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Politics of Climate Change in India: Navigating the Energy Transition and Pursuit of Clean, Green Energy Since 2014

Sonelal Kumar

Research Scholar, University Department of Political Science, Lalit Narayan Mithila University, Darbhanga (Bihar), Email: sonelalkumar695@gmail.com

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ABSTRACT

Since 2014, India has followed an ambitious yet politically challenging course toward decarbonization while continuing to emphasize developmental priorities such as universal energy access, industrial expansion and poverty reduction. The study analyzes the political economy of India's energy transition under the government of Narendra Modi by examining the policies, institutions and international commitments influencing the country's climate politics. It reviews the development of India's Nationally Determined Contributions (NDCs) and net-zero commitments, along with key domestic initiatives including the UJALA scheme, the Saubhagya electrification programme, renewable energy auctions and electric mobility campaigns. The paper also investigates the continuing importance of coal, variations in subnational politics, international climate negotiations and the influence of finance and technology on India's energy pathway. It argues that India's strategy represents a combination of ambition and practicality by integrating global climate leadership with domestic adjustments that emphasize energy security, fiscal sustainability and concerns related to a just energy transition. The study concludes that India's ability to achieve its targets will depend upon harmonizing international financial support with domestic institutional reforms, grid modernization and social safeguards for coal-dependent populations.

Introduction

Climate change is one of the most serious challenges facing humanity in the twenty-first century, with developing countries suffering the greatest consequences despite contributing comparatively less to historical greenhouse gas emissions.[1] India, the world's most populous nation and third-largest carbon emitter, occupies a distinctive position in global climate politics because it must simultaneously address rising emissions and the developmental needs of nearly 800 million people seeking improved living standards, energy access and economic opportunities.[2] Since the Narendra Modi government assumed office in 2014, India has adopted significant policy measures to combat climate change while continuing its developmental agenda.[3]

The political economy of climate change in India is shaped by multiple priorities such as ensuring energy security, reducing energy poverty, sustaining industrial growth, and fulfilling international climate commitments.[4] The year 2014 marked a major turning point in India's climate and energy governance as the government increasingly emphasized renewable energy expansion, climate diplomacy and sustainable development.[5] India announced ambitious renewable energy targets, promoted programmes such as the National Solar Mission, PM-KUSUM, FAME Scheme and the National Green Hydrogen Mission and strengthened energy efficiency initiatives.[6] Installed solar capacity increased from around 2.6 GW in 2014 to more than 81 GW by 2025, while non-fossil fuel sources now account for more than 45 percent of India's installed electricity capacity.[7]

India has also emerged as an important actor in global climate diplomacy. Along with France, India launched the International Solar Alliance during the Paris Climate Conference (COP21) in 2015 to promote solar energy cooperation among developing countries.[8] At the international level, India continues to emphasize the principle of "Common but Differentiated Responsibilities," highlighting the historical responsibility of developed nations while presenting itself as a global climate leader.[9]

India's energy transition remains a complex political process involving central and state governments, industries, financial institutions, civil society organizations and communities dependent on fossil fuels.[10] Although coal still dominates India's energy mix, the country is gradually moving toward cleaner energy systems while balancing economic growth, environmental sustainability and climate justice.[11]

Review of Literature

The literature on India's climate politics highlights major developments in governance, renewable energy expansion, international diplomacy and adaptation policies since 2014. Scholars argue that the National

Action Plan on Climate Change (NAPCC), launched in 2008, created an institutional framework through sectoral missions on solar energy, sustainable agriculture, water and energy efficiency, but implementation continues to face challenges such as limited financing, weak institutional coordination and Centre–State policy gaps.[12] Studies by Navroz K. Dubash emphasize that India follows a development-oriented climate strategy that prioritizes economic growth, poverty reduction and energy access while adopting gradual and technology-based reforms rather than strict regulatory measures.[13]

Research on renewable energy transition documents rapid growth in solar and wind capacity under the National Solar Mission and related initiatives. India's renewable energy capacity increased significantly due to competitive bidding, declining technology costs, policy incentives and foreign investment.[14] Literature also highlights the role of the National Green Hydrogen Mission, Production Linked Incentive schemes and Green Energy Corridor projects in promoting clean energy and reducing fossil fuel dependence.[15] However, scholars identify challenges including grid integration, financial stress in DISCOMs, land acquisition disputes and dependence on imported solar equipment.[16]

Studies on international climate diplomacy reveal that India has shifted from a defensive position during the Kyoto Protocol era to constructive engagement under the Paris Agreement framework.[17] Researchers identify the International Solar Alliance as an important mechanism for promoting South-South cooperation and enhancing India's geopolitical influence among developing countries.[18] Political economy studies further explain that coal remains central to India's economy because it supports employment, electricity generation and state revenues.[19] Therefore, scholars stress the importance of "just transition" policies to protect workers and coal-dependent regions during decarbonization.[20]

Adaptation-focused literature shows that agriculture remains highly vulnerable to climate change despite receiving less policy attention than mitigation. Researchers report gaps in farmers' awareness, climate finance, irrigation facilities and access to climate-resilient technologies.[21] Studies recommend stronger investment in climate-resilient agriculture, disaster preparedness and local adaptation strategies to reduce vulnerability.[22]

Objectives

- To study the development of India's climate change policy framework after 2014.
- To evaluate the progress and direction of India's transition toward renewable energy.

- To examine India's climate diplomacy, global commitments, and international cooperation since 2014.
- To analyze the political economy, major challenges, and sustainable development implications of India's energy transition and climate action.

Research Design

The study adopts a **descriptive and analytical research design** that examines both the substance of climate and energy policies and the political processes underlying their formulation and implementation This design enables systematic examination of policy evolution, institutional mechanisms, stakeholder dynamics, and the political economy shaping India's climate response since 2014.

Methodology

This research article employs a **qualitative research methodology** incorporating multiple analytical approaches to comprehensively examine the politics of climate change in India since 2014. The methodological framework integrates **policy document analysis**, **systematic literature review**, and **secondary data analysis** to construct a holistic understanding of India's climate politics and energy transition trajectory.

India's Climate Policy Architecture Since 2014

- **The National Action Plan on Climate Change and Eight Missions**

India's climate governance framework has largely evolved around the National Action Plan on Climate Change (NAPCC), introduced in 2008, which created the basic structure for climate mitigation and adaptation through eight national missions.[23] Since 2014, the government led by Prime Minister Narendra Modi has strengthened the implementation of these missions while aligning climate policy with economic growth, energy security and sustainable development goals. The eight missions include the National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a Green India, National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change. Together, these missions address renewable energy expansion, efficient energy use, forest conservation, agricultural resilience, water management, and scientific research related to climate change.

The National Solar Mission has become the most visible symbol of India's renewable energy transition. Initially launched in 2010 with a target of 20–22 GW solar capacity by 2022, the target was expanded in 2015 to 100 GW under the broader renewable energy goal of 175 GW.[24] This reflected India's intention to emerge as a global leader in clean energy. By 2023, India had achieved more than 63 GW of installed solar power capacity, while total non-fossil fuel electricity capacity crossed 180 GW.[25] The mission has relied on policy tools such as solar parks, rooftop solar schemes, competitive bidding, off-grid applications, PM-KUSUM solar pumps, and Production Linked Incentive schemes to encourage domestic manufacturing and reduce dependence on imported solar equipment.[26] India also enhanced its global climate role through the International Solar Alliance established with France in 2015.

The National Mission for Enhanced Energy Efficiency promotes market-based reforms and technological improvements to reduce energy consumption across industries and households.[27] Since 2014, programs such as UJALA and the Perform, Achieve and Trade (PAT) scheme have expanded significantly. Under UJALA, more than 370 million LED bulbs were distributed by 2023, reducing electricity demand and consumer costs.[28] The PAT scheme targeted energy-intensive industries like cement, steel, and thermal power by encouraging energy-saving practices through tradable certificates.[29] These initiatives have contributed substantially to lowering India's carbon emissions and improving energy productivity.

The National Mission for Sustainable Agriculture focuses on reducing the vulnerability of Indian agriculture to climate change. Agriculture supports nearly 45% of India's workforce and remains highly dependent on monsoon rainfall.[30] Formally launched in 2015, the mission promotes drought-resistant crops, efficient irrigation systems, soil health improvement, and climate advisory services for farmers. Programs such as Soil Health Cards and Pradhan Mantri Krishi Sinchai Yojana have been integrated into climate adaptation efforts. However, implementation challenges remain, including poor awareness among farmers, limited extension services, weak institutional coordination, and inadequate financial support.[31]

The National Mission for a Green India aims to restore degraded forests and increase forest cover across 5 million hectares of land.[32] This mission supports India's commitment under the Paris Agreement to create an additional carbon sink of 2.5–3 billion tonnes of CO_2 equivalent by 2030. Besides carbon sequestration, the mission contributes to biodiversity protection, soil conservation, and water security.[33]

- **Institutional Mechanisms and Governance Structures**

India's climate governance operates through a multi-level institutional system involving the Prime Minister's Council on Climate Change, the Ministry of Environment, Forest and Climate Change,

sectoral ministries and State Action Plans on Climate Change (SAPCCs). These institutions coordinate mitigation and adaptation strategies at national and state levels. Since 2014, the government has strengthened specialized agencies such as the National Institute of Solar Energy and the Bureau of Energy Efficiency to improve implementation capacity. However, scholars continue to identify challenges such as weak center-state coordination, insufficient local institutional capacity, financing limitations and gaps in adaptation planning for vulnerable regions. Stronger decentralization, technological innovation and institutional cooperation are therefore considered essential for achieving India's long-term climate and sustainable development goals.[34]

Renewable Energy Expansion and the Clean Energy Transition

- **Solar Energy Revolution**

India's solar energy expansion after 2014 has emerged as one of the most remarkable clean energy transformations in the developing world. The rapid increase in installed solar capacity has been driven by multiple structural and policy factors including a steep decline in global solar photovoltaic prices—estimated at nearly 85% between 2010 and 2020—competitive reverse bidding mechanisms that significantly reduced tariffs, development of ultra-mega solar parks with pre-arranged land and transmission infrastructure, fiscal incentives, renewable purchase obligations and the introduction of production-linked incentive (PLI) schemes for domestic manufacturing. India's installed solar capacity increased from nearly 2.6 GW in 2014 to more than 85 GW by early 2025, reflecting the scale of policy commitment and market expansion.[35] The government has implemented several flagship initiatives such as the Jawaharlal Nehru National Solar Mission, PM-KUSUM for solar-powered irrigation pumps, rooftop solar programs for households and institutions and decentralized off-grid systems for rural electrification.[36]

States including Rajasthan, Gujarat, Karnataka, Tamil Nadu, Maharashtra, and Andhra Pradesh have emerged as major solar energy hubs due to favorable climatic conditions, availability of land and proactive state-level renewable policies. Large solar parks such as Bhadla Solar Park in Rajasthan and Pavagada Solar Park in Karnataka have become internationally recognized examples of utility-scale renewable deployment.[37] Foreign direct investment and domestic private capital have increasingly entered India's renewable sector with international corporations and sovereign wealth funds investing in large-scale projects because of improving commercial viability and policy predictability. According to the International Energy Agency (IEA), India is expected to account for one of the world's fastest rates of renewable energy growth during the present decade.[38]

India's estimated solar potential of nearly 750 GW demonstrates enormous untapped capacity that can support long-term decarbonization and energy security objectives. However, achieving deeper penetration of solar power requires overcoming significant structural constraints such as land acquisition conflicts, ecological concerns in desert and forest regions, inadequate transmission networks, intermittency management, storage limitations and dependence on imported photovoltaic modules and critical minerals.[39] Strengthening domestic manufacturing ecosystems, expanding battery storage infrastructure and improving grid flexibility are therefore essential for sustaining the solar transition and reducing strategic vulnerabilities associated with global supply chains.

- **Wind Energy and Diversified Renewable Portfolio**

Wind energy represents one of India's earliest renewable energy success stories, with organized deployment beginning in the 1990s. By 2024, India had become one of the top global countries in installed wind power capacity, exceeding 46 GW of operational capacity.[40] Government support through accelerated depreciation benefits, generation-based incentives, renewable energy certificates and competitive bidding systems helped expand the sector, particularly in states such as Tamil Nadu, Gujarat, Karnataka, Maharashtra and Rajasthan. Offshore wind development has also gained attention, especially along the Gujarat and Tamil Nadu coastlines, though implementation remains at an early stage because of high capital costs and technological challenges.

Beyond solar and wind, India has attempted to diversify its renewable energy portfolio through biomass energy, small hydropower, biofuels, waste-to-energy projects, compressed biogas initiatives and emerging technologies such as green hydrogen. The launch of the National Green Hydrogen Mission in 2023 marked a major strategic intervention aimed at transforming India into a global hub for green hydrogen production, utilization and export. The mission targets annual production of nearly 5 million metric tonnes of green hydrogen by 2030 along with substantial electrolyzer manufacturing capacity.[41] Policymakers increasingly recognize that achieving deep decarbonization in hard-to-abate sectors—including steel, fertilizers, refineries, shipping, aviation and heavy transport—will require alternative fuels beyond conventional electrification. Green hydrogen therefore occupies an important position in India's long-term climate and industrial strategy.

The diversification of renewable energy sources also supports broader developmental objectives including rural employment generation, reduction of fossil fuel imports, improvement of local air quality and enhancement of energy security. Nevertheless, technological uncertainty, financing gaps and high production costs continue to limit rapid scaling of advanced renewable technologies. Sustained public

investment, international technology partnerships and long-term market assurance mechanisms are therefore necessary to enable commercial viability and industrial competitiveness in emerging clean energy sectors.

- **Grid Integration and Energy System Transformation**

India's transition toward high renewable energy penetration requires comprehensive transformation of the entire energy system rather than merely increasing generation capacity. Large-scale renewable integration demands modernization of electricity grids, expansion of interstate transmission infrastructure, development of smart grid technologies and deployment of large-scale battery energy storage systems capable of balancing intermittent renewable generation.[42] Renewable-rich states often generate electricity far from major industrial and urban consumption centers, making transmission connectivity a critical requirement for national energy integration. The Green Energy Corridor initiative has therefore been developed to strengthen transmission infrastructure connecting renewable energy zones with high-demand regions.

Research examining decarbonization pathways for India's electricity sector suggests that achieving nearly 90% renewable electricity generation by 2050 is technically feasible through optimized combinations of solar, wind, hydropower, storage technologies and flexible demand management systems.[43] However, this transformation requires substantial long-term investment, technological innovation and institutional coordination between central and state governments. Battery storage remains particularly important because renewable intermittency poses operational challenges for grid reliability and frequency management. Simultaneously, flexible gas-based generation, pumped hydro storage and demand-side management programs may serve as balancing mechanisms during the transition period.

The transition also requires digitalization of power systems through smart meters, advanced forecasting systems and real-time grid management technologies. India's electricity distribution sector, however, continues facing chronic financial stress due to high transmission losses, subsidy burdens and inefficiencies in state distribution companies (DISCOMs). Without reforms improving financial sustainability and operational efficiency, renewable integration may face structural bottlenecks despite rapid capacity additions. Consequently, energy transition policies increasingly emphasize integrated planning involving generation, transmission, distribution, storage and demand management simultaneously.

The Political Economy of Energy Transition

- **Coal Dependency and Just Transition Challenges**

Despite rapid renewable energy expansion, coal continues to dominate India's electricity system and accounted for nearly 70% of total power generation in 2024.[44] Coal remains deeply embedded in India's political economy because it supports energy security, industrialization, employment and state revenues. Public sector enterprises such as Coal India Limited and multiple thermal power utilities employ millions of workers directly and indirectly, while coal royalties constitute important revenue sources for states including Jharkhand, Chhattisgarh, Odisha and West Bengal. Existing thermal infrastructure also involves substantial sunk investments with operational lifespans extending several decades, creating resistance against rapid coal phase-out policies.

Multiple structural factors therefore reinforce continued coal dependency: availability of large domestic coal reserves reducing import vulnerability, rising electricity demand associated with economic growth, employment dependence in mining regions and concerns regarding grid stability and affordability.[45] Policymakers frequently argue that India's developmental priorities require a gradual and calibrated transition rather than abrupt fossil fuel elimination. Consequently, the government has emphasized parallel development of renewable energy while continuing limited expansion and modernization of coal-based thermal capacity.

The challenge of ensuring a "just transition" has consequently become central to climate policy debates. Scholars and policy institutions emphasize that energy transition strategies must incorporate worker retraining programs, alternative livelihood generation, social security measures, economic diversification plans for coal-dependent districts and participatory governance involving affected communities.[46]Without inclusive transition frameworks, decarbonization policies risk generating socioeconomic disruption, unemployment and political resistance in mining regions. Therefore, balancing environmental sustainability with social justice remains a defining feature of India's energy transition politics.

- **Financing the Energy Transition**

Financing India's clean energy transition requires investment amounting to several trillion dollars over coming decades to support renewable deployment, grid modernization, storage systems, electric mobility, industrial decarbonization and climate adaptation.[47] Funding sources include public expenditure, domestic private investment, multilateral development banks, sovereign green bonds, blended finance

structures, concessional international climate finance and sustainability-linked financial instruments. India has increasingly emerged as one of the largest destinations for renewable energy investment among developing countries, attracting substantial foreign capital from institutional investors and climate-focused funds.

However, major financing gaps continue to constrain the pace of transition. Investors frequently cite concerns regarding policy uncertainty, payment delays from financially stressed distribution companies, currency volatility, land acquisition risks and regulatory inconsistency across states.[48] Accessing international climate finance also remains challenging because of complex approval procedures and limited concessional funding availability. Adaptation projects face even greater constraints because many interventions lack direct revenue streams attractive to private investors.

To address these barriers, the government has introduced multiple policy innovations including sovereign green bonds, viability gap funding, production-linked incentives for clean technology manufacturing and credit guarantee mechanisms for renewable projects. International cooperation frameworks such as the Coalition for Disaster Resilient Infrastructure (CDRI) and Just Energy Transition Partnership discussions further reflect efforts to mobilize global financial support. Nevertheless, ensuring adequate financing while maintaining fiscal sustainability remains one of the most significant challenges confronting India's long-term climate strategy.

- **Technology, Manufacturing, and Self-Reliance**

Technological self-reliance has become an increasingly important dimension of India's energy transition strategy. Under the broader framework of "Atmanirbhar Bharat," the government has emphasized domestic manufacturing of solar modules, batteries, wind turbines, electrolyzers and electric vehicle components to reduce import dependence—particularly on China—and strengthen industrial competitiveness.[49] Production-linked incentive schemes for advanced chemistry cell batteries and solar photovoltaic manufacturing represent major attempts to develop integrated domestic supply chains.

The emphasis on self-reliance reflects broader geopolitical and economic considerations. Renewable energy technologies increasingly shape global industrial competition, strategic autonomy and future employment opportunities. Building domestic manufacturing capacity can therefore support economic growth, industrial modernization, export competitiveness and technological capability development simultaneously. However, Indian manufacturers face major challenges including competition from

established global firms benefiting from economies of scale, technological gaps in advanced production processes and dependence on imported raw materials and critical minerals.

Balancing short-term cost advantages from imports against long-term strategic objectives of domestic industrialization involves complex political and economic trade-offs. Excessive protectionism may increase renewable deployment costs, while unrestricted imports could weaken domestic manufacturing ecosystems. Consequently, India's clean energy industrial policy increasingly attempts to combine market expansion with strategic industrial support measures aimed at long-term technological competitiveness.

Climate Diplomacy and International Leadership

- **The International Solar Alliance**

The creation of the International Solar Alliance (ISA) during the Paris Climate Conference in 2015 represented one of India's most significant climate diplomacy initiatives. Jointly launched by India and France, the ISA is a treaty-based international organization headquartered in India that seeks to promote solar energy cooperation among more than 120 member and signatory countries, particularly nations located between the Tropics of Cancer and Capricorn.[50] The organization aims to mobilize more than one trillion dollars in solar investment by 2030, facilitate technology transfer, encourage capacity building and support collaborative research initiatives.

Academic analyses describe the ISA as an important instrument of India's soft power and South-South cooperation strategy. Through the alliance, India has attempted to position itself as a leader of developing countries in global climate governance while simultaneously advancing renewable energy deployment across the Global South.[51] Programs such as "One Sun One World One Grid" (OSOWOG) envision interconnected transnational electricity networks capable of sharing renewable energy resources across geographical regions and time zones.

Although the long-term effectiveness of the ISA remains dependent on financing, institutional coordination and implementation capacity, the initiative has substantially enhanced India's international profile in climate diplomacy. It reflects a shift from earlier defensive negotiating positions toward a more proactive and leadership-oriented climate strategy emphasizing cooperation, technology sharing and sustainable development.

- **Positioning in International Climate Negotiations**

India's approach in international climate negotiations has evolved considerably since 2014. While continuing to emphasize the principles of equity, common but differentiated responsibilities (CBDR) and historical responsibility of developed countries, India has increasingly adopted a more constructive and solution-oriented role within global climate governance. During the Paris Agreement negotiations, India successfully advocated for recognition of developmental priorities, enhanced climate finance obligations for developed nations and flexibility regarding nationally determined contributions (NDCs).[52]

India's updated NDC commitments include reducing emissions intensity of GDP by 45% from 2005 levels by 2030, achieving nearly 50% cumulative electric power capacity from non-fossil fuel sources and creating substantial additional carbon sinks through afforestation. At the Glasgow COP26 Summit in 2021, Prime Minister Narendra Modi announced the "Panchamrit" commitments, including achieving 500 GW non-fossil fuel capacity and reaching net-zero emissions by 2070.[53] These announcements signaled India's willingness to undertake ambitious climate commitments while maintaining emphasis on developmental equity and differentiated responsibilities.

Indian negotiators consistently argue that climate policies must not undermine poverty alleviation, employment generation, energy access or economic development. India's per capita emissions remain substantially lower than those of developed economies and policymakers contend that climate justice requires recognition of unequal historical emissions and developmental needs. This position continues shaping India's diplomatic strategy across multilateral climate forums.

- **Climate Performance and International Assessments**

International assessments generally recognize India as one of the better-performing major economies regarding climate policy relative to its developmental stage. The Climate Change Performance Index (CCPI) 2023 ranked India among the top-performing countries due to its renewable energy expansion, energy efficiency measures and relatively low per capita emissions.[54] The report noted that India is likely to meet several of its current emissions targets under existing policy trajectories.

Nevertheless, international organizations and climate advocacy groups continue urging India to accelerate coal phase-out timelines, strengthen adaptation planning and adopt more ambitious emissions reduction pathways consistent with limiting global warming to 1.5°C.[55] The tension between international expectations for enhanced climate ambition and domestic developmental priorities remains

a central feature of India's climate politics. Policymakers therefore continue seeking a balance between global environmental responsibilities and national socioeconomic imperatives.

Challenges, Implementation Gaps, and Sustainable Development Implications

- **Institutional and Coordination Challenges**

Despite adopting comprehensive climate policies and ambitious renewable energy targets, India continues to face major implementation gaps in climate governance. Weak coordination between the central and state governments, overlapping institutional responsibilities, delayed fund disbursement and inadequate monitoring mechanisms reduce the effectiveness of climate programs.[56] The involvement of multiple ministries such as Environment, Power, Agriculture and Renewable Energy creates administrative complexity and policy fragmentation. Although the Prime Minister's Council on Climate Change provides policy direction, operational coordination among institutions often remains insufficient.[57]

State Action Plans on Climate Change (SAPCCs) also differ significantly in quality and implementation capacity. Some states like Gujarat and Tamil Nadu have integrated climate concerns into development planning, while many less-developed states lack technical expertise, institutional infrastructure and financial resources.[58] Local governments frequently suffer from shortages of trained personnel and climate-related data systems, limiting evidence-based policymaking. Weak monitoring and evaluation systems further reduce transparency and accountability in climate governance.[59]

- **Adaptation Deficits and Climate Vulnerability**

India's climate strategy has largely focused on mitigation through renewable energy expansion, while adaptation efforts remain comparatively underdeveloped.[60] This imbalance is significant because India is highly vulnerable to climate change impacts. Agriculture, which supports nearly half of the country's workforce, remains heavily dependent on monsoon rainfall and is increasingly threatened by rising temperatures, droughts, floods and erratic weather patterns.[61]

Studies show that many farmers lack awareness of climate adaptation measures, access to weather information, climate-resilient crop varieties and financial support systems. Agricultural extension services often fail to effectively reach small and marginal farmers.[62] Women farmers face even greater challenges due to limited access to land ownership, credit facilities, information networks and decision-making authority.[63] Climate vulnerability also affects water resources, coastal areas, urban infrastructure

and public health systems. Coastal states face increasing risks from cyclones, sea-level rise and saline water intrusion, while urban regions experience heatwaves, flooding and water scarcity.[64]

Although adaptation planning is essential for long-term resilience, financing and institutional support for adaptation remains limited compared to mitigation initiatives. Strengthening community-based adaptation, resilient agriculture and climate-resilient infrastructure is therefore crucial for India's sustainable future.[65]

- **Financing and Investment Gaps**

The shortage of climate finance remains one of the biggest barriers to India's clean energy transition and climate resilience efforts. India requires massive investment to achieve its renewable energy targets, strengthen infrastructure and fulfill its long-term net-zero commitments.[66] However, international climate finance promised by developed nations has not been delivered adequately, limiting resources available for developing countries like India.[67]

Domestic financing also faces structural challenges including limited fiscal capacity, policy uncertainty and investment risks that discourage private participation in climate-sensitive sectors. Although India has promoted green bonds and public-private partnerships, the scale of investment remains insufficient.[68] Adaptation financing faces even greater difficulties because adaptation projects often do not generate immediate commercial returns, making them less attractive for private investors. As a result, adaptation programs depend heavily on public funding and concessional international support.[69]

Regional disparities in financing further complicate implementation. Economically stronger states attract more climate investment, while vulnerable and poorer regions struggle to secure adequate resources. Bridging these gaps requires stronger international cooperation, innovative financing mechanisms and better governance systems to ensure transparent and efficient utilization of climate funds.[70]

Implications for Sustainable Development

- **Energy Access and Equity**

India's energy transition must balance decarbonization with the need to ensure affordable and reliable energy access for its large population. Since 2000, nearly 800 million people have gained electricity access, yet many rural households still face unreliable supply and dependence on traditional biomass fuels for cooking.[71] Renewable energy solutions such as solar home systems, rooftop solar and mini-grids offer opportunities to improve energy access in remote regions where grid expansion is difficult.[72]

However, achieving an inclusive energy transition requires policies that address affordability barriers and ensure equitable distribution of benefits. Renewable energy expansion also creates employment opportunities in manufacturing, installation and maintenance sectors, although the transition away from coal-based industries may negatively affect workers dependent on fossil fuel economies. Therefore, India increasingly emphasizes a "just transition" approach that combines climate action with social protection and employment generation.[73]

- **Co-benefits and Sustainable Development Goals**

Climate action in India produces multiple developmental co-benefits. Renewable energy expansion improves energy security by reducing dependence on imported fossil fuels, while also lowering air pollution and improving public health outcomes.[74] Energy efficiency initiatives reduce electricity consumption and economic costs for households and industries. Climate policies also contribute to Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities) and SDG 13 (Climate Action).[75]

India's broader strategy emphasizes "climate-compatible development," which seeks to balance economic growth, poverty reduction and climate objectives simultaneously.[76] This approach recognizes that sustainable development and climate action are interdependent and mutually reinforcing.

Conclusion

Since 2014, India's climate politics under the leadership of Narendra Modi has shifted from a largely defensive approach to a more proactive and globally influential stance. This transition is reflected in the rapid expansion of renewable energy, strong international climate engagement, and policy innovations aimed at balancing economic development with environmental sustainability. Between 2014 and 2025, India recorded nearly 3,450% growth in solar capacity, achieved its 40% non-fossil electricity target well ahead of schedule, and emerged as the world's fourth-largest clean energy producer with 228 GW capacity. Initiatives such as the International Solar Alliance, the LiFE campaign launched at COP26, and the 2070 net-zero pledge highlight India's evolving climate diplomacy while continuing to emphasize climate justice and differentiated responsibilities. Nevertheless, dependence on coal, financial and institutional limitations, and implementation gaps remain major obstacles. Although India has met several emission intensity targets ahead of time, current progress is still considered insufficient for achieving the 1.5°C pathway, indicating the need for faster reforms, greater global support, and sustained policy innovation.

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