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Between Ambition and Reality: Geopolitical Conflict, Fossil Fuel Dependency, and the Structural Limits of Global Clean Energy Transition Governance

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ABSTRACT

The global clean energy transition, institutionalized through the Paris Agreement and successive Conferences of the Parties, rests on nationally determined contribution frameworks and multilateral renewable energy targets that presuppose stable geopolitical conditions, adequate development finance, and sustained political consensus. This paper critically examines whether these foundational assumptions hold under conditions of geopolitical disruption, using the 2026 Iran–United States conflict and the associated closure of the Strait of Hormuz as a revealing stress test. Drawing on energy governance literature, geopolitical risk theory, and NDC implementation evidence, this desk review argues that global clean energy transition frameworks are structurally overambitious in their design: they set targets without adequate demand-side realism, without conflict-resilience mechanisms, and without accounting for the fiscal displacement effects on Global South economies. The paper introduces the concept of the Ambition-Reality Gap as a governance design failure rather than a political failure, and argues that unless multilateral climate frameworks are redesigned to integrate geopolitical scenario planning, energy security contingencies, and differentiated transition pathways, successive geopolitical shocks will continue to entrench fossil fuel dependencies while eroding NDC credibility. The paper concludes with governance design recommendations oriented toward COP31.

Keywords:
clean energy transition; geopolitical risk; NDC implementation gap; fossil fuel dependency; climate governance; energy security

INTRODUCTION

The global imperative to transition away from fossil fuels has never been more urgently articulated than in the period following the 2015 Paris Agreement. The Agreement's architecture, premised on nationally determined contributions and successive rounds of ambition ratcheting, has generated an increasingly elaborate architecture

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of targets, pledges, and transition roadmaps. By 2023, the Conference of the Parties in Dubai had, for the first time, formally acknowledged the necessity of transitioning away from fossil fuels, a formulation that represented the outer boundary of political consensus achievable within a body that includes the world's largest petroleum exporters. Yet the distance between the language of ambition and the trajectory of actual energy systems has remained a defining tension within the climate governance literature.

The outbreak of the Iran–United States conflict in early 2026 and the subsequent militarization of the Strait of Hormuz exposed this tension in terms no longer amenable to technocratic optimism. The International Energy Agency (2026) characterized the resulting disruption as the most severe energy supply shock in modern history, with oil prices exceeding $110 per barrel and cascading effects on food systems, transport costs, and fiscal balances across the Global South. Governments that had, in formal terms, committed to clean energy transitions responded not with acceleration of renewable investment but with emergency fossil fuel subsidies, relaxed environmental standards, and accelerated approvals for new extraction. The global clean energy discourse, rather than providing an analytical framework for navigating the crisis, was effectively suspended in most mainstream policy arenas for the duration of the acute shock.

This paper argues that this suspension was not an aberration but a predictable outcome of structural flaws in how global clean energy transition targets are designed. The paper does not contest the scientific necessity of rapid decarbonization. Rather, it interrogates the governance architecture through which that necessity is pursued, asking whether frameworks built on demand-side assumptions that geopolitical conflict systematically invalidates can constitute credible instruments of global energy transformation. The paper proceeds through a critical review of the ambition-implementation gap literature, develops a conceptual framework for understanding the geopolitical vulnerability of transition governance, and applies this framework to three analytical dimensions: the inhibiting role of conflict on transition momentum; the demand-side realism problem embedded in current targets; and the differentiated fiscal effects on developing-country NDC implementation. The paper concludes with governance design recommendations relevant to COP31 preparations.

CLEAN ENERGY AMBITION AND GOVERNANCE OF TRANSITION

Ambition-Implementation Gap in Climate Governance

The gap between climate ambition and implementation outcomes is among the most thoroughly documented phenomena in the contemporary environmental governance literature. Rogelj et al. (2016) established that collectively, the first round of nationally determined contributions was insufficient to limit warming to 2°C, let alone 1.5°C, and that the emissions trajectory implied by stated commitments would result in warming of 2.7°C or higher by 2100. This finding has been replicated and updated across successive assessment cycles (Ellis et al., 2024; IPCC (Intergovernmental Panel on Climate Change), 2023; UNEP, 2023), each arriving at the consistent conclusion that the aggregate of national commitments falls substantially below what is physically necessary.

Beyond the aggregate insufficiency of NDC ambition, a second and analytically distinct problem concerns the implementation gap: the divergence between commitments made and policies deployed. The OECD and UNDP (2025) identified an implementation gap of approximately 2 GtCO2e for unconditional NDCs and 5 GtCO2e for conditional NDCs against 2030 targets as of current policies. Ürge-Vorsatz et al. (2020) distinguished between first-order ambition failures, in which targets are insufficient, and second-order governance failures, in which even insufficient targets are not pursued through adequate institutional mechanisms. This distinction is critical because it locates the problem not simply in a lack of political will but

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in the design of the governance frameworks through which commitments are operationalized.

The IRENA (2023b) World Energy Transitions Outlook documented that renewables accounted for 90% of new global power installations in 2023, a figure frequently cited as evidence of transition momentum. However, the same report noted that global renewable energy deployment remained on a trajectory to reach only 2.7 times its 2022 level by 2030, substantially below the tripling target agreed at COP28, and that the median national action score across assessed countries stood at 25 against a required 65 (Zhang et al., 2025). The concentration of clean energy investment in three economies, namely China, the United States, and the European Union, while the broader Global South received less than 20% of global annual power sector investment (Parra et al., 2025), represents a structural inequity with direct implications for the credibility of global transition frameworks.

Fossil Fuel Demand and the Realism Problem

A persistent challenge in the governance of clean energy transition concerns the treatment of demand-side realities within target-setting processes. The dominant approach within multilateral climate frameworks has been supply-side: defining targets for renewable energy capacity addition, carbon-intensity reduction, and fossil fuel phase-out schedules, while treating demand trajectories as either responsive to supply signals or as politically negotiable quantities. This approach has been critiqued by energy economists for its inadequate engagement with the structural drivers of fossil fuel demand, particularly in emerging and developing economies where energy access, industrial development trajectories, and fiscal capacity jointly determine the pace at which clean energy alternatives can displace incumbent fuels.

Smil (2016) established the principle of energy transitions as historically slow, capital-intensive, and path-dependent processes, arguing that the timescales assumed in contemporary transition narratives were inconsistent with historical precedents. While Smil's framework has been contested in light of recent solar and wind deployment acceleration (Way et al., 2022), its underlying observation that demand structures are shaped by decades of infrastructure investment, industrial organization, and consumption pattern formation retains analytical validity. The IMF Staff Climate notes (Gardes-Landolfini et al., 2023) documented that climate scenario models have consistently underestimated coal power capacity expansion since 2020, with actual annual coal-fired additions of 46 to 52 gigawatts between 2021 and 2023 against modeled projections of zero to 44 gigawatts across major climate scenarios. This systematic modeling failure reflects the extent to which transition frameworks have designed targets around aspired demand trajectories rather than observed demand dynamics.

The green hydrogen case illustrates the same dynamic at the level of specific technology pathways. Odenweller and Ueckerdt (2025) tracked 190 green hydrogen projects over three years and found that only 7% of global capacity announcements were completed on schedule in 2023, representing an implementation gap that reflects the compound difficulty of scaling electrolyzer capacity, creating end-use demand, and building supporting infrastructure simultaneously. Yet announced future project pipelines continued to grow, maintaining the appearance of alignment with 1.5°C scenarios while the actual implementation record demonstrated a persistent and widening gap between announcement and delivery.

Geopolitical Risk and Energy Transition

The relationship between geopolitical risk and energy transition has received increasing scholarly attention since Russia's 2022 invasion of Ukraine demonstrated the potential for geopolitical shocks to simultaneously disrupt fossil fuel markets and alter the political economy of clean energy investment (Haukkala, 2015; Kashani, 2023; Schuette, 2023). Wang et al. (2025) found a statistically significant negative correlation between geopolitical risk indices and

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energy transition progress across 38 countries over the period 2000 to 2022, with the mechanism operating primarily through reallocation of government research and development funding away from renewable energy toward energy security crisis management. Wang et al. (2024) extended this analysis to demonstrate that the effect was asymmetric: geopolitical shocks of high severity generated disproportionate reversions to fossil fuel dependency compared to moderate-severity events, suggesting non-linear dynamics in the relationship between conflict intensity and transition governance.

The European response to the Russia-Ukraine conflict provided a natural experiment in the dual possibilities of geopolitical shock. On one hand, the European Commission's REPowerEU plan accelerated renewable energy targets, raising the 2030 share of renewables in final energy consumption to 45%. On the other hand, the same crisis prompted a 34% expansion of European LNG import capacity between 2021 and 2024 (Black et al., 2023; Gardes-Landolfini et al., 2023), the approval of new coal power extensions in Germany, and the relaxation of environmental impact assessment timelines for fossil fuel infrastructure. The simultaneity of these responses illustrates what analysts have termed the energy paradox: geopolitical disruption both strengthens the rhetorical case for transition and creates the material conditions for fossil fuel entrenchment.

Alsagr and van Hemmen (2021) demonstrated that countries experiencing geopolitical turmoil exhibited measurably lower levels of domestic renewable energy investment and government expenditure on transition-related infrastructure, a finding consistent with the resource reallocation hypothesis. Critically, these effects were more pronounced in developing economies, where fiscal buffers are limited and energy subsidies constitute a higher proportion of public expenditure. The energy security literature (Desogus et al., 2023; Khan, 2025) has long recognized the Strait of Hormuz as the world's most consequential single chokepoint in global energy supply chains, through which approximately 20% of global oil transits. The strategic vulnerability of global energy systems to disruption at this point was acknowledged in academic and policy literature well before the 2026 conflict, yet it was not systematically incorporated into the scenario assumptions underlying multilateral transition frameworks.

Global South in Transition Governance

The distributional dimensions of clean energy transition governance represent a third strand of the relevant literature, one with particular salience for understanding the effects of geopolitical shocks. Developing countries, primarily in Sub-Saharan Africa, South Asia, and parts of Southeast Asia and Latin America, face a structurally different transition challenge from that of advanced economies. Their energy access deficits mean that the primary energy policy imperative is frequently expansion of supply rather than substitution of existing supply. Their fiscal constraints mean that conditional NDCs, which require international finance to become operational, constitute the majority of their formal commitments. Their industrial base means that fossil fuel-derived energy inputs remain integral to manufacturing and agricultural competitiveness for the foreseeable future.

IRENA (2023a) reported that developing countries, primarily least developed countries and small island developing states, planned to double renewable installed capacity by 2030, but that doing so was conditional on financial assistance in the majority of cases. The OECD and UNDP (2025) noted that only 33% of parties had identified domestic mitigation measures consistent with their long-term net-zero strategies, and that alignment between NDCs, national development plans, and fiscal frameworks was structurally limited across the Global South. These conditions create a fundamental asymmetry within global transition governance: the countries least responsible for historical emissions are expected to commit to transition pathways that are contingent on international finance that has historically been delivered at a fraction of pledged levels, while facing the greatest exposure to the

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economic shocks generated by fossil fuel supply disruptions.

AMBITION–REALITY GAP AS GOVERNANCE DESIGN FAILURE

This paper advances the concept of the Ambition-Reality Gap (ARG) as a framework for analyzing the structural limitations of global clean energy transition governance. The ARG is distinguished from the ambition-implementation gap in a specific and important sense. The ambition-implementation gap, as conventionally defined in the climate governance literature, refers to the divergence between stated commitments and the policies deployed to achieve them, a failure of political execution (Ananyan & Longhurst, 2023). The ARG, by contrast, refers to the divergence between transition targets and the structural conditions under which those targets must be achieved, a failure of governance design.

The ARG framework identifies three structural dimensions along which global clean energy targets are systematically misaligned with operational realities. The first dimension is demand-side unrealism. Global transition targets are predominantly defined in terms of supply-side metrics: renewable energy capacity additions, shares of clean energy in total power generation, and carbon intensity reductions. They are premised on demand trajectories derived from integrated assessment models that have systematically underestimated fossil fuel demand in developing economies, underestimated the pace of coal capacity expansion, and failed to account for the energy access imperatives of population growth in Sub-Saharan Africa and South Asia. When demand fails to decline as modeled, the targets become arithmetically unachievable regardless of supply-side progress.

The second dimension is conflict non-resilience. The institutional architecture of global clean energy transition governance, comprising the Paris Agreement, NDC cycles, COP communiqués, and multilateral finance mechanisms, contains no provisions for geopolitical contingency. There are no agreed protocols for how NDC commitments should be treated when signatory states are engaged in or affected by armed conflict. There are no mechanisms for protecting climate finance flows from the fiscal crowding-out effects of conflict-induced energy price shocks. There are no scenario planning requirements that stress-test transition pathways against geopolitical disruption. This institutional silence means that each geopolitical shock resets transition momentum to a lower baseline without institutional recourse.

The third dimension is fiscal asymmetry. The majority of conditional NDC commitments in developing countries are dependent on climate finance flows from advanced economies. These flows are themselves vulnerable to the same geopolitical shocks that generate emergency fossil fuel subsidy expenditures in developing countries. The result is a double fiscal displacement: developing economies simultaneously face higher import bills for fossil fuels during supply disruptions and reduced availability of the climate finance on which their transition commitments are conditioned. This dynamic is not a contingent feature of specific shocks but a structural property of the current governance architecture. The ARG framework does not suggest that clean energy transition targets should be abandoned or lowered. Rather, it argues that governance frameworks must be redesigned to embed conflict resilience, demand-side realism, and fiscal asymmetry correction mechanisms if transition targets are to constitute credible policy instruments rather than aspirational statements.

ANALYSIS

Geopolitical Conflict as a Structural Inhibitor of Transition Governance

The 2026 Iran–United States conflict provides the most direct contemporary illustration of the ARG framework's conflict non-resilience dimension (Bahree, 2026; Shokri, 2026). The militarization of the Strait of Hormuz in early 2026 constituted a geopolitical shock of first-order magnitude for global energy systems. The IEA's characterization of the resulting disruption as the most severe energy supply shock in modern

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history reflects the Strait's role as the transit route for approximately 20% of global oil supply, a concentration of energy geopolitical risk that had been extensively documented in the academic literature but never adequately addressed in multilateral transition governance design (International Energy Agency, 2026).

The immediate governance response across affected economies was structurally predictable. Governments that had formally committed to transition pathways under the Paris Agreement deployed emergency fossil fuel subsidies to shield consumers from price shocks, accelerated approvals for alternative fossil fuel supply routes, and suspended or deferred climate policy implementation to manage macroeconomic stability. Jordan (2026) documented that policymakers were actively using rising gasoline prices as political cover for rolling back previously implemented climate policies, a pattern consistent with the broader literature on how energy price shocks interact with climate policy durability. For developing countries, the effects were materially more severe: import-dependent economies were forced to divert fiscal resources from development budgets, including climate adaptation and renewable energy program expenditures, toward energy import subsidies and balance-of-payments stabilization.

The geopolitical risk literature provides a theoretical account of why this pattern recurs across different conflict episodes. Wang et al. (2024) found that geopolitical risk exerts a negative effect on energy transition through two primary mechanisms: the direct fiscal crowding-out of renewable energy research and development expenditure, and the indirect political economy effect whereby energy security anxieties elevate the political salience of fossil fuel supply security relative to long-term decarbonization. Wang et al. (2024) extended this analysis to demonstrate that the effect was asymmetric: geopolitical shocks of high severity generated disproportionate reversions to fossil fuel dependency compared to moderate-severity events, suggesting non-linear dynamics in the relationship between conflict intensity and transition governance.

The apparent counterevidence, namely the UNFCCC's characterization of the conflict as accelerating the global renewables boom and the observed surge in European rooftop solar demand, warrants analytical attention (UNFCCC, 2023). These trends are real and non-trivial. However, they reflect the responses of energy-secure economies with existing industrial capacity for renewable deployment and fiscal space to accelerate investment. They do not represent the modal response of the global energy system. The vast majority of countries experiencing energy price shocks responded by prioritizing fossil fuel supply security rather than accelerating transition. The selective visibility of the transition-acceleration narrative thus constitutes a form of availability bias in the governance discourse: the cases most consistent with normative hopes receive disproportionate attention relative to the quantitatively dominant pattern of fossil fuel entrenchment.

Demand-Side Realism Problem in Global Clean Energy Targets

The second analytical dimension of the ARG framework concerns the treatment of energy demand within global transition target architectures. The current framework, most concretely expressed in the IEA Net Zero by 2050 scenario, the IRENA 1.5°C pathway, and the COP28 Global Stocktake outcomes, is premised on demand trajectories that assume aggressive energy efficiency improvements, behavioral change in high-income economies, and structural industrial transformation in emerging markets proceeding substantially faster than historical precedent or current policy trajectory would support.

Against the requirement that global fossil fuel demand fall by a quarter by 2030, the global median action score across assessed countries in 2024 stood at 25 against a required 65, with renewable energy deployment on a trajectory to reach only 2.7 times its 2022 level by 2030 (Zhang et al., 2025). The commitments made in

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NDCs account for less than half of the renewable capacity increase required to align with the tripling pledge, and even national energy plans and policies outside the NDC framework fall short by 30% (IRENA, 2023b). These numbers do not represent a temporary lag in deployment. They represent a structural misalignment between the demand assumptions embedded in transition targets and the observed behavior of energy systems under real-world political and economic constraints.

Gardes-Landolfini et al. (2023) documented that NGFS Phase III models projected annual coal-fired power capacity additions of zero to 44 gigawatts between 2021 and 2025, while actual additions ran at 46 to 52 gigawatts per year over the same period. This is not a marginal modeling error but a categorical failure to account for the energy demand imperatives of industrializing economies, particularly in Asia and Sub-Saharan Africa, where the political and developmental logic of fossil fuel-based industrialization is not adequately captured in models calibrated to the energy system structures of advanced economies. Smil (2016) argued that energy transitions are historically slow, capital-intensive, and path-dependent processes, and while Way et al. (2022) demonstrated that solar and wind cost trajectories have improved faster than most models anticipated, cost reductions alone do not resolve the demand-side structural constraints that characterize fossil-fuel-dependent industrial economies.

The green hydrogen case illustrates the same dynamic at the level of specific technology pathways. Odenweller and Ueckerdt (2025) tracked 190 green hydrogen projects over three years and found that only 7% of global capacity announcements were completed on schedule in 2023. Yet announced future project pipelines continued to grow, maintaining the appearance of alignment with 1.5°C scenarios while the actual implementation record demonstrated a persistent and widening gap between announcement and delivery. The policy implication is that transition targets must be developed within governance frameworks that acknowledge demand-side constraints explicitly and build contingency provisions for scenarios in which demand trajectories diverge from modeled assumptions.

Differentiated Impacts on the Global South

The third analytical dimension of the ARG framework concerns the differentiated exposure of Global South economies to the fiscal displacement effects of geopolitical shocks. The architecture of conditional NDC commitments means that the transition ambitions of most developing countries are structurally dependent on international climate finance flows from advanced economies. IRENA (2023a) reported that developing countries, primarily least developed countries and small island developing states, had committed to renewable capacity doubling by 2030, but that the majority of these commitments were conditional on external financial assistance.

The 2026 conflict compounds this structural dependency through a double fiscal displacement mechanism. In the first instance, developing-economy governments face higher fossil fuel import costs during supply disruptions, requiring either fiscal expenditure on consumer subsidies or acceptance of inflationary and welfare consequences that are politically destabilizing. Jordan (2026) documented cascading effects including rising food prices, transport cost increases, and fertilizer supply disruptions that disproportionately burdened low-income households in import-dependent economies. In the second instance, the advanced-economy governments on whose climate finance developing-country transition commitments depend are themselves under fiscal pressure from the same energy price shock, creating conditions for climate finance deferral at precisely the moment when developing-country needs are most acute.

This double displacement dynamic has structural implications for NDC credibility that extend beyond the immediate conflict episode. When conditional commitments cannot be

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operationalized because finance has not been delivered, the formal record of NDC non-achievement attributable to the developing country accumulates regardless of the structural reasons for non-implementation. Over successive cycles, this dynamic erodes the perceived credibility of the NDC framework as a mechanism for achieving actual emissions reductions, while concentrating the visible governance failure on the parties least responsible for its causes. The energy justice literature (Newell & Mulvaney, 2013; Sovacool et al., 2021) identifies this dynamic as both a justice failure and a political economy constraint on the transition itself: populations experiencing energy poverty cannot be expected to accept renewable transition pathways that increase their near-term energy costs without the compensating benefits of energy access, economic development, and fiscal support that a just transition framework would provide.

The OECD and UNDP (2025) noted that the 2024 UNEP Emissions Gap Report estimated the implementation gap between current policies and NDC pledges at 2 GtCO2e for unconditional NDCs and 5 GtCO2e for conditional NDCs, with the conditional gap reflecting primarily the developing-country shortfall attributable to undelivered finance commitments. The structural implication is that no amount of additional NDC ambition from developing countries will close this gap if the fiscal architecture on which conditional commitments rest remains vulnerable to geopolitical displacement. Governance reform must address the finance delivery mechanism directly, not merely the ambition level of the commitments it is supposed to support.

DISCUSSION

The analysis presented in the preceding sections supports the ARG framework's central proposition: global clean energy transition targets are structurally overambitious in their governance design, not in their scientific necessity. The distinction is analytically important and normatively consequential. The scientific imperative of rapid decarbonization is not in question: the IPCC Sixth Assessment Report, the UNEP Emissions Gap Reports, and the body of attribution science on climate impacts leave no ambiguity on this point. What is in question is whether the governance architecture through which that imperative is pursued is designed with sufficient robustness to withstand the structural conditions that characterize the real world of international political economy: geopolitical disruption, demand-side inertia, and fiscal asymmetry between advanced and developing economies.

The 2026 Iran conflict is analytically valuable precisely because it is not an exceptional event but a representative one. The literature reviewed in Section 2.3 demonstrates that geopolitical shocks have a consistent and statistically significant negative effect on energy transition progress, operating through fiscal reallocation, political economy shifts, and fossil fuel entrenchment mechanisms that recur across different conflict episodes and geographies. A governance architecture that cannot maintain transition momentum through such events is not adequate to the challenge it is designed to address, particularly given the IMF's documentation that fossil fuel lock-in risk is increasing as the capital stock of fossil fuel infrastructure expands in response to geopolitical energy security imperatives (Gardes-Landolfini et al., 2023).

The governance design recommendations that follow from the ARG framework are oriented toward COP31. They center on three priorities. The first is the incorporation of geopolitical scenario planning into NDC design and review processes: transition pathways should be stress-tested against conflict scenarios affecting major energy supply chokepoints, with explicit contingency provisions for maintaining transition momentum under disrupted conditions. The second is the redesign of conditional NDC finance mechanisms to include conflict and shock resilience provisions: climate finance flows should be protected from bilateral fiscal crowding-out through multilateral pooling and automatic disbursement triggers. The third is the development of demand-side realism metrics as a complement to supply-side transition targets:

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governance frameworks should track actual demand trajectories against modeled assumptions and trigger adaptive policy responses when divergences exceed specified thresholds. These reforms do not require abandonment of the Paris Agreement framework: they require its deepening to engage with the political economy realities that successive geopolitical shocks have made unavoidable.

CONCLUSION

The global clean energy transition faces a governance crisis that is distinct from but related to its scientific urgency. The 2026 Iran–United States conflict has exposed, with unusual clarity, the structural vulnerability of multilateral transition frameworks to geopolitical shocks that they are neither designed to anticipate nor equipped to absorb. This paper has argued that the resulting governance failure reflects not primarily a deficit of political will but a deficit of governance design: transition frameworks that assume stable geopolitical conditions, responsive demand trajectories, and reliable international finance flows cannot function as intended in a world characterized by recurrent conflict, persistent fossil fuel demand, and chronic under delivery of climate finance commitments.

The ARG framework advanced here provides a conceptual basis for distinguishing between the scientific ambition of decarbonization, which must be maintained, and the governance architecture through which that ambition is pursued, which requires fundamental redesign. Recommendations for COP31 center on embedding conflict resilience, demand-side realism, and differentiated fiscal support mechanisms into the institutional foundations of global transition governance. Without these reforms, the pattern of the 2026 crisis, namely declared ambition displaced by emergency fossil fuel management, climate finance crowded out by energy import bills, and conditional NDC commitments further deferred, will constitute not an exception but a recurring feature of global climate governance in an era of geopolitical instability. The analytical contribution of this paper is to demonstrate that this outcome is structurally predictable, and therefore, with adequate governance redesign, structurally avoidable.

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