

Enabling the Energy Transition

Technology, politics, & institutions in India's energy system

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21st Century Energy Transition

India must build a 21st century energy system while simultaneously grappling with 20th century problems of energy access, operational inefficiencies, and financial leakages in electricity distribution. Unlike industrialised economies which are in a position to taper their demand, India needs to expand energy use to fuel economic growth and social aspirations. How India chooses to meet its future energy demand – how it produces and consumes energy – is consequential for India’s development future, but also the global energy transition.

India has positioned itself as a frontrunner in the energy transition by setting ambitious near-term targets for clean energy to contribute toward the long-term pledge of net-zero emissions by 2070. Its domestic energy targets include 500 GW non-fossil energy generation capacity, inclusive of 450 GW of renewable energy (RE)¹, and renewable purchase obligations (RPOs) – a de facto generation target – of 43% to be met by 2030². Besides, as part of its G20 presidency, India mobilised a consensus to triple RE capacity and double energy efficiency globally by 2030, subsequently reflected in the Dubai Declaration³.

The transition from fossil fuel to RE comes with the potential for energy self-sufficiency, a promise of low-cost power to meet welfare demands, and an opportunity for competitive, job-creating and green industrialisation. However, these opportunities are neither automatic nor free of costs. While an affordable, cleaner, greener, job-creating energy future beckons, the path from here to there will be disruptive, likely creating losers who have an incentive to slow-down changes, potentially risking stability of energy supply, and will depend on far greater finance and infrastructure investments.⁴

The technology shift that undergirds India’s energy transition will need to be accompanied by foundational institutional changes. Tapping the potential of RE depends on clear and coherent plans, institutional capacities, and governance processes that enable the unwinding of lock-ins to incumbent technologies, and create space for new and emerging technologies. Managing likely disruptions and enabling the transition requires fundamental shifts in politics and institutions in Indian energy along with adoption of new technology.

¹ Aman Srivastava, and Ashwini K Swain. “Pledges, Plans, and Actions: An Analysis of India’s Panchamrit Pledges.” Ideas For India, (July 2022).

² MoP order on renewable purchase obligation and energy storage obligation trajectory till 2029-30. (Ministry of Power, July 2022). https://powermin.gov.in/sites/default/files/Renewable_Purchase_Obligation_and_Energy_Storage_Obligation_Trajectory_till_2029_30.pdf.

³ G20 New Delhi Leaders Declaration. 2023. Available at <https://www.mea.gov.in/Images/CPV/G20-New-Delhi-Leaders-Declaration.pdf>, last accessed on March 14, 2024.

⁴ Navroz K Dubash, Ashwini K Swain, and Parth Bhatia. “The Disruptive Politics of Renewable Energy.” The India Forum, (May 2019).



Managing likely disruptions and enabling the transition requires fundamental shifts in politics and institutions in Indian energy along with adoption of new technology.

Our research and engagements at the Sustainable Futures Collaborative (SFC) focus on rethinking the configuration of technology, politics and institutions in Indian energy as a necessary complement to techno-economic solutions for enabling the transition. To explain the configuration and suggest priorities for change, we focus on three interlinked areas: the economic viability of electricity distribution, subnational preparedness, and just energy transition. The following sections explain why each area is important and our perspectives on viable transition pathways within each.

The Economic Viability of Electricity Distribution

The 21st century energy transition entails electrification of energy end-uses and decarbonization of electricity generation. Along with how electricity is produced and consumed, how it is distributed or supplied will also be critical to our energy future. About 80% of electricity consumed in India is supplied to end-users by the electricity distribution companies (discoms). Their persistent inefficiencies and financial leakages have been a key policy concern at the Centre and states over the past three decades⁵. Discoms' poor performance is often attributed to the layering of redistributive welfare functions – cross-subsidization from high-demand consumers to keep electricity affordable for the low-income consumers – and electricity-centred competitive populism in state politics.

Can the energy transition bypass the discoms? Modularity of modern RE enables localization in energy production and consumption – electricity generation at the point of end-use. Electricity consumers have the choice to be prosumers and free themselves from unreliable supply and the burden of cross-subsidization. These incentives work better for the wealthier consumers for whom the cost and value of reliable electricity access is high⁶ and may result in migration of high-paying load from discoms. This will further erode the

economic viability of discoms and will require adaptive reforms in their business model but will not make them redundant. With rapid electrification and integration of variable RE, discoms are likely to play a greater role as network operators, balancing service providers and the suppliers of last resort in the 21st century energy system. Economic viability of electricity distribution is a precondition to prepare the discoms for these critical functions.

Over the past two and half decades, governments have made sustained efforts - through legislative reforms, targeted policies and fiscal subventions - to improve discoms' efficiency and their finances.⁷ This has resulted in some important achievements. First, unbundling and corporatisation led to separation of profit and loss centres in the electricity supply chain and transparency around financial leakages. Second, a series of centrally sponsored schemes have supported expansion and strengthening of distribution networks and near universal access to the grid. Third, targeted technical interventions have been useful for improving operational efficiency. For example, rural feeder separation has enabled delinking of supply to households and farmlands, resulting in increased hours of supply to the households and rationed supply to farmlands. Improved metering has allowed better accounting

⁵ Navroz K. Dubash, Sunila Kale, and Ranjit Bharvirkar. "Mapping Power: The Political Economy of Electricity in India's States". New Delhi: Oxford University Press, 2019.

⁶ Marie-Hélène Zérah, and Sarada Das. "Solar Rooftop Systems and the Urban Transition: Shall the Twain Ever Meet? Interrogations from Rewari, India." *Journal of Urban Technology* 30, no. 2 (March 15, 2023): 103–25.

⁷ Ashwini K. Swain. "Political Economy Of Distribution Reforms In Indian Electricity." Working Paper. (New Delhi: Centre for Policy Research, 2016); Prayas (Energy Group). *Many Sparks but Little Light: The Rhetoric and Practice of Electricity Sector Reforms in India*. Pune: Prayas (Energy Group), 2017; Dubash e. al., *Mapping Power*, 2019.

of leakages and improved billing and collection. Fourth, there has been a greater recognition of the importance of cost recovery and payment discipline for improving electricity distribution.

Despite the sustained attention and interventions, there remain some areas of contention, with scope for improvement. First, while there are incremental improvements in supply, the vision for 24x7 reliable electricity access is yet to be fully realised. While infrastructure needs may have been met, the operational constraints on providing reliable,

An emphasis on productivity enhancement, and therefore paying capacity, that electricity access can bring – an approach one might call productive power – may provide a useful basis for structuring electricity reforms.

adequate-quality power are still not fully overcome. Second, despite two decades of efforts at pricing electricity appropriately, this is frequently undercut by using electricity as a vote-getting device and as a form of patronage. Third, there is a continued belief that privatisation of discoms will address many of the sector's ills (as illustrated by multiple efforts to reform the Electricity Act) but efforts at privatisation face persistent political and social resistance. Moreover, the track record does not fully bear out this belief, because in the absence of an effective incentive structure, ownership change by itself is unlikely to turn around the distribution business or win social and political acceptance. Finally, electricity distribution is caught between an unsettled discourse over electricity as a state provided public good that must be available to all versus electricity as a commodity that is available on payment of the cost. The result is a low-level equilibrium where demand for low-cost electricity is met by compromising the quality of supply and service.

While technological upgrades and financial disciplines will be critical, there is, therefore, a need for more fundamental shifts in approach to electricity supply and access. In particular, an emphasis on productivity enhancement, and

therefore paying capacity, that electricity access can bring – an approach one might call productive power – may provide a useful basis for structuring electricity reforms.

We identify the following priorities to complement the ongoing techno-economic interventions to prepare the discoms for a 21st century energy system:

- **Enhance consumers' ability to pay.** Consumers' ability to pay for electricity, particularly among the poorest, is critical to discoms' economic viability and electricity access security. Therefore, along with the measures to hold consumers accountable and ensure cost recovery, electricity reform interventions can usefully address the consumers' means to pay in order to revitalise the distribution business. Electricity-centred redistributive welfarism is increasingly becoming unviable. Unwinding this vicious cycle requires a new paradigm that empowers and enables the poor to pay for better quality service through the productive use of electricity.
- **Invest in enhanced productivity through electricity access.** Reliable electricity access could be an important input to stimulate productivity at different scales. Now that India has achieved universal access to the grid, the
- **Shift to one-time capital subsidies instead of repeated consumption subsidies.** One time infrastructure support for modular RE systems can be used to meet subsidy demands from the poorest.⁸ The priority is to devise a time bound strategy to shift away from recurring and inevitably rising tariff subsidies to one-time infrastructure support for targeted beneficiaries. Existing schemes like PM-KUSUM and financial assistance for solar rooftop have demonstrated the potential to reduce subsidy pressures. Support for solar rooftop has been enhanced recently under the PM-Saurya Ghar scheme. There are potential gains from ramping up and better targeting these schemes to incentivise productive use of electricity and identify financial models and implementation channels that best fit local context.

government has set a goal to ensure reliability of supply for all. Availability of reliable electricity is necessary, but not sufficient, to mobilise its productive use. This requires seeing electricity as an input to economic productivity and a broad strategy around productive power, by promoting rural industries and businesses with the required financial and infrastructure support.

⁸ Ashwini K. Swain, Anna Agarwal, and Parth Bhatia. "Our Electricity Future." The Indian Express, New Delhi. (July 2019).



Building Subnational Preparedness

While India has set ambitious national goals for energy transition and has been working towards creating incentives and enforcement mechanisms, a critical next step is to consider and engage with diverse state contexts, capabilities, and priorities. These state-specific contexts and priorities are shaped by available techno-economic options, fiscal space, and social and political imperatives.⁹

In a federal setting, states matter for four functions critical to energy transition. First, states as the sphere of implementation are critical to realise national targets. While the Centre may set goals, and create incentives to help achieve them, realisation of these goals often depends on how they are aligned to state priorities and capabilities. Second, legacy electricity challenges are embedded in the state political economy and, if not addressed, could be exacerbated by the transition. Third, states as laboratories of policy innovations have been instrumental to India's energy transition. Diversity of state contexts has allowed parallel policy experimentations and diffusion of successful models. For example, early initiatives by Gujarat and Rajasthan on solar power, and Maharashtra and Tamil Nadu on wind energy technologies, have contributed significantly to RE uptake at the national

level. Similarly, the PM-KUSUM is an adoption of state experiments on solarisation of agriculture at a national scale. Fourth, states could also be roadblocks to national goals, particularly when the goals are perceived to be misaligned with the state priorities. Therefore, it is a priority to prepare the states for this complex transition and tailor the political economy conditions in the states to enable the transition.¹⁰

In recent years, the importance of state and their diverse contexts are being recognised. The ongoing Revamped Distribution Sector Scheme (RDSS) illustrates that the government has increasingly recognised that a one-size-fits-all approach is less effective than allowing the states to select the sequence of interventions tailored to their local context. Simultaneously, there is emerging attention to getting the states on board for big reforms through regular engagement between the Centre and state energy ministers. Central guidelines or prescriptions with attached budgetary support increasingly appear the most effective pathway to stimulate state action. For example, as discussed in the previous section, centrally sponsored schemes have been effective in augmenting the distribution network in the states¹¹.

⁹ ETPI. "Indicator Guidebook - Energy Transition Preparedness Initiative." Centre for Policy Research, Prayas (Energy Group), & World Resources Institute India, 2023.

¹⁰ Ashwini K. Swain, Ann Josey, Bharath Jairaj, and Shantanu Dixit. "Seeing India's Energy Transition through Its States." The Hindu, Delhi. (June 2023).

¹¹ Swain, "Political Economy Of Distribution Reforms In Indian Electricity", 2016.

Meeting India's energy transition goals require bridging the ambition and implementation gaps between the Centre and states.

Meeting India's energy transition goals require bridging the ambition and implementation gaps between the Centre and states. National targets have been important signals of India's efforts and drawn global accolades. But the challenge is slow uptake of these goals and enforcement at the state level. This can be partly explained by low state capacity as well as states' inertia to change. Instead of fixing state capacities, the response to states' failure to implement has too often been to shift focus back to the Centre. This risks relying on more prescriptive policy measures that may not be sensitive to state-level conditions. For example, while RDSS does recognise the limits of a uniform approach, it only offers limited flexibility to the states to select from a menu of techno-economic



interventions. Moreover, disciplining interventions to ensure accountability from the state governments and their agencies have limited results and also fuels centre-state tensions.

As states are essential to India's energy transition outcomes, it is critical to focus on subnational preparedness for energy transition. We suggest the following priorities:

- **Enhance state-level capacities.** Now that there is a recognition of varying state contexts and capacities, there is a need to focus on enhancing the capacities at state level. This could imply different aspects in different contexts including skill building, expertise, institutional strengthening, coordination and fiscal space. Cross-state learning on what works under what conditions is a useful way to facilitate state capacity building.
- **Focus on district and local government capacity.** While the energy policy discourse has been limited to national and state capitals, accelerating the energy transition requires more local level action and facilitation. For example, cities as energy demand centres have played a vital role in shaping energy behaviours. Both rural and urban local bodies could be instrumental in promoting and managing decentralised energy resources. This requires

frontline capacity building at the district and local government level.

- **Design transition around state context supported by national steering.** Varying state contexts imply that Indian states will follow multiple pathways and pace for energy transition. Enforcing uniform targets and strategies is likely to fail. States must be given space to plan their own pathway to 20th century energy. The Centre can help by guiding institutionalisation of key processes (planning, tracking, monitoring), supporting resource mobilisation and allocations, and promoting an enabling ecosystem for state level innovations.

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STEP 6
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STEP 2
Find & book available charging slot

STEP 4
Get booking confirmation and OTP to start charging

STEP 6
View real-time charging status



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Planning for a Just Energy Transition

The ‘just transition’ discourse in India is emergent and brings together three narratives: considerations of India’s future energy needs and the importance of coal in meeting them; global pressure for accelerated coal phasedown; and civil society efforts to plan for the social costs of a transition. The just transition discourse emerged from global experience, but the challenge is to frame it appropriately in an Indian context, notably India’s current and persistent lock-in to fossil dependencies at multiple scales. Therefore, enabling energy transition requires a better understanding of these dependencies in the coal economies and on fossil revenue, and accordingly plan for an Indian approach to just energy transition.

The just transition discourse in India, informed by other contexts, has focused on the potential for loss of jobs and livelihoods in coal producing regions, and ways of ameliorating their impacts. This is important. However, to adequately tailor just transition discussions to India requires attention to several additional factors. First, a home-grown just transition narrative should account for the fact that India’s coal value-chain reflects the informal nature of its economy and intersectional biases in its society. For example, while a larger share of employment in the coal sector is informal, the nature of these jobs are often shaped by intersectional identities like gender, caste and land-ownership¹². Second, while the focus has been

on the labour supply-side of re-skilling labour, it is equally if not more important to focus on the labour-demand side, i.e. the question of regional economic development through which jobs will be created. This is particularly so because export-dependent coal-intensive manufacturing (e.g. iron and steel) in India’s coal-rich states may also come under competitive pressures due to new measures to benchmark the carbon content of energy-intensive imports. Third, shifts in the fossil fuel economy may have broader ripple effects on India’s economy, which should also be taken into account. For example, fossil fuel revenues account for 13 percent of central and state government revenues and 3.2 percent of India’s GDP¹³; fossil fuel phase-out over time carry implications for fiscal sustainability if they are not replaced by other sources of revenue. In another example, international fossil fuel phase out may affect Indian labour - nearly nine million Indian expats are employed in oil economies of Gulf countries¹⁴. Fourth, addressing these complex structural concerns requires high levels of state capacity in order to bring about economic transformation and attract industries of the future. Since developing these specialised capacities takes time, it is important to get an early start.

Given that energy transition will have implications for the wider economy, there is a case for expanding the conversation on just transition from the narrow,

¹² Suravee Nayak. “Coal Extraction, Dispossession and the ‘Classes of Labour’ in Coalfields of Eastern India.” *The Journal of Peasant Studies* 50, no. 7 (2023): 2829–50.

¹³ Laveesh Bhandari, and Aasheerwad Dwivedi. “Critical Challenges in Realizing the Energy Transition: An Overview of Indian States.” CSEP Working Paper 41. (Centre for Social and Economic Progress, 2022).

¹⁴ Lok Sabha unstarred question no 583. Indian workers in Gulf countries. (2022). <https://www.mea.gov.in/lok-sabha.htm?dtl/35979>.



Given that energy transition will have implications for the wider economy, there is a case for expanding the conversation on just transition from the narrow, albeit very important, agenda of managing the social costs of transition, to the broader discussion of the economic transformation opportunities and challenges.

albeit very important, agenda of managing the social costs of transition, to the broader discussion of the economic transformation opportunities and challenges. We suggest the following priorities:

- **Pay attention to social transformations.** Current just transition approaches are at the risk of reproducing gender marginalisation¹⁵ and intersectional biases in India's 20th century energy system. Just transition planning must proactively seek inclusion of marginalised

communities and remove barriers to their participation through targeted interventions.

- **Re-frame just transition around the challenge of state economic transformation.** Energy transition could usefully be viewed through the lens of economic transformation at the state level. Fossil fuel revenue and employment currently constitute a large part of several state economies. The energy transition will disrupt these dependencies, be it on coal

¹⁵ Suravee Nayak, and Ashwini K Swain. "Envisioning a Gender-Transformative Pathway to Energy Transition in India's Coal States." Working Paper. (New Delhi: Centre for Policy Research, 2023).

or petroleum or power plants. Efforts at economic diversification, and associated job creation, should ideally precede job losses due to phasedown. This requires long-term development plans aimed at creating new avenues for jobs, livelihoods, public finance and infrastructure development.

- **Focus on regional-scale transformation. Coal transition impacts could cascade as with decline of coal use, industries dependent on coal may leave the region.** As part of diversification, it is important to plan for regional green industrialisation policies to maintain the industrial balance in the region. Simultaneously, a regional green industrial policy approach could be a strategic lever to address India's chronic regional economic imbalances.
- **Build state capacity to envision, plan for, finance and manage complex economic and social transitions.** Undertaking state and regional re-development to plan for future phase out is a considerable task. Since plans needed to be tailored to local context, associated capacity also needs to be built within coal states and regions.





SFC's Role in Enabling India's Energy Transition

At SFC, our research and engagement aims to complement ongoing techno-economic analyses and interventions on energy transition by drawing attention to institutional and governance factors. Our research seeks to explain entrenched patterns in India's energy system, identify key bottlenecks to energy transition and suggest paths to ease these transition challenges. Our research aims to highlight the importance of getting energy governance right and approaches to align political conditions to achievement of energy transition goals.

We will provide evidence-based narratives to focus and enable techno-economic interventions in specific conditions. We will partner with government and private sector actors for collaborative planning

and development of proof of concepts to enable data-driven policy choices and targets. Through these engagements we hope to stimulate an evidence-based discourse on reconfiguration of technology, institutions and politics in the above areas. For example, on the economic viability of electricity distribution, our focus will be to identify and mobilise the levers to enable a productive power approach. For subnational preparedness, we develop frameworks for comparative state analysis to enable cross-state learning and faster diffusion energy transition solutions. And we seek to broaden the discourse towards economic transformation through just energy transition while being sensitive to complex dependencies in coal regions.

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