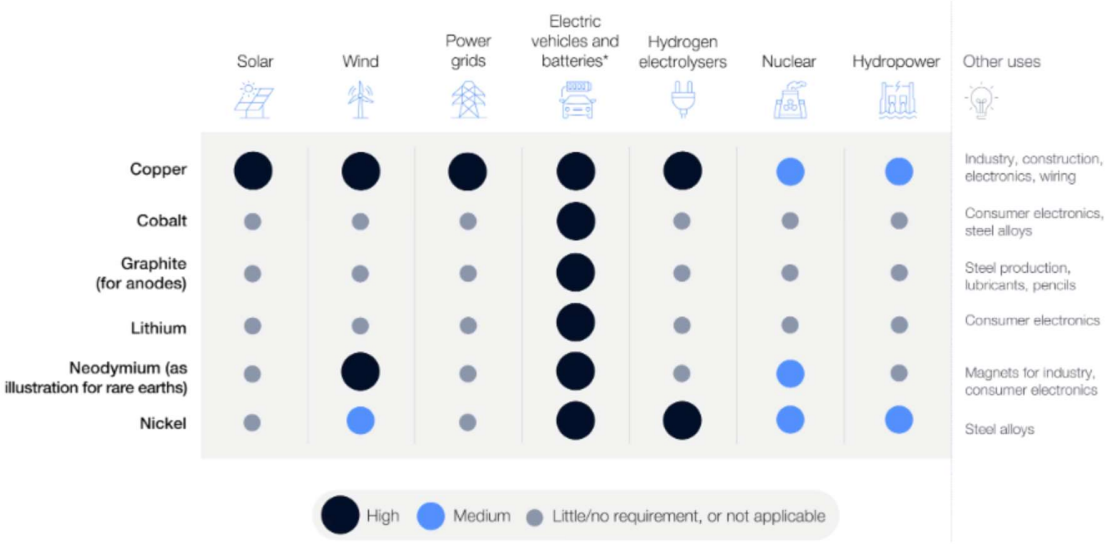
Vertical integration in renewables, batteries, and hydrogen mirrors earlier patterns observed in oil and gas industries, where dominant actors sought to secure supply, stabilize prices, and exert geopolitical influence. China's dominance in solar photovoltaic manufacturing, battery cells, and rare-earth processing exemplifies how control over key nodes of the value chain can generate durable strategic advantages (Goldthau & Hughes, 2020). Such dominance enables not only cost leadership but also leverage over competitors and downstream users.

These dynamics reinforce new forms of dependency, as states pursuing rapid decarbonization may find themselves reliant on foreign-controlled inputs, technologies, or logistics networks. As a result, value-chain security has become integral to energy security, prompting efforts to reshore production, establish friend-shoring arrangements, and diversify suppliers (Evenett & Baldwin, 2023). The energy transition, therefore, does not eliminate interdependence but restructures it along new technological and geopolitical fault lines.

### 5.3 Critical Minerals as Strategic Assets

Critical minerals, such as lithium, cobalt, nickel, and rare earth elements, have become strategic assets in the energy transition due to their essential role in batteries, wind turbines, electric vehicles, and grid infrastructure. These minerals are characterized by high geographic concentration of extraction and, even more critically, processing capacity, creating new vulnerabilities in global supply chains (IEA, 2024; Sovacool et al., 2020).

*Figure 5 - Importance of critical minerals in the transition to clean energy*




**Source:** World Economic Forum – 2024 / ETC, Material and Resource Requirements for the Energy Transition, 2023.

China's central role in refining rare earths and battery materials illustrates how mineral dependencies can translate into geoeconomic leverage. As demand for these inputs accelerates, states face risks related to supply disruptions, price volatility, and potential coercion, like historical oil dependencies but embedded within more complex industrial ecosystems (Mancheri et al., 2019).

In response, governments have increasingly adopted strategies of resource diplomacy, diversification of suppliers, and strategic stockpiling. Bilateral agreements with resource-rich countries, public support for domestic mining and processing, and the creation of strategic reserves are now central components of energy security planning (IEA, 2024). However, these strategies also raise concerns about environmental degradation, social conflict, and neo-extractive dynamics in the Global South.

Thus, critical minerals sit at the intersection of climate policy, development, and geopolitics. Their strategic importance underscores the paradox of the energy transition: while it aims to reduce dependence on fossil fuels, it simultaneously generates new material dependencies that are deeply embedded in global power structures.

## 6. Energy Security and the Clean Transition

### 6.1 Diversification as a Strategic Imperative

Diversification has long been a core principle of energy security, traditionally understood as reducing dependence on a single fuel, supplier, or transit route (Yergin, 1988; Cherp & Jewell, 2014). In the context of the clean energy transition, however, diversification has acquired a more complex and multidimensional character. States now seek diversification not only across fuels, oil, gas, renewables, nuclear, but also across technologies, value chains, and geopolitical jurisdictions, including suppliers of critical minerals and manufacturing hubs for clean technologies (IEA, 2021; Goldthau & Hughes, 2020).

This strategic imperative reflects heightened vulnerability to geopolitical shocks, supply disruptions, and weaponized interdependence (Farrell & Newman, 2019). Yet diversification often entails short-term trade-offs. Redundant supply chains, parallel infrastructure, and domestic reshoring strategies can increase costs and slow emissions reductions, particularly when cheaper fossil alternatives remain available (Helm, 2017; Aghion et al., 2016). As a result, diversification strategies may temporarily conflict with efficiency-driven decarbonization pathways, creating policy tensions between security, affordability, and climate objectives.

Recent crises, most notably energy market disruptions following Russia's invasion of Ukraine, have reinforced diversification as a political priority, even at the expense of short-term emissions targets (IEA, 2022; Van de Graaf & Colgan, 2023). This suggests that diversification in the clean transition is less a technocratic optimization problem than a strategic choice shaped by risk perceptions, geopolitical rivalry, and domestic political constraints.

### 6.2 Hybrid Energy Systems

Despite ambitious climate targets, global energy systems are likely to remain hybrid for decades, combining fossil fuels, renewables, nuclear energy, and emerging low-carbon technologies (Smil, 2017; Victor et al., 2019). Rather than a linear substitution process, the transition increasingly resembles a layered transformation in which new energy sources are added faster than incumbents are removed, particularly in emerging and middle-income economies.

Short-term fossil fuel expansion, especially in oil and gas, may coexist with long-term decarbonization strategies, driven by energy security concerns, fiscal dependence, and the inertia of existing infrastructure (Seto et al., 2016; McGlade & Ekins, 2015).

This coexistence complicates policy coherence: governments simultaneously subsidize renewables and approve new fossil projects, while financial institutions balance climate commitments against profitability and security considerations.

Hybrid systems also reshape geopolitical and geoeconomic dynamics. Fossil fuels, renewables, and critical minerals become intertwined within shared value chains, logistics networks, and financial markets, reinforcing the hybridization of energy geopolitics rather than its disappearance (Bridge et al., 2018; Goldthau et al., 2019). Managing this hybridity, rather than assuming a rapid fossil exit, emerges as a central challenge for energy governance in a fragmented international system.

### 6.3 Redefining Energy Security

As energy systems evolve, the concept of energy security is being redefined. Beyond supply adequacy and price stability, contemporary definitions increasingly emphasize resilience, flexibility, and technological autonomy (Cherp & Jewell, 2014; Sovacool, 2011). Energy security now encompasses the ability to absorb shocks, adapt to disruption, and maintain political and economic autonomy under conditions of uncertainty.

This shift reflects the growing importance of electricity grids, digital infrastructure, storage technologies, and critical minerals, all of which introduce new vulnerabilities

distinct from those associated with oil and gas dependence (IEA, 2023). Control over standards, intellectual property, and manufacturing capacity becomes as important as physical resource access, linking energy security to industrial policy and technological competition (Rodrik, 2022; Mazzucato, 2021).

In this context, energy security converges with broader geoeconomic strategies. States increasingly treat energy systems as instruments of strategic autonomy, aligning climate policy with industrial competitiveness, trade policy, and national security objectives (Tooze, 2022; Meckling & Allan, 2020).

## 7. Financial Stability, Scenario Design and Transition Risk

### 7.1 Fragmentation and Climate Risk Pathways

Geoeconomic fragmentation significantly complicates climate transition pathways by increasing uncertainty around trade, technology diffusion, and capital flows. Fragmented systems undermine the assumptions of smooth global coordination that underpin many integrated assessment models and climate scenarios (Battiston et al., 2017; NGFS, 2023).

Fragmentation also amplifies macroeconomic volatility. Trade barriers, sanctions, and investment restrictions disrupt energy and commodity markets, raising transition costs and increasing the likelihood of disorderly adjustment (International Monetary Fund, 2023). These dynamics challenge scenario design, as policymakers and financial institutions must now account for multiple, divergent transition trajectories rather than a single global pathway.

As a result, climate risk increasingly intersects with geopolitical risk, blurring the analytical boundary between environmental stress testing and traditional macro-financial surveillance (Bolton et al., 2020; Tooze, 2021).

### 7.2 Inflation, Interest Rates and Capital Allocation

The macro-financial environment plays a decisive role in shaping the pace and direction of the energy transition. Higher interest rates raise the cost of capital for renewable energy, infrastructure, and long-term clean investments, disproportionately affecting capital-intensive technologies such as wind, solar, and hydrogen (Pankratz & Zehntner, 2021; Brière et al., 2021).

At the same time, elevated rates and inflation can prolong the competitiveness of fossil fuels, particularly where existing infrastructure has already been amortized, reinforcing carbon lock-in dynamics (Seto et al., 2016). Monetary tightening thus interacts with geoeconomic fragmentation to slow clean investment and increase transition risk, especially in developing and middle-income economies with limited fiscal space.

These dynamics underscore the importance of aligning monetary, fiscal, and industrial policy with climate objectives, an alignment that becomes more difficult under conditions of geopolitical rivalry and financial instability (Campiglio et al., 2018; Gabor, 2021).

### 7.3 Corporate Strategy in a Geoeconomic Energy Order

In an increasingly fragmented and hybrid global energy order, firms can no longer treat geopolitics and geoeconomics as an external or exogenous constraint. Instead, geopolitical risk has become an endogenous component of corporate strategy, shaping board-level decisions on investment allocation, supply chain configuration, market exposure, and technological choice (Henisz 2016; Farrell and Newman 2021). Firms now operate in an environment where trade, finance, technology, and energy are systematically politicized, requiring strategic responses that closely resemble state geoeconomic behavior.

Large energy and industrial firms provide clear empirical illustrations. International oil companies such as ExxonMobil and Shell increasingly integrate geopolitical scenario analysis into capital planning, explicitly assessing sanctions risk, host-country stability, and regulatory divergence when approving long-lived upstream or LNG projects. ExxonMobil's concentration of new investments in the United States and Guyana reflects not only geological opportunity but also perceptions of regulatory predictability and geopolitical alignment, particularly after the tightening of sanctions regimes and investment screening mechanisms targeting Russia and other high-risk jurisdictions.

Strategic intelligence and scenario planning have thus become core corporate capabilities. Firms now routinely model alternative futures involving trade fragmentation, export controls, and subsidy races alongside traditional market scenarios. This is particularly evident in energy and technology intensive sectors. European industrial firms such as Siemens Energy have reassessed supply chains for gas turbines, grid equipment, and hydrogen technologies following disruptions linked to the war in Ukraine and the deterioration of EU–Russia energy relations. These reassessments prioritize supplier diversification, regionalization of production, and redundancy, even at the cost of reduced short-term efficiency.

Supply chain resilience has similarly become a strategic priority in clean energy technologies. Battery and electric vehicle manufacturers increasingly hedge against geoeconomic risk by diversifying production footprints across jurisdictions. CATL, for example, has invested in manufacturing facilities in Europe to maintain access to EU markets while mitigating exposure to trade barriers and industrial policy measures aimed at reducing dependence on Chinese supply chains. These strategies reflect corporate adaptation to a world of competing industrial policies rather than a return to market-driven globalization.

Financial actors reinforce this logic. Asset managers such as BlackRock increasingly frame geopolitical fragmentation, energy security, and climate transition as interconnected sources of portfolio risk. Rather than assuming a smooth global decarbonization pathway, firms are urged to stress-test investments against scenarios of persistent fossil demand, delayed transition, and regulatory divergence (BlackRock 2023). This contributes to more conservative capital allocation toward clean energy in jurisdictions where policy credibility is weak or politically contested.

In this context, corporate strategy increasingly mirrors geoeconomic behavior of the states. Firms hedge across jurisdictions, maintain parallel supply chains, stockpile critical inputs, and invest in technological optionality. These strategies accept higher operating

and capital costs in exchange for resilience, flexibility, and strategic autonomy, logics once associated primarily with national security policy rather than corporate governance (Bremmer and Kupchan 2022).

Crucially, the energy transition amplifies rather than diminishes these dynamics. As energy systems become more electrified, mineral-intensive, and technology-dependent, firms face overlapping pressures from climate policy, industrial subsidies, sanctions regimes, and financial markets. The result is a transformation in corporate governance: boards and executives must integrate geopolitics, climate risk, and geoeconomic fragmentation into a unified strategic framework. Firms are no longer merely adapting to the geoeconomic energy order, they are active participants in its reproduction and stabilization.

## 8. Conclusion: The Hybrid Energy Order

The analysis developed throughout this article challenges linear narratives of energy transition by demonstrating that oil is not undergoing a simple decline in geoeconomic relevance, but rather a process of transformation within an increasingly fragmented and hybrid global energy order. Far from being displaced, oil remains deeply embedded in the structural foundations of modern economies, global finance, and geopolitical competition. Its persistence is sustained by material indispensability, entrenched infrastructure, fiscal dependence, and the strategic behavior of both states and firms operating under conditions of uncertainty and rivalry.

At the theoretical level, the article has shown that a geoeconomic perspective is essential to understanding contemporary energy dynamics. Markets are not neutral allocative mechanisms but arenas of power, where interdependence generates both efficiency and vulnerability. Oil, as a historically central energy source, continues to function as a structural instrument of power, enabling coercion, shaping incentives, and reinforcing asymmetries across producers, consumers, and transit states. The resurgence of energy weaponization, particularly through financial, logistical, and regulatory channels, underscores the extent to which oil remains integral to statecraft in the twenty-first century.

At the same time, the transition to low-carbon energy systems is itself profoundly geoeconomic. Industrial policy, control over value chains, and access to critical minerals have emerged as key sites of strategic competition, redistributing power across technological and regulatory domains. Rather than eliminating dependency, the transition reconfigures it, shifting vulnerabilities from hydrocarbons to complex, globally dispersed supply chains. This process is unfolding unevenly, shaped by geopolitical fragmentation, divergent policy regimes, and competing national priorities, thereby reinforcing the likelihood of hybrid energy systems persisting over the medium to long term.

The persistence of carbon lock-in further complicates transition pathways. Continued investment in fossil fuel infrastructure by both private firms and state-owned enterprises reflects not only market expectations but deeply rooted political–economic structures. Corporate diversification into clean energy remains partial and constrained by financial incentives, institutional inertia, and policy uncertainty, resulting in a hybrid corporate landscape in which hydrocarbons retain primacy. This dynamic increases the risk of a

disorderly transition, where delayed policy action may trigger abrupt adjustments with significant macro-financial consequences.

These findings have important implications for energy security and financial stability. Energy security must be reconceptualized beyond traditional concerns with supply and price, encompassing resilience, technological autonomy, and control over the value chains. Simultaneously, climate transition risk emerges as a central macro-financial concern, particularly in a fragmented global system where coordination failures and geopolitical tensions amplify uncertainty. Monetary conditions, capital allocation, and regulatory frameworks will play a decisive role in determining whether the transition proceeds in an orderly or disruptive manner.

The article also highlights the growing convergence between state and corporate strategies in a geoeconomic energy order. Firms are no longer passive actors but active participants in shaping and navigating geopolitical risk, adopting strategies of diversification, redundancy, and strategic positioning that mirror state behavior. In this context, the boundaries between economics and geopolitics, markets and power, are increasingly blurred.

In sum, the future of energy is unlikely to be defined by the rapid displacement of oil, but by its coexistence with emerging technologies in a contested and evolving global system. Understanding this reality requires moving beyond dichotomies of decline versus transition, and instead recognizing the complex interplay between fossil persistence, technological change, and geoeconomic competition. The challenge for policymakers, firms, and scholars alike is not merely to manage a transition, but to navigate a transformation in which energy remains a central axis of power in international political economy.

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