

**Center-State Relations in India:
A Political Economy Approach to Climate and Energy Policy**

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Abstract

India plays a critical role in global climate and energy policy. Although India is only responsible for 7% of global greenhouse gas emissions today, it has a large population and considerable potential for rapid economic growth. India's energy demand is set to increase by 35% by 2030 and by 70% by 2040. Yet India has announced a 2070 net-zero goal backed by a 500-gigawatt target for non-fossil fuel power generation capacity by 2030. How can we best understand India's mixed record in energy transition and climate action? What are the key drivers and obstacles to raising ambition? Here we argue that the prospects of India's climate policy depend on balancing diverse social and economic agendas at the state level with global and national leadership ambitions. Striking this balance requires managing a complex set of center-state relations under India's federal structure. We argue that both Indian energy and climate policy reveal a deep conflict between the central government's global, often climate-friendly ambitions and the more localized, development-dominated concerns that preoccupy state governments.

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1. Introduction

India directly contributes to more than 7% of global greenhouse emissions. The nation is the third-largest emitter, just behind China and the United States. Although the Indian government argues that its per capita emission rates are well below the global average, it expects a 35% increase in energy demand by 2030 and 70% by 2040. Overall carbon emissions would increase by 45% in 2040, underscoring how pivotal they are to global climate action. Today, electricity, agriculture, transportation, and manufacturing are the primary contributors to Indian emissions.¹

The 2015 Paris Agreement on Climate Change was a turning point for Indian climate policy. At that time, Prime Minister Narendra Modi announced a series of climate targets that highlighted India's newfound success in renewable power generation. In Paris, the Indian government pledged to decrease its economy-wide emissions intensity to 33%–35% of its 2005 emission levels by 2030. This involved a target of 40% installed power capacity from non-fossil-based energy resources by 2030. India also pledged to increase its overall carbon sink by 2.5–3 gigatons of carbon dioxide equivalent (GtCO₂e) through additional forest cover. Although India has not yet formally submitted an updated nationally determined contribution (NDC), the Modi government has continued to optimize its targets through various statements at high-level international forums. This includes a 450 GW renewable energy capacity by 2030 and carbon-free energy generation by 2047 using hydrogen fuel. At the 2021 United Nations Climate Change Conference, COP26, Modi pledged to make India a net-zero nation by 2070 and highlighted a short-term target of avoiding 1 billion tonnes of carbon emissions between 2021 and 2030.²

But India's energy transition and climate action remain uncertain. The Paris commitments notwithstanding, India's emissions continue to grow as coal remains the backbone of the power sector. During the COVID-19 pandemic, Prime Minister Modi's Atmanirbhar Bharat - "self-reliant India" - program declared domestic coal mining a high priority. How can we best understand India's mixed record in energy transition and climate action? What are the key drivers and obstacles to raising ambition?

¹ World Resources Institute. 'This Interactive Chart Shows Changes in the World's Top 10 Emitters'. Available on: <https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters>

² The Guardian. 'Narendra Modi pledges India will reach net zero emissions by 2070'. Available on: <https://www.theguardian.com/world/2021/nov/01/narendra-modi-pledges-india-will-reach-net-zero-emissions-by-2070>

Here we argue that the prospects of India's climate policy depend on balancing diverse social and economic agendas at the state level with global and national leadership ambitions. Striking this balance requires managing a complex set of center-state relations under India's federal structure. We argue that both Indian energy and climate policy reveal a deep conflict between the central government's global, often climate-friendly ambitions and the more localized, development-dominated concerns that preoccupy state governments. The effect of these conflicts can be seen both in energy and climate policy. Besides center-state cleavages, the level of climate awareness and commitment to the energy transition varies significantly between different Indian states depending on their social and economic profile, as well as natural resource endowments.

In Indian energy policy, center-state relations are complicated by the heterogeneous interests of different state governments, the evolving balance of political power, and the center's weak enforcement capacities. First, the highly uneven pace of energy transition between leaders (e.g., Gujarat and Karnataka) and laggards (e.g., Chhattisgarh and Jharkhand) contributes to conflicting incentives regarding low-carbon energy development. Second, state governments have little incentive to consider national, let alone, international priorities in their energy policy. This results in the downplaying of energy transition policies at the state level. Finally, these conflicting incentives are difficult to resolve through central mandates because India's federal structure leaves state governments with considerable power to block the implementation of central policies, regulations, and programs.

In what follows, we first provide pertinent background on Indian climate and energy policy. We then discuss insights from the political economy of federalism and center-state relations. We then apply these insights to Indian federalism and argue that misaligned central and state preferences are a key obstacle to successful energy transition and low-carbon development in India. We conclude with institutional and policy recommendations, along with a few remarks on a future research agenda.

2. Energy and Climate Policy in India

India is the world's 5th largest economy by gross domestic product (GDP) and the 3rd largest source of greenhouse gas emissions. In 2019, before the COVID-19 pandemic, India emitted a total of 2.6 gigatons of greenhouse gases (carbon dioxide equivalent), a quadrupling relative to 1990 levels.³ Currently, India has an electricity generation capacity of 386 GW, the third-largest in the world, and 61% of this capacity is formed by thermal power. Renewable energy facilities constitute 100 GW of generating capacity followed by hydropower and nuclear power, or 46 GW and 7 GW of generation capacity, respectively. Thermal power has remained the undisputed energy leader, generating almost twice as much as all other energy sources combined.⁴

India's energy and climate policy cannot be understood without considering the country's economic status. India's current GDP per capita is about USD 1,900, or less than 2% of the United States. Although less than one-fifth of the GDP comes from agriculture, cultivation remains the primary livelihood for more than half the population.⁵ As a result of the low GDP per capita, India's per capita greenhouse gas emissions are only 2.47 tons of carbon dioxide equivalent.⁶ Table 1 summarizes key aspects of India's energy and economic profile. While the country has a relatively low per capita emissions as compared to a global average of 6.45 tons of carbon dioxide equivalent, the significant role of coal power in its energy mix cannot be ignored.

Table 1. Economy and energy in India.	
Population (2021) ⁷	1,363,006,000
Gross Domestic Product (At Current Prices) ⁸	USD 2.6 Trillion

³ Olivier, Jos GJ, K. M. Schure, and J. A. H. W. Peters. "Trends in global CO2 and total greenhouse gas emissions." *PBL Netherlands Environmental Assessment Agency* 5 (2017).

⁴ Ministry of Power. 'Power Sector At a Glance'. Available on: <https://powermin.gov.in/en/content/power-sector-glance-all-india>

⁵ Mathur, Archana S., Surajit Das, and Subhalakshmi Sircar. "Status of agriculture in India: trends and prospects." *Economic and political weekly* (2006): 5327-5336.

⁶ Climate Watch Historical GHG Emissions. 2021. Washington, DC: World Resources Institute. Available online at: <https://www.climatewatchdata.org/ghg-emissions>

⁷ Office of the Registrar General & Census Commissioner, India. 'Population Projection Report 2011-2036'. Available on: <https://censusindia.gov.in/>.

⁸ Reserve Bank of India. 'Handbook of Statistics on Indian Economy'. Available on: <https://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy>

Gross Domestic Product Per Capita ⁹	USD 1900.7
Energy Consumption Per Capita ¹⁰	24,246 Megajoules
Electricity Consumption Per Capita ¹¹	1208 kWh
Emissions Per Capita ¹²	2.47 tons carbon dioxide equivalent
Agricultural Share in Overall Emissions ¹³	19.6%
Share of Coal in Energy Mix ¹⁴	43.9%
Share of Coal in Electricity Mix ¹⁵	52.6%

Coal plays a particularly important role in India's energy and climate policy. India generated 75% of its total electricity through coal-fired facilities in 2018.¹⁶ In the process, the Indian coal fleet emitted 1.1 gigatons of carbon dioxide, contributing to poor air quality across the nation.¹⁷ These environmental problems notwithstanding, coal plays an integral role in covering energy demand in India. In addition to tackling the intermittency of renewable energy power, highly valued coal assets across the nation are used to fuel heat generation in various metallurgical industries.¹⁸ Moreover, each of the five regions of the Indian power sector procures the largest share of power from coal-based power facilities.¹⁹ The nation's high reliance on coal power is

⁹ Reserve Bank of India. 'Handbook of Statistics on Indian Economy'. Available on: <https://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy>

¹⁰ National Statistical Office, 'Energy Statistics India 2021'. Available on: http://www.mospi.nic.in/sites/default/files/reports_and_publication/ES/Energy%20Statistics%20India%202021.pdf

¹¹ Central Electricity Authority. 'Growth of the Electricity Sector in India from 1947-2020'. Available on: https://cea.nic.in/wp-content/uploads/pdm/2020/12/growth_2020.pdf

¹² Climate Watch Historical GHG Emissions. 2021. Washington, DC: World Resources Institute. Available online at: <https://www.climatewatchdata.org/ghg-emissions>

¹³ Climate Links. 'Greenhouse Gas Emissions Factsheet: India'. Available on: <https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-india>

¹⁴ Ministry of Power. 'Power Sector At a Glance'. Available on: <https://powermin.gov.in/en/content/power-sector-glance-all-india>

¹⁵ National Statistical Office, 'Energy Statistics India 2021'. Available on: http://www.mospi.nic.in/sites/default/files/reports_and_publication/ES/Energy%20Statistics%20India%202021.pdf

¹⁶ Ministry of Statistics and Programme Implementation. 'Energy Statistics 2019'. Available on: http://mospi.nic.in/sites/default/files/publication_reports/Energy%20Statistics%202019-final.pdf

¹⁷ NSEnergy. 'Coal power in India: A pathway to reduced emissions'. Available on: <https://www.nsenenergybusiness.com/features/coal-power-india-emissions/>

¹⁸ Osborne, Dave, ed. *The Coal Handbook: Towards Cleaner Production: Volume 2: Coal Utilisation*. Elsevier, 2013.

¹⁹ Central Electricity Authority. 'Executive Summary on the Power Sector - July 2021'. Available on: https://cea.nic.in/wp-content/uploads/executive/2021/07/Executive_Summary_Jul_2021_Final.pdf

only expected to increase beyond 2030 due to increasing energy demand. A prioritized effort to efficiently electrify all homes would force the government to source power from its existing fleet of coal-based power stations. It is also predicted that India would meet its NDC's without the complete mitigation of coal-based power.²⁰ Therefore, the nation would require the right political push in its approach towards defining its energy-climate nexus. robust energy policies that are expected to define India's approach to the energy-climate nexus.

2.1. Indian Energy Policy

India's energy policies have moved from direct state control toward partial, and uneven, liberalization. During the socialist pre-reform era, the Indian state exercised direct control of the energy sector. After economic liberalization, India has moved in the direction of partial reform and "hybrid" power markets.²¹ This logic of partial reform is key to understanding India's energy policy today.

In the power sector, between 1948-1991, the government largely depended on The Electricity (Supply) Act, 1948 which reorganized energy generation, transmission, and distribution across the nation. In the socialist economy, the power sector was vertically integrated from generation and transmission to distribution, with State Electricity Boards governed by political imperatives.²² Reorganization of the coal and power sector was completed through the formation of the National Thermal Power Corporation (NTPC) and Coal India Limited in 1985. The two centrally controlled organizations were tasked with handling larger investments in the coal sector.

The liberalization of the economy in 1991 paved the way for a revamp in Indian energy policy. In 1991, India opened generation investment to private players and welcomed independent power producers. While deregulation and privatization were intended to increase India's generation capacity, by 1999 less than two GW of private generation capacity had been added.²³ These problems contributed to continued reform efforts with the Electricity Regulatory Commissions Act, 1998, and the Electricity Act, 2003.

²⁰ The Brookings Institution. 'Coal is king in India—and will likely remain so'. Available on: <https://www.brookings.edu/blog/planetpolicy/2019/03/08/coal-is-king-in-india-and-will-likely-remain-so/>

²¹ Tongia, Rahul. "The political economy of Indian power sector reforms." *Program on Energy and Sustainable Development Working Paper 4* (2003).

²² Dubash, Navroz K., ed. *Mapping power: The political economy of electricity in India's states*. Oxford University Press, 2018.

²³ D'Sa, Antonette, KV Narasimha Murthy, and Amulya KN Reddy. "India's power sector liberalisation: an overview." *Economic and Political Weekly* (1999): 1427-1434.

The 1998 Electricity Regulatory Commissions Act mandated the establishment of the Central Electricity Regulatory Commission (CERC) and the State Electricity Regulatory Commission (SERC) - regulatory bodies at the center and state level that managed the generation, transmission, and distribution of electricity in India. The mandate provided a regulatory backbone to the power sector and helped manage the sale of power through a decentralized, government-controlled platform. The 2003 Electricity Act reshaped the nation's outlook towards rural electrification by providing national targets for pan-Indian electrification. Moreover, the act sought to liberalize the underperforming regulatory framework of power and synthesized broader goals of the Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948, and the Electricity Regulatory Commissions Act, 1998.

The initiative helped decentralize power regulation to the state level and pushed separate state organizations to take responsibility for generation, transmission, and distribution. An increased impetus on improving grid discipline called for the introduction of availability-based tariffs that promoted the use of scientific tools for tracking the purchase of power. The Electricity Act, 2003 was a market-oriented framework that notably initiated the de-licensing of thermal generation, the promotion of rural electrification and renewable energy, and the introduction of licensed power trading under the multi-year tariff framework. Most importantly, the act established open-access trade for transmission and distribution in which generators could directly sell to the highest bidding transmission organization, and end-users could buy power from the most cost-effective source.

While almost all Indian households now have access to electricity²⁴, the quality and reliability of electricity service remain a major issue. The India Residential Energy Survey (IRES 2020) identified that Indian households received an average electricity supply of 20.6 hours per day.²⁵ The energy deficit is higher in rural India, where an average household receives 19.9 hours of electricity supply per day. Households in Uttar Pradesh, Jharkhand, Haryana, Assam, and Bihar continue to face the longest power outages - over six hours per day. The survey found that 53% of rural Indian households experienced multiple power cuts at varying frequencies throughout the day, especially during the evenings. The phenomenon raises questions on the quality of power being supplied.

²⁴ World Bank Global Electrification Database from "Tracking SDG 7: The Energy Progress Report" led jointly by the custodian agencies: the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division (UNSD), the World Bank and the World Health Organization (WHO).

²⁵ Agrawal, Shalu, Sunil Mani, Abhishek Jain, and Karthik Ganesan. 2020. State of Electricity Access in India: Insights from the India Residential Energy consumption Survey (IRES) 2020. New Delhi: Council on Energy, Environment and Water.

India's power sector woes reflect deep governance problems that superficial liberalization, deregulation, and privatization have not fully addressed. When India began groundwater irrigation to promote high-yield varieties in the 1960s, farmers became dependent on access to affordable inputs such as water and fertilizer.²⁶ Politicians began to campaign on free electricity in state elections, driven by powerful farmers' movements in the 1970s.²⁷ This campaigning strategy spread across states and drove many states, from Punjab to Tamil Nadu, to offer free or almost free electricity to agricultural users. The results for India's power sector performance were disastrous, as distribution companies had to give away huge quantities of electrical energy.²⁸

Although India continues to struggle with power sector governance, the institutional reorganization has played a significant role in providing individual states with more options to govern their power sector. The notable amendments opened up the energy market and provided investors with a wealth of investment options. The market was segregated into three broad sections and incentivized the development of renewable energy, largely through feed-in-tariffs and renewable purchase obligations (RPOs). Consumers benefited from the new auction processes that provided development tenders to independent power producers (IPPs) that bid the lowest unit costs of energy under their power purchase agreements (PPAs).

India's traditional dependence on coal notwithstanding, a recent shift in the global outlook towards climate change and the building narrative of energy's role as a climate mitigation tool has pushed India towards renewable development. Renewable energy constituted 21% of India's total energy generation in FY2019.²⁹ Its capacity has increased over three times since 2015 with a current capacity of one hundred GW, largely consisting of solar and wind power. The government is now chasing an ambitious target of setting up 175 GW of renewable energy by 2022 and 450 GW of renewable energy by 2030. India aims to strategically place itself as a global champion in climate mitigation efforts while attending to its local development goals.

The development of renewable energy and energy efficiency policies have played a key role in enabling this growth. Notably, the renewable energy industry was placed as a priority sector under the Reserve Bank of India (RBI) norms in 2015, which meant banks were now obliged to earmark a certain percentage of their lending to the RE sector. The National Tariff Policy, 2016,

²⁶ Aklin, Michaël, Patrick Bayer, S. P. Harish, and Johannes Urpelainen. *Escaping the energy poverty trap: when and how governments power the lives of the poor*. MIT Press, 2018.

²⁷ Birner, Regina, Surupa Gupta, and Neeru Sharma. *The political economy of agricultural policy reform in India: Fertilizers and electricity for irrigation*. Vol. 174. Intl Food Policy Res Inst, 2011.

²⁸ Dubash, Navroz K., and Sudhir Chella Rajan. "Power politics: Process of power sector reform in India." *Economic and Political Weekly* (2001): 3367-3390.

²⁹ Ministry of Statistics and Programme Implementation. 'Energy Statistics India 2019'. Available on: http://mospi.nic.in/sites/default/files/publication_reports/Energy%20Statistics%202019-final.pdf

reformed renewable energy development using the concept of competitive bidding auctions - a system used to decrease the prices of energy for the consumer and invite private investments into the sector. The policy also mandated renewable purchase obligations (RPO), a regulation used to ensure state power distribution companies and certain other private firms procure part of their power requirement from renewable sources. The sector-specific policy development, aided by the National Solar Mission, has boosted the development of solar and wind energy in India. Prices of these energy sources have firmly competed with thermal power boosting the government's intentions for a faster energy transition.

The development of renewable energy has not been geographically even. Four of the top five renewable energy-producing states of India (Gujarat, Karnataka, Maharashtra, and Tamil Nadu) lie in the southern and western regions of the country. In contrast, eastern states like Jharkhand and Chhattisgarh have been unable to develop their renewable energy resources. The eastern and northeastern region of the Indian power sector harbors just 2.2 GW of renewable power compared to 21.5 GW, 31.4 GW, and 45.4 GW of renewable energy power in the northern, western and southern regions, respectively.³⁰

This stark difference has largely been due to eastern India's historical high reliance on coal power not only for their energy but as a source of revenue.³¹ This pattern has been accentuated by their development-centric policies and investments, leaving little room for the development of renewable energy. The gap is also widened by the relative unavailability of wind and solar resources in comparison with other regions of the country.^{32 33} Finally, many eastern states lack large swaths of land for renewable energy development.³⁴

India has also made progress on energy efficiency. The nation's flagship National Mission for Enhanced Energy Efficiency (NMEEE) harbors four initiatives to enhance energy efficiency in energy-intensive industries. First, the Perform, Achieve and Trade Scheme (PAT) - a market-based mechanism to enhance the cost-effectiveness in improving the energy efficiency in

³⁰ Central Electricity Authority. 'Executive Summary on the Power Sector - August 2021'. Available on: https://cea.nic.in/wp-content/uploads/executive/2021/08/Executive_Summary_Aug_2021.pdf

³¹ Tongia, Rahul, and Samantha Gross. "Coal in India: Adjusting to transition." (2019).

³² Data obtained from the Global Solar Atlas 2.0, a free, web-based application is developed and operated by the company Solargis s.r.o. on behalf of the World Bank Group, utilizing Solargis data, with funding provided by the Energy Sector Management Assistance Program (ESMAP)

³³ Data obtained from the Global Wind Atlas 3.0, a free, web-based application developed, owned and operated by the Technical University of Denmark (DTU). The Global Wind Atlas 3.0 is released in partnership with the World Bank Group, utilizing data provided by Vortex, using funding provided by the Energy Sector Management Assistance Program (ESMAP)

³⁴ Kiesecker, Joseph, Sharon Baruch-Mordo, Mike Heiner, Dhaval Negandhi, James Oakleaf, Christina Kennedy, and Pareexit Chauhan. "Renewable energy and land use in India: A vision to facilitate sustainable development." *Sustainability* 12, no. 1 (2020): 281.

energy intensive industries through the certification of energy saving which can be traded. Second, the Market Transformation for Energy Efficiency (MTEE) - a program used to accelerate the use of high-efficiency home appliances. A notable outcome of this has been the use of light emitting diode (LED) lights in over 80 percent of households in all but three Indian states.³⁵ Third, the Energy Efficiency Financing Platform (EEFP) - a platform for the creation of mechanisms that would help finance demand-side management programs in all sectors by capturing future energy savings. Fourth, the Framework for Energy Efficient Economic Development (FEEED) - a program that houses the development of innovative financing mechanisms that mitigate or support loan and funding risks attached with energy efficiency projects across India. Today, the combination of several government-led initiatives has improved awareness of energy efficiency across India. The Bureau of Energy Efficiency (BEE) label, commonly associated with the degree of an appliance's energy saving capacity, is known to more than one-fifth of rural and two-fifths of urban households.³⁶

2.2. Indian Climate Policy

Similar to its energy policy, India's climate policy is shaped by a number of historical legacies. India's current climate policies have been formed under an electoral radar and have been adjunct to its prioritized national development goals.³⁷ Energy security has been at the top of India's agenda, with a discussion on climate change and carbon-free energy gaining ground over the past two decades. But this position increasingly came under pressure, necessitating explicit analytical links between India's energy security concerns and their global climate implications. However, India's largely diplomatic approach at global climate conferences has strongly attested to the common but differentiated responsibilities (CBDR) principle often used to define the sharp differences in development focus between developed and under-developed nations. India's approach has largely pivoted around the fact that its per capita emissions are around a third of the global average.

Traces of climate institution development can be traced back to 1992. The government viewed climate change as a diplomatic problem, rather than a social issue and faced limited

³⁵ Agrawal, Shalu, Sunil Mani, Dhruvak Aggarwal, Abhishek Jain, Chetna Hareesh Kumar and Karthik Ganesan. 2020. *Awareness and Adoption of Energy Efficiency in Indian Homes: Insights from the India Residential Energy consumption Survey (IRES) 2020*. New Delhi: Council on Energy, Environment and Water.

³⁶ Agrawal, Shalu, Sunil Mani, Dhruvak Aggarwal, Abhishek Jain, Chetna Hareesh Kumar and Karthik Ganesan. 2020. *Awareness and Adoption of Energy Efficiency in Indian Homes: Insights from the India Residential Energy consumption Survey (IRES) 2020*. New Delhi: Council on Energy, Environment and Water.

³⁷ Dubash, Navroz K., Radhika Khosla, Ulka Kelkar, and Sharachandra Lele. "India and climate change: Evolving ideas and increasing policy engagement." *Annual Review of Environment and Resources* 43 (2018): 395-424.

expectations for mitigation, along with other developing nations. At that time, Indian institutions were more focused on climate diplomacy rather than actionable climate policy. While the establishment of the Ministry of New and Renewable Energy in 1992 helped establish a discussion on sustainable energy, the national government was hesitant to make 'a commitment of any sort'.³⁸

In the early 2000s, stronger international pressure and a slight shift in India's domestic narratives opened doors to the development of new climate institutions. A significant outcome was the creation of the National Action Plan on Climate Change (NAPCC) that created a foundation for current climate politics in India. It took the form of eight sectoral missions across eight independent verticals that forced bureaucrats to include climate targets in their daily functions. The NAPCC was described as a tool to organize India's climate mitigation efforts. The structure of the mission was closely related to a nuanced shift in India's outlook against climate change, consisting of implications for bureaucratic incentives. However, the mission did not call for a clear requirement for institution building or recruitment for climate-specific initiatives.³⁹

Since 2014, climate policy development has taken place in a more bottom-up fashion in the form of sectoral and state-level ministries. With the appointment of the Bharatiya Janata Party (BJP), the Indian government was more concerned about greater global visibility for India. The Paris Agreement created an ambitious benchmark dominated by the Prime Minister's 450 GW by 2030 renewable energy target and 33-35% emission intensity reduction from 2005 level by 2030 target. Today, the Prime Minister's Office (PMO) in partnership with the Ministry of Environment, Forests, and Climate Change (MoEFCC) has proactively played a role in climate policymaking.

This progress has largely been backed by the active participation of a few forward-looking state governments that have used climate mitigation incentives to boost development in their regions.⁴⁰ Gujarat has consistently led state-level climate policy development. Initiatives undertaken by key state nodal agencies to promote solar rooftop systems, subsidies for the purchase of battery-operated two-wheel vehicles, solar water heating systems, and waste-to-energy projects have pushed its overall climate-salient rankings. The state also saw a 27% increase in its forest cover, expanding the presence of its carbon sinks. To promote water

³⁸ Pillai, Aditya Valiathan, and Navroz K. Dubash. "The limits of opportunism: the uneven emergence of climate institutions in India." *Environmental Politics* (2021): 1-25.

³⁹ Byravan, Sujatha, and Sudhir Chella Rajan. "An evaluation of India's national action plan on climate change." *Available at SSRN 2195819* (2013).

⁴⁰ The Climate Group. 'Driving Climate Action: State Leadership in India'. Available on: http://www.indiaenvironmentportal.org.in/files/file/india_report.pdf

management, multiple regions have adopted a 100% drip and sprinkler irrigation system that has supported micro-irrigation and self-reliant agriculture. Currently, 12% of all EV vehicles running in India are registered in Gujarat. Similarly, Tamil Nadu has promoted climate mitigation largely through its robust renewable energy portfolio of 15.6 GW. The state is also on track to achieve its 2030 climate sink goal through a 48% increase in forest cover since 1991. The government continues to show financial prowess by its state budgetary allocation for climate change through grants from the Asian Development Bank, U.N. Adaptation Fund, and Japan International Cooperation Agency (JICA). In pursuit of becoming a regional carbon-free energy leader, Tamil Nadu has already leveraged 32% of its renewable energy potential, the most of any state in India.

Climate progress in India will, however, require building climate institutions and capacity across many other states.⁴¹ Maharashtra finalized its action plan in 2017, seven years after it was first ideated. States such as Bihar and Chattisgarh have adopted climate-centric agricultural roadmaps to integrate adaptation with their local development objectives. Although these steps have helped integrate climate focus into the local federal structure, the 'one-off' effort at mainstreaming climate focus onto a single industry cannot exhaustively improve climate governance in the state. Political appetite and a lack of knowledge on climate change are also fuelling a disruptive outlook towards climate-safe progress. In Kerala, every ruling party has an active society on conservation. The prevailing narrative of the government and society has primarily been around environmental conservation and 'green' development over the last decade. Climate change has been added to this agenda without sufficient discussion and clarity on the difference between tackling climate change and protecting the environment. Lastly, inadequacy in planning and timelines have created ambiguity in state-level climate plans. In Madhya Pradesh, impact assessments in the state's climate action plan have been conducted just for forest ecosystems and water resources in the state.⁴² Similarly, Odisha's plans have not included local, regional, or state and sector-specific climate projections within specific time periods.

India's dependence on synergies between development and climate outcomes anchors its focus in a co-benefit framework. While the NAPCC failed to stimulate institutional expansion, it helped build a narrative of promoting India's development objectives while contributing to climate mitigation. The recognition of deeper linkages between climate and development in India has pulled climate policy away from just a 'diplomatic' issue and has pushed policy

⁴¹ Kumar, Vineet. "Coping with Climate Change: An Analysis of India's State Action Plans on Climate Change." *New Delhi, India: center for Science and Environment*. (2018).

⁴² Kumar, Vineet. "Coping with Climate Change: An Analysis of India's State Action Plans on Climate Change." *New Delhi, India: center for Science and Environment*. (2018).

makers to co-create climate-friendly solutions for development. Earlier, Indian diplomats focused on developing and reinforcing a legal case against mitigation obligations for developing countries: the principle of 'common but differentiated responsibility and respective capabilities'.⁴³

However, Isaksen et al. identified a sharp change in the nation's climate outlook after 2007.⁴⁴ While climate change was once thought to be an issue and a responsibility of the global North, the consequences and vulnerabilities of climate change in the global South, as well as emerging economies' responsibility and tactics, were being actively debated in India since 2007. Civil society actors such as WWF India and state officials such as the former Minister of Environment and Forests (2009–2011), Jairam Ramesh, began raising awareness about India's vulnerability to climate change. This was linked with India's underlying need to promote climate action to protect its growing economy. Climate policies were also seen as an opportunity for business growth. Climate change was increasingly being included in the domestic agendas of the Federation of Indian Chambers of Commerce and Industry (FICCI) and the Confederation of Indian Industry (CII). The CII had encouraged the government to adopt policies that allow the private sector to participate in the Clean Development Mechanism (CDM) - an international mechanism used to fund and claim ownership of emission-friendly overseas projects.⁴⁵ A 'win-win discourse' used to navigate through national development goals while meeting international climate mitigation strategies were being used. However, the process gave birth to significant differences amongst policymakers in India.

The uneven and partial development of India's climate policy and institutions reflects deep disagreements among Indian policy elites on climate change as a social issue. Until recently, climate change was rarely acknowledged as a phenomenon having relevance for the country's development imperatives. While India has realized the need to act on climate mitigation issues, it has reserved its right to increase the nation's per capita energy consumption, provided largely by coal power. The nation's policymakers have prioritized economic development and do not feel threatened by the chronic social impacts of climate change. Although a few of these impacts are in the form of poor air quality and irregularities in agriculture cycles, rigid policies, and

⁴³ Aditya Valiathan Pillai & Navroz K. Dubash (2021) The limits of opportunism: the uneven emergence of climate institutions in India, *Environmental Politics*, 30:1, 93-117

⁴⁴ Isaksen, Kari-Anne, and Kristian Stokke. "Changing climate discourse and politics in India. Climate change as a challenge and opportunity for diplomacy and development." *Geoforum* 57 (2014): 110-119.

⁴⁵ Pulver, Simone. *Corporate responses to climate change in India*. Routledge, 2012.

laws are yet to determine the interplay between climate mitigation and increasing social responsibility.^{46 47}

3. The Political Economy of Federalism: Center-State Relations in India

India's federal structure has important implications for its ability to undergo a rapid and equitable energy transition. In this section, we review both the general literature on federalism and studies focused on India's federal structure. We also discuss studies of center-state relations in Indian politics and the consequences of India's multi-level elections for federal governance. This review reveals a complex set of incentives that are often poorly aligned and raise high barriers to the energy transition.

3.1. Theoretical Approaches to Federalism

Theories of federalism emphasize the implications of shared governance between the central and subnational governments.⁴⁸ Both levels of governance have distinct advantages. Central policymakers have an incentive to consider the benefits and costs of policies across the nation, which is useful when sub-national governments produce negative or positive externalities that affect other subnational jurisdictions. Subnational governments tend to focus on their own economic, environmental, and political objectives even at the expense of other subnational jurisdictions.

In the United States, for example, state governments undervalue the cost of their state's air pollution to other states.⁴⁹ The U.S. federal government has a role to play in enforcing policies, rules, and regulations that reduce interstate air pollution flows. Other examples can be found in innovation policy, where each subnational government undervalues the national benefits of positive technological spillovers, and in constraints on a "race to the bottom" between subnational jurisdictions to attract capital investments.⁵⁰

⁴⁶ Dimitrova, Asya, Guillaume Marois, Gregor Kiesewetter, K. C. Samir, Peter Rafaj, and Cathryn Tonne. "Health impacts of fine particles under climate change mitigation, air quality control, and demographic change in India." *Environmental Research Letters* 16, no. 5 (2021): 054025.

⁴⁷ Palanisami, K., Krishna Reddy Kakumanu, Udaya Sekhar Nagothu, and C. R. Ranganathan. "Climate change and agriculture in India." In *Climate Change and Future Rice Production in India*, pp. 1-6. Springer, Singapore, 2019.

⁴⁸ Oates, Wallace E. *A reconsideration of environmental federalism*. No. 1318-2016-103317. 2001.

⁴⁹ Banzhaf, H. Spencer, and B. Andrew Chupp. "Fiscal federalism and interjurisdictional externalities: New results and an application to US Air pollution." *Journal of Public Economics* 96.5-6 (2012): 449-464.

⁵⁰ Carbado, Devon W. "Race to the Bottom." *UCLA L. Rev.* 49 (2001): 1283.

In contrast, subnational governments often have an advantage in local information⁵¹ and proximity to citizens.⁵² The central government's advantage in controlling positive and negative externalities must be weighed against subnational governments' superior knowledge about local conditions, public opinion, and political processes. To give an extreme example, central governments sometimes opt for "one size fits all policies", such as uniform pollution standards, that fail to recognize heterogeneity in abatement costs, vulnerability, and politics across subnational jurisdictions.

Besides local information and proximity to citizens, subnational jurisdictions can also be laboratories of innovation in a federal system.⁵³ As federal policymakers look for effective, efficient, and politically feasible solutions to mitigating environmental problems, they can review experiences at the state level and scale up successful initiatives in a true bottom-up fashion. An example is found in Southern India, in Kerala's solar rooftop plan. Historically dependent on hydropower,⁵⁴ Kerala's leaders did not want to cut down forests to build new dams across the states. Inspired by other innovative state-level solar rooftop campaigns that fueled a 116% growth of solar rooftop capacity between 2012 and 2018, the government has now decided to cover a quarter of Kerala's electricity needs through rooftop solar by 2022.⁵⁵ The initiative was propelled by a strategic public-private partnership with India's largest integrated power company, Tata Power.⁵⁶ The partnership secured the development of 84 MW of solar rooftop capacity across every district in the state. To help integrate these systems into local grids, the state introduced a creative mix of capital and purchase subsidies that promote technology implementation and awareness. In this case, Kerala learned from other state-level experiences and launched an ambitious public-private partnership that can inform other states' and central solar rooftop policy.

From a political perspective, conflicts between the central and subnational governments present a particular challenge for environmental and energy federalism.⁵⁷ While the federal governance

⁵¹ Urpelainen, Johannes. "Explaining the Schwarzenegger phenomenon: Local frontrunners in climate policy." *Global Environmental Politics* 9.3 (2009): 82-105.

⁵² Rao, M. Govinda, and Nirvikar Singh. *The political economy of federalism in India*. Oxford University Press, 2006.

⁵³ Victor, David G., Joshua C. House, and Sarah Joy. "A Madisonian approach to climate policy." *Science* 309.5742 (2005): 1820-1821.

⁵⁴ Kerala State Electricity Board. 'Overview of the Generation Mix'. Available on: https://www.kseb.in/index.php?option=com_content&view=article&id=45&Itemid=525&lang=en

⁵⁵ World Economic Forum. 'This Indian solar energy scheme will turn homes into power stations'. Available on: <https://www.weforum.org/agenda/2021/03/india-kerala-benefit-new-solar-power-scheme>

⁵⁶ Livemint. 'Tata Power to Setup Solar Rooftop Projects on Kerala Homes'. Available on: <https://www.livemint.com/industry/energy/tata-power-to-set-up-solar-rooftop-projects-in-kerala-homes-11625896696298.html>

⁵⁷ Percival, Robert V. "Environmental federalism: historical roots and contemporary models." *Md. L. Rev.* 54 (1995): 1141.

structure can promote cooperative decision making to avoid duplication of efforts, it also gives rise to conflicts as a result of differing incentives. The central government's efforts to reduce negative spillovers and increase positive spillovers can run into difficulties when sub-national governments object to those efforts. Institutions of federalism must strike a balance between central and subnational authority, and each side is trying to increase its relative power. This can result in a tug of war that paralyzes policymaking.

In the United States, extreme levels of political polarization in the federal government going from the Trump to Biden presidencies have resulted in high levels of policy and regulatory volatility. This volatility results in abrupt changes in the rules that U.S. states face and disruptive conflicts between the federal and state governments. Depending on the federal government's direction, some states support and others oppose current federal rules. Continuous changes at the federal level result in political conflicts and legal disputes, creating uncertainty and delaying environmental protection.

In Brazil, the national environment policy or the CONAMA (Conselho Nacional do Meio Ambiente) defines the role of institutions covering environmental governance. The guidelines decentralize institutional arrangements and distribute regulatory power to individual states.⁵⁸ However, disputes centered around which level of government will legislate and regulate the Permanent Preservation Areas - a key tool in environmental conservation - have led to environmental shortcomings. The confusion about central versus state authority has fueled deforestation, as landowners believe their state governments will not penalize land clearing and logging, even when technically illegal.

3.2. Indian Federalism

India's federal structure was set in the country's constitution in 1950. Against the backdrop of a highly diverse nation, the constitution allocated power to the central and state governments, seeking the right balance between coherence and respect for subsidiarity.⁵⁹ In practice, the constitution assigned different sectors to the center, the states, or for joint decision-making ("concurrent list"). Although most sectors are governed by states, the electricity sector, which is central to climate and energy policy, is on the concurrent list. While the center holds considerable authority over generation and transmission planning, states control the

⁵⁸ Chakrabarty, PG Dhar, and Nidhi Srivastava. "Green Federalism: Experiences and Practices." The Energy and Resource Institute (2011).

⁵⁹ Pillai, A.V., N. K. Dubash, and P. Bhatia. 2021. "Unlocking climate action in Indian federalism". Policy Brief, Initiative for Climate, Energy, and Environment. New Delhi: center for Policy Research.

distribution of electricity.⁶⁰ As we shall see below, this division of authority is key to understanding India's energy transition challenges. Other important sectors with split powers include industry and transportation.

Although the sectoral division of powers seems to favor the states, India's federalism is highly centralized when it comes to finances and institutional capacity.⁶¹ Indian states depend on centrally sponsored schemes and center-state fiscal transfers for policy implementation, and their institutional capacity is weak compared to the center's. As a result, the seemingly neat sectoral division rarely gives states full autonomy, as they lack the resources and capabilities they need. Conversely, the center rarely has the sectoral autonomy to implement policies without cooperation from the states.

Consider the example of air pollution.⁶² India's massive air pollution problem results from a combination of unfavorable geography, with the Indo-Gangetic basin trapping polluted air, and multi-sectoral air pollution sources subject to weak regulations.⁶³ Under India's federal structure, states have the primary responsibility for controlling air pollution, but almost 50% of the total air pollution load crosses state borders.⁶⁴ As a result, each state has weak incentives to control air pollution: half of the environmental benefit goes to other states, and even aggressive within-state activities cannot fully clean the air. This dynamic can also be seen in India's agricultural sector, which has contributed to air pollution.⁶⁵ Every year during the farmer's harvest season in north India, agricultural residue is burnt by farmers causing a spike in air pollution levels across the Indo-Gangetic plain, particularly around New Delhi. Delhi's current chief minister, Arvind Kejriwal is often quick to blame the neighboring states of Haryana and Punjab for allowing their farmers to practice stubble burning.⁶⁶ The problem is further exacerbated due to the cold Delhi winters, which cause smog, leading to low visibility

⁶⁰ Pargal, Sheoli, and Sudeshna Ghosh Banerjee. *More power to India: The challenge of electricity distribution*. Washington, DC: World Bank, 2014.

⁶¹ Pillai, A.V., N. K. Dubash, and P. Bhatia. 2021. "Unlocking climate action in Indian federalism". Policy Brief, Initiative for Climate, Energy, and Environment. New Delhi: Center for Policy Research.

⁶² Du, Xinming, et al. "Cross-state air pollution transport calls for more centralization in India's environmental federalism." *Atmospheric Pollution Research* 11.10 (2020): 1797-1804.

⁶³ Singh, Siddharth. *The Great Smog of India*. Penguin Random House India Private Limited, 2018.

⁶⁴ Du, Xinming, et al. "Cross-state air pollution transport calls for more centralization in India's environmental federalism." *Atmospheric Pollution Research* 11.10 (2020): 1797-1804.

⁶⁵ McDonald, Andrew J., Amit K. Srivastava, and Bruno Gerard. "Tradeoffs between groundwater conservation and air pollution from agricultural fires in northwest India." *Nature Sustainability* 2, no. 7 (2019): 580-583.

⁶⁶ Indian Express. 'Arvind Kejriwal blames the center, Haryana & Punjab govt for Delhi's air pollution'. Available on:

<https://indianexpress.com/article/cities/delhi/arvind-kejriwal-blames-center-haryana-punjab-govt-for-delhis-air-pollution-5423576/>

throughout the city. While the Punjab government has sought support from the center⁶⁷, a decline in pollution levels of the national capital is yet to be witnessed. Here the lack of central control results in high levels of air pollution.

The literature on Indian federalism highlights the conflicts and tensions between the center and the states, as well as different states. Although India's first decades as an independent nation saw a high degree of centralization,⁶⁸ the outcome turned out to be temporary. When the Indian National Congress lost its dominant status and competition with other parties, including the Bharatiya Janata Party (BJP) and regional parties, intensified, the level of fragmentation in federal governance surged.⁶⁹ With different parties and coalitions controlling various states and the center, disagreements about policy direction surfaced, and implementation difficulties complicated governance.

In the Modi era, the tendency to centralize has again shaped India's federal governance. Historically, his government has not relied on support from regionalist parties with concentrated power in Indian states. However, several instances of country-wide political centering have been witnessed under the BJP government.⁷⁰ First, the use of the President's Rule⁷¹ has been a widespread occurrence. Since the onset of the Modi era, the BJP has ousted nine governors previously appointed by the preceding government. Leveraging the political abilities of its self-appointed governors, India has witnessed the impositions of President's Rule in two Congress Party-led states - Sikkim and Arunachal Pradesh. Second, the government's ability to undertake unilateral decisions in the form of demonetization on November 8th, 2016 violated the spirit of cooperative federalism.⁷² Although this move was intended to revoke the use of 'black money', researchers have argued that the move was aimed at destroying political rivalry.⁷³ Third, the gradual revokement of Article 370 - a provision that gives Jammu and Kashmir a special and independent autonomy status - benefited the government by decreasing

⁶⁷ TimesNow News. 'Delhi air pollution: Punjab CM criticises Arvind Kejriwal, declines request to meet'.

Available on:

<https://www.timesnownews.com/india/article/delhi-air-pollution-punjab-cm-amarinder-arvind-kejriwal-war-of-words-stubble-burning-farmers/125575>

⁶⁸ Tillin, Louise. *Indian federalism*. Oxford University Press, 2019.

⁶⁹ Pillai, A.V. and Dubash, N. K. 2021. "Compensatory Climate Governance in Indian federalism". Working Paper, Initiative on Climate, Energy and Environment. New Delhi: Center for Policy Research. April 2021.

⁷⁰ Sharma, Chanchal Kumar, and Wilfried Swenden. "Modi-fying Indian federalism? center-State Relations under Modi's tenure as Prime Minister." *Indian Politics & Policy* 1, no. 1 (2018): 51-81.

⁷¹ President's Rule refers to the suspension of a state government and the imposition of direct rule of the center. The central government takes direct control of the state in question and the Governor becomes its constitutional head.

⁷² Tillin, Louise. "India's Democracy at 70: The Federalist Compromise." *Journal of Democracy* 28, no. 3 (2017): 64-75.

⁷³ Bose, Feler. "An Economic and Public Policy View of Demonetization in India." *Society* 56, no. 1 (2019): 38-46.

the capacity of regional actors to influence state policies. Although the government claimed that Article 370 was the reason behind the region's lack of development and economic progress, the co-benefits of the initiative were clear.

In the federal structure, electoral cycles and partisan alignment, or lack thereof, between the center and the states are important determinants of policy alignment and progress.⁷⁴ Because Indian states depend on the center for fiscal transfers, center-state alignment in partisan politics results in higher levels of transfers.⁷⁵ The center uses fiscal transfers to support co-partisan state governments in an opportunistic fashion, making generous transfers where electoral competition is intense.

The result is a distortion of transfers: they do not go where they are needed the most, but where they bring political gains. But from the center's perspective, there is no plausible alternative to this system. The center knows that (i) opposition parties will not use fiscal transfers to promote the center's goals and that (ii) the transfers could help opposition parties solidify their political position.

In the case of climate policy, Pillai and Dubash argue that a system of "compensatory federalism" could unlock action and address inherent structural weaknesses in India's federalism.⁷⁶ While the center has financial control, state governments have authority over implementation in most sectors relevant to climate change. This multi-level system of administration requires compensatory center-state interactions to promote climate change mitigation, with states adopting central initiatives to the local context and development concerns. In turn, state-level experiences can diffuse across the nation and inform central policy formulation.

To see the need for compensatory action, consider that twelve of the central government's 33 climate initiatives lie under the state-controlled categories of transportation, agriculture, water, health, and education.⁷⁷ Two interventions (electricity and forestry) are on the concurrent list, while the others are either under federal control or are multi-jurisdictional schemes with various components. Beyond this, state governments are also supported by the centrally controlled National Steering Committee on Climate Change (NSCCC) which provides

⁷⁴ Arulampalam, Wiji, et al. "Electoral goals and center-state transfers: A theoretical model and empirical evidence from India." *Journal of Development Economics* 88.1 (2009): 103-119.

⁷⁵ Bhavnani, Rikhil R., and Bethany Lacina. "Fiscal federalism at work? Central responses to internal migration in India." *World Development* 93 (2017): 236-248.

⁷⁶ Pillai, A.V. and Dubash, N. K. 2021. "Compensatory Climate Governance in Indian federalism". Working Paper, Initiative on Climate, Energy and Environment. New Delhi: Center for Policy Research. April 2021.

⁷⁷ Pillai, A.V. and Dubash, N. K. 2021. "Compensatory Climate Governance in Indian federalism". Working Paper, Initiative on Climate, Energy and Environment. New Delhi: Center for Policy Research. April 2021.

assistance, funding, and approval for state-level climate projects. Under this compensatory dynamic, states are forced to serve as the crucial final link in delivery by elevating the profiles of climate-relevant development projects. Evidence suggests that states have done a good job of managing this political burden through a series of policies that constitutes a step forward in Indian climate action. States have established 15 solar policies, 10 energy conservation building codes, and seven electric vehicle policies. This is in addition to several LED-village lighting campaigns, energy efficiency programs, and afforestation initiatives as well as the 32 adaptation-focused climate action plans mandated by the federal government. This active process of top-down, climate-relevant policy-making, although compensatory, spotlights the idea of Indian states as laboratories in climate policymaking where local policy innovations can diffuse vertically to become the standard for national action.

4. Understanding Indian Energy and Climate Policy: A Center-State Perspective

Having set the stage for analysis, we now apply the logic of Indian federalism to understand the political economy of Indian energy and climate policy. India’s current federal structure raises high barriers to its energy transition and climate ambition, raising the cost of low-carbon development and slowing down the institutionalization of climate action.

The key arguments regarding energy and climate policy are summarized in Table 2. We evaluate the implications of (i) lacking central authority, (ii) conflicting center-state incentives, (iii) center-state resource asymmetry, and (iv) partisan politics and electoral volatility for energy and climate policy. In both sectors, we find evidence of barriers to progress through differences in nature.

Table 2. Center-State Relations in Indian Federalism: Comparing Energy and Climate Policy.		
Feature	Energy Policy	Climate Policy
Lack of central authority	Power sector (distribution); industrial standards; transportation	Multiple sectors, including all that apply to energy policy
Conflicting center-state incentives	Home bias for in-state generation; lack of state contributions to grid stabilization; heterogeneous	Lack of state interest in decarbonization

	state preferences	
Center-state resource asymmetry	State resistance to central planning and coordination; center's lack of interest in state-specific concerns	State fiscal dependence on the center; weak state institutional capacity
Partisan politics and electoral volatility	Unpredictable policy changes; center-state conflicts without partisan alignment	Lack of long-term programmatic coordination

4.1. Energy Policy

The central and state governments share many common goals in energy policy. The standard concerns with affordable, abundant, and reliable energy supply do not differ across levels of government. Whenever a less expensive option is available, both central and state governments choose it. However, the center and the states assign different weights to costs in different locations. While the center is trying to balance total costs across the country, each state is mostly concerned with its own costs.⁷⁸

This fundamental conflict greatly complicates India's low-carbon energy transition. When introducing large loads of renewable energy, the management of electricity flow between states becomes a central challenge. At any given time, states with surplus supply of wind, solar, and hydroelectric power should be exporting to states facing deficits. But each state government discounts the value of both renewables and complementary assets, such as storage, in balancing the grid for the rest of the country.

This problem applies to capacity and transmission expansion, as well as electricity scheduling. In the case of capacity and transmission expansion, the center must find ways to balance the grid across highly heterogeneous demand and supply profiles in India's states and union territories. To do this over the medium term, both generation and transmission assets must be deployed in a coordinated manner, considering their complex, systemic implications.⁷⁹ But from a state's perspective, nationally appropriate strategies may appear counterproductive to their development focused goals tailored to appease the local majority. Similarly, in electricity scheduling the center is trying to minimize the total cost of generation while balancing the

⁷⁸ Gately, D. 1974. Sharing the Gains from Regional Cooperation: A Game Theoretic Application to Planning Investment in Electric Power. *International Economic Review*, 15(1).

⁷⁹ Ryan, Nicholas. "The competitive effects of transmission infrastructure in the Indian electricity market." *American Economic Journal: Microeconomics* 13, no. 2 (2021): 202-42.

national grid, but the resulting decisions may prove unfavorable to producers and consumers in certain states.

In Rajasthan, the Rajasthan Electricity Regulatory Commission (RERC) stated that costs associated with executing the state government's renewable energy policy would not be passed on to customers and would require the state government subsidization.⁸⁰ The new directive presented attractive business advantages that gave a 50% concession on the total cost of transmission and wheeling charges⁸¹ for the first 7 years to all new renewable projects, and a 75% concession for projects with storage and repowered wind systems. Plants being utilized to power electric vehicle charging stations are said to benefit from a 100% exemption on transmission and wheeling charges for the first 10 years of their operations. However, the loophole in this process lies in Section 108 of the Electricity Act, which mandates the RERC to legally comply with state government directions that did not allow electrification cost incentives to be subsidized by the consumer. These involve the RERC operating as per the state government's directives in matters of policy-making involving the public interest. Further, in such decision-making scenarios, the state government's verdict would be final. However, the RERC refuted such jurisdictional claims and cited judgments by the Appellate Tribunal for Electricity (APTEL). The claim cited two independent events in Punjab and Tamil Nadu, that upheld the autonomous rights of their respective state regulatory commissions and ordered the state governments not to 'discharge a statutory function of the state commission'. The matrix of events in these states proves the significance of alignment between a state's power sector and the state government.

India's worst blackout illustrates the serious consequences of center-state misalignment. On July 30-31, 2012, two large-scale power blackouts covering 21 out of 28 Indians caused the worst power crisis in world history.⁸² The first of the two outages affected nearly 350 million people, while the second one involved a whopping 670 million people, one-tenth of the world's population. The minimal South-West monsoon rains had led to the extensive use of water pumps to meet water requirements in the region, while a power surplus in the western region resulted in very high outflows of power to the northern region. Adding further to the woes of the imbalanced system, only two of the four 400 kV high capacity West-North interconnections

⁸⁰ Prayas Pune. 'Regulatory compliance with state government directives: The case of renewable energy policy in Rajasthan'. Available on: <https://www.prayaspune.org/peg/resources/power-perspective-portal/237-regulatory-compliance-with-state-government-directives-the-case-of-renewable-energy-policy-in-rajasthan>

⁸¹ A wheeling charge is a cost per megawatt-hour amount that a transmission owner receives for the use of its system to export energy.

⁸² Tang, Yong, Guangquan Bu, and Jun Yi. "Analysis and lessons of the blackout in the Indian power grid on July 30 and 31, 2012." In *Proceedings of the CSEE*, vol. 32, no. 25, pp. 167-174. 2012.

were operational.⁸³ Policymakers, regulators, and system operators were unable to curb the demand in the northern region or to curtail the generation in the western region. Instead, the power surplus from the western region detoured via the central and eastern states to reach the deficit northern region. In such situations, state-owned utilities were expected to utilize grid protective devices called under-frequency relays (UFR) to disconnect regional grids from state grids during periods of demand and supply imbalances. However, significant political pressure to continue drawing from the national grid drove grid operators to put their regional grids at risk of shutting down due to the non-tripping of the UFRs.

An equally problematic incentive stems from each state government's preference for in-state generation. Chitkara et al. analyze state generation profiles and find that state governments' preferences for in-state generation significantly increase the total cost and add to the curtailment of renewables in the Indian power system.⁸⁴ On average, the home bias in generation adds 16% to total power generation cost and 3% to carbon dioxide emissions. As renewable power generation grows, these issues will be exacerbated.

Electricity's status as a concurrent subject⁸⁵ plays a critical role in the center-state conflict and the uneven performance of the states. Although the Ministry of Power remains the highest level of authority, states are allowed independent electricity distribution ownership and autonomy. The de-facto distribution of authority between the different levels of government is prone to be misinterpreted. Moreover, the unique federal structure gives state governments the power to block or influence decisions on local concerns.

An illustration of this is the center-state standoff over wind energy in Andhra Pradesh which is threatening to terminate renewable energy investment in the state. In 2019, Chief Minister Jaganmohan Reddy appointed a sub-committee to probe into decreasing the unit costs of renewable energy in the state. He requested all 139 state projects to renegotiate PPAs that were previously signed during the term of his predecessor. The gesture propelled India's RK Singh, India's minister of power and new and renewable energy to threaten the Andhra Pradesh chief minister by proposing to ban energy investments into the state.⁸⁶ The showdown was followed by the involvement of the Andhra Pradesh high court, multiple foreign investors, and India's

⁸³ Sarkar, Sayan, Gairik Saha, Gaurav Pal, and Taniya Karmakar. "Indian experience on smart grid application in blackout control." In *2015 39th National Systems Conference (NSC)*, pp. 1-6. IEEE, 2015.

⁸⁴ Chitkara, Puneet et al. "Political and institutional barriers to renewable electricity integration and emissions reductions in India". Under review at *Applied Energy*.

⁸⁵ A concurrent subject is a topic on the concurrent list in the India constitution. Decision making for topics on this list can be governed by state and central governments.

⁸⁶ Quartz India. 'A timeline: The Mexican standoff in Andhra Pradesh, India's renewable energy badland'. Available on: <https://qz.com/india/1755170/timeline-of-andhra-pradeshs-standoff-with-renewable-developers/>

home minister, Amit Shah. The misinterpretation of power and transfer of decision-making powers to the Indian judicial system potentially depreciates investor interest, especially in decentralized federal systems.

Distribution companies, almost exclusively controlled by state governments, add to the difficulty. India's distribution sector faces a major challenge in trying to maintain technical performance and fiscal solvency under political pressure to subsidize both poor residential consumers in rural areas and provide free or heavily subsidized power to farmers for irrigation purposes.⁸⁷ With weak and unstable revenue, distribution companies face difficulties in paying their dues to generators, even when they have signed long-term power purchase agreements.⁸⁸ Anticipating such difficulties, generation companies insist on highly favorable terms and guarantees. The issue is further compounded by state governments forcing debt relief on generators, again resulting in hold-up problems in investment.

Indian distribution companies (DISCOMs) owed USD 1.97 billion to renewable energy generators in August 2021. This was 3.3% higher than their cumulative debts in July 2021.⁸⁹ The state distributors of Tamil Nadu, Maharashtra, Rajasthan, Andhra Pradesh, Jharkhand, Telangana, and Andhra Pradesh have the highest debt records in India. Disrupted by the COVID-19 pandemic, DISCOMs are also burdened by a significant tariff subsidy debt that increased by 140% between 2014 and 2019.⁹⁰ During the pandemic, these organizations saw their revenue fall by at least 80%, forcing Prime Minister Modi to provide an INR 900 billion (USD ~12 billion) fiscal bailout to the distribution domain of the Indian power sector.

At the social level, state governments have incentives to continue running non-performing coal mines. As many as 70% of Coal of India mines run into losses and half of the operational mines in Jharkhand are unprofitable. However, coal mining is one of the largest employers in India. The sector is estimated to provide almost 2.6 million jobs, of which 70% are informal. This

⁸⁷ Prayas (Energy Group). 'Elephant in the Room: Implication of subsidy practices on DISCOM finances'. Available on: <https://www.prayaspune.org/peg/publications/item/419-elephant-in-the-room-implications-of-subsidy-practices-on-discom-finances.html>

⁸⁸ Balani, Kanika, Bharat Sharma, and Shalu Agrawal. 2020. Addressing Discoms' Revenue Recovery Concerns During and After the Pandemic: A Case Study of MVVNL Discom in Uttar Pradesh. New Delhi: Council on Energy, Environment and Water.

⁸⁹ Mercom India. 'DISCOMs Owed Renewable Generators ₹146 Billion at the End of August 2021'. Available on: <https://mercomindia.com/discoms-owed-renewable-generators-billion/>

⁹⁰ The Council on Energy, Environment and Water. 'In Dire Straits: How the Pandemic Added to Discoms' Financial Woes, and How to Fix Them?'. Available on: <https://www.ceew.in/blogs/dire-straits-how-pandemic-added-discoms%E2%80%99-financial-woes-and-how-fix-them>

dependence is especially high in coal-producing states and regions where there is limited economic diversification, such as Jharkhand, Chhattisgarh, and Odisha.⁹¹

The problems in planning, operations, distributions, and a growing society mask a deeper political conflict between the center and different states. The center is interested in country-level outcomes, often with a bias for co-partisan state governments, but with limited local knowledge about conditions in each state. Each state primarily cares about its own outcome, and the states are highly heterogeneous.

These problems are a direct consequence of India's federal architecture for the power sector. The center is supposed to balance state interests, which is essential for a successful energy transition, but central authorities do not have the policy and regulatory instruments to encourage system-optimal behavior by the states. The placement of distribution companies under state rule, though consistent with the principle of subsidiarity, discourages private investment in renewable energy through curtailment and financial risk.

4.1. Climate Policy

India's center-state problems in climate policy resemble those in the energy transition. While the center has some incentive to position itself as a leader in the global fight against climate change, it has only limited control over climate outcomes at the state level. Because state governments generally have little to gain from climate leadership, only a few of them have embraced it. As a result, action on the ground lags behind Delhi's ambition.

The center's incentive to embrace climate policy stems from global reputational gains, commercial opportunities in clean technology, and India's vulnerability to climate change.⁹² First, unlike the states, the center's actions are visible to a global audience. From Europe and the United States to China, a wide variety of stakeholders concerned about climate change observe India's decisions. Second, for India's economic success, opportunities in clean technology, from wind turbines to electric two-wheelers, are highly appealing. Finally, India's high vulnerability to climate change is a growing concern.

State governments have few of these incentives. Indian state policies are not widely reported in the global media or social media. Global commercial opportunities in clean technology are, for

⁹¹ Bhushan, Chandra et al. *Just Transition in India: An inquiry into the challenges and opportunities of a post-coal future*. iFOREST. 2020.

⁹² Dubash, Navroz K., ed. *India in a warming world: Integrating climate change and development*. Oxford University Press, 2019.

any given state, more limited and scattered than those for India as a whole. No individual state can have much impact on global greenhouse gas emissions or negotiations under the Paris Agreement.

This divergence of interests is not a major issue in those sectors that belong under central authority. In the case of nuclear energy, for example, the center can develop and finance plans with fewer conflicts, though siting remains an issue. But in most other areas, from agriculture and forests to industry and transportation, states have substantial authority. In these areas, the center must resort to indirect strategies, such as partial mandates and generous financing. Progress in climate policy becomes an exercise in navigating the conflicts, institutional constraints, and weak capabilities of different states.

These divergent incentives are exacerbated by the center's financial dominance.⁹³ Specifically, the states' dependence on central financial transfers produces a suboptimal climate policy outcome. The establishment of a National Action Plan on Climate Change in the run-up to the 2009 Copenhagen Summit compelled the environment ministry to investigate how to seed climate change into state governance practice. The underlying central influence on climate federalism in India involves directive state policy development that forces states to prioritize adaptation over mitigation actions to guard India's stance on climate mitigation being the primary responsibility of developed nations. Imbalance of autonomy and a high dependency on central funds have created variations of climate policies across different states.

Historically, the State Action Plans on Climate Change (SAPCC) did not provide a separate channel of money for state governments from the center. Instead, states were supposed to cover expenses using funds from their approved 12th Plan outlays and other smaller central finance pools. The lack of financial incentivization decreased the willingness of states to undertake climate-related development.⁹⁴ Here, the center has also requested states to coordinate their efforts with national initiatives such as the national rural employment program. To fuel their local interests and development targets, states have actively experimented with this approach and attempted to pull additional climate-centric funds.⁹⁵ State climate plans have also been drafted with a considerable degree of ambiguity on the source of funding available to carry out this work. This has paved the way for the evolution of a money-grab approach of states towards

⁹³ Pillai, A.V. and Dubash, N. K. 2021. "Compensatory Climate Governance in Indian federalism". Working Paper, Initiative on Climate, Energy and Environment. New Delhi: Center for Policy Research. April 2021

⁹⁴ Kumar, Vineet. "Coping with Climate Change: An Analysis of India's State Action Plans on Climate Change." *New Delhi, India: Center for Science and Environment*. Available at: [Accessed 24 March 2020] (2018).

⁹⁵ Jogesh, Anu, and Navroz K. Dubash. "State-led experimentation or centrally-motivated replication? A study of state action plans on climate change in India." *Journal of Integrative Environmental Sciences* 12, no. 4 (2015): 247-266.

climate funds that emphasize on their “greed and not specific need”.⁹⁶ The center’s attempt to enforce alignment between its vision and state action cannot be completed by micromanaging projects at the state level.

Frequent changes in central and state governments further accentuate these problems. Climate policy is a “long-term policy problem,”⁹⁷ which requires years of institutional and policy development. But when center and state political alignments shift, elected officials lose interest in previously acceptable climate policies. Even when the center remains steady, as in the case of Prime Minister Modi’s re-election in 2019, state governments come and go. As a result, the ambition and direction of climate policy may rapidly change in the states. Overall, this volatility makes Indian climate policy less predictable than ideal.

Some states, from Gujarat to Karnataka, have made considerable progress in climate policy. But these states are exceptions. Their leadership, without coordinated efforts to mainstream climate action, threatens to create a two-speed system. Some states lead by example and reap reputation and commercial gains. Most, however, do very little to prepare for the energy transition or the impacts of climate change. In such a situation, a few forerunners move forward with gradually increasing ambition, while others do very little. Even the forerunners are always at risk of losing their momentum because of political realignment.

5. Conclusion

India has, on balance, made major progress on its energy transition and climate action. For a country that still struggles with widespread poverty and has per capita emissions below the global average, India’s achievements in renewable energy and energy efficiency are noteworthy. But India’s complex federal structure also raises barriers to the kind of “ratcheting up”⁹⁸ that the 2015 Paris Agreement requires. Overall, Indian states continue to lag behind the center in both the energy transition and climate ambition. Although some states have led the way in energy transition (e.g., Gujarat and Karnataka) and others on climate action (e.g., Maharashtra), most Indian states are either uninterested or, at times, hostile to constraints on their development ambitions.

⁹⁶ Pillai, A.V. and Dubash, N. K. 2021. "Compensatory Climate Governance in Indian federalism". Working Paper, Initiative on Climate, Energy and Environment. New Delhi: Center for Policy Research. April 2021

⁹⁷ Hovi, Jon, Detlef F. Sprinz, and Arild Underdal. "Implementing long-term climate policy: Time inconsistency, domestic politics, international anarchy." *Global Environmental Politics* 9, no. 3 (2009): 20-39.

⁹⁸ Dimitrov, Radoslav, Jon Hovi, Detlef F. Sprinz, Håkon Sælen, and Arild Underdal. "Institutional and environmental effectiveness: Will the Paris Agreement work?." *Wiley Interdisciplinary Reviews: Climate Change* 10, no. 4 (2019): e583.

In this situation, dealing with India's federal realities is essential to success in energy transition and climate policy. In our assessment, it is unlikely that the center could force these policies on the states. States are too heterogeneous and have too many levers they can pull to halt the center's effort. Despite a centralizing tendency in Indian federalism in the Modi era, top-down planning remains an implausible approach. Instead, widespread progress in deploying clean technology and bending the emissions curve will require a focus on co-benefits, be they in the form of cleaner urban air or green livelihoods for economically at-risk communities due to the energy transition. State governments can become agents of change when they see the suite of economic opportunities available in a new climate-focused global economy. Each state faces different realities, with some exploring cutting-edge opportunities in clean technology and others building industry and commerce from a low baseline.

For India to continue making progress on climate change, a strategic focus on developmental co-benefits motivates efforts to strengthen institutional foundations. The center needs to find a way to strengthen both energy and climate institutions in the states. In energy policy, the weak performance of distribution companies is already hampering the energy transition, as renewable power developers worry about non-payment and political interference with contracts. Immediate actions currently under consideration include (i) national market-based economic dispatch, which would enable distribution companies to source power through the market across state boundaries, and (ii) new regulations to encourage ancillary services such as battery storage to improve grid reliability. Both approaches will require striking a balance between the center and state goals. In climate policy, many states have no institutional framework for climate mitigation, adaptation, and resilience. Developing this institutional capacity while navigating the conflicts, disagreements, and disparities caused by India's political economy promises to be an important area for research and practice in the coming decades.