

Governing the Global Green Energy Transition: Ambition, Equity, and the Politics of International Climate Policy

Hritochit Chakraborty

Student

Amity Institute of International Studies
Amity University, Noida

(Prof) Dr Nagalaxmi M Raman

Head of Institution

Amity Institute of International Studies
Amity University, Noida

Abstract

The international governance of green energy occupies one of the most contested spaces in contemporary global politics — where scientific urgency intersects with entrenched national self-interest and where the good intentions of multilateral diplomacy repeatedly collide with the harder realities of power, money, and competing development priorities. This article examines that collision through three connected lenses: the structural weaknesses of the Paris Agreement's nationally determined contributions (NDCs) framework; the rapidly intensifying geopolitics of critical minerals and clean energy supply chains; and the deep, persistent inequities in climate finance that are systematically eroding the foundations of multilateral consensus the global transition depends upon. Drawing on reports from the United Nations Environment Programme and the International Renewable Energy Agency, alongside peer-reviewed scholarship in environmental politics and international relations, this article advances a critical and normatively significant argument— that the green energy transition, rather than facilitating a genuinely cooperative architecture of global governance, is generating fresh axes of geopolitical competition and distributional injustice. Without a fundamental renegotiation of the terms on which global climate governance operates — including binding finance commitments, substantive adherence to the principle of common but differentiated responsibilities, and serious multilateral oversight of critical mineral supply chains — the transition risks reproducing the very inequities of the fossil fuel order it is supposed to replace.

Keywords:

Green Energy Transition, International Climate Governance, Critical Minerals, Climate Finance, Energy Justice

1. Introduction

A useful point of departure is that the green energy transition is, at its core, fundamentally a political challenge, often framed as a technical issue. The technological capabilities required to decarbonise the global energy system are largely available. Solar photovoltaics, wind turbines, battery storage, and green hydrogen electrolyzers all exist, are rapidly becoming cheaper, and are being deployed at a meaningful scale in many parts of the world. The primary constraints on a timely transition are not technological but structural and political. They are about power — who bears the costs of change, who controls the resources the transition depends on, who writes the rules that govern it, and the distributive consequences for actors excluded from dominant decision-making structures.

These questions have simmered beneath the surface of international climate negotiations for decades. The Paris Agreement (2015) did not fully resolve these structural tensions. What it did — and this was genuinely significant — was create a universal framework that, for the first time, bound both rich and poor countries to a shared long-term temperature goal: limiting global average warming to well below 2°C above pre-industrial levels and pursuing efforts to keep it to 1.5°C (UNFCCC, 2015). The mechanism chosen to pursue this goal was the nationally determined contribution — a climate pledge that each state designs for itself, submits every five years, and is expected to strengthen with each new cycle. It was, deliberately, a bottom-up architecture. Universal participation was the prize; binding targets were the price paid to achieve it.

A decade later, the divergence between stated ambition and empirical outcomes remains substantial. According to the UNEP Emissions Gap Report 2024, if every country implemented its current NDC in full, the world would still be heading for 2.6–3.1°C of warming by the end of the century — a temperature range that climate scientists have consistently described as catastrophic (UNEP, 2024). Staying on a 1.5°C pathway requires cutting emissions by 42 per cent from 2019 levels by 2030. Eleven of the G20 economies — together responsible for 77 per cent of global greenhouse gas emissions — are not even on track to meet the commitments they have already made, let alone what the science demands (UNEP, 2024).

This is not an argument that climate governance has simply failed and should be abandoned. That would misread what is actually a complicated picture. Renewable energy capacity has grown faster than almost anyone predicted in 2015. The share of global emissions covered by net-zero pledges has risen from nothing at the time of the Paris Agreement to around 70 per cent today. These gains are real. But gains in aspiration are not the same as gains in delivery, and the architecture of international green energy governance has three specific structural problems — in the NDC framework, in the geopolitics of clean energy supply chains, and in the distribution of climate finance — that urgently need to be named and confronted.

2. The NDC Framework: Promises, Gaps, and the Limits of Voluntary Ambition

2.1 Why the Bottom-Up Design Was Chosen — and What It Cost

To understand the NDC framework's weaknesses, it is necessary to examine the rationale underlying its institutional design. The architects of the Paris Agreement were operating in the aftermath of the Kyoto Protocol's limited effectiveness. Kyoto had imposed top-down, legally binding emissions targets on developed countries. The United States never ratified it. Canada withdrew in 2011 rather than face the consequences of missing its targets. The principal institutional lesson informing the Paris framework was a treaty that demanded binding targets from the outset would not achieve universal participation, and a climate agreement without the United States and China was of limited functional relevance.

So the NDC framework was built instead around a different logic — voluntary ambition, universal participation, and a progressive ratchet mechanism that would strengthen commitments every five years. NDCs are not legally binding in their substance. What is binding is the obligation to submit them, to report transparently on progress, and to ensure that each new NDC is more ambitious than the one before (UNFCCC, 2015; UNFCCC NDC, 2024). In terms of participation, this worked. Nearly every country in the world is now part of the Paris framework, and the 2025 NDC Synthesis Report of the UNFCCC notes that 89 per cent of recent submitting parties have communicated economy-wide targets — a genuine sign of procedural engagement (UNFCCC, 2025).

The problem, though, is that procedural engagement and substantive ambition are entirely different things. A country can file an NDC that is technically compliant with the Paris framework while committing to emissions reductions that are nowhere near sufficient. And that is, in aggregate, precisely what has happened.

2.2 The Ambition Gap in Numbers

Den Elzen et al. (2022) conducted a rigorous analysis of the updated NDCs submitted by 143 countries and found that even their full implementation would deliver only around 3.8 gigatonnes of additional CO₂-equivalent reductions by 2030 compared to the previous round of pledges. To keep warming below 2°C, that number needs to be roughly three times larger. For 1.5°C, it needs to be seven times larger. These discrepancies are structurally significant. They are the difference between a difficult but manageable transition and one that is simply not happening in time.

The UNEP Emissions Gap Report (2024) quantifies the escalating costs associated with delayed action. If action consistent with a 1.5°C pathway begins now, annual global emissions need to fall by around 7.5 per cent every year until 2035. Wait until 2030 to ramp up action, and that rate roughly doubles to 15 per cent per year — a rate of transformation with no clear historical precedent. Every year of delay makes the target harder and more expensive to reach.

2.3 The Political Economy Behind the Gap

The persistence of insufficient NDC ambition can be explained through the domestic political economy constraints that shape national climate commitments. The answer lies not in a simple lack of political will but in the structure of domestic political economies. Colgan, Green, and Hale (2021), writing in *PS: Political Science & Politics*, argue that the key dynamic is what they call the power of "climate-forcing asset owners" — oil and gas companies, fossil fuel utilities, and carbon-intensive industries — who have both enormous material stakes in resisting decarbonisation and well-developed capacities for translating those stakes into political influence. Each country's NDC is, in effect, the product of its own domestic political economy. In many of the world's largest emitters, that political economy is shaped by actors who benefit from the continuation of high-carbon systems and who possess strong structural incentives to ensure that transition commitments remain manageable from their perspective.

The NDC framework is structurally designed to accommodate these domestic political economy constraints. This is both the framework's greatest political achievement — it brought everyone into the room — and its most serious structural limitation.

2.4 Transparency, Trade, and Possible Reforms

Some reform pathways are worth examining carefully. Strengthening the Enhanced Transparency Framework — the mechanism through which states report on NDC progress — would improve accountability without requiring a fundamental redesign of the system. The European Union's Carbon Border Adjustment Mechanism, which entered its transitional phase in late 2023, offers a more ambitious model: it imposes costs on imports from countries without equivalent carbon pricing, creating a direct economic incentive for trading partners to strengthen their own climate policies. But this instrument carries its own complications. For many developing countries, it functions less as a climate incentive and more as a trade barrier — a point returned to in Section 4.

3. Critical Minerals: The Green Transition's New Geopolitical Fault Line

3.1 From Oil Dependency to Mineral Dependency

One of the underexplored implications of the shift away from fossil fuels is that it does not end resource dependency — it transforms it. The global energy system has run on coal, oil, and gas for two centuries, and the political and economic structures that have grown around those commodities are well understood. What remains insufficiently examined is that the renewable energy system being built to replace them is itself deeply dependent on a set of metallic minerals whose supply is geographically concentrated, technically demanding to process, and frequently extracted under conditions that raise serious social and environmental concerns.

Lithium, cobalt, nickel, manganese, and rare earth elements are the essential building blocks of solar panels, wind turbines, electric vehicle batteries, and grid storage systems (IRENA, 2023). Decarbonising the global economy requires them in vast and rapidly increasing quantities. The International Renewable Energy Agency estimates that demand for these materials will increase between two and six times over current levels by 2030, and potentially by an order of magnitude by 2050, depending on the pace of the transition.

3.2 Supply Chain Concentration and Strategic Dependence

The governance challenge begins with geography. The Democratic Republic of Congo produces over 70 per cent of the world's cobalt. Argentina, Bolivia, and Chile — the so-called "lithium triangle" — hold the majority of global lithium reserves. China dominates rare earth mining and, crucially, controls an even larger share of rare earth processing and refining capacity. For many of the critical components that go into clean energy technologies — battery cells, permanent magnets, solar wafers — China holds dominant positions not just in raw material supply but across multiple stages of the manufacturing chain (IRENA, 2023). This is a degree of supply chain concentration that makes the old OPEC-era concerns about oil dependency appear comparatively less complex.

Governments across the globe have responded with increasing strategic urgency. The EU's Critical Minerals Act of 2023 explicitly targets a reduction in dependence on third countries for critical raw materials. The United States' Inflation Reduction Act (2022) created substantial fiscal incentives for domestic and allied-country mineral processing, and more than 162 bills related to critical minerals were introduced in the US Congress in 2023–2024 alone (EESI, 2025). Australia, sitting on significant reserves of lithium, rare earths, nickel,

and cobalt, has invested over a billion dollars in developing its domestic extraction capacity and has blocked Chinese-linked companies from acquiring stakes in key mining operations, citing national security concerns (Goldman Sachs, 2023).

3.3 Friend-Shoring and the Fragmentation Risk

While these national responses are individually rational Collectively, they raise a serious problem. The architecture of "friend-shoring" — deliberately redirecting supply chains toward geopolitically aligned partners — threatens to fragment the multilateral trading system that has historically driven down the cost of renewable energy technology. Solar panels are cheap partly because of the global specialisation and scale economies that free trade enables. If each major power bloc attempts to develop self-sufficient or politically aligned clean energy supply chains, some of those economies of scale will be lost. The geopolitics of critical minerals and the economics of the energy transition are, in this sense, structural tensions.

3.4 Distributional Implications and Justice Concerns”

There is also a justice dimension to this picture that the "supply chain security" framing of wealthy governments tends to obscure. The communities that actually live with the environmental and social consequences of mineral extraction — many of them in the Democratic Republic of Congo, Chile, Bolivia, and Indonesia — are rarely the communities that stand to benefit from the electric vehicles and wind turbines their resource-intensive extraction processes borne by local communities help to build. A study published in **PNAS Nexus** (PMC, 2024) documents patterns of conflict, labour exploitation, and what it explicitly calls "transactional colonialism" embedded in clean energy technology supply chains, particularly in cobalt and lithium extraction. A single royalty dispute at the DRC's Tenke Fungurume copper and cobalt mine in 2022 disrupted 15 per cent of the global cobalt supply for several months — “highlighting the fragility of existing supply arrangements and how little leverage extraction communities currently have in shaping the terms under which their resources are taken" (IRENA, 2023).

The Minerals Security Partnership, launched by the United States and its allies in 2022, is primarily a security initiative. It is not a justice initiative. Comprehensive international governance of critical mineral supply chains — covering labour standards, environmental protection, equitable revenue distribution between producer and consumer countries, and meaningful recycling obligations — does not yet exist. This is a governance gap that will only grow more consequential as the transition accelerates.

4. Climate Finance, the Global South, and the Broken Promise of Differentiated Responsibility

4.1 The Principle and the Practice

No issue in international climate negotiations generates significant contention— or more disappointment — than climate finance. The Paris Agreement formally incorporated the principle of Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC), which acknowledges that while climate change is a shared problem, countries' responsibilities for causing it and their capacities to address it are very different (UNFCCC, 2015). In practice, this principle was supposed to translate into substantial financial transfers from wealthy industrialised countries — which built their prosperity on a century and a half of largely unconstrained fossil fuel combustion — to developing countries, which contributed far less to the problem and have far fewer resources with which to respond.

The famous \$100 billion per year pledge, made by developed countries at COP15 in Copenhagen in 2009, was supposed to be the concrete expression of that commitment, starting in 2020. It was not met on time. More importantly, when it was eventually counted as having been reached, much of the reported figure consisted of loans — many of them at commercial or near-commercial interest rates — rather than grants. Counting debt as climate finance is a raises normative concerns regarding the classification of finance the donor gets credit for the contribution while the recipient incurs the obligation to repay it.

4.2 Green Conditionality and the World Bank Problem

The Bretton Woods Project's 2024 analysis of the World Bank's approach to Paris Agreement alignment adds a further complication. Of the 71 energy projects approved by the World Bank in fiscal year 2024, 38 were Development Policy Financing operations — budget support loans that come with conditions requiring recipient governments to implement specific policy reforms. The analysis found that the volume of finance flowing through these "green conditionality" mechanisms was larger than the volume of direct green investment (Bretton Woods Project, 2024). In effect, a substantial portion of what is counted as climate finance is money that comes with policy

strings attached, requiring governments in the Global South to redesign their energy sectors in ways determined in Washington rather than in their own capitals.

This raises a fundamental question regarding the functional purpose of climate finance about what climate finance is actually for. If it is genuinely intended to support developing countries in making a transition they lack the resources to make on their own, then grants, concessional lending, and technology transfers are the appropriate instruments. If it is primarily a mechanism for leveraging policy change in line with the preferences of capital-exporting countries, then the framing of "climate finance" is, at least in part, a misnomer.

4.3 The Structural Barriers Developing Countries Face

For many countries in the Global South, the barriers to green energy transition are not primarily about political will. They are structural. Heras et al. (2024), in a systematic review published in **WIREs Climate Change**, document that renewable energy investments in developing countries remain far below the scale the transition requires, and that where renewables are deployed, they frequently add to energy systems still running on fossil fuels rather than replacing those systems. Countries that lack access to affordable capital, advanced technology, and institutional capacity cannot decarbonise at the pace that the Paris Agreement's ambition requires, regardless of what they put in their NDCs.

The "recognition justice" framework in energy justice scholarship puts this clearly: the global energy transition as currently structured is more concerned with the outcome — a decarbonised energy system — than with whether the process of getting there is just (Tandfonline, 2024). Countries in sub-Saharan Africa, South and Southeast Asia, and the Pacific have contributed a fraction of the cumulative emissions that have created the climate crisis. Many of them are also the most exposed to its consequences. Asking them to accelerate expensive energy transitions while their access to affordable finance remains constrained, and while the European Union simultaneously designs trade mechanisms that could penalise their exports, undermines the normative coherence of the principle of shared responsibility.

4.4 The Fossil Fuel Dilemma

There is also a harder version of this conversation that international climate governance has consistently failed to have honestly. Many developing countries have legitimate development aspirations that have historically been met, in part, through fossil fuels. The global call to "leave fossil fuels underground" is asymmetric in practice: it asks countries that have only recently begun to exploit their hydrocarbon resources to forego revenues that industrialised countries used freely for generations to build their wealth. Heras et al. (2024) frame this as a question about stranded assets and the Right to Development: without adequate financing alternatives, the international community is effectively asking the Global South to strand its own assets in the name of a climate solution that the Global North caused and that the Global North is not adequately funding.

The UNEP Emissions Gap Report (2024) acknowledges this directly, noting that enhanced climate finance and international support will be essential if climate and development goals are to be achieved fairly. Coming from a body that has historically focused on emissions reduction above distributional concerns, this is a significant statement. It signals, however belatedly, a recognition that the financing dimension is not a technical afterthought to climate governance — it is a political prerequisite for it.

5. Conclusion: Three Reforms, One Honest Reckoning

The picture drawn across these three sections not an optimistic assessment, but a necessary analytical one. International green energy governance is demonstrating partial but significant structural limitations but in ways that are specific, identifiable, and addressable if there is sufficient political will to address them.

The NDC framework has achieved the impressive feat of universal participation but has not generated anywhere near the ambition or implementation that the climate science demands. Critical mineral supply chains are becoming a new axis of geopolitical competition, with consequences that are likely to fragment the multilateral cooperation the transition requires and impose familiar patterns of extractive injustice on communities in the Global South. And climate finance has fallen so far short of its stated commitments that its credibility as an instrument of genuine North-South solidarity is increasingly in question.

Three reform directions follow from this diagnosis.

On ambition: the NDC framework needs mechanisms capable of exerting genuine upward pressure on national targets. Sectoral agreements among major emitting industries — in steel, cement, shipping, and aviation — could create domestic political coalitions in favour of more ambitious national policy, as Colgan, Green, and Hale (2021) suggest. Instruments like the Carbon Border Adjustment Mechanism, however imperfect, point in the right direction, though they need to be designed with much more careful attention to their impacts on developing countries' trade competitiveness than the current EU version displays.

On supply chains: the Minerals Security Partnership and its equivalents are security-first arrangements that do nothing to address the justice dimensions of critical mineral extraction. What is needed is a comprehensive multilateral framework — potentially built through the WTO and the UN system — that establishes baseline standards for labour rights, environmental protection, and revenue-sharing in critical mineral supply chains, alongside serious recycling and circular economy obligations for consuming countries.

On finance: the \$100 billion pledge was always inadequate for the scale of the challenge; replacing it with a figure that is actually calibrated to need, delivered primarily as grants rather than loans, and governed by institutions in which developing countries have genuine voice, is the minimum that credibility in international climate governance requires.

These reforms are less constrained by technical feasibility than by political economy considerations. That difficulty should be acknowledged honestly rather than papered over with the kind of diplomatic language that has characterised so many climate summits. The green energy transition — of critical importance, particularly given the narrowing temporal window for effective intervention for the international community to keep confusing process with progress.

References

- Bretton Woods Project. (2024). *Year one of World Bank Paris Agreement alignment in the energy sector: 'Green conditionality' dwarfs green investments*. <https://www.brettonwoodsproject.org/2024/10/year-one-of-world-bank-paris-agreement-alignment-in-the-energy-sector-green-conditionality-dwarfs-green-investments/>
- Colgan, J., Green, J., and Hale, T. (2021). Global climate policy beyond the Paris Agreement. *PS: Political Science & Politics*, 57(1), 40–44. <https://doi.org/10.1017/S1049096523000318>
- Den Elzen, M., et al. (2022). Updated nationally determined contributions collectively raise ambition levels but need strengthening further to keep Paris goals within reach. *PMC / Mitigation and Adaptation Strategies for Global Change*, 27(33). <https://pmc.ncbi.nlm.nih.gov/articles/PMC9209833/>
- EESI (Environmental and Energy Study Institute). (2025). *Issue brief: Critical minerals and the U.S. clean energy transition*. <https://www.eesi.org/papers/view/issue-brief-critical-minerals-and-the-u.s-clean-energy-transition>
- Goldman Sachs. (2023). *Resource realism: The geopolitics of critical mineral supply chains*. <https://www.goldmansachs.com/insights/articles/resource-realism-the-geopolitics-of-critical-mineral-supply-chains>
- Heras, I., Kreinin, H., and Johannisova, N. (2024). Fossil fuels, stranded assets, and the energy transition in the Global South: A systematic literature review. *WIREs Climate Change*, 15(3), e866. <https://doi.org/10.1002/wcc.866>
- IPCC. (2023). *Climate Change 2023: Synthesis Report*. Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/syr/>
- IRENA. (2023). *Geopolitics of the energy transition: Critical materials*. International Renewable Energy Agency. <https://www.irena.org/Digital-Report/Geopolitics-of-the-Energy-Transition-Critical-Materials>
- PMC / PNAS Nexus. (2024). A global fairtrade partnership needed to address injustices in the supply chains of clean energy technology materials. *PNAS Nexus*, 3(11). <https://pmc.ncbi.nlm.nih.gov/articles/PMC11564201/>
- Sørensen, E., Bryson, J. M., and Crosby, B. C. (2024). Drivers of collaborative governance for the green transition. *Public Management Review*, 26(12), 3715–3740. <https://doi.org/10.1080/14719037.2024.2358321>

Tandfonline / Journal of Energy & Natural Resources Law. (2024). Climate change, energy transition, and the Global South: Learnings from the international framework on the ozone layer. *Journal of Energy & Natural Resources Law*, 42(3), 255–277. <https://doi.org/10.1080/02646811.2024.2345012>

UNEP. (2024). *Emissions Gap Report 2024: No more hot air ... please!* United Nations Environment Programme. <https://www.unep.org/resources/emissions-gap-report-2024>

UNFCCC. (2015). *The Paris Agreement*. United Nations Framework Convention on Climate Change. <https://unfccc.int/process-and-meetings/the-paris-agreement>

UNFCCC NDC. (2024). *Nationally determined contributions (NDCs)*. <https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs>

UNFCCC. (2025). *2025 NDC Synthesis Report*. <https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/2025-ndc-synthesis-report>

Copyright & License:



© Authors retain the copyright of this article. This work is published under the Creative Commons Attribution 4.0 International License (CC BY 4.0), permitting unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.