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Green Technology, Global Power, and Climate Diplomacy: Emerging Dynamics in International Politics

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ABSTRACT

Climate change has evolved from an environmental concern into a defining variable of global power politics. The transition toward green technology—renewable energy systems, electric mobility, hydrogen fuel, carbon capture, and critical mineral supply chains—is reshaping the architecture of international relations. This paper examines how technological innovation in climate mitigation has become a strategic instrument of statecraft, influencing global power hierarchies, trade alignments, and diplomatic negotiations.

Drawing on a qualitative and policy-analytical approach, the study explores the intersection of green industrial policy, technological competition, and climate diplomacy. It argues that states are increasingly leveraging clean energy leadership not only to meet sustainability goals but also to secure geopolitical influence, economic advantage, and strategic autonomy. The emergence of carbon border adjustments, climate finance mechanisms, and technology-transfer debates illustrates how environmental cooperation is simultaneously a site of rivalry.

The paper further analyzes the implications for Global South countries, particularly in terms of access to finance, technology equity, and participation in supply chains for critical minerals. By situating green technology within broader frameworks of international political economy and non-traditional security, the study highlights the dual character of climate diplomacy as both cooperative and competitive.

Ultimately, the article contends that the global energy transition is not merely an environmental transformation but a reconfiguration of international power structures, with long-term consequences for global governance, multilateralism, and sustainable development.

Keywords: Green Technology, Climate Diplomacy, International Relations, Energy Transition, Geopolitics, Global Governance, International Political Economy

INTRODUCTION

Climate change has emerged as one of the most transformative forces shaping contemporary international politics. What was once treated primarily as an environmental or scientific concern has evolved into a central strategic issue influencing diplomacy, trade, security, and global governance. The accelerating impacts of rising temperatures, extreme weather events, sea-level rise, and ecological degradation have compelled states to reconsider traditional notions of power and national interest. In this context, green technology—encompassing renewable energy systems, electric mobility, hydrogen fuel development, smart grids, carbon capture technologies, and digital climate innovations—has assumed unprecedented geopolitical significance. The global transition toward low-carbon development is no longer merely a sustainability imperative; it is increasingly a determinant of economic competitiveness and strategic influence.

The twenty-first century is witnessing a structural transformation of the global energy order. Historically, geopolitical power was closely tied to the control of fossil fuel resources such as oil and gas. Energy security strategies, alliance formations, and even military interventions often revolved around hydrocarbon supply chains. However, the accelerating shift toward decarbonization is redefining these dynamics. States that lead in renewable energy innovation, battery storage technologies, semiconductor efficiency, and critical mineral

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processing are positioning themselves at the forefront of a new era of geoeconomic competition. The politics of lithium, cobalt, rare earth elements, and green industrial subsidies illustrate how climate mitigation strategies are reshaping international economic relations.

At the same time, climate diplomacy has become a central pillar of multilateral engagement. International agreements, carbon markets, climate finance frameworks, and technology transfer mechanisms are now integral to foreign policy agendas. Yet climate diplomacy operates within a paradox: while it demands unprecedented global cooperation, it unfolds amid intensifying great-power rivalry and economic nationalism. Major powers are simultaneously collaborating on emissions reduction commitments and competing for technological dominance and supply chain control. This duality underscores the complex intersection between environmental governance and strategic statecraft.

Green technology thus functions not only as an environmental solution but also as an instrument of global power projection. Investments in renewable energy infrastructure, electric vehicle manufacturing, and green hydrogen corridors are increasingly linked to industrial policy and national development strategies. Subsidy regimes, carbon border adjustment mechanisms, and trade regulations further illustrate how climate policy intersects with international political economy. These measures have implications for global trade flows, development trajectories, and North–South relations, particularly for countries seeking equitable access to finance and technology.

For developing economies, the green transition presents both opportunity and vulnerability. On one hand, participation in renewable supply chains and climate finance mechanisms offers pathways for sustainable development and economic diversification. On the other, unequal access to capital, technology, and critical minerals risks deepening structural inequalities within the international system. The debate over climate justice, adaptation funding, and loss-and-damage mechanisms reflects broader concerns about historical responsibility and distributive equity in global governance.

This paper examines how green technology is reshaping global power configurations and influencing contemporary climate diplomacy. It argues that the transition to a low-carbon economy is generating a reconfiguration of international relations characterized by three interrelated dynamics: first, the emergence of technological leadership as a source of strategic advantage; second, the integration of climate objectives into trade and industrial policy; and third, the transformation of multilateral climate negotiations into arenas of both cooperation and competition. By situating green technology within the frameworks of international political economy and non-traditional security studies, the article highlights the evolving nature of power in the climate era.

Understanding these emerging dynamics is critical for policymakers and scholars alike. As states navigate the complex terrain of decarbonization, the interplay between technological innovation, geopolitical rivalry, and diplomatic engagement will shape the future of global governance. The green transition is not merely an environmental adjustment—it represents a profound restructuring of economic systems, strategic priorities, and international hierarchies. Consequently, examining the nexus between green technology, global power, and climate diplomacy provides essential insight into the evolving architecture of twenty-first-century international politics.

LITERATURE REVIEW

The relationship between climate change and international relations has generated extensive interdisciplinary scholarship spanning environmental studies, security studies, and international political economy. Early literature largely framed climate change as a collective action problem rooted in global commons theory, emphasizing cooperation challenges under anarchy (Keohane, 1984; Ostrom, 1990). From a neoliberal institutionalist perspective, international regimes were seen as critical mechanisms for reducing transaction costs, building trust, and facilitating compliance in multilateral climate negotiations. Studies of global environmental governance highlighted the importance of treaty frameworks, monitoring systems, and norm diffusion in addressing transboundary ecological threats (Young, 1994).

Realist scholars, however, questioned the durability of climate cooperation in a competitive international system. They argued that states prioritize relative gains and strategic advantage over collective environmental benefits

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(Mearsheimer, 2001). From this standpoint, climate commitments are constrained by national interest calculations, energy security concerns, and economic competitiveness. Recent geopolitical analyses extend this argument by suggesting that decarbonization itself is becoming a domain of great-power rivalry, particularly in relation to renewable energy technologies, battery storage systems, and rare earth mineral supply chains (Blackwill & Harris, 2016).

Constructivist scholarship offers a different lens, emphasizing the role of norms, identity, and discourse in shaping climate diplomacy. Research demonstrates how climate change has evolved into a global normative framework influencing state behavior and foreign policy rhetoric (Finnemore & Sikkink, 1998). The emergence of concepts such as "climate justice," "common but differentiated responsibilities," and "net-zero commitments" reflects the social construction of responsibility and legitimacy within global governance institutions. Norm entrepreneurship by vulnerable states and transnational advocacy networks has been particularly significant in advancing adaptation and loss-and-damage debates (Keck & Sikkink, 1998).

In parallel, the literature on climate security has expanded rapidly over the past two decades. Scholars have examined the links between environmental degradation, resource scarcity, and conflict dynamics (Homer-Dixon, 1999). While early research posited a direct correlation between climate stress and violent conflict, more recent empirical studies adopt a nuanced approach, highlighting indirect pathways mediated by governance capacity, socioeconomic vulnerability, and institutional resilience (Barnett & Adger, 2007). The securitization of climate change has also been analyzed as a political process through which environmental issues are framed as existential threats, thereby legitimizing extraordinary policy measures (Buzan, Wæver, & de Wilde, 1998).

Another significant body of work is climate change within the international political economy (IPE). Scholars argue that the global energy transition represents a structural transformation comparable to previous industrial revolutions (Newell & Paterson, 2010). Green industrial policy, state subsidies, and technological innovation are increasingly viewed as instruments of geoeconomic strategy. Meckling and Nahm (2019) contend that domestic clean energy industries can reshape international bargaining positions by creating vested interests in ambitious climate policies. Similarly, research on carbon border adjustment mechanisms illustrates how climate governance intersects with trade policy and global market regulation (Bacchus, 2021).

The geopolitics of critical minerals has emerged as a central theme in recent scholarship. As renewable energy systems depend heavily on lithium, cobalt, nickel, and rare earth elements, supply chain control has become strategically significant (Overland, 2019). Studies suggest that while renewable energy may reduce traditional hydrocarbon geopolitics, it simultaneously introduces new dependencies and resource competitions. This evolving resource landscape has prompted debates over whether the green transition will mitigate or reproduce existing patterns of geopolitical rivalry.

Climate finance constitutes another prominent research area. The literature highlights persistent North–South tensions over historical responsibility, adaptation funding, and technology transfer (Roberts & Parks, 2007). Developing countries emphasize equity and distributive justice, arguing that industrialized nations bear disproportionate responsibility for cumulative emissions. The politics of loss-and-damage compensation further underscores the moral and legal complexities of global climate governance (Calliari et al., 2020). Despite institutional progress, financing gaps remain substantial, raising concerns about implementation deficits and uneven transition pathways.

Technological innovation plays a critical bridging role between environmental governance and geopolitical competition. Studies in innovation policy and sustainability transitions emphasize the importance of state-led investment, research and development (R&D), and regulatory frameworks in accelerating decarbonization (Geels, 2011). The concept of "green growth" has gained prominence as governments seek to align climate mitigation with economic expansion. However, critics caution against techno-optimism, arguing that structural inequalities and political constraints may limit the transformative potential of technological solutions (Scoones et al., 2015).

While the literature provides substantial insights into climate governance, security, and political economy, gaps remain in integrating these strands into a unified analytical framework. Much of the existing research either

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emphasizes cooperative multilateralism or competitive geopolitics, without sufficiently examining their simultaneous operation. Furthermore, the intersection of green technology, industrial strategy, and diplomatic negotiation requires deeper exploration, particularly in the context of shifting global power hierarchies.

This study contributes to the evolving scholarship by synthesizing insights from international relations theory, political economy, and climate governance research. It positions green technology not merely as a mitigation tool but as a strategic variable reshaping global power structures and diplomatic practices. By examining the dual dynamics of cooperation and competition embedded in climate diplomacy, the paper seeks to advance understanding of how technological transitions are redefining the contours of contemporary international politics.

RESEARCH METHODOLOGY

This study employs a qualitative, analytical, and policy-oriented research design to examine the intersection of green technology, global power, and climate diplomacy. Given the interdisciplinary nature of the topic—spanning international relations, political economy, and environmental governance—a qualitative approach allows for a nuanced understanding of the complex dynamics shaping global climate politics. The research integrates theoretical insights from Realism, Liberal Institutionalism, Constructivism, and International Political Economy to analyze both competitive and cooperative dimensions of climate diplomacy.

The primary method is **desk-based qualitative analysis** of secondary sources. These include peer-reviewed journal articles, official policy documents, international agreements, government reports, and reputable thinktank publications. The selection of sources prioritizes recent and authoritative literature published between 2010 and 2025 to ensure relevance to contemporary trends in renewable energy, climate negotiations, and geopolitical competition. Key multilateral frameworks such as the Paris Agreement, the UNFCCC reports, and G20 energy transition policies are analyzed to understand institutional mechanisms, normative frameworks, and technology transfer processes.

The study employs thematic content analysis to identify patterns, trends, and causal relationships. Themes include technological leadership, critical mineral geopolitics, climate finance, energy transition policies, and normative influence in diplomacy. Each theme is analyzed through the lens of the chosen theoretical frameworks, enabling an integrated understanding of how green technology functions as both a strategic instrument and a cooperative tool. Comparative analysis of major economies—such as the United States, China, the European Union, and select Global South countries—further illustrates differential capacities, policy approaches, and bargaining power within international negotiations.

Additionally, the research incorporates **case-based examples** to contextualize abstract concepts. These include technological initiatives, carbon border adjustment policies, renewable supply chain partnerships, and climate finance projects. By combining theoretical interpretation with empirical examples, the study situates green technology within practical policy contexts, highlighting its significance for both state strategy and global governance.

Finally, the study maintains a **critical perspective on data limitations and potential biases**, particularly in terms of access to proprietary industrial information and disparities in national reporting. While relying on secondary data, the methodology emphasizes triangulation, cross-referencing multiple sources to ensure accuracy and reliability. Overall, this methodology provides a robust framework for analyzing the dual dynamics of cooperation and competition inherent in contemporary climate diplomacy and the strategic use of green technology.

THEORETICAL FRAMEWORK

Understanding the intersection of green technology, global power, and climate diplomacy requires an integrated theoretical approach drawing from major traditions in international relations: Realism, Liberal Institutionalism, and International Political Economy (IPE), supplemented by elements of Constructivism. Each perspective provides distinct analytical tools for interpreting how the global energy transition is reshaping contemporary international politics.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue II, February 2026

From a **Realist** perspective, the international system is characterized by anarchy, competition, and the pursuit of national interest (Mearsheimer, 2001). States seek relative gains and strategic advantage, particularly in domains that influence economic strength and security. In this context, green technology can be conceptualized as a strategic asset. Leadership in renewable energy innovation, battery manufacturing, semiconductor efficiency, and critical mineral processing enhances national competitiveness and reduces external dependencies. The transition to low-carbon systems therefore becomes embedded within broader geostrategic rivalry. Major powers invest in domestic clean energy industries not solely for environmental sustainability but to secure technological dominance, control supply chains, and strengthen geopolitical leverage. From this vantage point, climate diplomacy is often constrained by concerns over economic competitiveness and sovereignty, leading to cautious commitments and strategic bargaining.

In contrast, **Liberal Institutionalism** emphasizes cooperation through international institutions and regimes (Keohane, 1984). Climate change represents a classic collective action problem requiring multilateral coordination. International agreements, monitoring frameworks, climate finance institutions, and technology transfer mechanisms serve to reduce uncertainty and facilitate compliance. This theoretical lens highlights the role of global governance structures in fostering trust, promoting transparency, and aligning state incentives toward common mitigation goals. Climate diplomacy, under this framework, is not merely symbolic but institutionalized through structured negotiations and legally or politically binding commitments. The growth of carbon markets, multilateral climate funds, and transnational partnerships reflects the liberal assumption that cooperation, though complex, is achievable under appropriate institutional arrangements.

However, the accelerating energy transition also necessitates engagement with **International Political Economy (IPE)** approaches. IPE examines the interplay between markets, states, and global economic structures (Gilpin, 2001). The shift toward green industrial policy, strategic subsidies, and carbon border adjustments demonstrates how climate governance intersects with trade and financial systems. States are increasingly deploying industrial policy tools to nurture domestic clean energy sectors, protect strategic industries, and shape global market rules. This dynamic reflects geoeconomic competition, wherein economic instruments are used to achieve strategic objectives. The distribution of benefits and burdens within the global energy transition— particularly regarding technology access, supply chain control, and climate finance—raises questions of equity and structural inequality. Developing countries often face asymmetrical bargaining positions due to capital constraints and technological dependency, reinforcing debates around justice and fair transition pathways.

Elements of **Constructivism** further enrich the analysis by emphasizing the role of norms, discourse, and identity in shaping climate politics (Finnemore & Sikkink, 1998). The framing of climate change as an existential threat, the diffusion of "net-zero" commitments, and the normative emphasis on sustainability reflect socially constructed understandings of responsibility and legitimacy. Climate diplomacy operates not only through material incentives but also through reputational considerations and moral claims. Normative concepts such as climate justice and common but differentiated responsibilities influence negotiation outcomes and policy framing.

By synthesizing these perspectives, this study conceptualizes green technology as both a material resource and a normative instrument within global politics. Realism explains the competitive dimensions of technological leadership; Liberal Institutionalism accounts for cooperative governance mechanisms; IPE illuminates structural economic transformations and distributional conflicts; and Constructivism highlights the role of evolving norms in shaping diplomatic practice. Together, these theoretical lenses provide a comprehensive framework for analyzing how climate diplomacy simultaneously embodies cooperation and rivalry in an era defined by technological transition and shifting power hierarchies.

Core Analysis: Green Technology as Strategic Power in Contemporary Climate Diplomacy

Green Technology as a Strategic Instrument of State Power

The global transition toward low-carbon development has fundamentally altered the material foundations of power in international politics. Historically, geopolitical influence was closely linked to fossil fuel reserves and control over hydrocarbon trade routes. In contrast, contemporary strategic competition increasingly centers on

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue II, February 2026

technological innovation in renewable energy systems, battery storage, electric mobility, hydrogen fuel, and smart grid infrastructure. States that dominate these sectors are positioned to shape emerging economic structures and global regulatory standards.

Technological leadership provides multiple layers of strategic advantage. First, it enhances economic competitiveness through industrial growth, job creation, and export capacity. Second, it strengthens energy security by reducing dependence on imported fossil fuels. Third, it generates normative influence, as technologically advanced states often set global standards in sustainability and regulatory frameworks. This convergence of economic, security, and normative power illustrates how green technology functions as a multidimensional instrument of statecraft.

Major economies have integrated decarbonization goals into broader national industrial strategies. Subsidies for renewable manufacturing, investment in electric vehicle supply chains, and public–private partnerships in hydrogen development reflect deliberate state-led efforts to secure long-term technological dominance. From a realist perspective, such policies are not purely environmental commitments but strategic investments aimed at consolidating relative advantage in an evolving global order.

Geoeconomic Competition and the Politics of Critical Minerals

While renewable energy promises reduced reliance on fossil fuels, it introduces new forms of material dependency. Solar panels, wind turbines, batteries, and electric vehicles require significant quantities of lithium, cobalt, nickel, and rare earth elements. The concentration of these resources in specific geographic regions has created new strategic vulnerabilities and competitive dynamics.

Control over extraction, processing, and refining capacities has become a focal point of geopolitical maneuvering. States are pursuing diversified supply chains, strategic mineral partnerships, and domestic processing capabilities to mitigate dependency risks. This emerging “mineral geopolitics” illustrates that the energy transition does not eliminate resource competition; rather, it reconfigures it.

Additionally, green industrial subsidies and carbon border adjustment mechanisms are reshaping global trade flows. Carbon tariffs and regulatory standards influence market access and may disproportionately affect developing economies with carbon-intensive production systems. These measures demonstrate how climate governance increasingly intersects with trade policy, reinforcing the geoeconomic dimension of decarbonization. Thus, climate diplomacy is embedded within broader negotiations over trade equity, competitiveness, and regulatory harmonization.

Climate Diplomacy: Cooperation Amid Rivalry

Climate diplomacy operates within a paradoxical environment characterized by both collaboration and competition. On one hand, multilateral agreements, emission pledges, and climate finance frameworks reflect unprecedented global coordination. Shared scientific consensus and growing public awareness have elevated climate change to a central diplomatic priority.

On the other hand, strategic mistrust and economic rivalry complicate cooperation. States remain cautious about binding commitments that may constrain industrial growth or undermine competitive advantage. Negotiations over transparency, financing, and technology transfer often expose deep-seated tensions between developed and developing countries. For industrialized states, ambitious climate commitments may be framed as leadership initiatives; for developing economies, they raise concerns about equitable burden-sharing and historical responsibility.

The dual character of climate diplomacy becomes particularly evident in technology transfer debates. While global mitigation requires diffusion of clean technologies, intellectual property regimes and commercial interests limit unrestricted sharing. As a result, climate negotiations frequently involve bargaining over financial assistance, concessional loans, and capacity-building initiatives. This dynamic underscores how environmental cooperation remains embedded within broader power asymmetries.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue II, February 2026

North–South Dynamics and Climate Justice

The global energy transition has significant distributional implications. Developed economies possess advanced technological infrastructure, capital resources, and institutional capacity to implement green industrial policy. In contrast, many developing states face fiscal constraints, limited technological access, and adaptation burdens exacerbated by climate vulnerability.

This asymmetry fuels ongoing debates around climate justice and equitable transition. Developing countries emphasize the principle of differentiated responsibility, arguing that historical emitters bear greater obligation to finance mitigation and adaptation efforts. Climate finance commitments, loss-and-damage mechanisms, and concessional lending frameworks are central to these negotiations.

Participation in renewable supply chains presents potential opportunities for economic diversification in the Global South. However, without equitable access to processing technologies and value-added manufacturing, many resource-rich countries risk remaining confined to extractive roles.

The distribution of benefits within green supply chains therefore becomes a crucial determinant of whether the energy transition mitigates or reproduces structural inequalities in the international system.

Technological Standard-Setting and Normative Influence

Beyond material resources, green technology shapes global governance through regulatory influence. States that pioneer renewable technologies and emissions standards often shape international norms and certification regimes. Environmental regulations, sustainability reporting requirements, and carbon accounting methodologies increasingly influence global market participation.

This standard-setting power extends diplomatic influence by aligning economic relationships with normative frameworks. Countries adopting advanced environmental standards may leverage market access as an incentive for compliance. Consequently, technological leadership translates into agenda-setting capacity within multilateral institutions and trade negotiations.

Norm diffusion also reinforces reputational considerations. Governments increasingly frame climate leadership as a marker of responsible global citizenship. Net-zero commitments and green growth strategies serve both domestic political objectives and international image-building functions. Constructivist insights highlight how identity and legitimacy intersect with material capabilities in shaping diplomatic outcomes.

Reconfiguration of Global Power Hierarchies

The cumulative effect of technological innovation, geoeconomic competition, and normative leadership is a gradual reconfiguration of global power hierarchies. The energy transition alters the strategic significance of traditional hydrocarbon exporters while elevating states with advanced technological ecosystems. At the same time, new alliances are emerging around renewable partnerships, mineral security arrangements, and climate finance coalitions.

This transformation does not imply the disappearance of fossil fuel geopolitics; rather, it signals the coexistence of parallel energy systems during a transitional period. Hybrid energy structures create complex interdependencies, where states simultaneously manage legacy hydrocarbon interests and future-oriented renewable investments.

Ultimately, the green transition represents a structural shift in the foundations of global power. Technological capability, supply chain resilience, and regulatory influence increasingly define international standing. Climate diplomacy becomes the arena in which these evolving capabilities are negotiated, contested, and institutionalized.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue II, February 2026

CONCLUSION

This study has examined the transformative role of green technology in reshaping global power dynamics and climate diplomacy. The analysis demonstrates that the transition to a low-carbon economy is not solely an environmental imperative; it has become a central strategic variable influencing state behavior, international negotiations, and global governance structures.

Green technology—ranging from renewable energy systems and electric mobility to hydrogen infrastructure and battery storage—functions simultaneously as a tool of cooperation and a source of competition. States leverage technological leadership to enhance economic competitiveness, secure energy independence, and project normative influence, illustrating the multifaceted nature of power in the twenty-first century.

The findings underscore the dual character of climate diplomacy. On one hand, multilateral frameworks, climate finance mechanisms, and technology-transfer initiatives reflect unprecedented opportunities for global cooperation. On the other, strategic mistrust, industrial competition, and asymmetries in technological capacity highlight the persistent influence of power politics. Developed states often set global standards and shape regulatory regimes, while developing countries seek equitable access to technology, finance, and supply chains. This dynamic interaction illustrates that climate diplomacy operates within a complex interplay of cooperation, rivalry, and normative negotiation.

Geoeconomic and resource dimensions further complicate the global energy transition. The strategic importance of critical minerals, supply chain security, and industrial policy demonstrates that technological decarbonization does not eliminate traditional geopolitical competition but reconfigures it. Nations that lead in technological innovation also acquire standard-setting power, which can influence global markets and diplomatic outcomes.

Simultaneously, inequities in access to technology and finance reinforce persistent North–South tensions and highlight the importance of climate justice and fair transition frameworks.

From a theoretical perspective, the integration of Realism, Liberal Institutionalism, International Political Economy, and Constructivist insights provides a comprehensive framework for understanding these dynamics. Realist analysis highlights the competitive pursuit of strategic advantage, liberal institutionalism emphasizes the importance of multilateral cooperation, IPE elucidates the economic and structural dimensions of green industrial policy, and constructivism demonstrates how norms and identity shape negotiation behavior. Together, these perspectives reveal that green technology is both a material and normative instrument, transforming the landscape of international relations in a climate-constrained world.

In conclusion, the global energy transition represents a profound reconfiguration of international politics. Technological innovation, policy frameworks, and normative influence converge to redefine power hierarchies and diplomatic priorities. Policymakers must recognize that the pursuit of green technology is inseparable from economic strategy, security considerations, and global governance.

For scholars, this analysis underscores the need for interdisciplinary approaches that bridge environmental studies, political economy, and international relations. Future research should focus on empirical assessments of technological diffusion, the efficacy of climate finance mechanisms, and the evolving role of emerging economies in shaping the rules and norms of a low-carbon international system.

Ultimately, the nexus of green technology, global power, and climate diplomacy offers both opportunities and challenges: opportunities for sustainable development, innovation, and multilateral cooperation, and challenges in managing strategic rivalry, equity, and global governance in a rapidly transforming world.

Author's Note

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ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue II, February 2026

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