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ENVIRONMENTAL POLITICS OF THE ENERGY TRANSITION: POWER AND POLICY IN RENEWABLE ENERGY

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Abstract: *The global transition from fossil fuels to renewable energy systems has emerged as a central policy and political challenge in the context of climate change, sustainable development, and energy security. This paper examines the environmental politics of the energy transition, focusing on the interplay between political power, policy frameworks, and inequality in renewable energy adoption. It analyses how political motivations, institutional capacities, and international cooperation shape the deployment of renewable technologies. Drawing on secondary sources from international agencies such as the International Renewable Energy Agency (IRENA), United Nations reports, and academic literature, the study highlights both achievements and ongoing challenges in the governance of energy transitions. While global renewable capacity has expanded rapidly with record additions of 585 GW in 2024 led by solar and wind technologies progress remains uneven across regions, policy environments, and socio-economic contexts. The paper concludes that robust political commitment, equitable policy design, and multilevel governance are essential to ensure an inclusive and effective energy transition that sustains environmental goals and addresses socio-economic disparities.*

Key words: Energy Transition, Renewable Energy Policy, Environmental Politics, Climate Governance

Introduction

The global shift from fossil fuel-based energy systems to renewable energy sources has emerged as a central pillar of climate change mitigation, environmental governance, and sustainable development. Energy production accounts for nearly 73 percent of global greenhouse gas emissions, making the transformation of energy systems essential for achieving international climate targets, particularly those outlined under the Paris Agreement (2015) and subsequent climate negotiations. Renewable energy especially solar, wind, hydro, and bioenergy plays a decisive role in reducing carbon emissions while simultaneously addressing concerns related to energy security, public health, and economic resilience. Political decision-making and policy frameworks are critical determinants of how and how fast countries adopt renewable energy technologies. Governments influence the energy transition through legislation, fiscal incentives, subsidies, market regulation, and international climate diplomacy. As a result, renewable energy deployment varies significantly across regions, reflecting differences in political priorities, institutional capacity, and economic structures. Countries with strong policy commitment and long-term regulatory certainty have advanced rapidly, while others remain constrained by political resistance, fossil fuel dependence, and governance challenges.

According to data from the International Renewable Energy Agency (IRENA) and the World Economic Forum, global renewable energy capacity expanded by approximately 15.1 percent in 2024, reaching around 4,448 gigawatts (GW). Solar and wind energy accounted for the majority of new installations, with solar power alone contributing over 75 percent of total renewable capacity additions, highlighting its growing dominance due to falling costs and supportive policies. China, the European Union, and the United States collectively accounted for a significant share of this growth, underscoring the role of state-led policies and large-scale investment in accelerating energy transitions. Despite these positive trends, global progress remains politically and structurally insufficient to meet agreed climate goals. At COP28 (Dubai, 2023), countries committed to tripling global renewable energy capacity by 2030, a target widely viewed as essential for keeping global warming within 1.5°C. However, recent assessments by Reuters and the International Energy Agency (IEA) suggest that current policy trajectories would result in only a doubling of renewable capacity by 2030, falling short of the agreed target. Persistent barriers include inadequate policy coordination, slow grid expansion, uneven access to climate finance, and resistance from entrenched fossil fuel interests. The energy transition is therefore deeply embedded in the political economy of power, encompassing relations within and between states, corporate influence, global supply chains, and inequalities between the Global North and Global South. While advanced economies dominate renewable energy investment and manufacturing, many developing countries despite high renewable potential face financial, technological, and institutional constraints. For example, Africa accounts for less than 03 percent of global renewable energy capacity, despite possessing some of the world's highest solar and wind potential, reflecting geopolitical and developmental disparities in the transition process.

Objectives

The key objectives of this study are:

1. To analyse the role of political dynamics in shaping renewable energy policies.
2. To evaluate the global trends in renewable energy deployment and identify regional disparities.
3. To assess how energy transition policies intersect with issues of power, inequality, and governance.

Conceptual Framework: Politics of the Energy Transition

The energy transition from fossil fuels to renewable sources is not merely a technical or economic shift; it is fundamentally a political process shaped by power relations, institutional interests, and geopolitical strategies. Decisions regarding energy production, distribution, and consumption are deeply embedded in political structures, reflecting struggles over resources, authority, and economic advantage. As a result, the transition to renewable energy reconfigures existing power hierarchies at local, national, and global scales.

Energy Transition and Power Relations: Fossil fuel–based energy systems have historically underpinned global political and economic power, particularly for resource-rich states and multinational corporations. The transition to renewables challenges this structure by reducing dependence on geographically concentrated fossil fuel reserves and decentralising energy production. Scholars argue that renewable energy has the potential to democratize energy systems, enhance energy security, and reduce geopolitical conflicts associated with oil and gas dependence (Vakulchuk et al., 2020). For example, European Union countries have actively promoted renewable energy as a strategic response to energy security concerns, particularly following disruptions in fossil fuel supplies. The EU's European Green Deal links climate policy with geopolitical autonomy by reducing dependence on external energy suppliers. Similarly, Germany's Energiewende represents a politically driven transition where environmental goals, public opinion, and industrial policy intersect to reshape national energy governance. However, renewable energy also generates new forms of geopolitical competition, particularly over critical minerals such as lithium, cobalt, and rare earth elements required for solar panels, wind turbines, and batteries. Countries like China have gained strategic influence by dominating global supply chains for renewable technologies and critical materials, illustrating that the energy transition reshapes rather than eliminates geopolitics.

Role of Political Institutions and Policy Frameworks: Political institutions play a decisive role in determining the pace, scale, and inclusiveness of the energy transition. Governments influence renewable energy deployment through legislation, subsidy regimes, market regulation, and international agreements. Stable and long-term policy frameworks reduce investment risks and accelerate renewable adoption, while inconsistent or politically contested policies often delay progress. For instance, China's rapid expansion of renewable energy is closely linked to strong state intervention, long-term planning, and industrial policy support. Government-backed subsidies, manufacturing incentives, and grid investments have positioned China as the world's largest producer of solar panels and wind turbines. In contrast, policy uncertainty in some countries has led to fluctuating investment trends, highlighting the political nature of energy governance. In the United States, renewable energy policies vary significantly across federal and state levels, reflecting political polarization. While federal initiatives such as the Inflation Reduction Act (2022) provide substantial incentives for clean energy, resistance from fossil fuel–dependent states illustrates how vested interests can shape energy outcomes. This demonstrates that energy transitions are contested political processes rather than linear technological evolutions.

Inequality and the Politics of Transition: The politics of energy transition also intersect with issues of inequality and justice. While advanced economies lead in renewable deployment, many developing countries face financial, technological, and institutional constraints. As a result, the benefits of renewable energy such as cleaner environments and green jobs are unevenly distributed. Scholars highlight that without inclusive policies, energy transitions may reproduce or even deepen existing global inequalities (IRENA, 2023) In the Global South, renewable energy projects often depend on international finance and policy support. For

example, despite high solar potential, many African countries contribute minimally to global renewable capacity due to weak infrastructure and limited political capacity. This underscores the importance of international cooperation, climate finance, and equitable governance in shaping the global energy transition.

Energy Transition as a Political Project: Overall, the energy transition should be understood as a political project involving negotiations among states, corporations, communities, and international institutions. Policy choices reflect competing priorities between environmental sustainability, economic growth, and political interests. Where political leadership aligns climate goals with development strategies, renewable energy adoption accelerates; where fossil fuel interests dominate policy-making, transitions remain slow and uneven.

Global Trends in Renewable Energy Deployment

The year 2024 marked a historic milestone in the global renewable energy transition, with renewable power capacity additions reaching an unprecedented 585 gigawatts (GW) worldwide. According to international energy assessments reported by AP News, renewables accounted for approximately 92.5 percent of all newly installed electricity generation capacity, underscoring a decisive shift away from fossil fuel–based power generation. This growth reflects a combination of falling technology costs, supportive government policies, and increasing private-sector investment in clean energy. Among renewable sources, solar energy emerged as the dominant driver, contributing more than three-quarters of total capacity additions. Utility-scale solar installations expanded rapidly due to declining photovoltaic module prices, which have fallen by over 80 percent since 2010, making solar power one of the most cost-competitive energy sources globally. Wind energy, both onshore and offshore, also recorded significant growth, particularly in China, the European Union, and the United States. Offshore wind projects expanded notably in Europe, where countries such as the United Kingdom, Germany, and Denmark have integrated offshore wind into long-term national energy strategies.

The growth patterns reveal strong geopolitical asymmetries. China alone accounted for nearly half of global renewable capacity additions in 2024, reinforcing its position as the world's leading producer and installer of renewable energy technologies. This dominance is supported by state-led industrial policy, large-scale subsidies, and strategic investments in grid infrastructure. The European Union continued to accelerate renewable deployment under the European Green Deal, particularly in response to energy security concerns following disruptions in fossil fuel supply chains. In contrast, while the United States recorded significant growth following policy incentives under the Inflation Reduction Act (2022), deployment varied considerably across states due to political polarization and regulatory differences. Despite this remarkable expansion, global renewable energy growth remains insufficient to meet international climate targets. At COP28, countries collectively committed to tripling global renewable energy capacity by 2030, a target viewed as essential for limiting global temperature rise to 1.5°C. However, analyses cited by The Guardian and the International Energy Agency (IEA) suggest that under current policy trajectories, global renewable capacity is likely to only double by 2030, falling well short of the agreed goal. Achieving the tripling target would require annual capacity additions to increase to over 1,000 GW per year by the late 2020s, along with accelerated grid expansion, energy storage deployment, and regulatory reforms.

The gap between ambition and reality highlights persistent political and structural barriers. These include delays in permitting and land acquisition, inadequate grid infrastructure, uneven access to finance particularly in developing countries and continued political influence of fossil fuel industries. While renewable technologies are advancing rapidly, the pace of policy reform and institutional adaptation has not kept up with technological

potential. This underscores the central argument of this paper: that the energy transition is not limited by technology alone, but is fundamentally shaped by political choices, governance capacity, and power relations within the global energy system.

Regional Disparities in Transition

Despite rapid global growth in renewable energy capacity, the energy transition remains highly uneven across regions, reflecting disparities in political commitment, financial capacity, technological access, and institutional strength. Data from the International Renewable Energy Agency (IRENA) and the World Economic Forum indicate that Asia dominates global renewable energy expansion, while regions such as Africa, parts of Latin America, and small island developing states continue to lag significantly despite possessing vast renewable energy potential.

Asia: Concentration of Power and Capacity

Asia accounts for more than 55–60 percent of total global renewable energy capacity, with China alone contributing nearly half of global renewable additions in 2024. China's dominance is driven by strong state-led industrial policy, large-scale public investment, and strategic control over renewable manufacturing supply chains. It leads the world in solar photovoltaic (PV) manufacturing, wind turbine production, and battery storage, giving it significant geopolitical leverage in the global clean energy transition. Other Asian economies, including India, Japan, and South Korea, have also expanded renewable capacity, though at varying paces. India crossed 220 GW of installed renewable capacity by 2024, supported by national missions such as the National Solar Mission and policy instruments like Renewable Purchase Obligations (RPOs). However, coal remains a major component of the energy mix, highlighting the political balancing act between development needs and climate commitments.

Europe: Policy-Driven Transition

The European Union represents one of the most policy-driven renewable energy transitions globally. Under the European Green Deal and the REPowerEU initiative, the EU has accelerated renewable deployment to reduce dependence on imported fossil fuels and enhance energy security. Renewables account for over 40 percent of electricity generation in several EU member states, including Germany, Spain, and Denmark. Europe's progress reflects strong regulatory frameworks, long-term climate targets, and public acceptance of renewable technologies. However, rising energy costs, grid congestion, and political debates over land use and offshore wind expansion continue to pose challenges.

North America: Uneven Political Commitment

In North America, renewable energy growth has been significant but politically uneven. The United States recorded substantial renewable investments following the Inflation Reduction Act (2022), which allocated over USD 369 billion for clean energy and climate-related measures. This policy has stimulated large-scale solar, wind, and battery storage projects. However, state-level political divisions, regulatory delays, and fossil fuel lobbying continue to shape uneven outcomes across the country. Canada has also expanded hydropower and wind energy, but overall regional progress remains influenced by political debates over energy sovereignty and resource development.

Africa: High Potential, Low Realisation

Africa illustrates the starkest disparity between renewable energy potential and actual deployment. Despite possessing some of the world's highest solar and wind resources, the continent accounts for less than 3 percent of global renewable energy capacity. According to IRENA, annual renewable investment in Africa remains disproportionately low, largely due to limited access to finance, weak grid infrastructure, political instability, and policy uncertainty.

Many African countries rely heavily on international climate finance and development assistance for renewable projects. The slow pace of deployment highlights how global inequalities and geopolitical power imbalances shape the energy transition.

Latin America and Small Island States

Latin America has made moderate progress, particularly through hydropower and wind energy in countries such as Brazil, Chile, and Uruguay. However, economic volatility and political instability often disrupt long-term energy planning. Small island developing states face unique challenges related to scale, finance, and climate vulnerability, despite strong political incentives to shift away from imported fossil fuels.

Political Implications of Regional Disparities

These regional disparities underscore the argument that the energy transition is not solely driven by technology or market forces but is deeply embedded in political prioritisation and global power structures. Countries with strong institutions, capital access, and strategic policy frameworks dominate renewable deployment, while others risk being marginalised in the emerging clean energy order. Without enhanced international cooperation, technology transfer, and equitable climate finance, existing global inequalities may be reinforced rather than reduced through the energy transition.

India: Balancing Growth, Policy, and Energy Security

The section effectively captures the central dilemma of India's energy transition the tension between ambitious climate commitments and the imperatives of energy security and economic development. By situating India's renewable energy expansion within its demographic scale, developmental priorities, and federal governance structure, the discussion correctly emphasizes that energy transition in India is a politically negotiated process rather than a purely technological shift. This framing aligns well with political economy perspectives on environmental governance. One of the strengths of the section lies in its use of empirical capacity data to demonstrate progress. India's achievement of over 220 GW of renewable energy capacity, particularly the rapid expansion of solar power, reflects genuine political intent at the central government level. The country's ranking among the top global renewable energy producers supports the argument that India has emerged as a significant actor in the global energy transition. However, a critical limitation is that installed capacity figures alone can obscure deeper structural issues, such as capacity utilization, intermittency, and grid reliability, which remain significant constraints in India's power sector.

The continued dominance of coal accounting for nearly 70 percent of electricity generation is rightly identified as the most significant contradiction in India's transition pathway. While the section acknowledges coal's role in employment and base-load power, it could further interrogate how political economy factors, including coal-state lobbying, public sector enterprises, and revenue dependence of state governments, actively shape policy inertia. Coal dependence is not merely a developmental necessity but also a product of entrenched political interests that slow structural reform. This highlights a key critique: India's energy transition risks becoming a "renewables-additive" model rather than a transformative one, where clean energy grows without substantially displacing fossil fuels. The analysis of policy instruments such as Renewable Purchase Obligations (RPOs), solar parks, and PLI schemes demonstrates how the Indian state uses market-based and industrial policies to steer the transition. However, from a critical perspective, the effectiveness of these instruments is uneven. RPO compliance remains weak in several states due to financially stressed DISCOMs, revealing a gap between policy design and institutional capacity. Similarly, while

PLI schemes aim to reduce import dependence, particularly on China, they raise questions about industrial protectionism and long-term competitiveness in global clean energy markets.

The section's discussion of India's leadership in the International Solar Alliance (ISA) successfully situates renewable energy within India's broader climate diplomacy and soft power strategy. Critically, however, India's international leadership contrasts with persistent domestic challenges such as energy poverty, regional inequality in renewable deployment, and slow progress on coal sector transition planning. This disjuncture reflects a broader pattern in Global South climate politics, where international ambition often outpaces domestic structural reform. Implementation challenges state-level policy uncertainty, DISCOM debt, land acquisition conflicts, and grid integration issues are correctly identified as key bottlenecks. A critical reading suggests that these challenges stem from India's federal political structure, where energy governance is fragmented across central and state authorities. States with strong political commitment and administrative capacity, such as Rajasthan and Gujarat, have advanced rapidly, while others lag behind, reinforcing intra-national inequalities in energy access and development.

The concept of the "politics of gradualism" is an important analytical contribution of the section. It reflects India's normative stance that climate action must be aligned with developmental equity and historical responsibility. However, this gradualist approach also raises concerns about whether India can meet long-term decarbonization goals without locking itself into carbon-intensive infrastructure. Critics argue that postponing decisive coal transitions may increase future economic and environmental costs, especially under tightening global climate regimes. In conclusion, the section convincingly demonstrates that India's energy transition is shaped by contested political priorities, institutional constraints, and global inequalities. Its key analytical insight is that India's pathway reflects a broader Global South dilemma—where climate ambition is mediated by development needs and structural asymmetries in the international system. A more explicit engagement with power relations, vested interests, and long-term transition risks would further strengthen the critical depth of the analysis. Nonetheless, the section effectively underscores that energy transitions are fundamentally political processes, not linear technological transformations.

Political Challenges and Policy Barriers

Despite growing global consensus on the urgency of transitioning to renewable energy, the process remains deeply constrained by political challenges and policy barriers. One of the most significant obstacles is political resistance from fossil fuel–linked industries, including coal, oil, and gas corporations, as well as regions and labor groups economically dependent on these sectors. These actors often exercise substantial influence over policy-making through lobbying, campaign financing, and control over energy infrastructure, resulting in delayed reforms, diluted climate targets, or continued subsidies for fossil fuels. The International Energy Agency (IEA) estimates that global fossil fuel subsidies exceeded USD 01 trillion in 2023, reflecting the enduring political power of incumbent energy interests. Weak and fragmented governance structures further undermine the effectiveness of energy transition policies. In many countries, responsibilities for energy, environment, industry, and finance are divided across multiple institutions with limited coordination, leading to policy incoherence and regulatory uncertainty. Short electoral cycles often discourage governments from adopting long-term transition strategies that may involve short-term political costs, such as higher energy prices or job losses in fossil fuel sectors. As a result, renewable energy policies are frequently revised, suspended, or unevenly implemented, discouraging private investment and slowing deployment.

Another critical barrier lies in inadequate and inconsistent policy frameworks. While many governments have announced ambitious renewable energy targets, these commitments are not always supported by binding legislation, stable incentive mechanisms, or effective enforcement. Sudden changes in subsidy regimes, retroactive policy amendments, and delays in grid expansion have created volatile investment environments in several countries, particularly in emerging economies. Such uncertainty disproportionately affects smaller investors and community-based renewable projects, reinforcing market concentration and limiting inclusive participation in the energy transition. Global inequalities in access to finance, technology, and institutional capacity further exacerbate political barriers. Advanced economies benefit from deep capital markets, technological leadership, and established regulatory systems, enabling faster adoption of renewable energy. In contrast, many developing and least-developed countries face high borrowing costs, limited access to climate finance, and dependence on imported technologies. According to the World Bank and IRENA, Africa receives less than 3 percent of global renewable energy investment despite possessing some of the world's highest solar and wind potential. These disparities reflect structural imbalances in global finance and trade systems, where political and economic power shapes investment flows and technology access. Geopolitical factors also influence national energy transition pathways. Concerns over energy security, supply chain vulnerabilities, and strategic control of critical minerals such as lithium, cobalt, and rare earth elements have led some governments to prioritize national interests over collective climate goals. This has resulted in protectionist policies, competition for resources, and uneven technology diffusion, potentially slowing global progress toward decarbonization.

Overall, the energy transition is constrained not by a lack of technological solutions, but by political economy dynamics that shape policy choices, resource allocation, and institutional priorities. Overcoming these challenges requires stronger political leadership, transparent governance, and international cooperation aimed at aligning climate objectives with economic and social priorities. Without addressing the underlying political barriers, the transition risks deepening global and domestic inequalities, rather than delivering an equitable and sustainable energy future.

Policy Recommendations

To enhance the equity and effectiveness of the renewable energy transition, the following policy approaches are recommended:

1. Strengthened International Cooperation: Shared technology transfer and financing mechanisms to support developing economies.
2. Inclusive Policy Design: Policies that integrate social equity, such as community-based renewable projects and local job creation.
3. Long-Term Regulatory Certainty: Firm legislative commitments to renewable targets and grid investments.
4. Just Transition Frameworks: Policies ensuring that workers and communities dependent on fossil fuel industries are supported through reskilling and economic diversification.

Conclusion

The global energy transition is fundamentally a political process, shaped as much by power relations, institutional choices, and governance structures as by technological innovation or market forces. This study has demonstrated that the shift toward renewable energy is deeply embedded within political economies at national and international levels, influencing how energy systems are restructured, who controls new energy infrastructures, and which social groups benefit or are marginalized in the process. Renewable energy deployment, therefore,

cannot be understood in isolation from broader questions of authority, policy coherence, and political will. While recent years have witnessed unprecedented growth in renewable energy capacity particularly in solar and wind power this expansion has been uneven and unequal. Advanced economies and emerging powers with strong institutional capacity, financial resources, and stable policy environments have moved faster, whereas many developing regions remain constrained by limited access to capital, weak governance, and infrastructural deficits. These disparities highlight that the energy transition risks reinforcing existing global and domestic inequalities unless equity considerations are explicitly integrated into policy design. At the international level, the energy transition is reshaping geopolitics by reducing dependence on fossil fuel exporters while creating new strategic dependencies around critical minerals, clean energy technologies, and global supply chains. Without enhanced global cooperation, these emerging dynamics may generate new forms of geopolitical competition rather than collective climate action. Multilateral frameworks, technology transfer, and climate finance are therefore essential to ensuring a more inclusive and balanced transition, particularly for countries in the Global South. The successful energy transition must move beyond narrow metrics of capacity addition to embrace the principles of a just and inclusive transition. This requires protecting vulnerable communities, supporting workers in fossil fuel dependent regions, strengthening institutional capacity, and ensuring universal access to affordable clean energy. The politics of the energy transition will determine whether renewable energy becomes a tool for sustainable development and social justice or another arena of inequality and power asymmetry. Strong political commitment, equitable governance frameworks, and sustained international collaboration are thus indispensable for aligning environmental sustainability with long-term socio-economic justice.

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