



ENERGY TRANSITION
PREPAREDNESS INITIATIVE

ELECTRICITY SECTOR

August 2023

Author names

Ann Josey
Shivani Kokate
Ashwini K. Swain
Shantanu Dixit
Bharath Jairaj
Manasi Jog
Varun Potty
Sarada Prasanna Das
Catherine Ayallore
Rushabh Soni
Dhilon Subramanian
Harish Palani
Vaisakh Kumar

Suggested Citation

ETPI (2023). The Electricity Sector: A Study on Transition Preparedness in Ten Indian States (2020–2021). Prayas (Energy Group), Centre for Policy Research, and World Resources Institute India.

ENERGY TRANSITION
PREPAREDNESS INITIATIVE

ELECTRICITY SECTOR

A STUDY ON TRANSITION PREPAREDNESS
IN TEN INDIAN STATES (2020–2021)

AUGUST 2023

PARTNERS

ETPI is a joint initiative by PEG, CPR, and WRI India.

Prayas (Energy Group) is a non-governmental organisation working toward furthering public interest in the electricity sector through analysis-based research. It has been active in this field for more than 25 years. PEG works on theoretical, conceptual, regulatory, and policy issues in the energy and electricity sectors. Our activities cover research and engagement in policy and regulatory matters, as well as training, awareness, and support to civil society groups.

The Centre for Policy Research is an independent, non-partisan, non-profit research institute and think tank established in 1973. ETPI will be implemented by the Initiative on Climate, Energy and Environment (ICEE) at CPR. CPR-ICEE aims to stimulate an informed debate on the laws, policies, and institutions shaping climate, energy, and environmental governance in India. Our research focuses on an improved understanding of climate, development, and environmental challenges—and pathways to improved outcomes—in three key areas: climate policy and institutions, the political economy of energy transition in India, and air quality governance.

WRI India is a research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being. WRI India is enabling the deep sectoral shifts needed in key geographies like India, and in sectors like energy, transport, and buildings where emissions are high.

ABOUT ETPI

India's energy transition is critical to achieving its global climate commitments and domestic economic growth aspirations. India has been recognized for its ambitious targets for clean energy generation and usage. To achieve these goals, several initiatives have been introduced at the central and state levels, with a focus on domestic developmental imperatives and energy security concerns.

Much of the progress towards the transition is taking place at the state level, driven by varying institutional capacities, governance processes, and political economy contexts, as well as emerging techno-economic choices. States have introduced policy innovations to enable the transition and have developed unique practices. Understanding these state-level trends and exploring opportunities for cross-state learning is crucial for achieving the transition.

Energy Transition Preparedness Initiative (ETPI), a joint initiative by the Centre for Policy Research, World Resources Institute India, and Prayas (Energy Group), is an attempt to understand the state level preparedness and facilitate productive engagement with the transition. The ETPI Indicator Guidebook, a product of collaborative research by the three institutions, provides a state-level framework for assessing plans, actions, and governance processes towards an energy transition.

The three partner institutions have a long history of engagement with India's energy policy and governance processes. The research team for this initiative have experience of assessing and analysing governance trends in the electricity sector through a multi-year, multi-country initiative – the Electricity Governance Initiative (EGI) – implemented over the 2000s to track the effectiveness of governance processes during the period of structural reforms in the sector. Through EGI, we have demonstrated the importance of a governance lens on understanding and managing electricity sector issues.

The framework developed for ETPI is informed by our collective understanding of the energy transition and sectoral trends and priorities in the electricity, building, and transport sectors. It encapsulates indicators to study sector progress, including the techno-economic drivers, sector-specific enablers, the role of planning and implementation processes, as well as the socio-economic and equity-related impacts of the transition. The framework has been developed by incorporating state-level status and stakeholder consultations and is a reflection of what is necessary for a people-centric transition. The aim is for this framework and assessments based on it to complement the existing sector discourse, highlight state-level trends, and underscore good practices.

The indicator framework, assessment reports, and all other knowledge products developed as part of ETPI will be available at www.etpi.in. We hope that these research outputs will help policymakers, regulators, sector actors, and researchers to make informed decisions and contribute to achieving India's energy transition objectives.

CONTENT

Executive Summary	5
Introduction	11
E1 Long-term Vision for Electricity Sector Transition	19
E2 Development of renewable energy and electricity storage	25
E3 Management of coal thermal capacity	33
E4 Integrated Resource Planning (IRP)	41
E5 Demand Side Management	47
E6 Financial Health of Electricity Distribution Companies	53
E7 Electricity Demand and Supply for Agriculture	63
E8 Affordability and reliable supply for small consumers	71
E9 Access to competitive supply alternatives for industrial and commercial consumers	79
E10 Preparedness of state-level grid transmission and distribution networks	87
E11 Regulatory Governance and Processes	97
Insights	104
Annexures E1 to E11 (Explanatory notes on attributes and sub-attributes)	113
List of Abbreviations	130
Endnote	132
References	135
Acknowledgements	143

LIST OF FIGURES

Figure 1. Snapshot of the Themes Covered in the Electricity Indicators	12
Figure 2. Overview of Indicators, Attributes, Sub-Attributes, and Thresholds	16
Figure 3. Long-Term Vision for the Electricity Transition	19
Figure 4. Development of RE and Storage	25
Figure 5. Alignment of SERC RPO Targets with National RPO Targets for FY2020-21	27
Figure 6. Compliance of DISCOMs with the SERC RPO Target for FY 2020-21	28
Figure 7. Management of Coal Thermal Capacity	33
Figure 8. State-Owned Generating Coal-Based Capacity Meeting Availability Norms in FY 2020-21	36
Figure 9: Proposed and Under-Construction Coal Capacity across States as of 1 April 2021	37
Figure 10: Integrated Resource Planning	41
Figure 11. Demand Side Management	47
Figure 12. Financial Health of Electricity Distribution Companies	53
Figure 13. Outstanding Revenue Gap and Losses as a Percentage of DISCOM ARR for FY 2020-21	55
Figure 14. Overview of Revenue Sources of DISCOMs for FY 2020-21	57
Figure 15. Electricity Demand and Supply for Agriculture	63
Figure 16. Extent of Subsidy and Cross-Subsidy Required and Consumer Contribution for Agriculture	67
Figure 17. Affordability and Reliable Supply for Small Consumers	71
Figure 18. Cost of Electricity for Consumers using 30 Units per Month (Rupees/Unit, in FY 2020-21)	73
Figure 19. Access to Competitive Supply Alternatives for Commercial and Industrial Consumers	79
Figure 20. Open Access (OA) and Captive Sales in FY 2019-20	80
Figure 21. Savings of OA and Captive Consumers Compared to Industrial Category Energy Charges and Duties for FY 2020-21	81
Figure 22. Latest Revision of OA Regulations by SERCs by Year of Notification	82
Figure 23. Preparedness of State-Level Transmission and Distribution Network	87

Figure 24. Percentage of Distribution Transformers Reported as Metered for FY 2020-21	89
Figure 25. Incentives and Penalties within the ToD Tariff Framework Applicable in FY 2020-21	92
Figure 26. Regulatory Governance and Processes	97
Figure 27. SERC Fees and Charges for Individual and Consumer Groups to File Applications	99
Figure 28. SAC Meetings Conducted by ERCs in FY 2019-20 and FY 2020-21	102

LIST OF TABLES

Table 1. Solar Installed Capacity Targets according to Applicable State Policies	22
Table 2. Extent of Working Capital Borrowing and Issues with Reporting by Discoms for FY 2020-21	56
Table 3. Pending Subsidy Payment to DISCOMs for FY2020-21	59
Table 4. Pending Dues from Public Bodies to Discoms by end of FY 2020-21	60
Table 5. Separation of Predominantly Agricultural DISCOM Feeders for FY 2020-21	65
Table 6. Basis of Agricultural Demand Estimation in Various States for FY 2020-21	66
Table 7. Differentiation in Tariffs within the LT Industrial Category for FY 2020-21	74
Table 8. Years in which Standards of Performance Regulations Were Revised (up to 2021)	75
Table 9. Status of Quality of Supply and Service Metrics for FY 2020-21	76
Table 10. State Measures to Compensate Discoms Adequately in FY 2020-21	83
Table 11. Unmetered Consumer Categories (Other than Agriculture) in States (FY 2021)	90
Table 12. ToD Tariff Applicability for LT Consumers in FY 2020-21	92
Table 13. The FoR's Recent Contributions to Energy Transition Aspects	100
Table 14. Data Availability Challenges	107
Table 15. Recent Actions by the Central Government and Their Relevance to State-Level Developments	109

LIST OF BOXES

Box 1. Revenue Sources of Assessed Discoms	58
Box 2. The Inevitability of Sales Migration (Especially via Captive Options)	80



EXECUTIVE SUMMARY

Highlights

- India's energy transition is being shaped by its states. Proactive and coordinated state-level actions will be required to realise India's ambitious energy transition goals.
- The Energy Transition Preparedness Initiative (ETPI) provides a framework to study and understand state-level plans, actions, and governance processes towards an energy transition. The framework covers multiple themes in 24 indicators representing crucial aspects of the energy transition in the electricity, buildings, and transport sectors. The electricity sector spans many themes across 11 indicators.
- This study covers ten states, accounting for about two thirds of India's electricity demand. Drawing on information available in the public domain, it sheds light on the level of preparedness for the energy transition in these states as of FY 2020 – 21.
- The study finds that these states have taken steps towards an energy transition. There are indications of progress on techno-economic aspects in the states even while they grapple with legacy and foundational challenges. A clear articulation of long-term objectives and pathways at the state level is necessary to accelerate the pace of the transition.
- The study also finds that continuity in approach, investments, and actions and sustained interventions that build on past experiences produce better outcomes. Pro-transition actions are found to be feasible in some cases, despite the financial constraints in the distribution segment.
- The report highlights the need to exercise and expand the regulatory mandate and ensure centre – state alignment on policy priorities. It also highlights good practices that can be diffused across the states.

Study Findings

The 11 theme-based electricity indicators (E1 to E11) cover aspects of policy vision, techno-economic preparedness, institutional preparedness, and socio - economic and environmental considerations.

The various aspects of the indicators as well as their relevance to the energy transition and notes to help researchers make use of the indicator framework can be found in the Indicator Guidebook, which is also available on the ETPI website (etpi.in).

In this study, the states fared well in areas where renewable - energy-related techno-economic changes are drivers (E2, E9) and showed progress in areas where they were able to innovate by building on sustained investments in measures such as metering, feeder segregation, and distribution network planning (E7 and E10). However, in areas related to planning and addressing legacy but foundational challenges in the sector (captured in E1, E4, and E6), concerted actions in the coming years will accelerate the pace of the transition. In some areas (for example, aspects of managing coal-based capacity in E3 or

demand-side management (DSM) in E5), sustained forward-looking actions on crucial elements of the transition were missing.

This study highlights several key trends and good practices related to the transition in the states. It also highlights areas that have been neglected or areas that have seen limited action.

Key Trends Observed

Renewable purchase obligations (RPO) compliance reporting and penal action:

Karnataka discoms met (and surpassed) their targets in FY 2020–21. Only five of the ten states' Electricity Regulatory Commissions (ERCs) tracked RPO compliance of electricity distribution companies (discoms). ERCs in Madhya Pradesh and Uttar Pradesh took penal action for non-compliance in FY 2020–21, and the Delhi ERC has been consistently levying penalties for RPO non-compliance with every true-up process. RPO compliance processes have not been undertaken in Kerala and Tamil Nadu for many years.

Coal capacity in the pipeline: Wide variation is seen across the states. Pipeline coal thermal capacity in FY 2020–21 was limited to less than 8% of the contracted coal capacity in that year in six of the ten states. However, in four states, the pipeline capacity was significant, ranging from 20% to 125% of the contracted coal thermal capacity in FY 2020–21. Across the states, about 85% of the pipeline capacity was non-pit-head, and 64% of the pipeline projects were greenfield. The ERCs in Maharashtra and Uttar Pradesh have taken proactive steps in the past five years to defer coal capacity addition until 2025 and 2022, respectively. Since 2022, no additional capacity has been approved in Uttar Pradesh.

Extent of discoms' financial challenges: At the national level, discoms' losses had accumulated to the staggeringly high figure of Rs. 5.16 lakh crores by FY 2020–21. Five states, namely, Tamil Nadu, Uttar Pradesh, Rajasthan, Madhya Pradesh, and Maharashtra, accounted for 67% of the national cumulative losses. Accumulated and annual losses, the extent of working capital borrowing, dependence on subsidies, and the payment discipline of the government are all important and

interlinked signs of financial stress in discoms. To get a complete picture, it is necessary that the data is reported and studied to understand the trends of all these parameters.

Subsidy dependence (discoms' dependence on revenue support): Cross-subsidy revenue and state government subsidies together account for more than a quarter of the discoms' revenue requirement in six of the ten states. Of this, government subsidies play a much more critical role than cross-subsidies. In half the states, inter-category cross-subsidy revenue contributes to less than 8% of the revenue requirement of discoms. In nine states, the share of government subsidies was more than double the cross-subsidy requirement. In five of these states, the cross-subsidy contribution was marginal compared to the subsidies.

The cross-subsidy for a category is the difference between the average tariff and the cost of supply. In Bihar and Madhya Pradesh, for a traditionally cross-subsidised category such as agriculture, the tariff set by the regulator is more than 80% of the average cost of supply (ACoS). Thus, the cross-subsidy to agricultural consumers is limited to less than 20% of the ACoS to comply with the National Tariff Policy. In both these states, this cross-subsidy design has resulted in increased government subsidy contribution rather than consumer contribution to tariffs.

Payment discipline of the state governments: Despite significant subsidy dependence, state government subsidy payments were made on time in six states in FY 2020–21. At the same time, outstanding dues from public bodies for their electricity consumption are rising:

A quarter of the total pending dues from consumers was attributable to government departments and public bodies in Rajasthan. In Delhi and Kerala, the share was about a third, and in Uttar Pradesh, about half the dues was from government entities.

The Ministry of Power reported that as of August 2022, dues from government departments and local public bodies to discoms for the sale of power stood at Rs. 65,300 crores. This is comparable to the pending payments by the discoms to all the generators at on July 2023. This decreased in subsequent years with the implementation of the Revamped Distribution Sector Scheme (RDSS).

Open access (OA) and captive development: With the growth in renewable energy (RE), non-discom sales in states have increased. In energy terms, consumers who opt for open access and the captive route save about 20% to 45% on their bills compared to discom tariffs. However, given the applicable charges, OA was economically viable only in four of the ten states in FY 2020–21. With OA becoming more prominent, frameworks to price services provided by the discom to

such consumers need to evolve, along with streamlined processes and clarity to aid non-discom sales. Maharashtra, Gujarat, Bihar, and Madhya Pradesh have innovative approaches towards such pricing frameworks.

Concessions on OA charges for RE: Six of the ten states have RE policies with sunset clauses for concessions. In the operative RE policies for FY 2020–21, Maharashtra, Karnataka, and Tamil Nadu have discontinued concessions on various OA charges.

Public participation in regulatory processes: Seven of the ten states (the exceptions are Maharashtra, Uttar Pradesh, and Delhi) have been conducting public hearings not just for tariff determination but also for other crucial processes. Except for Tamil Nadu, fees paid by individuals and consumer groups for filing applications before the commissions were not more than Rs. 10,000.

State Spotlight

Balanced and enabling framework for OA in Maharashtra: With respect to setting up frameworks for non-discom supply options, Maharashtra has a good balance between ease of access to alternative supply options for consumers and clear frameworks for discom cost compensation. There exist streamlined processes for using OA and captive procurement, stipulates charges for OA clearly, and provide frameworks to compensate discoms for costs incurred in providing grid services and for revenue loss due to sales migration.

Progress in solarisation of agriculture through state-level efforts: Maharashtra, Karnataka, Gujarat, and Rajasthan led the way with agricultural solarisation using centralised and

feeder-level procurement of low-cost RE power to ensure daytime supply to farmers. Three of these states had dedicated state-level schemes for agricultural solarisation.

Innovations building on feeder segregation and metering in Maharashtra: In Maharashtra, feeder segregation and the use of communicable metering infrastructure at the feeder level has enabled reassessment of unmetered agricultural demand. It has also enabled early efforts towards dedicated, decentralised daytime supply to farmers and pilots for feeder-meter-based group billing of consumers.

Circle-wise distribution plans: Tamil Nadu and Madhya Pradesh have prepared circle-wise

disaggregated distribution network investment plans, which is an important and necessary step towards decentralised planning in the future, especially with decentralised developments in renewables, storage, and market development.

Areas Requiring Attention

Long-term vision and medium-term planning: An integrated, comprehensive long-term vision document with clear goals and pathways was not formulated by the states as of FY 2020–21. Integrated Resource Planning (IRP) exercises with long-term demand and supply and demand forecasts were not being conducted. Only the Bihar ERC mandated approval of ten-year demand–supply projections, a prerequisite for IRP. However, this mandate has not translated to an IRP process in Bihar.

DSM: ERCs in eight of the ten states (the exceptions are Kerala and Rajasthan) have provided a regulatory mandate for DSM, but activities towards DSM were limited.

Accountability for coal costs: Regulatory mandates to track and scrutinise disaggregated data on coal availability, quality, and costs were present in only half the states, and reporting and tracking of these all the parameters, especially transport cost, was done only in Maharashtra.

Forward-looking frameworks to manage eventual coal retirement: A techno-economic

Time of day (ToD) tariffs: Delhi levied ToD tariffs for consumers with loads as low as 10 kW, and Uttar Pradesh levied ToD tariffs that vary seasonally.

assessment for the retirement of coal capacity and a framework to address the socio-environmental impacts of coal retirement were not initiated by any state as of FY 2020–21, clearly indicating the dominant role of coal in energy security for these states.

Supply and service quality: Between FY 2015–16 and FY 2020–21, five states tightened the supply and service quality benchmarks in the Standards of Performance (SoP) regulations. Despite legal requirements, only four of the ten states published quarterly reports in compliance with the SoP. Actions to hold discoms accountable for supply and service quality and reporting of supply quality parameters have been limited.

Working capital borrowing: Despite the financial stress of discoms, there was limited regulatory scrutiny or reporting of actual borrowings to meet working capital requirements. Only three states (Rajasthan, Kerala, and Maharashtra) reported the extent of actual working capital borrowing in regulatory processes, and there was wide variation in how data were captured in financial audit reports.

Insights

Some broad observations based on this study are as follows:

States are on the transition path. Articulation of long-term objectives and pathways can help accelerate the pace. Developments related to RE integration, OA, and captive avenues for power procurement have put states on the transition path. However, this has not been complemented with a clear long-term vision in states. A long-

term vision with specific objectives and pathways would reduce the risk of ad hoc, issue-based responses and assure investors and stakeholders regarding states' preparedness for an ambitious and complex transition.

Expanding and effectively exercising the regulatory mandate is necessary to meet the complex requirements of the transition. Electricity regulatory commissions are crucial

institutions with strong mandates to hold utilities accountable and design techno-economic and policy frameworks. However, regulatory mandates to ensure RPO compliance, implement IRP, and encourage DSM measures were not exercised adequately. Electricity regulators must play a crucial role in planning, energy accounting, formulation of frameworks for technology rollout, market development, and accountability for utility performance. Progress on the transition aspects may be limited if the regulatory mandate is not exercised and expanded.

Forward-looking techno-economic frameworks and coordinated actions will help achieve the speed and scale required for the energy transition. There are multiple instances of policy and regulatory frameworks being developed as a result of litigation. Some examples include banking, captive status verification, and RE curtailment. State governments, the central government, and regulators play crucial and distinct roles in keeping pace with developments in the sector. For example, the national KUSUM (Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana) scheme was built on schemes in three states for solarising agriculture. In Maharashtra, the rapid evolution of the regulatory framework was instrumental in aiding the on-ground implementation for feeder-level, MW-scale solar deployment. Such coordinated actions will be required for complying with RPOs, operationalizing green OA, and scaling storage deployment.

Sustained actions, which build on past initiatives and outcomes, have enabled transition-related progress in the states. Maharashtra built on the foundation of early actions related to feeder segregation and metering to better estimate agricultural demand, pilot feeder-level group billing for agriculture, and report feeder-level outages. States with clear sunset clauses on concessions were able to move from concessions to developing frameworks for adequate compensation for services provided to RE consumers and generators. In the same vein, early action is needed for storage deployment

and wider implementation of ToD tariffs so that the states can build on progress, innovate, and accelerate the transition.

Discom finances continue to be a challenge, still, several pro-transition actions are being implemented in some cases: Discoms straddle two worlds, one in which their decisions and actions herald futuristic sectoral developments (related to RE, storage, and OA) and another where they have to manage growing financial indebtedness and slow progress in on-ground metering and rural infrastructure improvement. Despite the scale of the challenges they face due to present and past inefficiencies, transition-related progress is occurring even in states with high financial losses. The five states with the highest cumulative financial losses at the national level are front runners in adopting storage technologies. Some of these states have also taken actions towards reviewing pipeline thermal capacity, innovating with ToD tariffs, improving feeder metering status, and limiting cross-subsidy requirements.

Sales migration is likely to be inevitable, and a streamlined approach is needed to address its diverse implications. With the steep reduction in RE generation cost in the last decade and a similar trend for battery storage expected in the coming decade, sales migration through OA and the captive route is inevitable. With the potential increase in the demand for such options, regulatory commissions and state governments must track crucial trends and evolve a balanced framework for enabling consumer choice by streamlining application processes and providing certainty to investors and adequate compensation to discoms. In comparison with some of the more industrialised states, Uttar Pradesh and Bihar have efficient online portals for streamlining processes. Maharashtra and Gujarat have evolved frameworks to ensure that discoms are compensated for banking and standby services; they also track crucial trends in OA and captive migration. Incorporating and accounting for such trends is critical for the implementation of the resource adequacy framework going forward.

An institutionalised approach towards data reporting and analysis would help timely and coordinated actions. Transparency in regulatory proceedings, centralised data collection processes, and proactive reporting by utilities have resulted in a greater amount of information being available in the public domain in the power sector than in other infrastructure sectors. However, issues with data-reporting methodologies and lack of regular reporting highlight the need for central and state institutional mandates for data collection, standardization, and reporting. Without data reporting, crucial trends (for example, on working capital borrowing, supply quality, and green O&A) that shape the transition will not inform policymaking in a timely manner.

Central and state agencies have unique and complementary roles in shaping the energy transition. Better-aligned plans and actions will create the foundation for a successful transition. Both the central government and state governments have important and unique roles to play in the sector, and it is essential that their actions should be complementary, aligned, and coordinated. Without this, the scale and speed required for the electricity sector transition is unlikely to be achieved. The central government is best placed to provide a guiding and enabling framework with a clear directional certainty that fosters cross-learning and innovation in states. Achieving such an alignment will enable a transition that is not just dominated by techno-economic changes but is also in the public interest. Such a transition will be able to address pressing challenges for a better future.



INTRODUCTION

Energy Transitions and the need for tracking developments

Globally, concerns around energy security, access and affordability, climate change impacts and responses, and the increased techno-economic viability of renewable energy (RE) sources have been shaping the energy transition discourse.

The ongoing transition is even more complex for developing countries such as India. The challenges include decarbonising while simultaneously meeting the energy demands of economic growth. This challenge has to be addressed while managing the constrained fiscal space for high capital investments in clean energy infrastructure, possible exposure to potential energy security risks, and frequent disruptions in energy access. Even so, the transition comes with the potential for energy self-sufficiency, the promise of clean low-cost power to meet welfare demands, and the opportunity for competitive, job-creating, and green industrialisation. These opportunities are not guaranteed; the realisation of these gains will require clear and coherent plans, institutional capacities, and governance processes.

India has committed to 50% of the installed electricity generation capacity from non-fossil-fuel-based energy resources by 2030 (PIB 2022). In addition, ambitious transition-oriented targets are being set for alternative clean fuels, clean transportation, energy-efficient buildings, and decarbonisation of industrial processes. The central and state governments are working on multiple legislative, policy, and institutional reforms that will enable these targets to be achieved.

About the Energy Transition Preparedness Initiative (ETPI)

Ambitious national targets, enabling policies, and institutional frameworks are critical to the realisation of the energy transition goal. However, given India's federal governance structure, achieving these goals will depend on the capabilities of the state agencies and the alignment of targets and actions with national and state priorities. A smooth and inclusive energy transition necessitates a better understanding of, and engagement with, the divergent contexts, capabilities, and priorities of Indian states and how they shape the states' energy transition plans, actions, processes, and outcomes.

As an attempt in this direction, Energy Transition Preparedness Initiative (ETPI) provides a framework to document and understand state-level plans, actions, and governance processes towards an energy transition. Through an annual study across various themes, ETPI seeks to fill the knowledge gap by identifying state-level incentives, opportunities, innovations, and achievements. This will facilitate engagement with diverse political economic conditions and incentive structures as part of the energy transition discourse. By covering state-level developments in three sectors – electricity, buildings, and transport – ETPI seeks to facilitate cross-agency, cross-state, and cross-sectoral learning.

About the Energy Transition Preparedness Indicators

The indicator framework, which covers various transition-related themes, spans three sectors: electricity, buildings, and transport. These sectors are the key contributors to future energy demand as well as emissions, and therefore are critical to India's energy transition. A total of 24 theme-based indicators cover these sectors. The indicators also capture 'cross-cutting' aspects relevant to energy transition preparedness that apply across the three sectors.

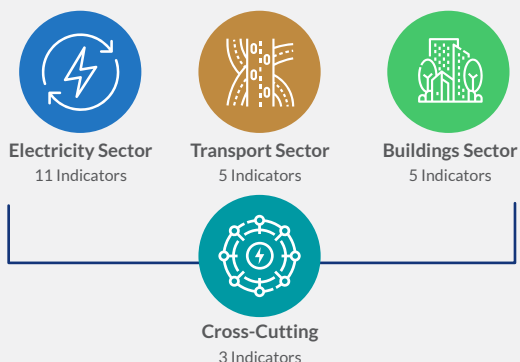
Sectoral developments are studied in ten Indian states that are socio-economically and geographically diverse and account for two thirds of the national electricity demand in India.

These states are Bihar, Delhi, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and Uttar Pradesh.

The theme-based indicators track progress, or the lack thereof, and highlight areas where ground action has been initiated as well as crucial aspects that remain neglected. The indicator framework to capture state-level developments was created through a two-year deliberative process. It was finalised based on extensive review comments by sector experts, stakeholder consultations, and a three-state pilot study to test the robustness of the indicators. See the Indicator Guidebook (ETPI 2023) for a detailed description of the intent and specifics of each theme and indicator.

Of these 24 indicators, 11 relate to electricity and 5 each to transport and buildings; 3 are cross-cutting indicators.

Overview of ETPI thematic indicators



Indicators Cover

These themes are informed by the following four important dimensions of the energy transition.

- Policy intent, vision, and commitment to accelerate transitions;
- Transparency and fairness in the process and effectiveness of procedures;
- Institutional capacity and actions to enforce commitments by decisions makers
- Outcomes of stated efforts to aid the energy transition

The indicators across the identified themes cover state-level plans, actions, and governance processes on an annual basis in a comprehensive manner, in the context of state practices and realities. It is a useful framework to capture state-level practices to promote cross-learning. The indicator framework is not designed to rank or compare states. Further, in order to capture multiple facets in a sector, the indicators are composite and interrelated. Thus, the sectoral indicators together cover the dimensions of policy intent, transparency, institutional capacity, and outcomes, but all these aspects may not be covered in each indicator.

About the Electricity Sector

India is the third-largest economy in purchasing power parity terms and the third-largest electricity consumer in the world (IEA 2021). As of 2016, energy accounted for about 75% of the total greenhouse gas (GHG) emissions, and electricity generation accounted for about 40% of the total emissions in the energy sector (MoEFCC 2021). About 72% of India's electricity demand was met through coal in 2022. However, the share of renewables (excluding large hydro) in total electricity generation has been steadily rising from 6% in 2011 to 13% by 2023. RE, especially solar and wind, will continue to grow due to its cost competitiveness. Since 2018, the winning bids for solar and wind had tariffs less than Rs. 3/unit, fixed for a 25-year period. This is 30% to 40% lower than the average variable cost of coal power plants at the national level in 2021. Further, these tariffs were fixed for a 25-year period. The modularity, low gestation periods, and minimal price escalation risk make the techno-economic case for increased RE procurement. The push for increased deployment is driven not just by techno-economic considerations but also by the national target of 43% RE (including large hydropower) procurement by 2030. It must be noted that the pace of coal capacity addition has declined in the recent past. Between FY 2011–12 and FY 2016–17, India was adding about 16 GW of coal per year; however, between FY 2016–17 and FY 2021–22, the average capacity addition was just 3.25 GW per year. It is yet uncertain whether coal capacity would remain muted with the increase in electricity demand and storage deployment not occurring at the desired pace.

Over the past decade, electricity demand has been growing at the rate of 5% per annum. About a third of the sales is to residential consumers and a fifth is to agricultural consumers. Commercial and industrial consumers (about 40% of the sales) typically cross-subsidise agricultural and residential consumers. These consumers also receive the bulk of the state government subsidies. State government power subsidies amounted

to Rs. 1.32 lakh crores (USD 17.7 billion) in FY 2020–21. From data reported by the Central Electricity Authority (CEA), the total electricity consumption in the country is 15% higher than consumption by utilities, indicating that many consumers are using other avenues such as third-party procurement using open access (OA) and investing in captive power plants to obtain power at competitive rates. In FY 2020–21, the average cost of supply was about Rs. 7.61/unit for utilities, whereas non-electricity-distribution-company (i.e., non-discom) sales could be obtained at about Rs. 5/unit. The share of non-utility consumption will increase in the future not just due to the availability of cost-competitive options but also due to the policy push to provide such options to a wider net of consumers and streamline the application processes. Such measures are part of the Green Open Access Rules, introduced in 2022 by the central government.

For the past two decades, electricity regulators have been taking critical decisions related to planning, tariff setting, performance evaluation of electricity utilities, and electricity market development at the national and state levels (PEG 2017a). This has made it easier to track sector progress, and planning processes have become more streamlined and publicly accessible.

The electricity sector has also seen investments of more than Rs. 60,000 crore (USD 8 billion) in rural network development since 2005¹ ((PIB 2014); (MoP 2014), (MoP 2017)) and has achieved near 100% electrification of all villages and homes. Discoms are tasked with ensuring reliable power supply for all, in conjunction with multiple responsibilities: procuring RE and storage, managing coal-based power supply, and ensuring grid reliability. Going forward, the challenge would be to ensure that domestic consumers as well as small enterprises in rural areas continue to receive affordable, reliable, good-quality, and safe power supply during the sector transition. Meeting this challenge will be especially difficult because discoms – saddled as they are with significant losses and financial woes – are in a precarious position.

The contours of the transition in the electricity sector, and consequently the end goal of the transition, will vary depending on state contexts, resources, the strength of existing institutions, the capacity of implementing agencies, and the efforts of policymakers. With these developments

at the national and sub-national levels as well as the persistent challenges in various states, it is crucial to understand the status of the states and progress with respect to the critical elements of the transition.

About the Electricity Indicators

The framework has 11 themes or indicators for the electricity sector.

Figure 1: Snapshot of the Themes Covered in the Electricity Indicators



E7: Electricity Demand and supply for agriculture

Progress in feeder segregation and metering, estimation of agricultural demand, progress in solarisation, quality of supply and service.

5 attributes | 8 Sub-Attributes



E8: Affordable and Reliable Supply for Small Consumers

Affordable power for domestic consumers and small enterprises, regulatory evaluation of supply and service quality, improvement in supply quality.

5 attributes | 12 Sub-Attributes



E9: Access to competitive supply alternatives for industrial and commercial consumers

Clarity and certainty in charges and processes, adequate compensation for discoms, tracking and reporting.

5 attributes | 16 Sub-Attributes



E10: Preparedness of State-Level Transmission and Distribution Network

Disaggregated and transition oriented network planning, public reporting of projects, progress in consumer and interface metering, incorporating time-of-day tariffs.

5 attributes | 14 Sub-Attributes



E11: Regulatory Governance and Processes

Transparency, accessibility and wider participation, timely appointments from a diverse pool, proactive steps towards accountability, transition-oriented challenges.

5 attributes | 14 Sub-Attributes



Source: (ETPI 2023)

The broad themes covered in the indicators focus on various aspects of the transition and need to be studied. Although they are numbered, the numbers do not indicate a hierarchy of importance; rather, they emphasise the crucial relationships and interlinkages between the indicators. For example, developments related to RE and storage (E2 in Figure 1) and management of coal (E3) provide the necessary context for

the aspects captured in E4, the indicator related to integrated resource planning (IRP) (ETPI 2023). As the discoms will be a key institution in implementing many transition-related changes, discom financial viability (E6) is discussed after the techno-economic drivers of the transition, namely, E2, E3, and E5. It must also be kept in mind that the indicator boundaries are not watertight. Crucial aspects related to regulatory decision-making

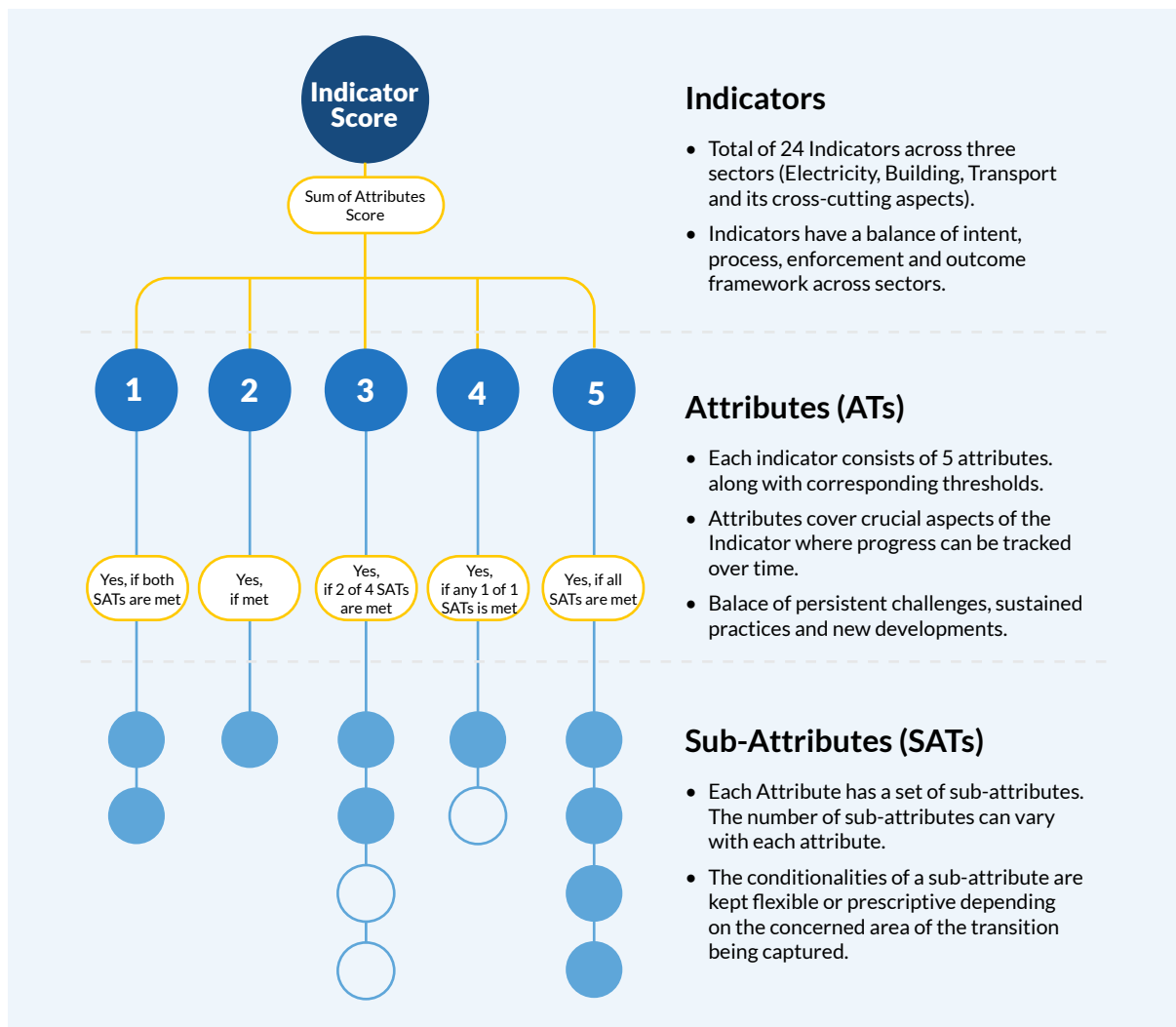
are covered in all the indicators, not just in E11. Aspects of RE development are not restricted to E2 but are also covered in E1, E7, E9, E10, and E11. The link to the transition may not be apparent in the case of some Indicators, especially E7 and E8. Although developments in these indicators may not directly drive transition-related changes substantially, without adequate attention, small, rural consumers may be left behind, and aspects such as the quality of supply in underserved areas may remain ignored.

Each indicator has five attributes. Each attribute has multiple sub-attributes covering various developments related to the theme-based indicator. To enable a better understanding of

developments on various fronts, the attributes have a qualifying threshold. Figure 2 details the structure of the framework.

The qualifying criteria or thresholds for each sub-attribute and attribute will remain the same for subsequent studies (ETPI 2023). The criteria or thresholds were finalised based on state-level pilot studies and vetted based on feedback from sector experts. These criteria are designed to be more exacting for elements crucial for the transition and for areas characterised by a sustained push and investments over decades and where further improvements are expected. The thresholds are thus less stringent for transition-specific but aspirational aspects where only

Figure 2. Overview of Indicators, Attributes, Sub-Attributes, and Thresholds



Indicators

- Total of 24 Indicators across three sectors (Electricity, Building, Transport and its cross-cutting aspects).
- Indicators have a balance of intent, process, enforcement and outcome framework across sectors.

Attributes (ATs)

- Each indicator consists of 5 attributes, along with corresponding thresholds.
- Attributes cover crucial aspects of the Indicator where progress can be tracked over time.
- Balance of persistent challenges, sustained practices and new developments.

Sub-Attributes (SATs)

- Each Attribute has a set of sub-attributes. The number of sub-attributes can vary with each attribute.
- The conditionalities of a sub-attribute are kept flexible or prescriptive depending on the concerned area of the transition being captured.

Source: (ETPI 2023).

nascent developments are anticipated at this stage. For example, the attributes tracking the financial health of discoms have higher thresholds, but those tracking the adoption of storage technologies have relatively lower thresholds. The framework is designed to be relevant for a five-year period in a rapidly changing sector. The intent is to not only track progress over time but to also identify and highlight good practices from across states. The framework, indicators, attributes, and sub-attributes covering specific themes are more important than the thresholds; therefore, practices across states are documented even if they do not meet the qualifying threshold.

About This Study

This study covers developments across various themes up to FY 2021 (April 2020 to March 2021). When it is feasible, the report also mentions critical developments after FY 2020–21 to provide a more complete picture of the sector. Several indicators track developments in the states in the recent past (three to five years) up to 2020–21; thus, the report is not restricted to changes that occurred only in FY 2020–21.

The study was conducted using publicly available data such as regulatory filings pertaining to tariff determination and true-up processes by utilities, the consequent orders issued by regulators, and annual reports released by utilities to comply with the Companies Act, 2013. Wherever relevant, data available on the websites of the regulatory commissions, discoms, state nodal agencies, and state energy departments and replies to RTI filings were used. Most of the information was obtained from state sector sources. However, central sector sources were used to supplement findings where relevant. Critical information was verified through conversations with state officials, where possible. The documentation of sources and justifications is

available in the worksheets of this report and can be downloaded from the ETPI website (www.etpi.in).

Many of the studied states have multiple discoms. The study includes all the discoms that catered to more than 15% of the total state's sales mix in FY 2018–19. A standardised methodology was used for the study that is captured in the Indicator Guidebook (ETPI 2023). The details of how variations in terminology and reporting formats were handled are given in the worksheets and annexures of this report, which are available online.²

The subsequent 11 chapters (E1 to E11) of this report present theme-based findings across the indicators for FY 2020–21. Each chapter shares the indicator-level findings for all the states, followed by a broad overview of specific attributes and sub-attributes. For each indicator, the number of attributes for which the states have met a predefined threshold is depicted using a fan chart.³ This is followed by a description of the structure of the indicators, indicator-level insights focussing on developments across the states, and a discussion of the critical areas for future action. The intent is also to emphasise state-level trends and unique practices that need to be taken into consideration or adopted by other states. Key highlights of the study for each indicator are captured at the end of the chapter. Each indicator chapter is also accompanied by an annexure that describes the structure of the indicator and gives explanatory notes on the study. The 11 chapters are followed by the concluding 'Insights' chapter, which synthesises observations across chapters and provides broad insights about the electricity sector transition obtained from the study.



E1 : LONG-TERM VISION FOR ELECTRICITY SECTOR TRANSITION



Development of a comprehensive long-term vision is in the early stages, and states have medium-term policies on the sectoral aspects of the transition.

Overview

An integrated vision document outlining the contours of the future electricity sector and articulating the associated goals will help align efforts, attract investments, and enable better coordination towards attaining the transition-specific objectives. This should ideally be

complemented by medium-term policies for concerted action.

Figure 3 describes the indicator with details of its 5 attributes and their 13 sub-attributes.

Figure 3. Long-Term Vision for the Electricity Transition



Source: (ETPI 2023).



- In FY 2020–21, Bihar, Delhi, Karnataka, Maharashtra, and Tamil Nadu showed developments in areas covered in one of the five attributes in this indicator.
- Annexure E-1 gives more details on the attributes, sub-attributes, thresholds, and methodology used.⁴
- The data collection sheets are available on the website. (<http://etpi.in>)

E1.1: EXISTENCE OF A LONG-TERM VISION

Maharashtra released Power Sector Vision 2030 in 2019. Though published by the state government, the document was not approved by the state cabinet and does not provide specific targets or mechanisms for coordinated action. In the same year, Kerala published a draft energy policy that has not been finalised yet. Besides demand–supply outlook and investment projections, the draft energy policy in Kerala touched upon issues that typically do not receive adequate attention, such as rural supply and

service and electrical safety. However, this document does not specify long-term targets or action steps.

In 2022, Maharashtra, Rajasthan, Bihar, and Karnataka initiated actions towards the development of a comprehensive, long-term vision document. As these developments are in the nascent stage, it is not possible to comment on the outlook, objectives, and priority areas identified.

Need for a Comprehensive Vision

A vision helps coordinate actions at the state level between various agencies and stakeholders, and given the concurrent jurisdiction over the electricity sector, it also helps align the actions of the centre and the state.

For example, clear articulation of state-level renewable energy (RE) deployment ambition, ideally based on a detailed least-cost planning exercise, can help align national RE targets with state commitments. In the same vein, state policies on demand-side management and positions on RE concessions could also inform national actions. Currently, there are no such state-level policy goals that can inform the centre’s vision.

There is some articulation of long-term objectives in the Memorandum of Understanding (MoU) signed between the central government and the state government under the national Ujjwal Discom Assurance Yojana (UDAY) scheme and, more recently, the Revamped Distribution Sector Scheme (RDSS). However, these long-term goals for specific issues such as the financial turnaround of discoms do not provide a clear outlook for new technology adoption, demand–supply

projections, and so on. The schemes provide flexibility within a prescribed framework and may not account for state priorities. Though approved by the cabinet, plans under these MoUs have been developed without public consultation.

States also have comprehensive climate action plans that focus on integrated and coordinated efforts across government departments to address the climate emergency. Importantly, these plans also consider investments, employment, and climate justice. These plans will be discussed in the study using the cross-cutting indicators or themes that are part of ETPI.

E1.2: CLEAR GOALS, STRATEGIES, GOVERNMENT SUPPORT, AND PRESENCE OF MONITORING MECHANISMS

Only Maharashtra has a long-term vision document, a 2030 vision document, but it does not articulate goals and strategies or outline government support. Though the vision document

notes the importance of monitoring mechanisms, it lacks provisions for assigning monitoring responsibility or mechanisms to track progress over the years.

E1.3: PUBLIC CONSULTATION PROCESS

The Maharashtra vision document was finalised after stakeholder consultations, but a public

consultation process was not involved.

E1.4: MEDIUM-TERM POLICIES

All states have medium-term sectoral policies. Bihar, Delhi, Karnataka, and Tamil Nadu qualify for this attribute because their policies were finalised through consultative processes and have explicit provisions for review and revision. A wide range of stakeholders were consulted as part of policy preparation in Bihar and Delhi. In Kerala, Karnataka, and Uttar Pradesh, the policies were finalised through public consultation. Specific provisions for mid-term review or revision were present in Bihar, Delhi, Gujarat, Karnataka, and Maharashtra. In fact, Karnataka used such a provision to amend its solar policy in 2017.

In FY 2020–21, all ten states had RE policies operational for five-year periods. In addition to RE-specific policies, seven of the ten states have electric vehicle policies.⁵ Maharashtra and Karnataka notified energy conservation policies in 2017 and 2022, respectively; this step could be adopted by other states. Going forward, states could also consider formulating a medium-term policy for priority areas such as storage deployment and enhancing the quality of supply and service in rural areas.

Targets in Sub-Sectoral Policies

In the existing sub-sectoral policies, review or revision of targets is not prioritised. For example, Table 1, a compilation of solar installed capacity targets from operative policies, shows that three states – Karnataka, Madhya Pradesh, and Uttar Pradesh – set five-year targets in 2022.

Table 1. Solar Installed Capacity Targets according to Applicable State Policies

State	Year Policy Was Notified	Target for solar in GW	Time Horizon for Achieving the Target	Year to Meet Target
Bihar	2017	2.9	5	2022
Delhi	2016	2	9	2025
Gujarat	2021	No target specified in the policy		
Karnataka	2022	17	5	2027
Kerala	2013	2.5	17	2030
Madhya Pradesh	2022	12.4	5	2027
Maharashtra	2020	17	4	2024
Rajasthan	2019	30	6	2025
Tamil Nadu	2019	9	4	2023
Uttar Pradesh	2022	22	5	2027

Source: Compiled by the authors from applicable state solar policies.

Targets for Delhi, Maharashtra, and Rajasthan have not been set beyond the next couple of years. Further, Tamil Nadu and Bihar have not set any targets for future years, and nor does the recent Gujarat policy include targets. Although Kerala has set targets for 2030, it has not been revised since 2013 and thus does not reflect many of the recent transformational changes in the electricity sector.

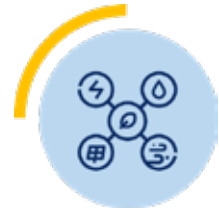
With the notification of the electricity sector vision and energy policy documents, medium-term sub-sectoral policies can also be revised and reviewed to align them with the state-level electricity vision.

Highlights

- A comprehensive long-term power sector vision document was absent in the ten states as of FY 2020–21. However, efforts towards this were initiated in 2022 by Rajasthan, Karnataka, Tamil Nadu, and Maharashtra.
- Maharashtra has a 2030 vision document, but it is broad in coverage and does not clearly state goals and institutional mechanisms. It was also not approved by the cabinet. Kerala has a draft energy policy, but the target year is unclear and goals are not articulated.
- Medium-term policies are present for renewable energy (RE) and electric vehicle adoption, which are key technological drivers of the energy transition. Similar clarity will be required in other critical areas such as energy storage and energy efficiency. Maharashtra and Karnataka have such policies for energy conservation and efficiency.
- In RE (solar) policies, only six of the ten states have targets at least up to 2025.
- Five of the ten states had policies with provisions for mid-term review or revision of the policy. While finalising medium-term policies, widespread stakeholder consultations were undertaken in Bihar and Delhi, and public consultations were conducted in Kerala, Karnataka, and Uttar Pradesh.



E2 : DEVELOPMENT OF RE AND STORAGE



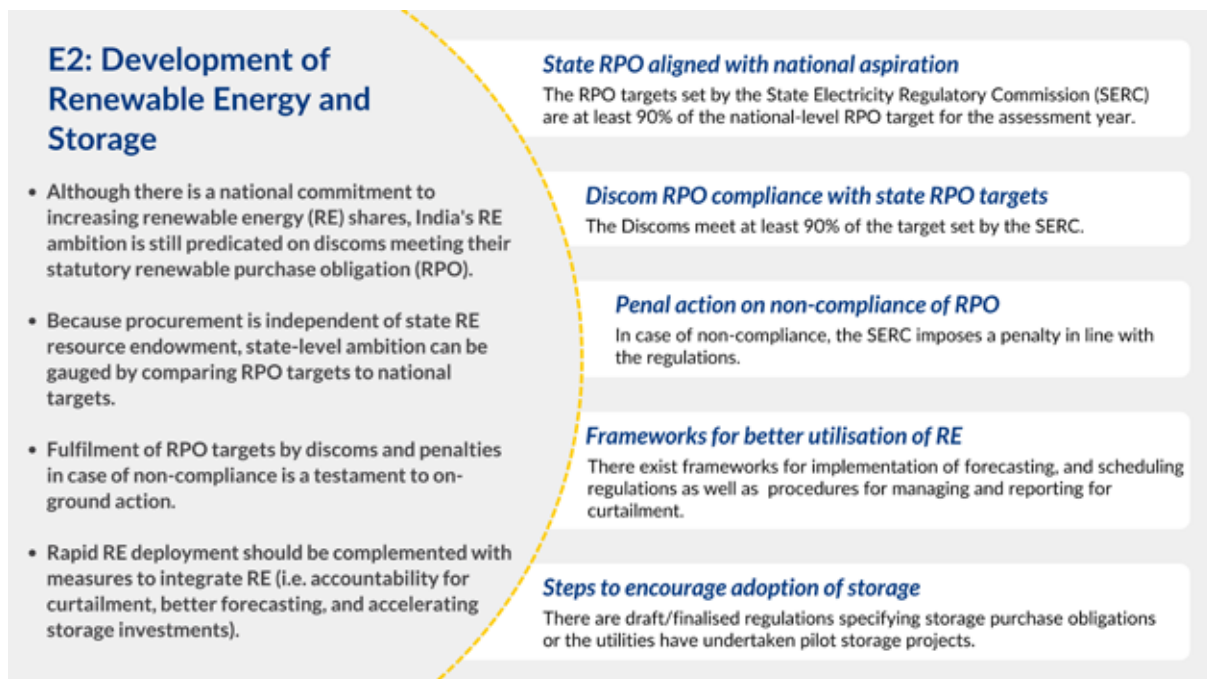
Although there was significant action on multiple fronts for better RE integration, compliance with RPOs remains the key bottleneck to accelerating RE deployment in many states.

Overview

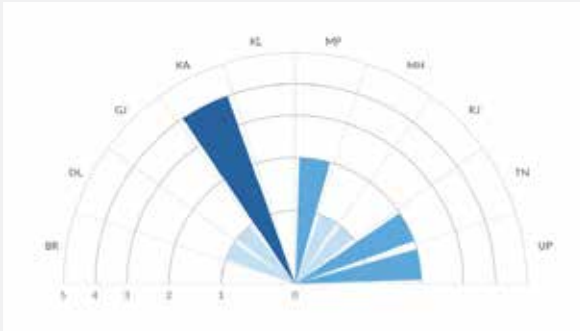
Like India's past RE deployment, India's RE ambition for the coming decade will depend on discoms meeting their RPOs⁶ ((CEA 2022a); (MoP 2022a)). Recognising this, in 2022, the Ministry of Power (MoP) released long-term RPO trajectories for 2030 at 43% of consumption and stipulated

energy storage obligations (ESOs)⁷ ((MoP 2022a)). Regulatory action, discom procurement, and steps towards better RE integration are key to meeting these targets. Figure 4 describes the indicator with details of its five attributes and their ten sub-attributes.

Figure 4. Development of RE and Storage



Source: (ETPI 2023).



- In FY 2020–21, Karnataka showed developments in areas covered in four attributes; Madhya Pradesh, Tamil Nadu, and Uttar Pradesh in two attributes; and Gujarat, Delhi, Maharashtra, and Rajasthan in one attribute.
- Annexure E-2 gives details of the five attributes and ten sub-attributes of the indicator, thresholds, and methodology used.⁸
- The data collection sheets are available on the website. (<http://etpi.in>)

This indicator focuses on RE procurement by discoms rather than on RE capacity addition because procurement is less dependent on RE resources in the state. Thus, even states

with significant RE resource endowments such as Maharashtra and Rajasthan show limited developments in the attributes due to poor RPO compliance.

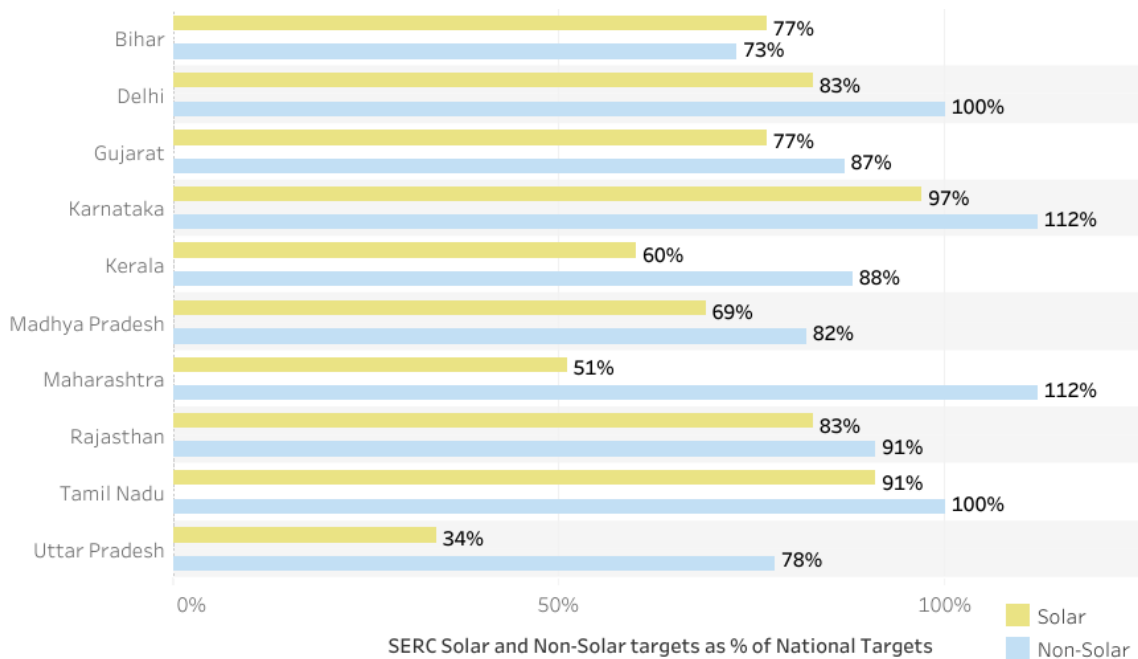


E2.1: ALIGNMENT OF STATE TARGETS WITH NATIONAL TARGETS

In FY 2020–21, Karnataka and Tamil Nadu were states where the binding targets set by the State Electricity Regulatory Commission (SERC) were in close alignment with the national guiding targets.

In general, non-solar targets were more aligned with national targets than solar targets in FY 2020–21 (see Figure 5).

Figure 5. Alignment of SERC RPO Targets with National RPO Targets for FY2020-21



Source: Compiled by the authors based on SERC RPO regulations or state government notifications.

Target Setting for Renewable Energy (RE) Procurement

National and state-level targets should be informed by detailed bottom-up modelling exercises to assess the capacity addition of RE required for least-cost procurement that is techno-economically feasible. This is discussed in greater detail in Section E4. Recent state-level and national modelling studies have shown that with investment in storage, meeting 40% to 50% of the energy requirement from RE is techno-economically feasible ((PEG 2021a); (CEA 2023a); (Idam Infra 2023a), (Idam Infra 2023b), (Idam Infra 2023c), (Idam Infra 2023d)).

National targets are guiding and not binding in nature, and depending on the state's demand–supply mix, there might be potential to meet or exceed the guiding target.

It is also important to review the RPO framework itself. Earlier, with high solar prices, a separate solar RPO mandate was required to ensure solar procurement. However, prices have drastically decreased for solar and wind in recent years. In FY 2020–21, the average cost of power from coal-based plans was Rs. 3.57 per unit. Winning bids since 2019 have been in the range of Rs. 2.5 to 2.8 per unit for solar and Rs. 2.5 to 3.0 for wind (PEG n.d.).

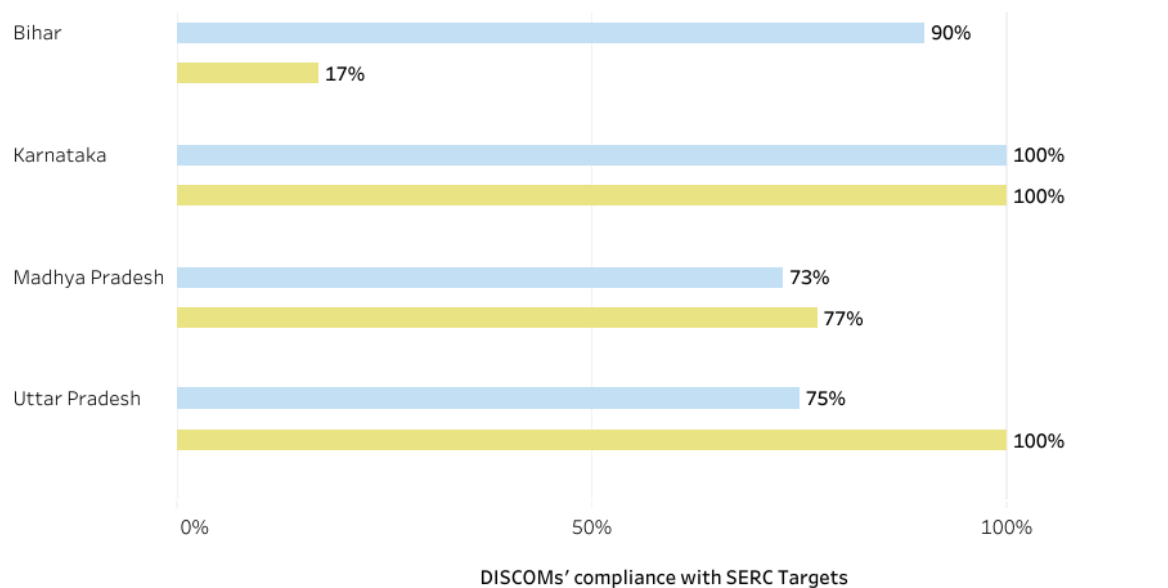
With the cost of wind and solar capacity being lower than that of conventional energy sources and sufficient installation of solar and wind in the country, RPO targets need not be for a specific technology and should now be made fungible. Discoms can thus freely procure RE capacity to suit their load profile rather than to meet technology-specific RPOs (PEG 2022). Karnataka (KERC 2022), for example, has recently adopted composite targets for future years.

E2.2: COMPLIANCE WITH STATE TARGETS BY DISCOMS

Karnataka was the only state that met (and surpassed) its targets in FY 2020–21. This is also noteworthy because the state's targets are in line with the national targets. Early policy focus on RE technologies and rapid RE deployment in Karnataka have contributed to this cumulative achievement.

Besides the gap in ambition in most states in FY 2020–21, the pace of RE deployment was further affected by a gap in compliance. Figure 6 captures the status of RPO compliance in states where compliance orders were available for FY 2020–21.

Figure 6. Compliance of DISCOMs with the SERC RPO Target for FY 2020-21



Note: RPO compliance orders for FY21 for Delhi, Gujarat, Kerala, Maharashtra and Tamil Nadu are unavailable as on Jan 2023. RPO order for Rajasthan does not have clear actual RPO compliance as the estimates are restricted to projections.

■ Non-Solar
■ Solar

Source: Compiled by the authors based on the RPO compliance orders of the ten states.

RPO Compliance Orders

As of January 2023, compliance scrutiny had not been conducted for the year FY 2020–21 in five states. In most states, this is due to delays in initiating compliance proceedings. In Tamil Nadu and Kerala, regulatory scrutiny of RPO compliance has not been done for years.

E2.3: PENAL ACTION FOR RPO NON-COMPLIANCE

Karnataka met its RPO targets for FY 2020–21, and in Delhi, Uttar Pradesh, and Madhya Pradesh, the ERCs levied penalties for RPO non-compliance.

Regulatory action on RPO non-compliance has varied across the states. The Delhi ERC does it as a practice every year,⁹ and the Uttar Pradesh and Madhya Pradesh ERCs levied substantial penalties in FY 2020–21 for persistent non-compliance. The Uttar Pradesh ERC directed the discoms

to deposit a whopping Rs. 7,244 crores into the RPO fund.¹⁰ The commission also directed the Uttar Pradesh discoms to submit quarterly status reports to comply with its regulations. Although the discoms created a separate RPO fund as directed, the fund had a mere Rs. 76 crores in FY 2020–21 and Rs. 62 crores in FY 2021–22. This clearly highlights the need for sustained regulatory oversight.

Penalties, Incentives, and Carryforward in case of Target Shortfall

The Maharashtra Electricity Regulatory Commission (ERC) introduced an innovative incentive mechanism to nudge discoms to meet their renewable purchase obligations (RPO) targets. The commission introduced an incentive of Rs. 0.25 per unit for renewable energy power procured, over and above the state RPO target (up to the national target) and a reduction in the annual revenue requirement (ARR) of discoms at the rate of Rs. 0.10 per unit for the cumulative shortfall (MERC 2019b). However, these penalties were not levied because Maharashtra has been allowing carryforward of shortfall.

Bihar and Rajasthan have allowed for significant carryforward of cumulative RPO shortfall.

The Gujarat ERC diluted its RPO targets (with a downward revision) for 2019–20 to allow the state discoms to reach compliance. Allowing carryforward of RPO shortfall and diluting targets will reduce the possibility that discoms will take actions to ensure compliance.

E2.4: FRAMEWORKS FOR BETTER UTILISATION OF RE

Seven of the ten states – Karnataka, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and Uttar Pradesh – have taken steps to implement forecasting and scheduling (F&S) regulations for wind and solar capacity installed within the state boundary.

Except Kerala and Delhi (which do not have significant in-state RE generation), all the states have notified forecasting, scheduling, and deviation settlement mechanism regulations

for solar and wind generators. Among these states, all except Bihar have taken action towards implementing these regulations:

Provision of a period of non-applicability for stakeholders to adapt to regulatory changes:

Gujarat followed a six-month post-notification non-applicability period for deviation settlement mechanism charges. The Rajasthan ERC, upon the request of the stakeholders, had eight months of post-notification non-applicability, followed

by graded recovery of deviation settlement mechanism charges.

Clarity on implementation aspects: The Maharashtra ERC issued practice directions for better clarity on the implementation framework. The Madhya Pradesh ERC amended the regulations, providing clear timelines. The Uttar Pradesh and Karnataka State Load Dispatch Centres (SLDCs) shared a draft F&S implementation procedure for public comments.

Non-provision of clear timelines makes implementation challenging. The Tamil Nadu ERC, for example, initially notified its F&S regulations with a period of non-applicability of DSM charges for the first six months. Thereafter, it amended its regulations, extending this period indefinitely without providing clarity to the generators about when the charges would become applicable. This framework is a prerequisite for effective grid integration, and postponing its implementation in this way will hurt the state in the long run.

The RE Curtailment Framework

The Maharashtra ERC has specified a detailed framework for RE curtailment in its forecasting and scheduling (F&S) regulations, giving clarity and confidence to the RE generators in the state.

Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu actively reported instances of curtailment on their respective SLDC websites in FY 2020–21.

The Appellate Tribunal for Electricity (APTEL) judgment (APTEL 2021) in August 2021 gave clear directions to all SERCs, SLDCs, and discoms for transparent tracking of curtailment and compensation at twice the rate in the power purchase agreement for curtailment due to reasons other than grid security. In accordance with the APTEL directions, the Forum of Regulators (FoR) has released model guidelines for RE curtailment (FoR 2022). In the coming years, clearer frameworks will evolve in all the states.

E2.5: STORAGE PILOTS AND SPECIFICATION OF STORAGE OBLIGATIONS

Development of storage was at a nascent stage with limited progress in FY 2020–21.¹¹ However, the situation is evolving rapidly, and many significant milestones were achieved in 2022. For example, Tata Power Delhi Distribution Limited installed 10 MW/10 MWh of battery energy storage systems (BESS). Kerala awarded a 10 MW/20 MWh BESS project. Tenders were also been issued in Uttar Pradesh, Maharashtra, Gujarat, Tamil Nadu, Madhya Pradesh, and Bihar, which will be covered in subsequent reports as

part of ETPI. In addition, Bihar, Rajasthan, and Madhya Pradesh proposed storage purchase obligations in 2022.

Discoms will continue to be the driver of RE procurement and deployment, and it is crucial that the regulatory mandate to ensure RPO compliance is exercised. At the same time, there is a need for measures to address the many challenges confronting RE integration in order to aid procurement.

Highlights

- Karnataka was the leading state in the development of renewable energy (RE). The state's renewable purchase obligation (RPO) targets are aligned with the national targets, and its discoms also surpassed the state targets in FY 2020–21.
- Only a few State Electricity Regulatory Commissions (SERCs) track RPO compliance of discoms in a timely manner, and fewer punish non-compliance with penal action. The Delhi, Uttar Pradesh, and Madhya Pradesh ERCs imposed penal charges on discoms in FY 2020–21, whereas the other SERCs allowed for carryforward of the shortfall.
- Most SERCs have notified forecasting and scheduling regulations and have undertaken innovative ways to ease its implementation. Further, five states report curtailment transparently, but only the Maharashtra ERC has specified a clear and detailed framework for curtailment.
- Although development of energy storage is at a nascent stage, it is a rapidly evolving scenario. After FY 2020–21, many states have issued tenders for the deployment of storage projects or have proposed storage purchase obligations.



E3: MANAGEMENT OF COAL THERMAL CAPACITY



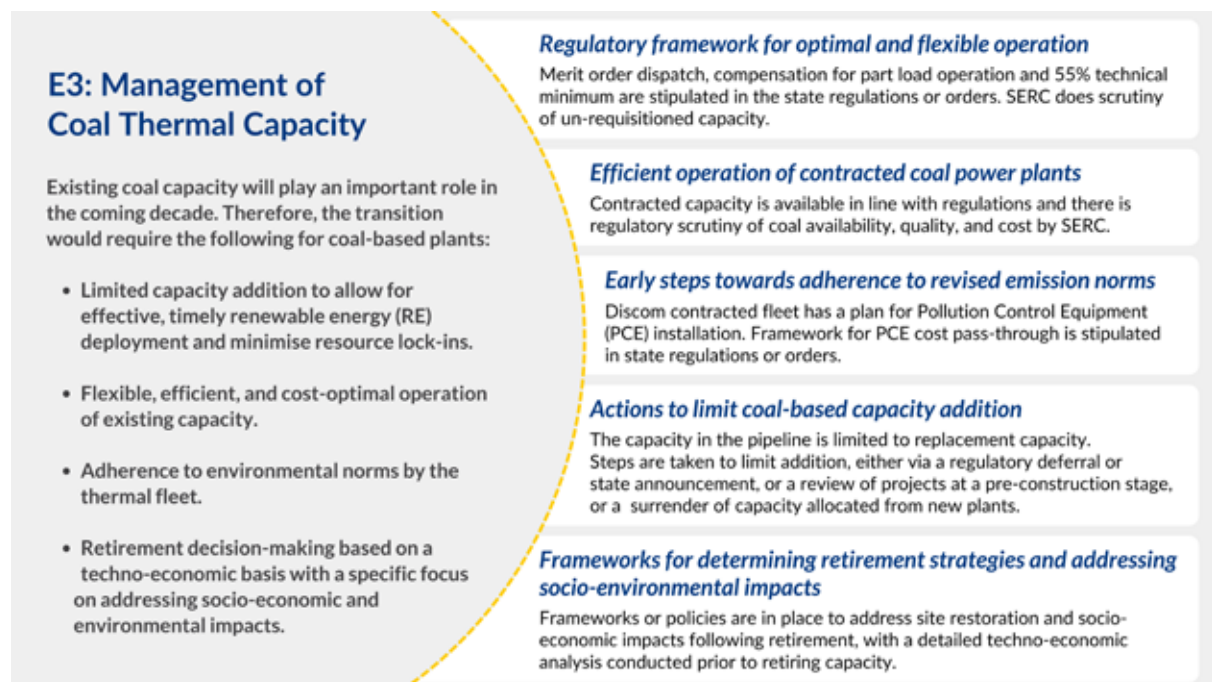
Some states have taken steps towards flexible, cost-optimal utilisation of the existing thermal fleet in 2020–21. More actions are needed to plan future capacity and address the techno-economic challenges and socio-environmental impacts of operating and eventually retiring capacity.

Overview

About 70% of India's electricity demand in FY 2020–21 was met by coal power plants. By 2030, in line with national targets, discoms are expected to meet 43% of their energy requirement

from renewables (MoP 2022a). Although this necessitates a reduction in the relative dependence on coal, the existing fleet will play a crucial role in the transition period.

Figure 7. Management of Coal Thermal Capacity



Source: (ETPI 2023).

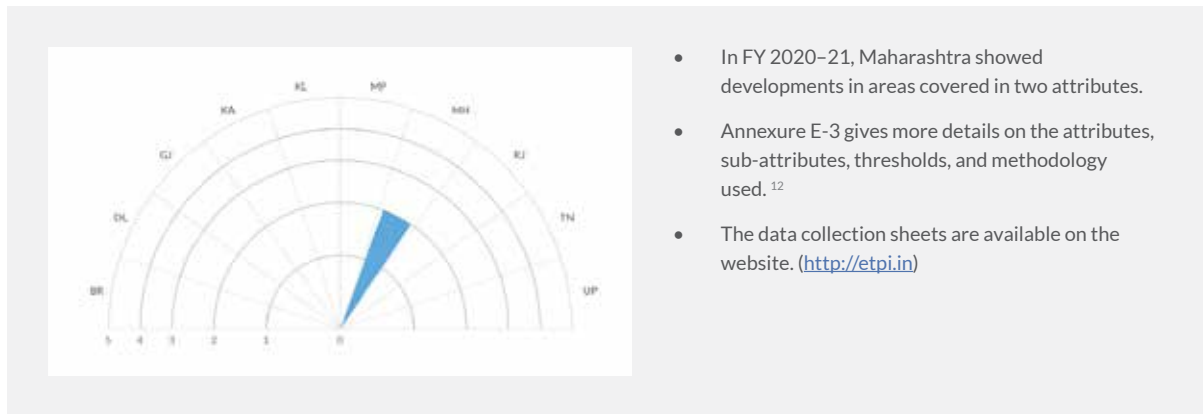


Figure 7 describes the indicator with details of its 5 attributes and their 14 sub-attributes. Kerala and Delhi contract capacity from coal plants outside their state. These plants are regulated by

the Central Electricity Regulatory Commission (CERC). Thus, regulatory action for the contracted capacity will be noted for these states based on the CERC regulatory framework.

E3.1: REGULATORY FRAMEWORK FOR OPTIMAL AND FLEXIBLE OPERATION

In Maharashtra, the regulatory commission has specified a framework for the following:

- Compensating costs due to part load operation of coal plants,¹³ with 55% specified as the technical minimum requirement¹⁴ for its capacity, similar to the CERC stipulations.¹⁵
- Specific regulations for merit order dispatch (MoD),¹⁶ which are published by the SLDC on a monthly basis.
- Detailed scrutiny of un-requisitioned capacity, which requires discoms to submit block-wise details of backing down, sale of power, and cost details to assess this in the discom's tariff process.

These regulatory measures are necessary, especially with the possibility of part load or seasonal operation being more likely for some capacities due to increasing demand uncertainty, increased avenues for market participation, and higher renewable utilisation.

Besides the ERC in Maharashtra, the ERCs in Delhi, Madhya Pradesh, and Kerala have specified the framework for cost compensation and have adopted the 55% technical minimum criterion. The Uttar Pradesh ERC has stipulated the technical minimum criterion but is yet to adopt the framework for part load compensation. In 2022, Karnataka introduced the 55% technical minimum criterion in its regulations, and the Tamil Nadu ERC has proposed to do so.

In January 2023, the CEA issued the 'Flexible Operation of Coal-based Thermal Power Generation Units' Regulations, which are applicable to all stations in the country (CEA 2023a). The regulations specified that all plants would have to achieve a technical minimum of 55% by January 2024. Following this, in March 2023, the CEA also issued a roadmap for the phase-wise completion of works in thermal power plants required for operation at a technical minimum of 40%. All plants are estimated to be covered by 2030 (CEA 2023b). Perhaps with these developments, more plants contracted by the

states will have a lower technical minimum in the coming years.

Although almost all states dispatch power based on MoD principles, clear frameworks and regulations and transparent reporting will be useful under circumstances of increased RE procurement and variations in demand and supply. Fluctuation in the variable costs of thermal power plants due to coal availability; enforcement of 'change in law' provisions of power procurement contracts; and seasonal variations in demand due to OA, captive, agricultural supply, etc., will also contribute to uncertainty in demand, supply, and the cost of power. To facilitate cost-optimal operation, the Uttar Pradesh ERC has also stipulated an MOD framework. Other than

Maharashtra, Uttar Pradesh and Rajasthan provide details of the MOD stack on the SLDC website. The Rajasthan SLDC provides this information on a weekly basis, which is a good practice; in most other states, MoD stack details are available on a monthly basis.

With two-part tariffs and a commitment to fixed cost payments, efforts to optimally use the un-requisitioned capacity contracted by discoms are critical. The ERCs in Rajasthan and Tamil Nadu have directed discoms to conduct studies in this regard, and the Maharashtra ERC has sought block-wise details of backing down, sale of power, and cost details to assess the impact of the un-requisitioned capacity.

E3.2: EFFICIENT OPERATION OF CONTRACTED COAL POWER PLANTS

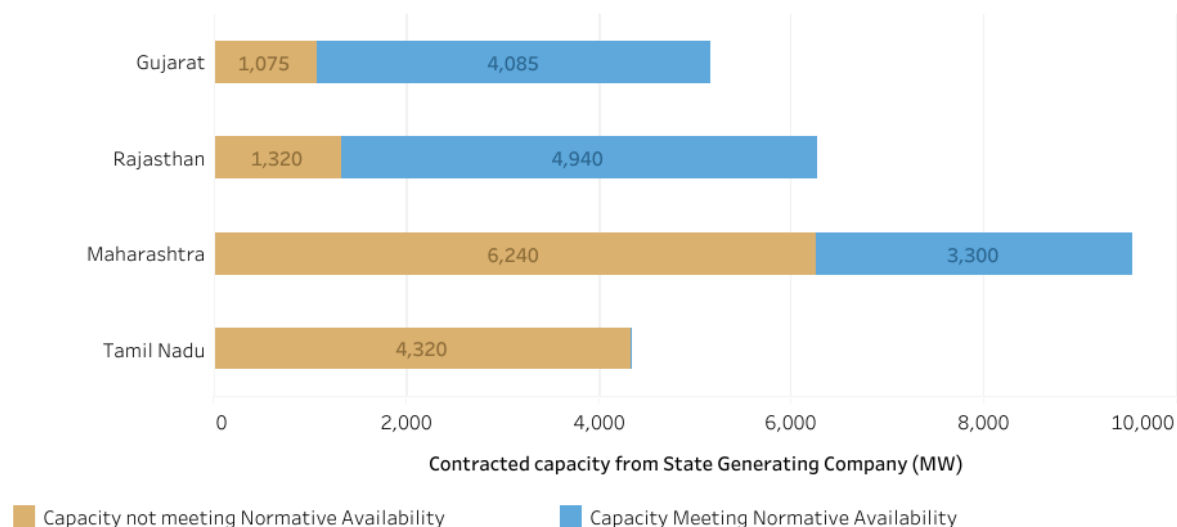
As regards plant availability of the contracted capacity in states, either most of the capacity could not meet the normative availability stipulated by the commission or the data regarding availability were not reported for FY 2020–21. Detailed regulatory scrutiny of coal availability, quality, and costs was also limited.

The actual availability of the contracted thermal capacity is a crucial metric to assess plant performance, and these data were not reported even for cost-plus state-owned generators in Karnataka, Madhya Pradesh and Uttar Pradesh.¹⁷ The reported low availability could be due to an increase in the number of planned and forced outages, water availability issues and other issues attributable to plant efficiency. About 79% of Rajasthan's and Gujarat's generating capacity met the availability norm. In sharp contrast, only 35% of Maharashtra's capacity managed to meet this norm, whereas none of Tamil Nadu's plants were compliant (Figure 8).

Coal costs account for most of the thermal capacity procurement costs; thus, scrutiny of coal quality, availability, prices, and transport costs is crucial. Given its importance, the CERC and ERCs in Gujarat, Karnataka, Rajasthan, Maharashtra, and Uttar Pradesh require reporting of details on coal source, quality, and prices and transport costs separately. Although many of the details were provided, transport costs were not separately reported by generators. Only Maharashtra's state-owned generating company reports coal availability, quality, cost, and transport details for the entire year.

In addition, the company also publishes detailed monthly reports (MSPGCL n.d.) on its website, which are scrutinised by the regulator as part of the periodic fuel surcharge approval process (MSEDCL n.d.). This practice can be adopted by central sector companies such as NTPC Limited and other state sector generators and regulators.

Figure 8. State-Owned Generating Coal-Based Capacity Meeting Availability Norms in FY 2020-21



Note: Plant Availability data for the assessment year was collected from regulatory submissions and state generating companies' websites. No data were publicly available for the state-owned thermal power plants in Karnataka and Uttar Pradesh.

Source: Compiled by the authors from tariff orders, petitions, and related regulatory filings.

E3.3: EARLY STEPS TOWARDS ADHERENCE TO THE REVISED EMISSION NORMS

Because coal will play a critical role in the energy transition, adherence to the emission norms stipulated under the Environment (Protection) Amendment Rules, 2015 is vital. The CERC has provided a clear mechanism to address the cost impacts – both capital and variable – due to the installation and operation of pollution control equipment (PCE) for cost-plus and competitively bid projects. The cost of installation of PCE is considered as additional capitalisation for regulatory approval and recovery from consumers. PCE operation has variable cost impacts. None of the states that were a part of this study had

provided a clear framework and mechanism by the year FY 2020–21. The Madhya Pradesh, Maharashtra, and Rajasthan regulations provide clarity on additional capitalisation approval for all projects. The topic is also addressed in orders in Uttar Pradesh and more recently in Karnataka (in 2022). Tamil Nadu provides in-principle approval only for capital expenses of state generation capacity. Treatment of variable cost impact has only recently been proposed in Maharashtra ERC's draft tariff regulations and is currently largely unaddressed in the other states.

E3.4: ACTIONS TO LIMIT COAL-BASED CAPACITY ADDITION

In FY 2020–21, the net capacity in the pipeline in Maharashtra was limited. Regulatory action has also been taken to defer coal-based capacity addition in the recent past. Further, few

previously announced projects have been formally abandoned. Across states, there has been wide variation in coal capacity in the pipeline, making the medium-term trends uncertain.

Coal-based capacity in the pipeline

Figure 9 gives the status and details of coal capacity in the pipeline (planned as well as under construction) for the ten states as of April 2021. In six states, the pipeline capacity was less than 8% of their contracted coal capacity.

Figure 9 also shows the share of pit-head and brownfield capacity in each state. On average, about 85% of the pipeline capacity in the states was non-pit-head, which implies significant transport costs. As many as 64% of the pipeline projects were greenfield, increasing the risk of resource lock-ins.

Bihar, Madhya Pradesh, Tamil Nadu, and Uttar Pradesh have substantial capacity in the pipeline. However, the status in each state is different.

- The power purchase agreements (PPAs) for most of Bihar's pipeline plants were signed over a decade ago.
- In Uttar Pradesh, all the pipeline capacity was under construction. Here, agreements for a third of the capacity were signed ten years ago and for the remaining two thirds about four years ago. Thus, with delays in project execution and with changing demand–supply scenarios, this capacity may lead to unavoidable lock-ins in these states.
- This is also relevant in Madhya Pradesh, where the bulk of the capacity in the pipeline was approved recently (in 2019). The situation is dynamic and can shift from year to year. For example, though Tamil Nadu reported the highest pipeline capacity among the states at 15 GW in FY 2021, only a third of this capacity was under construction, indicating that projects in the pre-construction stage could be kept in abeyance.

Figure 9: Proposed and Under-Construction coal capacity across states as of 1 April 2021

State	Pipeline capacity as on 01.04.21 (GW)	Pipeline % of existing contracted coal thermal capacity	% share of pipeline capacity based on ownership			% of total Pipeline Capacity	
			State	Central/ Joint Venture	Private	Non-Pithead	Greenfield
Tamil Nadu	15.7	125%	88%			0.916	0.831
Uttar Pradesh	6.5	32%	61%	39%		1.000	0.290
Bihar	4.3	87%		100%		0.842	0.654
Madhya Pradesh	2.4	20%	55%	18%	27%	0.455	0.921
Gujarat	1.0	7%	78%		22%	0.776	0.224
Karnataka	0.8	8%	100%			1.000	1.000
Maharashtra	0.7	4%	100%			0.333	0.000
Rajasthan	0.7	6%	100%			1.000	0.000

Note: Rajasthan approved 1,460 MW capacity addition after FY 2020-21, which is not included in the graph. Even with this addition, pipeline addition would be less than 10% of the total contracted capacity.
Discoms in Kerala and Delhi have no coal thermal capacity in the pipeline.

Source: Compiled by the authors from state regulatory orders or government notifications.

Though Gujarat, Maharashtra,¹⁸ Karnataka, and Tamil Nadu have expressed the intention to prevent any thermal capacity addition beyond the existing pipeline, there does not seem to be any formal announcement by the state government in this regard.

In the past five years, the ERCs in Maharashtra and Uttar Pradesh took proactive steps to defer

coal capacity addition until 2025 and 2022, respectively. Between FY 2020–21 and FY 2022–23, no further capacity addition was approved in Uttar Pradesh. Similar steps can be undertaken in other states based on their demand–supply situation.

E3.5: FRAMEWORKS FOR DETERMINING RETIREMENT STRATEGIES AND ADDRESSING SOCIO-ENVIRONMENTAL IMPACTS

As more and more plants come to the end of their operational lifespan, state-level frameworks to determine retirement strategies and address socio-environmental post-retirement impacts are required. On-ground efforts are currently limited in the states.

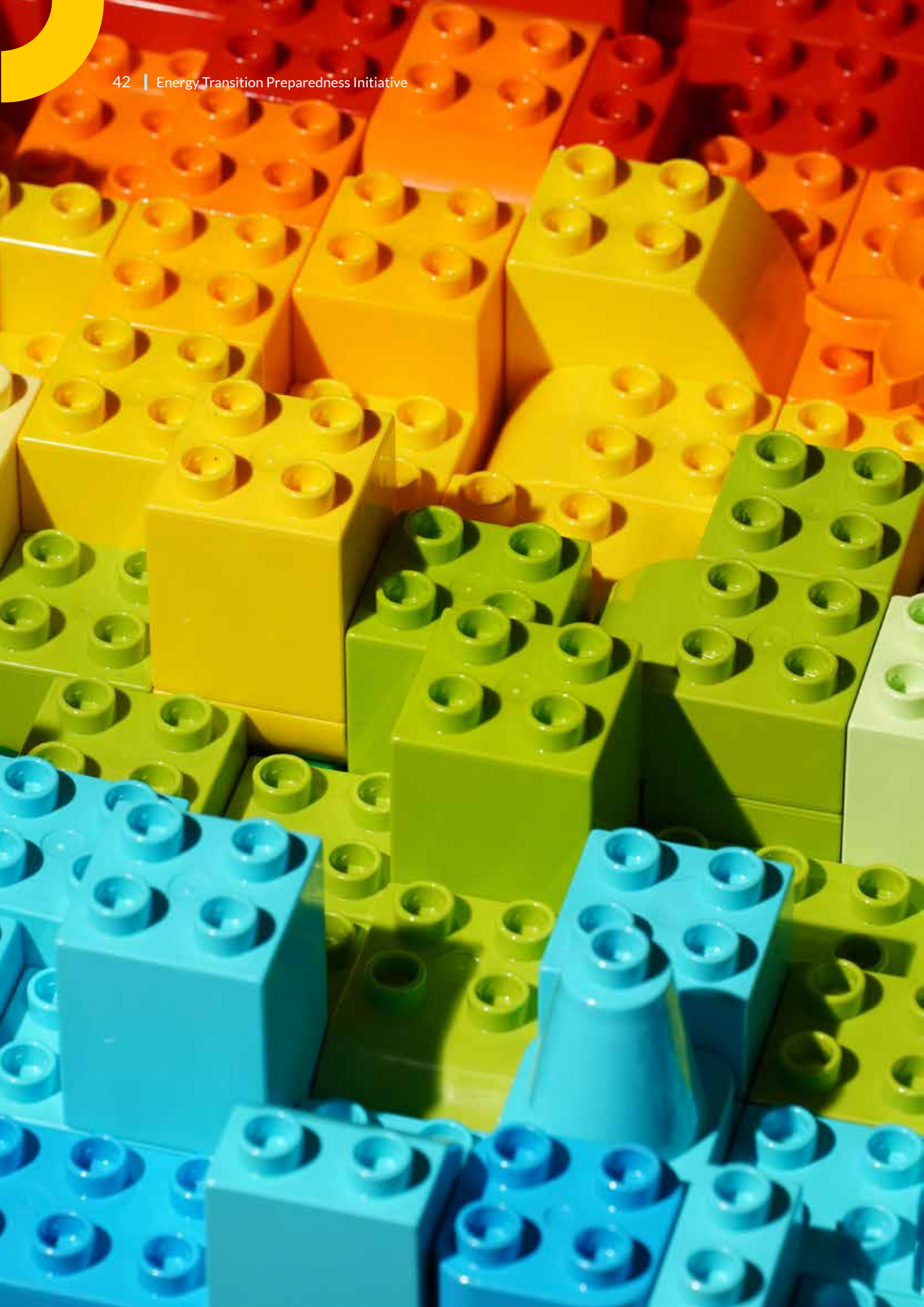
Given the imperative to accelerate RE deployment and the commitment to ensure that reliability

and energy security considerations will be fulfilled, management of coal thermal capacity will be centre stage in the transition-related developments at the state level. Year-on-year changes based on central and state policies and planning would be critical to track and minimise resource lock-in and to optimise the role of coal in India's energy transitions.



Highlights

- Pipeline capacities in Gujarat, Karnataka, Maharashtra, Rajasthan, Kerala, and Delhi were less than 8% of their contracted coal-based capacity in FY 2020–21.
- On the other hand, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, and Bihar have significant pipeline capacity. On average, about 85% of the pipeline capacity is non-pit-head, and 63% of the pipeline projects is greenfield.
- With rising demand uncertainty going forward, there is a strong case for review and deferment of pipeline capacity. Such a review was undertaken by Maharashtra and Uttar Pradesh regulators in the past.
- The critical challenge for discoms and generating companies lies in managing the existing coal capacity to better complement the envisioned RE deployment and inevitable demand uncertainty. Going forward, some capacity could also be used on a seasonal basis.
- Frameworks to support part load operation of coal plants (the central ERC and the ERCs in Maharashtra and Madhya Pradesh), transparent reporting and a framework for merit order dispatch (Maharashtra and Uttar Pradesh), and detailed regulatory scrutiny of un-requisitioned capacity (Maharashtra) are important. Wider adoption of these practices is necessary.
- Reporting and compliance of plant availability was low in FY 2020–21. Rajasthan and Gujarat have 70% of the state-generating plants, whose actual availability complies with the regulated performance norm.
- Maharashtra's cost-plus plants report detailed disaggregated data on coal quality, cost, and availability on an annual and monthly basis. This practice should be adopted by other states.
- Although no state has adopted the CERC framework for cost determination of pollution control equipment, Madhya Pradesh, Maharashtra, and Rajasthan regulations provide clarity on additional capitalisation approval for all projects.
- To ensure that retirement of capacity is not based only on age, techno-economic decision-making frameworks for retirement of coal capacity are needed. Early action towards policies to address the socio-economic impacts of coal retirement is also critical. However, no publicly available information is available that the groundwork for these aspects was initiated as of FY 2020–21.



E4: INTEGRATED RESOURCE PLANNING



Despite its importance, long-term IRP was largely absent in the states, perhaps because policy focus and regulatory mandates have been inadequate. Recent policy efforts, if harmonised, could aid the future adoption of robust IRP processes.

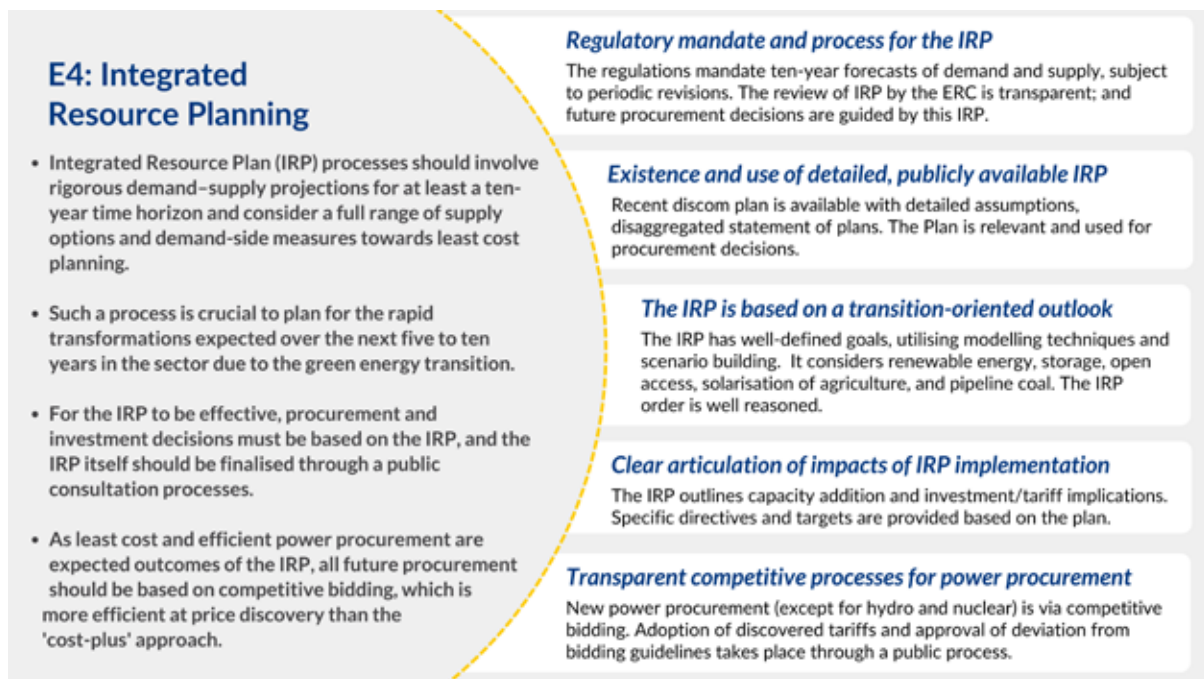
Overview

For well over two decades, IRP has been advocated as a necessary practice while planning for reliable, least-cost supply in the Indian policy discourse.¹⁹ Lack of robust IRP processes and reliance on the rule-of-thumb approach contributed to poor power purchase planning and

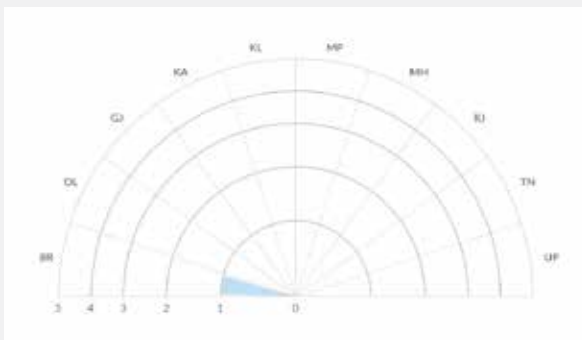
significant thermal baseload capacity addition between 2005 and 2015 ((PEG 2017b); (Swain and Singh 2018)).

Figure 10 describes the indicator with details of its 5 attributes and their 18 sub-attributes.

Figure 10: Integrated Resource Planning



Source: (ETPI 2023).



- In FY 2020–21, Bihar showed development in areas covered in one attribute in this indicator.
- Annexure E-4 gives more details on the attributes, sub-attributes, thresholds, and methodology used.²⁰
- The data collection sheets are available on the website. (<http://etpi.in>)

E4.1: REGULATORY MANDATE FOR IRP

This study shows that only the Bihar ERC regulations²¹ mandate that the IRP process should be conducted with demand–supply projections for a ten-year time horizon and that all the assumptions and projections should be made publicly available.

The Gujarat and Rajasthan ERCs mandate that projections should be provided for a ten-year period. However, these ERCs do not specify that the assumptions and data used should be made publicly available.

In the other seven states, the mandate for demand–supply projections is limited to the

Control Period for the Multi-Year Tariff (MYT) process, which is typically 3 to 5 years. Until 2019, Maharashtra MYT regulations required the submission of base and peak ten-year demand projections with every tariff petition, but in a regressive step, this requirement was removed²² and thus the practice stopped.

The Bihar, Uttar Pradesh, and Maharashtra ERCs stipulate that crucial IRP data and information should be made publicly available.

In Karnataka, because the MYT process has not been implemented by the ERC, there is currently no mandate for the IRP.

Recent policy changes recognising the need for IRP at the state level

Electricity (Amendment) Rules issued in December 2022 mandates that state regulators should frame regulations on resource adequacy and the IRP, and review discom plans.

Guidelines for Resource Adequacy Planning Framework, 2023 issued by the Ministry of Power in June 2023 states that discoms shall prepare a ten-year IRP to be approved by the Electricity Regulatory Commission (ERC). The exercise should involve modelling and consider storage, renewable energy, thermal capacity constraints, and demand response. All future capacity addition is to be based on this exercise (MoP 2023a).

Draft Guidelines for long-term and medium-term power demand forecast, 2023 issued by the CEA specifies forecasts for five to ten years revised annually using disaggregated inputs. It should not only model discom demand but also consider OA and captive growth (CEA 2023c).

It is hoped that a clear mandate and robust framework for IRP implementation as recommended in the national framework for resource planning would contribute to an increased focus on this aspect in the states. The national framework for resource adequacy should also be appropriately integrated into the existing state-level planning frameworks.

E4.2: EXISTENCE AND USE OF DETAILED, PUBLICLY AVAILABLE IRP

Despite the mandate in Bihar, Rajasthan, and Gujarat for ten-year demand–supply projections, IRP processes were not conducted in the recent past in these states. The discoms in Bihar have not submitted any petitions in this regard, and the ERC has not held them accountable for non-compliance.

Although a clear mandate is critical, it is not necessary for the adoption of IRP processes. Tamil Nadu Generation and Distribution Company, the discom in Tamil Nadu, has been providing demand–supply projections for a seven-year period in its Capital Investment Plan (CIP) petition without an explicit mandate.

IRP processes would be more effective if regulatory commissions disallowed power procurement unless approved as part of the IRP

exercise. Currently, such a framework is not part of the power procurement or multiyear tariff regulations in Delhi, Karnataka, Madhya Pradesh, Rajasthan, and Tamil Nadu.

It must be noted that outside of the IRP, separate ad hoc ten-year demand supply assessments were submitted by discoms for approval of a thermal capacity of 660 MW in Maharashtra (FY 2019–20), 1,320 MW in Madhya Pradesh (FY 2019–20), and 294 MW in Rajasthan (FY 2021–22). These had different demand–supply trajectories and assumptions for projections. Thus, multiple projections are being submitted in various proposals (for power purchase approval, capital investment, multi-year tariff, etc.) for the same time period. This reduces trust and undermines certainty in planning.

E4.3: IRP WITH A TRANSITION-ORIENTED OUTLOOK AND CLEAR ARTICULATION OF IMPACT

A detailed IRP was not submitted in any of the ten states. Tamil Nadu provided demand–supply projections as part of their CIP. Maharashtra and Madhya Pradesh provided assessments with the power purchase approval petitions. These

plans did not account for RE deployment impacts or the role of storage. In terms of implications, the assessments did not estimate the impact on supply quality, tariffs, or the total investment requirements based on an IRP.

The IRP Is Crucial for All Procurement Decisions, Including Renewables

Between FY 2018–19 and FY 2021–22, all states added substantial renewable energy (RE) capacity, both solar and non-solar. This deployment was driven by renewable purchase obligations (RPO) targets and was not based on integrated resource planning (IRP) processes.

Even when approving thermal capacity requirements, RE projections can be considered in a more comprehensive manner to reflect state commitments and ambitions. For example, the approval orders for thermal capacity in Maharashtra, Tamil Nadu, and Madhya Pradesh had not clearly reflected RE growth for a ten-year time horizon and were restricted to medium-term RPO commitments.

The IRP should also assess the 'capacity value' of RE resources and its contribution to the peak. The IRP process should provide energy projections as well as capacity contributions of resources. This will help the states plan for specific resources to meet their requirements. Such a requirement is proposed as part of the central resource adequacy guidelines (MoP 2023a).

E4.4: COMPETITIVE BIDDING AND PUBLIC PROCESSES FOR TARIFF ADOPTION

Except for Kerala, all the states have undertaken competitive bidding for future procurement.²³ However, tariff adoption processes or approval of procurement did not take place through public consultation processes.

The Maharashtra ERC regulations clearly stipulate that public consultation will be restricted to tariff determination of cost-plus projects. The other nine states do not specify the need for public consultation. With the increasing size and scale of investments, having participatory public consultation processes for all procurement would

increase public accountability and legitimacy for the adopted tariffs. This can also be included in future regulations.

Procurement and investment decisions should be based on comprehensive IRP exercises in the future to determine medium- and long-term least-cost transition pathways. The recent national guidelines are a good start to encourage the adoption of IRP practices in the states in the context of the transition. It is hoped that state planning processes will evolve with the policy push and the techno-economic imperative.



Highlights

- The Bihar Electricity Regulatory Commission (ERC) provides a clear, robust regulatory mandate for the IRP, including ten-year demand–supply projections, which are supposed to be revised every year. Mandates for ten-year projections and annual revisions were also issued in Rajasthan and Gujarat. However, a separate integrated resource plan (IRP) exercise was not conducted by any of the studied states between FY 2017–18 and FY 2020–21.
- Power procurement by discoms in these ten states takes place without a robust and comprehensive integrated planning process. Decisions on renewable energy procurement are driven mainly by renewable purchase obligations (RPO). Between FY 2018–19 and FY 2021–22, Maharashtra, Rajasthan, and Madhya Pradesh planned for coal-based power procurement through separate ad hoc demand–supply projections.
- The recent central sector policy focus on resource adequacy and the IRP can aid the adoption of the IRP and encourage use of modelling tools and scenario building exercises to plan investments. However, there is a need to harmonise efforts, given the mandates in different policies. Planning would be complex if multiple IRP exercises are needed to be conducted as part of the Multi-Year Tariff, the resource adequacy framework, and power procurement guidelines.
- Most procurement is taking place through competitive bidding in the states. However, there is limited public consultation in matters pertaining to tariff adoption and approval for deviation from bidding guidelines. Such a measure is necessary to encourage transparency and accountability.



E5: DEMAND-SIDE MANAGEMENT



In FY 2020–21, measures towards utility-scale demand-side management (DSM) in states were few and small in scale due to limited regulatory accountability, lack of dedicated funds, and inattention from utilities.

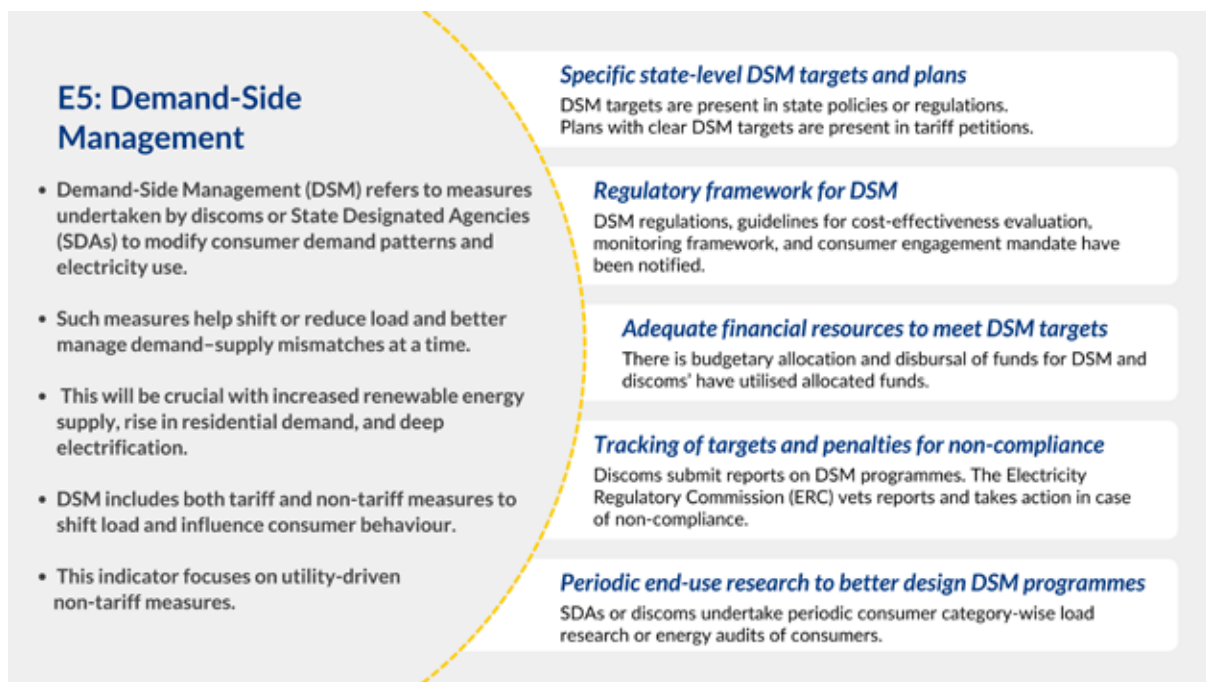
Overview

DSM measures play a crucial role in India's energy transition because they can reduce energy requirements and shift the demand in a cost-effective manner to times when low-cost RE is available. DSM includes both tariff and non-tariff measures to shift the load and influence consumer

behaviour. This indicator focuses on utility-driven non-tariff measures. Time of day (ToD) tariffs are a tariff measure that is covered in Indicator 10.

Figure 11 describes the indicator with details of its 5 attributes and their 12 sub-attributes.

Figure 11. Demand Side Management



Source: (ETPI 2023).



- In FY 2020–21, Maharashtra showed developments in areas covered in two attributes, and Kerala and Uttar Pradesh in one attribute.
- Annexure E-5 gives more details on the attributes, sub-attributes, and methodology used.²⁴
- The data collection sheets are available on the website. (<http://etpi.in>)

E5.1: SPECIFIC STATE-LEVEL DSM TARGETS AND PLANS

As of FY 2020–21, Maharashtra was the only state to have notified an Energy Conservation Policy, which it did in 2017 (GoM 2017a). One of the explicit objectives of this policy was to achieve a savings target of 1,000 MW in various sectors over a five-year period. However, in the tariff petition, the discoms did not specify any actions towards achieving this target.

Karnataka notified its Energy Conservation and Energy Efficiency Policy in 2022 (GoK 2022). The policy targets savings of 744 MU from

various sectors in Karnataka by FY 2026–27. For context, this is less than 1% of the total discom consumption in FY 2020–21.

After two decades of the Energy Conservation Act (2001), states are failing to recognise the potential of DSM and lack the ambition and commitment to scale efforts. The act was amended in 2022, which may help renew the focus on target setting, channelise resources for programmes, create incentives for implementation, and result in strong policy mandates at the state level (MoLJ 2022).

E5.2: REGULATORY FRAMEWORK FOR DSM

The ERCs in eight of the ten states (the exceptions are Kerala and Rajasthan) have provided a regulatory mandate for DSM.

Besides having a regulatory mandate for DSM, the Maharashtra and Uttar Pradesh ERCs established DSM Consultation Committees. The committee's mandate includes assisting the commission by reviewing and evaluating programmes and plans, promoting cross-learning across discoms, and conducting studies. In both these states, the committees have consumer representation.²⁵

The Maharashtra ERC was the only commission to

have notified a clear cost-effectiveness framework to evaluate DSM programmes.

However, these are nascent efforts, and the ERCs' role in nudging discoms to undertake steps towards DSM implementation remains minimal.

The Forum of Regulators (FoR) published model regulations for DSM in 2010 (FoR 2010), after which most of these states adopted these regulations. Although the notified regulations establish a broad implementation framework, the ERCs were expected to come up with detailed and effective guidelines on the cost-effectiveness

of DSM programmes and the evaluation and monitoring of approved programmes. However,

there was limited action and follow-up after the notification (FoR 2017).

E5.3: ADEQUATE FINANCIAL RESOURCES TO MEET DSM TARGETS

Eight of the ten states have no dedicated funding available from the state governments, due to lack of a policy mandate (the exceptions are Maharashtra and Kerala). Kerala State Electricity Board Limited reported an expenditure of Rs. 33 crores (0.24% of its total revenue requirement) for the implementation of its 'Filament Free Kerala'

Programme (KSEBL 2020). The Maharashtra government had disbursed at least 50% of the dedicated Rs. 800 crores (per the 2017 policy) to the Maharashtra Energy Development Agency (MEDA) by FY 2020–21,²⁶ but data were unavailable for 2021.

E5.4: TRACKING OF TARGETS AND PENALTIES FOR NON-COMPLIANCE BY SERCS

There was limited regulatory oversight and accountability of DSM activities.

In FY 2020–21, discoms in the ten states did not report the progress of DSM activities to the ERC. Given Delhi's unique consumer base and discom proactiveness, efficient lighting and demand response programmes had been implemented in the past, but DSM-specific information was absent in regulatory filings and other statutory reporting. This is probably because some of Delhi's present DSM activities fall outside the purview of regulatory scrutiny. Kerala has a large-scale

programme for replacing existing bulbs with LEDs called the 'Filament Free Kerala' scheme (KSEBL n.d.), whose progress and achievements are not reported to the regulator. Further, the Bangalore and Hubli Electricity Supply Companies in Karnataka report undertaking a few DSM-specific activities (ranging from a caller-tune-based consumer awareness notification to energy-efficient lamps for streetlights), but there is insufficient tracking of these activities. Further, apart from tracking such initiatives, the ERCs should also mandate that discoms should make these data publicly available.

E5.5: PERIODIC END-USE RESEARCH TO BETTER DESIGN DSM PROGRAMMES

The Maharashtra Energy Development Agency has been incentivising energy audits for consumers. Rajasthan had also mandated that its larger industrial consumers should conduct these audits every three years, but there is no publicly available evidence that these audits occur.

Periodic load research was not conducted in any of the ten states. The success of DSM measures largely depends on how successfully they lead to behavioural change. With every state having a different consumer mix, power purchase mix, and load profile, it is imperative that discoms

should conduct surveys/load research to assess consumer category-wise load profiles. Between 2012 and 2020, the Bureau of Energy Efficiency (BEE) had provided capacity support to discoms in a staggered manner to conduct load research studies and finalise DSM action plans (BEE n.d., BEE 2023). This seems to have been treated as an ad hoc exercise in the ten states, because there is no evidence that discoms conducted further research or load surveys after this initiative. Similar initiatives were underway in Rajasthan and Karnataka, but they have not been pursued further.²⁷ Without consumer load surveys, it would be impossible for the discoms to come up with a coherent and periodically revised action plan to

provide DSM to various consumer profiles.

DSM programmes, especially large-scale non-tariff schemes, seem to be in their nascency despite a decade-long policy push. Apart from efforts towards target setting, a comprehensive baseline should be established using disaggregated information on sales and energy input based on metered data. This should be supplemented with adequate funding, regulatory tracking/scrutiny, and participative planning and monitoring. Going forward, with the renewed focus on DSM action plans as part of the transition efforts, more progress is expected in the states.



Highlights

- Utility-scale DSM measures were absent in the ten states due to the lack of a policy and regulatory mandate as well as state-level dedicated funding at scale for DSM.
- Some developments, albeit disparate, were observed in the ten states. This includes target setting in Maharashtra and Karnataka, notification of DSM regulations in most states, and DSM programmes in Kerala and Karnataka.
- Notification of a cost-effectiveness framework in Maharashtra to assess the benefits from the implementation of DSM schemes as well as the institution of DSM consultation committees (with the participation of consumer groups) to plan and evaluate DSM programmes and conduct studies are good practices that can be adopted by other regulatory commissions.
- In the recent past, discoms, regulators, and state agencies have not been conducting DSM-specific studies or undertaking consumer category-wise load surveys. With changes in the supply mix and the heightened need to manage demand–supply uncertainties, it is important that state-level agencies should undertake consumer category-wise load surveys and demand studies that can inform DSM action plans at the national and state levels.
- With the renewed national focus on energy conservation, it is expected that states will push for strong policy and regulatory mandates. This should be followed by establishing good and publicly available data tracking and reporting practices.



E6 : FINANCIAL HEALTH OF ELECTRICITY DISTRIBUTION COMPANIES



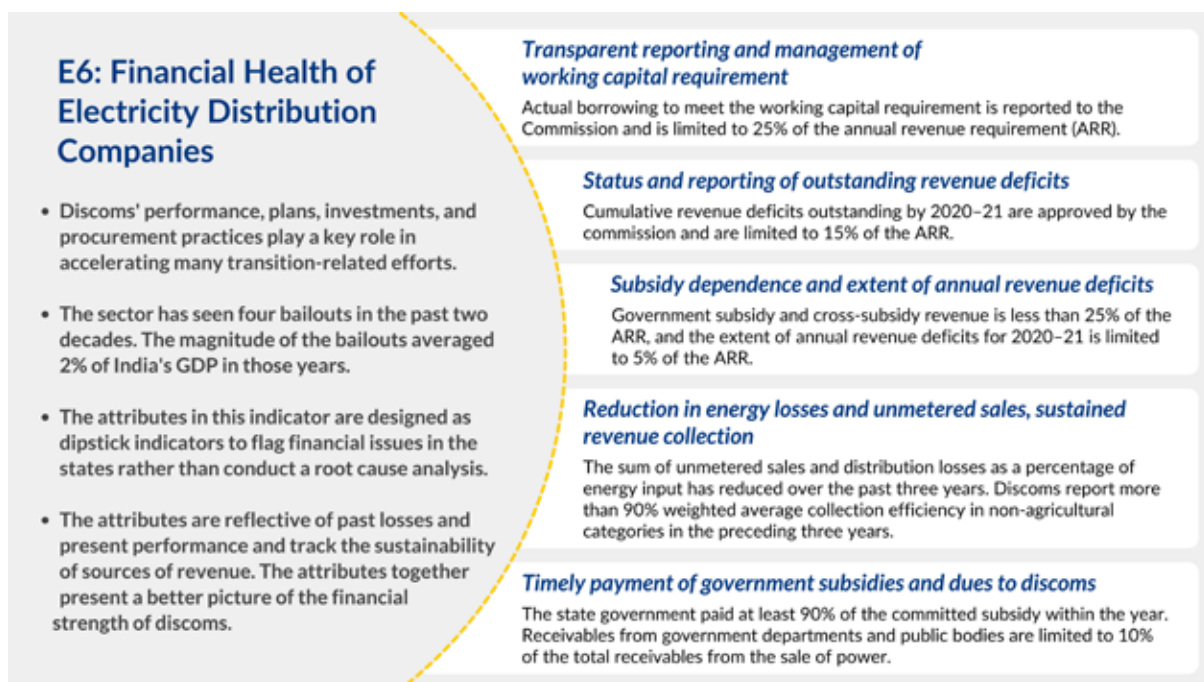
Despite multiple bailouts, the poor financial health of discoms continues to be a complex challenge due to legacy issues and ongoing inefficiencies in planning and operation.

Overview

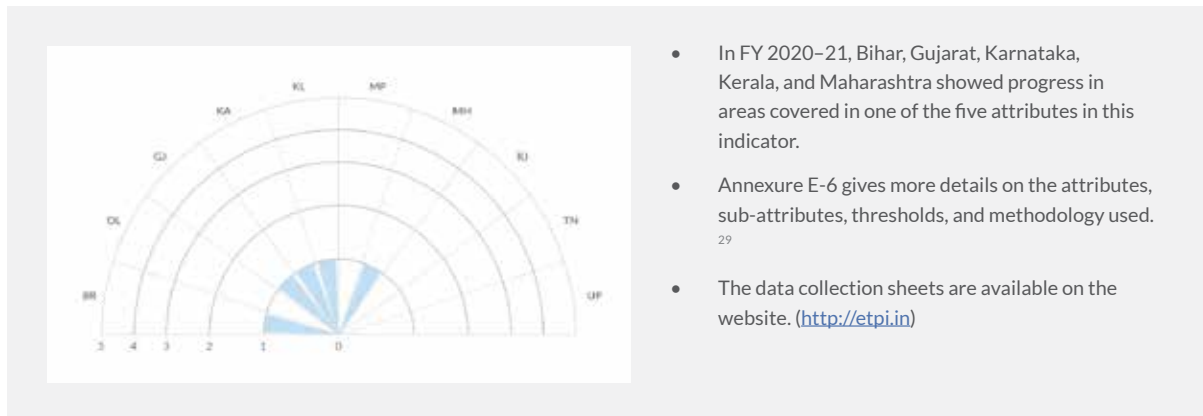
As of FY 2020–21, five years since the last bailout in the electricity sector, discoms in India had accumulated losses of about Rs. 5.16 lakh crores.²⁸ These losses have also been rising at 7% per annum since 2015–16. Five states that are

a part of the study – Tamil Nadu, Uttar Pradesh, Rajasthan, Madhya Pradesh, and Maharashtra – contributed to 67% of the total outstanding national losses.

Figure 12. Financial Health of Electricity Distribution Companies



Source: (ETPI 2023).



- In FY 2020–21, Bihar, Gujarat, Karnataka, Kerala, and Maharashtra showed progress in areas covered in one of the five attributes in this indicator.
- Annexure E-6 gives more details on the attributes, sub-attributes, thresholds, and methodology used.²⁹
- The data collection sheets are available on the website. (<http://etpi.in>)

Figure 12 describes the indicator with details of its five attributes and their ten sub-attributes.

As a regulated cost-plus business, discoms have regulatory and financial accounts that track aspects of their financial status. Each attribute in this

indicator captures various signs or symptoms of legacy losses and challenges, tracks parameters that indicate the current performance, and checks actions towards increased accountability for poor financial performance. All of these need to be seen together to assess the overall health of the discoms.

E6.1: STATUS AND REPORTING OF OUTSTANDING REVENUE DEFICITS

Two of the ten states, Gujarat and Karnataka, have reported cumulative revenue gaps of less than 5% of their ARR. Figure 13 shows that the build-up of revenue gaps in Tamil Nadu, Rajasthan, Uttar Pradesh, Kerala, and Maharashtra is of particular concern. Cumulative revenue gaps, also called regulatory assets in some states, are past revenue deficits of the discom along with interest costs approved by the regulator for recovery from future tariffs. Revenue deficits occur due to significant expenses (perhaps due to planning and operational inefficiencies) and the inability of revenue increases to keep pace with the rise in costs (due to limits to tariff increase, subsidy support, etc). Cumulative revenue gaps indicate

financial issues and are also a major driver of the interest cost burden on consumers. In Delhi, the figures for cumulative revenue gaps were not available, because the true-up process was not conducted for FY 2020–21 even by June 2023. Cumulative revenue gaps are neither recorded nor approved by the ERCs in Bihar and Madhya Pradesh. As a regulatory practice, recovery of past revenue gaps and the interest cost burden from future tariffs is disallowed. At the same time, this practice also curtails regulatory action to address the build-up of losses and the interest cost burden and to acknowledge the financial challenges confronting the discom.

Cumulative Losses and Cumulative Revenue Gaps

Cumulative losses are the outstanding losses of the discom based on their financial accounts, whereas cumulative revenue gaps are based on regulatory accounts and are allowed to be recovered from future tariffs. Because the outstanding losses of each discom are compiled and reported by the Power Finance Corporation (MoP 2022b), we could compare the cumulative losses and revenue gaps across states, as shown in Figure 13.

The cumulative losses in six of the ten states are comparable to their annual revenue requirement, indicating the extent of legacy financial challenges. These states also have substantial revenue gaps. State governments in Rajasthan, Tamil Nadu, and Uttar Pradesh have even agreed to take over discom losses starting FY 2022–23, which should reduce the immediate burden on discoms.

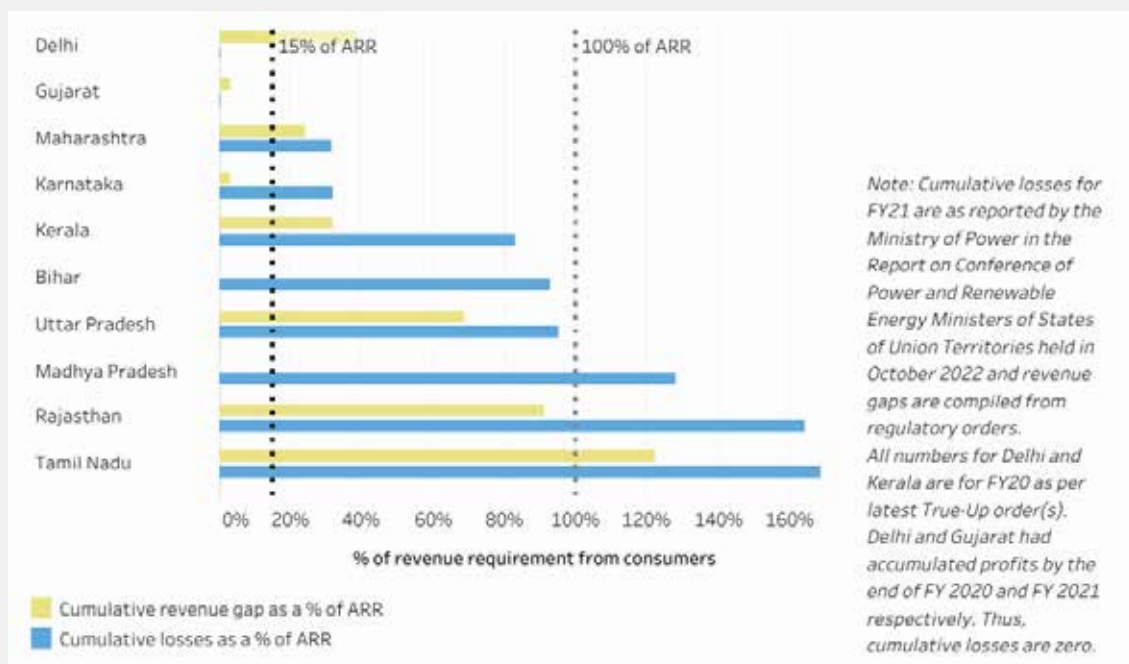
It must be noted that the Bihar and Madhya Pradesh ERCs disallow previous year revenue gaps during true-ups though the discoms have substantial cumulative losses.

Gujarat was the only state with low losses and revenue gaps. The state's experience in containing losses and revenue gaps (as well as liabilities) is due to significant equity infusion and capital expenditure grants provided by the state government for decades (CAG 2020) and needs to be studied.

In Kerala and Karnataka, the cumulative losses are much higher than the revenue gaps, which indicates significant costs disallowed by the ERCs for recovery from consumers.

The difference between revenue gaps and losses in the states also underscores the need for the regulator and state governments to track both to ascertain the financial strength of the discoms.

Figure 13. Outstanding Revenue Gap and Losses as a Percentage of DISCOM ARR for FY 2020-21



Source: The authors' analysis based on regulatory filings and the Power Finance Corporation report (PFC 2022) on the performance of power utilities.

E6.2: TRANSPARENT REPORTING AND MANAGEMENT OF WORKING CAPITAL REQUIREMENT

Kerala and Maharashtra were the two states where discoms reported the extent of actual working capital borrowing to the regulators and managed to restrict such borrowing to less than 25% of the ARR. Rajasthan discoms also reported this information, but their borrowing exceeded the 25% limit prescribed under the UDAY scheme for working capital borrowing.

More than 95% of the Rs. 2.4 lakh crore of past liabilities taken over by state governments under the UDAY scheme (the 2015 power sector bailout) was to address working capital borrowing.³⁰ Despite its importance, the dependence on working capital borrowing was not captured consistently (see Table 2).

Table 2. Extent of Working Capital Borrowing and Issues with Reporting by Discoms for FY 2020-21

State	Borrowing as a Percentage of the annual revenue requirement	Reported as	Reported in
Kerala	8%	Working capital loan or borrowing	Regulatory filings
Maharashtra	17%		
Rajasthan	27%		
Madhya Pradesh	Reported by East discom		
Karnataka	Reported by Hubli Electricity Supply Company		
Delhi	3%	Short-term liabilities/ working capital demand loans/current borrowings	Annual report in compliance with the Companies Act, 2013
Bihar	8%	Working capital borrowing	
Karnataka	18%	Short-term borrowing	
Tamil Nadu	31%	Borrowing under current liabilities	
Uttar Pradesh		Not reported	
Gujarat			

Source: Compiled by the authors based on regulatory filings and annual reports of discoms for FY 2020-21.

Reporting of Actual Borrowing by Discoms to Meet Working Capital Requirements

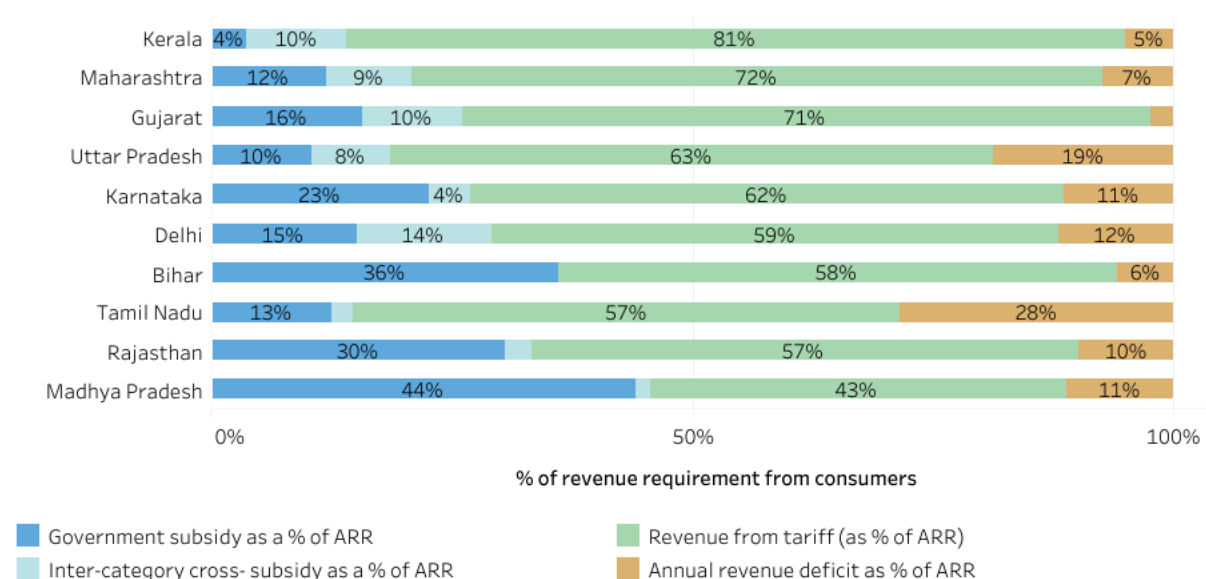
Although all ERCs allow for working capital borrowing in the tariff orders, this is estimated on a normative basis with the intention of limiting the interest burden on consumers. There is limited scrutiny of the actual working capital borrowing of discoms. Discoms in Rajasthan and Maharashtra report detailed information on the status, repayment, and build-up of working capital borrowings along with interest payments to the regulator. Detailed lender-specific information was also sought by the regulators in Madhya Pradesh and Karnataka, but only a few discoms complied.

Working capital borrowing was also reported in the annual financial audit reports of the discoms, but there is wide variation in practices followed.³¹ Disaggregated details are not provided, making it challenging to vet information. Even so, the reports show that Tamil Nadu has borrowings at unsustainably high levels. Karnataka, which has low cumulative revenue deficits, has a relatively high working capital borrowing. This indicates that the inefficiencies of the discoms are not financed through revenue recovery from consumers but through short-term borrowing.

E6.3: DISCOMS' SUBSIDY DEPENDENCE AND EXTENT OF ANNUAL REVENUE DEFICITS

The extent of subsidy dependence and the level of annual revenue deficits in the ten states for FY 2020–21 is shown in Figure 14, and the details are provided in Box 1.

Figure 14. Overview of Revenue Sources of DISCOMs for FY 2020-21



Note: Revenue from tariffs includes consumer contribution to tariffs and intra-category cross subsidy, if any.

Source: Compiled by the authors from tariff orders and other regulatory filings.

Box 1. Revenue Sources of Assessed Discoms

Depending on the tariff design, discoms obtain revenue from subsidies or tariffs. For categories that pay more than the cost of supply, their tariffs have a cross-subsidy component. The cross-subsidy can be inter-category (e.g., industrial consumers cross-subsidise residential consumers) or intra-category (e.g., residential consumers in higher consumption slabs cross-subsidise those in lower slabs). Inter-category cross-subsidies contribute 3% or less to the revenue requirement in Tamil Nadu, Rajasthan, Bihar, and Madhya Pradesh. However, the contribution was higher than 10% in Gujarat, Kerala, and Delhi.

It is pertinent to note that the contribution of government subsidies to the revenue requirement was substantially higher than the cross-subsidy in all states except Kerala. The role of government subsidies was notably high in Karnataka, where almost a quarter of the revenue requirement is met via subsidies, and in Rajasthan (30%), Bihar (36%), and Madhya Pradesh (>40%). In these states, perhaps due to their sales mix and a significant share of agricultural and domestic consumers, the share of inter-category cross-subsidy is negligible, and the dependence on government subsidies is unsustainably high.

In FY 2020–21, the average per unit revenue requirement of all the discoms in India exceeded the average per unit revenue obtained from consumers and subsidies by about 10% (i.e., the revenue deficit was Rs. 0.74/unit) (PFC 2022). Since FY 2015–16, this gap has been rising at 6% per annum. The annual revenue gaps were higher than 10% of the revenue required in six of the ten states. It was the lowest in Gujarat. By FY 2020–21, Tamil Nadu had not revised its tariffs for seven years, resulting in a 28% revenue gap.

An overview of the revenue sources of the discoms as well as the unmet revenue requirement is presented in Figure 13. In seven of the ten states, subsidy and annual revenue gaps accounted for about 40% of the revenue required by discoms; in Madhya Pradesh, this figure was 57%.

High dependence on inter-category cross-subsidy may not be sustainable if consumers migrate to alternative supply options and dependence on government subsidy is contingent on the state government's capacity to ensure timely payments of subsidies.

E6.4: REDUCTION IN POWER LOSSES AND UNMETERED SALES AND IMPROVED COLLECTION OF REVENUE

In FY 2020–21, Delhi and Tamil Nadu showed a consistent reduction in unaccounted energy (that is, the sum of the distribution losses and unmetered sales) as a percentage of the total energy required. For non-agricultural categories, the collection efficiency was reported to be consistently higher than 90% in Maharashtra, Karnataka, Gujarat, and Rajasthan. However, no state was able to demonstrate a reduction in unaccounted energy along with high revenue collection efficiencies over a sustained period.

Most states have certain consumer categories that are unmetered or poorly metered. Due to poor metering and energy accounting, there is a tendency for discoms to report power losses as consumption in these unmetered/poorly metered categories. Therefore, a reduction in both unmetered consumption and losses is required to demonstrate an improvement in operational efficiency. Maharashtra and Karnataka registered a marginal year-on-year increase in unaccounted energy for three years – from FY 2018–19 to FY

2020–21 – whereas Uttar Pradesh, Bihar, and Rajasthan data showed sharp rises and reductions over the three-year period.

Delhi reported collection efficiencies that were slightly lower than 90% in FY 2020–21, possibly due to the impact of COVID-19 lockdowns and delays in bill payments. Collection efficiencies

were also lower in Bihar when the combined collection efficiencies of both utilities were considered. Consumer-category-wise collection efficiencies were not reported in Tamil Nadu, Kerala, and Uttar Pradesh and not consistently across all discoms in Madhya Pradesh.

E6.5: TIMELY PAYMENT OF GOVERNMENT SUBSIDIES AND DUES TO DISCOMS

About 41% of discoms' revenue requirement was met via government subsidy in Bihar, and yet, the Bihar government ensures timely payment of subsidy. Pending dues from public bodies to Bihar discoms were not substantial. The Bihar government's payment discipline with discoms is a good practice that should be explored further.

Tables 3 and 4 present the extent of pending government subsidy payments and pending dues

in the ten states for FY 2020–21. Subsidies are paid without a significant³² delay except in the cases of Maharashtra, Rajasthan, and Madhya Pradesh. This is a positive trend because delays in subsidy payments were a significant issue across states even three to five years ago. At the same time, ensuring timely payment of dues from public bodies seems to be a challenge across states and needs to be addressed urgently.

Table 3. Pending Subsidy Payment to DISCOMs for FY2020-21

State	Pending Subsidy Payment as a Percentage of Subsidy Committed (%)
Gujarat	0% pending payments
Kerala	
Tamil Nadu	
Uttar Pradesh	
Karnataka	6%
Delhi	8%
Bihar	9%
Maharashtra	14%
Rajasthan	23%
Madhya Pradesh	29%

Source: Compiled by the authors based on regulatory filings of discoms and the Power Finance Corporation report (PFC 2022) titled Report on Performance of Power Utilities 2020–21.

Table 4. Pending Dues from Public Bodies to Discoms by end of FY 2020-21

State	Pending Dues from Public Bodies as a Percentage of Total Dues from Sale of Power (%)
Bihar	7%
Karnataka	11%
Maharashtra	11%
Rajasthan	24%
Delhi	29%
Kerala	33%
Uttar Pradesh	50%
Gujarat	
Madhya Pradesh	Data not available
Tamil Nadu	

Source: Compiled by the authors based on regulatory filings and annual financial audit reports of the discoms.

The Ministry of Power reported that as of August 2022, dues from government departments and local public bodies to discoms for the sale of power stood at Rs. 65,300 crores. This is comparable to the pending payments by the discoms to all the generators at on July 2023.³³ Thus, the scale of the issue is significant enough to merit a call for concerted action on this front at the central and state levels. Resolving the issue is also complex because disconnecting the supply to public bodies for pending dues in accordance with the law would be challenging as these consumers provide essential public services. Even in the case of pre-paid metering for government services, it is not clear if disconnecting the supply to an essential service is possible if recharge is not done. Instead, to prevent future build-up of dues, innovative measures such as virtual net metering for public bodies can be introduced to reduce the bills of these consumers (PEG 2021b).

Our study shows that outstanding and annual losses, the extent of working capital borrowing, dependence on subsidy, and the payment

discipline of the government are all important and interconnected signs of the financial stress discoms are subject to. Tracking the financial viability of discoms is a complex exercise due to multiple reporting conventions; the differing objectives of regulatory and financial accounting; variations in the sales mix, revenue models, and cost structures; and dependence on debt. For example, some discoms may have low revenue gaps but high losses, or low losses but an unsustainable dependence on subsidies. To get a complete picture, it is necessary to track all these parameters. Further, to address the challenge, medium-term actions and long-term plans are required.

Crucial energy transition initiatives (such as RE and storage deployment, solarising agriculture, improved metering, and dynamic tariffs) need to be undertaken even if financial viability is a challenge. However, these initiatives will have more traction if they also address the financial challenges confronting discoms.

Highlights

- Gujarat is the only state where the cumulative revenue gaps and losses were within manageable levels. The outstanding losses in Tamil Nadu, Uttar Pradesh, Rajasthan, Madhya Pradesh, and Maharashtra contribute to 67% of the national cumulative losses, which stood at Rs. 5.16 lakh crores as of FY 2020–21 end.
- Despite being the driver for the UDAY bailout in 2016, working capital borrowing is not reported or tracked consistently in seven of the ten states: Maharashtra, Rajasthan, and Kerala were the exceptions in FY 2020–21.
- On an aggregate basis, annual revenue gaps, inter-category cross-subsidy, and subsidy account for about two-fifth of the revenue required in seven states (the exceptions were Kerala, Maharashtra, and Gujarat). This points to a lack of sustainability in the revenue sources of discoms.
- The share of inter-category cross-subsidy is less than 10% in seven states, whereas government subsidies contribute to more than 15% of the revenue in six states.
- The annual revenue gaps were higher than 10% of the revenue requirement in six states. They were highest in Uttar Pradesh and Tamil Nadu.
- With substantial subsidy dependence, a positive development is that government subsidy payments are made on time in seven states. At the same time, dues from public bodies are rising and are comparable to the dues of discoms to generators for power procured at the national level.
- With loss reduction measures, mostly metered consumers, and low agricultural demand, Delhi was able to demonstrate a reduction in both sales to unmetered/poorly metered categories and distribution losses. Tamil Nadu also registered a marginal reduction, which is commendable given that it has significant agricultural and unmetered demand. For non-agricultural categories, the collection efficiency is reported to be consistently higher than 90% in four states.



E7 : ELECTRICITY DEMAND AND SUPPLY FOR AGRICULTURE



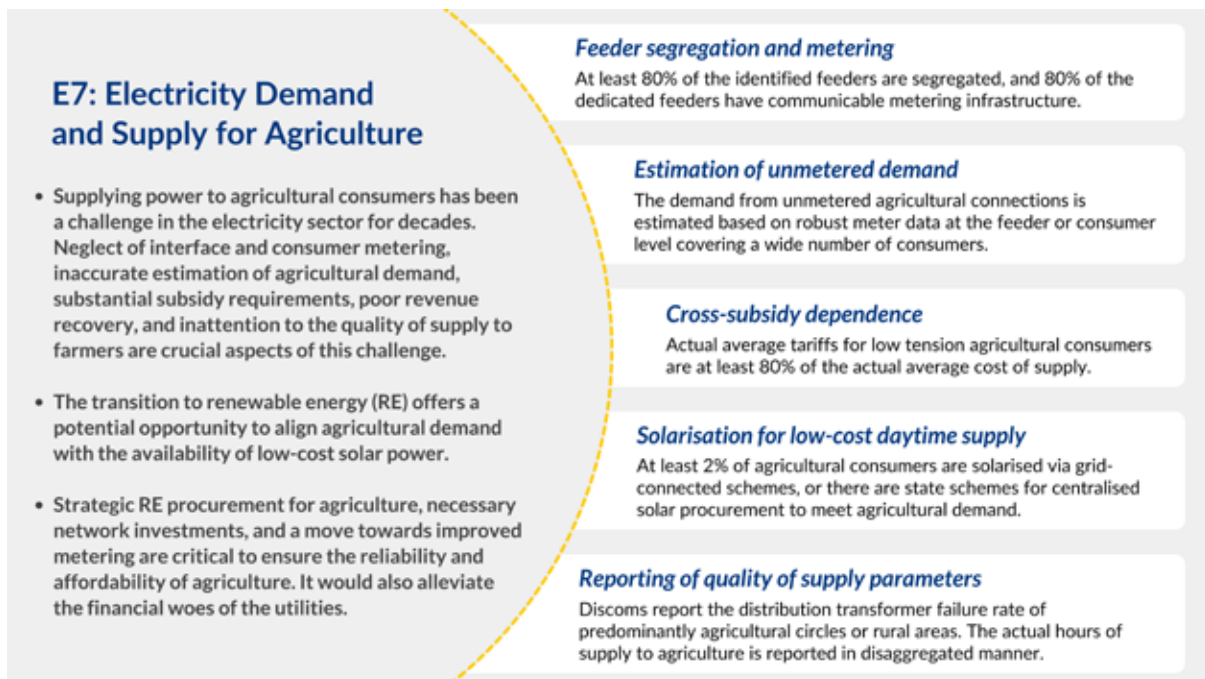
Some states have attempted to address persistent challenges related to agricultural supply through feeder separation, solarization for dedicated daytime supply, improvements in metering, and tariff design. However, accountability for the quality of supply continues to be largely neglected.

Overview

Agricultural electricity demand accounted for about a fifth of sales nationally in FY 2020–21 and is the recipient of the bulk of the electricity subsidies (CEA 2021, CEA 2022b). To address the challenges in this segment, investments were undertaken in central and state schemes that

can potentially facilitate several innovations to improve the quality of supply, reduce subsidy requirements, and improve energy accounting. Figure 15 describes the indicator with details of its five attributes and their eight sub-attributes.

Figure 15. Electricity Demand and Supply for Agriculture



Source: (ETPI 2023).



- In FY 2020–21, Maharashtra and Delhi showed developments in areas covered in two attributes, and Rajasthan, Madhya Pradesh, Kerala, Karnataka, and Gujarat in one attribute.
- Annexure E-7 gives more details of the attributes, sub-attributes, and methodology used.³⁴
- The data collection sheets are available on the website. (<http://etpi.in>)

The focus on Kerala and Delhi will be less in this indicator because the proportion of agricultural

sales in these states is negligible at 1.8% and 0.2%, respectively.

E7.1: STATUS OF FEEDER SEGREGATION AND METERING

Maharashtra reports that more than 80% of the identified feeders are separated. Of the segregated feeders in Maharashtra in 2019, about 96% of them are reported to have communicable metering infrastructure (either Automated Meter Reading [AMR] or Advanced Metering Infrastructure [AMI]) to enable regular capture of data without manual intervention.

In 2021, the BEE issued regulations for the Conduct of Energy Audit in discoms (BEE 2021). According to the regulations, annual and periodic (quarterly) audit reports are to be publicly reported by the discoms. Karnataka's discom filings show that 95% of the identified feeders are segregated, but AMR/AMI metering of agricultural feeders has not been reported. Other states have been reporting³⁵ feeder segregation status in their regulatory filings to the BEE, as shown in Table 5. Tamil Nadu has only recently begun investments in feeder segregation but reports 100% AMR/AMI metering of the few separated feeders. Bihar has successfully separated a large number of feeders in recent years, but these efforts would need to be continued in the coming years with rapid electrification of diesel pump sets.

Gujarat and Madhya Pradesh, similar to Maharashtra, have invested in feeder separation for decades and reported significant coverage in the past, but they have not reported the current status. Rajasthan has had sustained programmes for decades, but progress seems to be slow. Pilots towards virtual feeder segregation (where instead of physical segregation there is remote monitoring and smart metering at the distribution transformer [DT] level) are underway in the state (JVNL n.d.).

Despite the mandate for reporting feeder-level AMR/AMI metering status as part of the BEE energy audit regulations, consistent information is not available in most states. Non-compliance in mandatory reporting also makes it impossible to showcase good practices and progress. In Bihar and Karnataka, some discoms are more proactive and consistent in reporting than others, showing that there is potential for learning not just across states but also between discoms within a state.

Table 5. Separation of Predominantly Agricultural DISCOM Feeders for FY 2020-21

State	Bihar	Uttar Pradesh	Rajasthan	Tamil Nadu
Percentage of separated feeders in FY 2021 from those identified as predominantly agricultural feeders (%)	65%	43%	37%	2%

Source: Compiled by the authors based on regulatory filings to the Bureau of Energy Efficiency (BEE).

E7.2: ESTIMATION OF AGRICULTURAL DEMAND IN REGULATORY ORDERS

Maharashtra is the only state where the ERC revised the consumption norm in the past five years based on consumer surveys and metered data through a detailed, rigorous exercise. The ERC constituted a working group to devise a methodology for estimation (MERC 2020a). Based on the working group study, which relied on AMR/AMI readings as well as consumer survey data, the commission re-stated the agricultural consumption

from the Maharashtra discom's proposed figure of 33 BU to 25 BU (a 25% reduction from the claim), thus reassessing distribution losses from 14.7% to 20.5% in FY 2019. Agricultural consumers are metered in Kerala and Delhi; thus, their consumption is measured in a manner similar to that of other consumers, eliminating the need to estimate the demand.

Agricultural demand estimation by Electricity Regulatory Commissions

Due to poor metering at the consumer level, agricultural demand is typically estimated based on ERC-approved norms. The norm used impacts the estimation of subsidies, distribution losses, and power procurement. As detailed in Table 6, among the states with significant agricultural consumption,³⁶ only Maharashtra has revised its agricultural consumption norms in the recent past. Other states have not revised their norms in at least over a decade.

Table 6. Basis of Agricultural Demand Estimation in Various States for FY 2020-21

State	Details of Agricultural Demand Estimation
Maharashtra	Norm revised in 2020 based on working group report using AMR/AMI data and a survey of 1.3 lakh consumers
Tamil Nadu	Norm based on study of 5% of consumers in FY 2011-12
Rajasthan	The number of metered consumers reported is high, but the actual metering status has not been verified or validated with a third-party study. The unmetered consumption norm has not been revised since 2006.
Karnataka	Estimation is based on metered feeder input data (not AMR/AMI), assuming 10% sub-feeder losses.

State	Details of Agricultural Demand Estimation
Uttar Pradesh	Based on the ERC's norm, which was approved in 2016. The norm is not based on a study.
Madhya Pradesh	The benchmark consumption norm has not been revised since at least FY 2012-13.
Gujarat	The same norm has been in force since 1999. It is based on the P.K Mishra Committee report, which relied on data from 4,000 metered consumers.
Bihar	The Multi Year Tariff regulations have very specific provisions for a detailed study to be undertaken for estimation of unmetered agricultural demand using survey and feeder metering data each year (BERC 2018b). However, no such study has been conducted in recent years.

Source: Compiled by the authors based on regulatory filings and annual financial audit reports of the discoms.

Despite early investments in feeder segregation and feeder metering, efforts for norm revision have not been undertaken in Gujarat, Karnataka, Madhya Pradesh, and Rajasthan. However, the ERCs in Madhya Pradesh, Rajasthan, and Karnataka have issued repeated directives to use AMR/AMI data to estimate agricultural demand. Such proactive steps are necessary and should lead to the commissioning of independent studies by the ERCs for demand estimation.

The Bihar ERC even has specific provisions in their regulations requiring such a study to be conducted every year. This is a practice that can be adopted by the other states. The existing mandate should be exercised by the Bihar ERC to ensure that a study is conducted in the state.

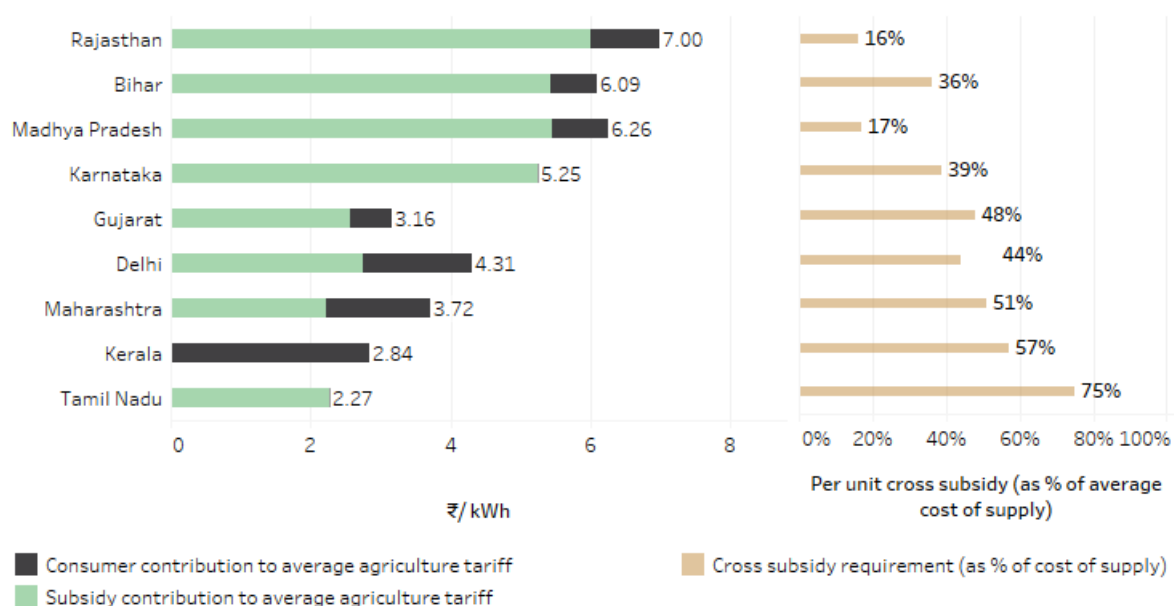
E7.3: EXTENT OF SUBSIDY AND CROSS-SUBSIDY SUPPORT TO AGRICULTURAL CONSUMERS

Figure 16 shows that the tariffs charged in Rajasthan and Madhya Pradesh³⁷ are already in line with the recommendation in the National Tariff Policy to limit cross-subsidy to 20% of the average cost of supply (ACoS).³⁸ Although the tariffs are relatively high in these states, consumer contribution to the tariffs is less than Rs. 1/unit, implying that about 85% of the contribution to the tariff is from subsidies. This is significant for Rajasthan and Madhya Pradesh because agriculture contributes as much as 40% of the consumption (PFC 2022).

Consumer contribution and cross-subsidies to agriculture play a larger role in Maharashtra

than in other states. In fact, among the states with significant agricultural demand, consumer contribution is highest in Maharashtra at Rs. 1.8/unit. Though challenges related to revenue recovery exist, the consumer contribution signals a culture of payment, which reduces the subsidy requirement to some extent.

The share of subsidies in providing tariff support is very high in Karnataka and Tamil Nadu, where agricultural consumers get free power. In Karnataka, the cross-subsidy requirement was only 39% of the ACoS in FY 2020-21.

Figure 16. Extent of Subsidy and Cross-Subsidy Required and Consumer Contribution for Agriculture³⁹

Source: Compiled by the authors from tariff filings and orders.

E7.4: SOLARISATION OF AGRICULTURAL SUPPLY

In FY 2020–21, Karnataka and Gujarat undertook centralised RE procurement to shift the substantial agricultural load under state-level schemes.

About 1.48% of the total agricultural consumers were supplied power under the state feeder-level solar scheme in Maharashtra. However, significant progress has occurred since then, with the state even launching a scheme for procuring 7,000 MW of capacity to solarise 30% of its agricultural feeders by 2025 (Phadke 2023).

Decentralised grid-connected schemes covered 0.23% of agricultural consumers in Gujarat under its state scheme. In Rajasthan, 0.07% of agricultural consumers were covered under the implementation of the Kisan Urja Suraksha evam

Utthaan Mahabhiyan Yojana (KUSUM) scheme. The Government of India's KUSUM scheme seeks to install 10 GW of decentralised megawatt-scale plants at the feeder level and solarise 15 lakh grid-connected pumps by FY 2025–26. Besides Rajasthan, limited progress was reported under the scheme in other states for FY 2020–21. Maharashtra, Karnataka, and Gujarat had state schemes for solarisation before the launch of KUSUM in FY 2020–21.

Agricultural solarisation reduces the dependence on subsidy and cross-subsidy by substantially reducing the cost of supply. Centralised and decentralised grid-connected schemes designed to provide daytime solar power also accelerate RE deployment with minimal grid integration costs.

E7.5: REPORTING OF QUALITY OF SUPPLY AND SERVICE TO AGRICULTURAL CONSUMERS

This attribute checks if states have been publicly reporting information on the rate of failure of DTs and hours of supply to rural circles or agriculture-dominated areas. Despite regulatory directives in Madhya Pradesh to report disaggregated data on the DT failure rate, this information is available only for East discom for FY 2021–22.

There is wide variation in the hours of supply committed⁴⁰ to agricultural consumers, ranging from 18 hours in Uttar Pradesh, 12 in Maharashtra to 10 hours in Madhya Pradesh, 8 hours in Gujarat, and 6 hours in Karnataka. However, except in Gujarat, there is limited reporting of the actual hours of supply to agriculture at the feeder level on a periodic basis. In Gujarat, all the discoms report average hours of supply to agriculture at the discom level as part of their regulatory filings. The Maharashtra discom reports 11 kV feeder level outage data on a monthly basis, which also includes agricultural feeders.⁴¹ Thus, data on the hours of supply are available at the feeder level in Maharashtra for each month. Similar reporting has also been initiated by the Karnataka discoms in 2022.⁴²

Simultaneous and continued investments in feeder separation and AMR/AMI infrastructure have helped Maharashtra initiate several innovations to address long-standing issues. Some of these include the following:

- The launch of a state scheme in 2017 (GoM 2017b) towards solarization of dedicated agricultural feeders, which was adapted as part of the KUSUM scheme launched in 2020 (MNRE n.d.).
- Estimation of agricultural demand based on detailed feeder-level AMR/AMI-based input data (MERC 2020b).
- Pilots for feeder-based group metering (MERC 2023) and billing where feeder energy input is used to bill consumers on a pro-rata basis depending on the connected load of each consumer. Details on the effectiveness of the scheme and its implementation challenges will be available after the pilot.
- Regulatory directives towards reporting AMR/AMI data, agricultural consumer mapping, and addressing issues with overloading of feeders in a time-bound manner.
- Regular public reporting of feeder-level outages and periodic feeder loading.⁴³

States that have undertaken feeder segregation and metering such as Karnataka, Gujarat, Rajasthan, and Madhya Pradesh can adopt some of these approaches. Similarly, states such as Bihar, Tamil Nadu, and Uttar Pradesh can initiate efforts towards feeder segregation and AMR/AMI metering of feeders by utilising funds under the centrally sponsored Revamped Distribution Sector Scheme (RDSS) announced in July 2021 (MoP 2021b).

Highlights

- Feeder segregation and the use of communicable AMR/AMI metering infrastructure at the feeder level enables innovation to address several persistent challenges. For example, in Maharashtra, these actions enabled the reassessment of unmetered agricultural demand, early efforts towards dedicated, decentralised daytime supply to farmers, and pilots for feeder-meter-based group billing of consumers.
- States that have made early investments in segregation (Madhya Pradesh, Rajasthan, Karnataka, and Gujarat) should continue to accelerate efforts and adopt innovative measures as Maharashtra has done.
- Bihar discoms, especially SBPDCL, have reported progress in segregation in a short period of time. Their experience can offer lessons to Uttar Pradesh and Tamil Nadu, who have initiated efforts more recently.
- Rajasthan and Madhya Pradesh have agricultural tariffs that are higher than 80% of the average cost of supply (ACoS), thus substantially limiting the cross-subsidy requirement. Even when regulated tariffs were close to the ACoS, farmers paid about Rs. 1 per unit on average for FY 2021 in the studied states. Thus, the subsidy contribution is substantial. Perhaps strategies to reduce the cost of supply should be the focus.
- Large-scale, grid-connected solar schemes (both with centralised and decentralised procurement) were in their nascency in FY 2020–21 with Maharashtra, Karnataka, Gujarat, and Rajasthan leading the way. Given their potential to reduce the cost of supply and improve the quality of supply, accelerated efforts towards early adoption and addressing implementation issues from ongoing experience are the key.
- There was wide variation in the hours of supply committed to agricultural consumers, ranging from 18 hours in Uttar Pradesh to 6 hours in Karnataka. However, there is limited periodic tracking of the actual hours of supply to agriculture at the feeder level. Some efforts towards reporting feeder-level outages are underway in Maharashtra and Karnataka.



E8: AFFORDABILITY AND RELIABLE SUPPLY FOR SMALL CONSUMERS



Some states are taking steps towards providing concessional tariffs to small residential consumers and enterprises. However, more attention needs to be paid to regulatory accountability for supply and service quality.

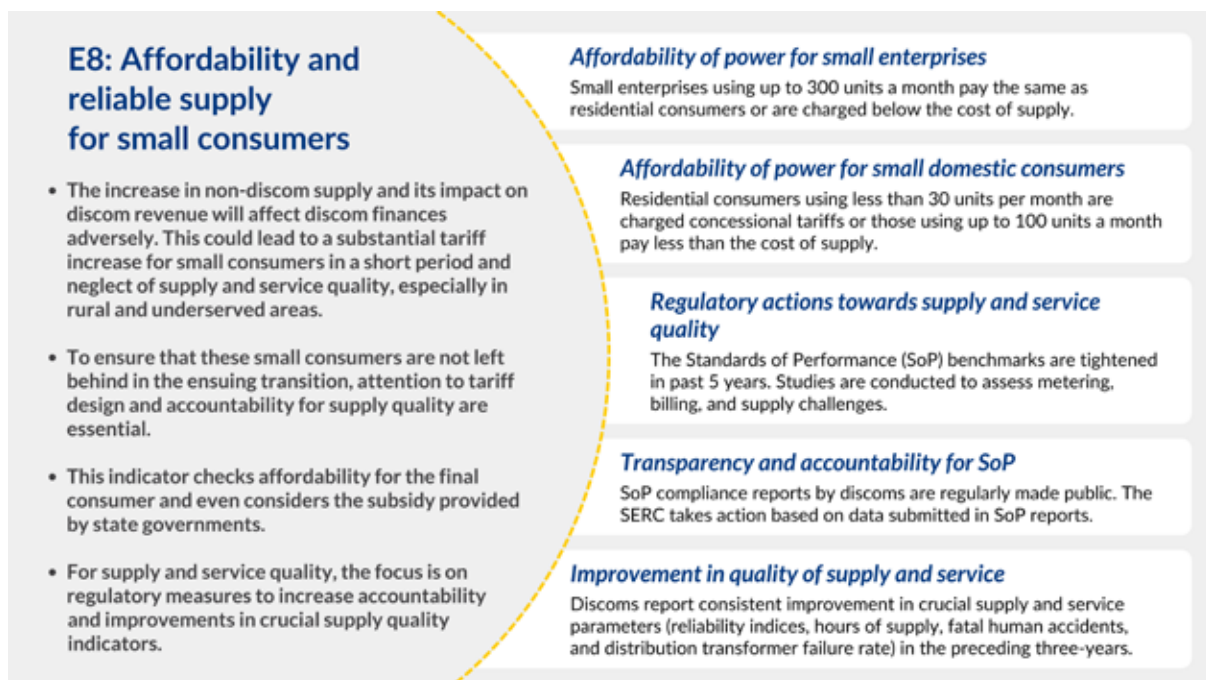
Overview

In FY 2020–21, it cost discoms in India Rs. 7.61 on average to supply 1 unit of power to its consumers (PFC 2022). With limits to obtaining cross-subsidy revenue from other consumers and the strain on discom finances, small consumers may see a

significant increase in their tariffs or deficient supply and service quality.

Figure 17 describes the indicator with details of its 5 attributes and their 12 sub-attributes.

Figure 17. Affordability and Reliable Supply for Small Consumers



Source: (ETPI 2023).



- In FY 2020–21, Maharashtra showed developments in areas covered in two attributes, and Karnataka, Madhya Pradesh, Tamil Nadu, and Uttar Pradesh in one attribute.
- Annexure E-8 gives more details on the attributes, sub-attributes, and methodology used.⁴⁴
- The data collection sheets are available on the website. (<http://etpi.in>)

E8.1: AFFORDABILITY OF POWER FOR SMALL DOMESTIC CONSUMERS

Domestic consumers who use 30 units per month or less than 100 units per month have basic electricity needs.⁴⁵ According to the National Electricity Policy, a minimum consumption of 1 unit per day (30 units per month) should be provided as merit goods to all households (MoP 2005). According to the National Tariff Policy, Below Poverty Line (BPL) consumers with less than the minimum consumption per the National Electricity Policy will have tariffs of at least 50% of the ACoS (MoP 2016).

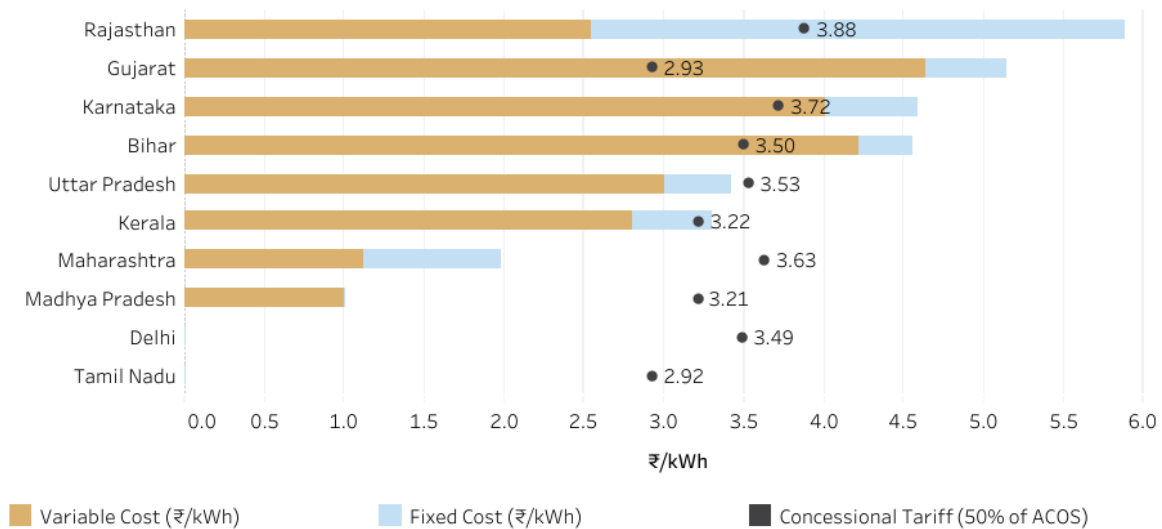
Between 2011 and 2019, 140 million households were electrified in India.⁴⁶ Affordable power supply, at least for 30 units as prescribed in national policies, is essential to ensure that these ‘electrically poor’ consumers⁴⁷ can retain their electricity connections.

Figure 18 compares the tariff paid by consumers with the concessional tariff prescribed by the National Tariff Policy at 50% of ACoS. Five states – Uttar Pradesh, Maharashtra, Madhya

Pradesh, Tamil Nadu, and Delhi – provide concessional tariffs to all domestic consumers (even those without BPL cards) who use less than 30 units per month.

For consumers using about 100 units per month, seven states charge tariffs at less than 80% of the ACoS. In sharp contrast, Uttar Pradesh and Rajasthan charge these consumers more than the ACoS, mostly due to the high fixed charges component in the tariff. Thus, rather than receiving tariff support, these consumers cross-subsidised the other consumers. In FY 2020–21, Karnataka was the only state where consumers using 100 units were charged at about 10% less than the ACoS. Thus, the cross-subsidy provided was within the 20% limit prescribed by the National Tariff Policy. Since FY 2020–21, subsidies have increased in Karnataka, and this 20% limit no longer seems to hold. It must be noted that in many cases, concessional tariffs were due to government subsidy in the other states in FY 2020–21.

Figure 18. Cost of Electricity for Consumers using 30 Units per Month (Rupees/Unit, in FY 2020-21)



Note: Delhi and Tamil Nadu offer free power to small residential consumers through state government subsidies; hence the effective tariff to consumers is zero.

Source: Compiled by the authors from tariff orders and subsidy order/schemes of the state governments.

Concessional Tariffs through Subsidies

- Residential consumers using less than 200 units in Delhi got free power.
- The first 50 units for all residential consumers in Tamil Nadu were at no cost to the consumer.
- In Madhya Pradesh, consumer contributions to tariffs were limited to Rs. 1/unit for 100 units as a substantial government subsidy was provided.
- Since 2022, Karnataka has been providing free power of up to 75 units for residential consumers, which increased in 2023 to up to 200 units of free power.

On the other hand, small residential consumers in Rajasthan pay higher than the average cost of supply despite receiving a subsidy support of Rs.1.30/unit; this is the result of a significant share of fixed charges in the tariff design.

It is uncertain if the state governments will be able to sustain such subsidy commitments in the face of the rising costs of supplying power.

Besides increasing the subsidy burden, providing free power results in inefficient use of electricity, neglect of service quality by the distribution companies, and reduced pressure for metering (Nhalur and Josey 2021).

E8.2: AFFORDABILITY OF POWER FOR SMALL ENTERPRISES

Maharashtra charges the same tariff on a slab-wise basis for consumers using less than 300 units in the residential, commercial, and industrial categories. Although the tariff is higher than the cost of supply, it is far lower than what commercial and industrial consumers with higher

demand would pay. This ensures affordability for consumers and reduces unauthorised use (PEG 2010). This innovation in the tariff structure is designed to protect small consumers and should be replicated in other states.

Tariffs for small commercial and industrial consumers

In all the ten states, commercial consumers were cross-subsidising. Gujarat differentiates between small and large commercial consumers. Consumers with less than 10 kW load pay 35% lower fixed charges and 6% lower variable charges than commercial consumers with higher loads. Similarly, the Electricity Regulatory Commissions (ERCs) in four states (Karnataka, Kerala, Rajasthan, and Tamil Nadu) differentiate between large and small industrial consumers in their tariff design (see Table 7).

Table 7. Differentiation in Tariffs within the LT Industrial Category for FY 2020-21

Charge		Karnataka	Kerala	Rajasthan	Tamil Nadu	
Monthly fixed charge	Applicable connected load	5 HP to 40 HP	Less than 10 kW	All connected load	Less than 12 kW	
	Charge	Rs. 70/HP	Rs. 120/connection	Rs. 80/HP	Rs. 40/kW	
Variable charge	Applicable slab	Consumption ≤ 500 units	Entire consumption	Consumption ≤ 500 units	0–250 units	>250 units
	Charge in Rs. per unit	5.9	5.65	6	4	4.6
Concessional tariff for small consumers compared to the highest slab in the category	Savings in fixed charge	53%	29%	25%	43%	43%
	Savings in energy charges	0%	2%	7%	37%	28%

Source: Compiled by the authors from tariff orders and subsidy orders/schemes of the state governments.

E8.3: REGULATORY ACTIONS TOWARDS SUPPLY AND SERVICE QUALITY

Between 2015–16 and 2020–21, the ERCs in four states tightened Standards of Performance (SoP) benchmarks. This is shown in Table 8. However, there was no publicly available information on studies or surveys conducted by state ERCs or discoms to address metering, billing, and supply issues.

Delhi, Maharashtra, Uttar Pradesh, and Rajasthan were the states that revised and tightened the SoP benchmarks. The tightened benchmarks related to restoration of supply, supply voltage

variations, and metering and billing errors. The Madhya Pradesh ERC amended its regulations and tightened benchmarks in July 2021 and thus was not considered for the present report. The SoP regulations in Gujarat, Karnataka, and Tamil Nadu have not been revised for more than 15 years.

The ERCs in Karnataka and Gujarat have issued directives requiring discoms to conduct studies to assess issues related to metering, billing, and supply, but action on this front has not been taken.

Table 8. Years in which Standards of Performance Regulations Were Revised (up to 2021)

State	Year	Whether Benchmarks Were Tightened with the Revision
Uttar Pradesh	2005, 2019	Yes
Bihar	2006, 2017	No
Rajasthan	2014, 2021	Yes
Maharashtra	2005, 2021	Yes
Madhya Pradesh	2012, 2021	Yes
Gujarat	2005	No
Karnataka	2004	No
Tamil Nadu	2004	No
Delhi	2019	Yes
Kerala	2015	No

Source: Compiled by the authors based on the State Electricity Regulatory Commission (SERC) regulations.

E8.4: TRANSPARENCY AND ACCOUNTABILITY OF SOP REPORTED TO THE COMMISSION

In FY 2020–21, four of the ten states published SoP reports as mandated by the regulator. The reports provide disaggregated details on performance for service quality parameters in the formats prescribed by the regulator. However, the ERCs have neither taken regulatory action to hold discoms accountable for their performance nor issued directives based on the report in FY 2020–21.

The Electricity Act, 2003 stipulates that SoP data should be regularly furnished to the ERCs and subsequently made public at least once a year. SoP regulations require that the reports should be submitted every quarter in all the states, except Tamil Nadu, which has a half-yearly mandate. The regulations also empower the ERCs to penalise licensees for non-compliance. For the discoms in Rajasthan, Maharashtra, and Gujarat, the ERCs

have been regularly publishing quarterly SoP reports in accordance with their regulations. The

Delhi ERC and discoms go a step further and make compliance reports public every month.

E8.5: IMPROVEMENT IN QUALITY OF SUPPLY AND SERVICE

This attribute requires consistent improvement in any two of the following four service quality metrics: hours of supply, the DT failure rate, reliability indices, and the number of fatal electrical accidents. Consistent reporting of these parameters was not available in most states. Where they were reported, the states were unable to demonstrate consistent improvement in at least two parameters over three years.

The status of such reporting and improvements (on a year-on-year basis for three years) in these crucial metrics is captured in Table 9.

Since 2005, about Rs. 60,000 crores have been invested in rural network strengthening under central government schemes. Investments have been made in power procurement and supply in the same period to address many of the bottlenecks hindering reliable supply. Although there have been improvements in supply and service quality in the past decade, the regulatory

accountability of discoms with respect to supply and service quality remains poor. Without such accountability in the transition period, the impact of many changes will not translate to benefits.

Tracking service quality is an essential first step to tracking discom performance, paying attention to underserved areas, and improving the resilience of the distribution infrastructure to climate disasters. Centralised reporting of supply quality has led to the public availability of important information such as discom-level hours of supply and DT failure rates (REC India 2023), but it can be improved. Despite the CEA's mandate to capture circle-wise DT failure rates since 2007,⁴⁹ this information has not been publicly reported. The central sector agencies can also play a role in standardising the reporting of many of these parameters. Efforts from the CEA were underway in this regard for the reporting of reliability indices.⁵⁰

Table 9. Status of Quality of Supply and Service Metrics for FY 2020-21

Metrics	Tracked By	Data Availability	Issues with Reported Data	State with Improvement
Hours of Supply	National Power Portal, Ministry of Power.	All discoms. The Maharashtra discom reports feeder-level outages every month.	Feeder-level reports. Sub-feeder outages are not captured. Quality of reporting depends on the status of communicable metering infrastructure at the feeder level.	Bihar and Tamil Nadu
DT Failure Rate	Discoms in regulatory filings and annual reports.	Delhi, Gujarat, Rajasthan, Uttar Pradesh, and Madhya Pradesh East discom.	Reported on an ad hoc basis in regulatory formats, except in Gujarat, where it was given in audit reports. Not reported by central agencies.	Delhi

Metrics	Tracked By	Data Availability	Issues with Reported Data	State with Improvement
Number of Fatal Human Accidents	National Crime Records Bureau (NCRB), Central Electricity Authority (CEA), discoms, and chief electrical inspectors.	All states in CEA and NCRB reporting.	Variation in data reported by the CEA and NCRB and in discom regulatory filings (where available).	Gujarat, Maharashtra, and Uttar Pradesh
Reliability Indices ⁴⁸	Electricity regulatory commissions and discoms.	Delhi, Gujarat, Maharashtra, Rajasthan, and Karnataka (only Hubli Electricity Supply Company).	Variation in methodology across states and even across discoms in the same state, across years (data captured at the feeder/consumer level, interruptions captured in minutes/hours, etc.)	Difficult to capture due to methodological variations.

Highlights

- Five states provide concessional tariffs to all domestic consumers (even those without BPL cards) who use less than 30 units per month. Madhya Pradesh, Delhi, Tamil Nadu, and Bihar provide concessional tariffs due to subsidy provisions by the state government.
- Even with the subsidy, small residential consumers in Rajasthan pay more than the average cost of supply due to significant monthly fixed-cost payments.
- In most states, residential consumers using less than 100 units pay less than the average cost of supply and were cross-subsidised, except in Rajasthan and Uttar Pradesh due to the high fixed charges.
- Small consumers in the commercial and industrial (C&I) categories in Maharashtra are subject to the same tariff slabs and rates as domestic consumers. Kerala, Rajasthan, Tamil Nadu, Karnataka, and Gujarat have a tariff design that differentiates between smaller and larger C&I consumers.
- By FY 2020–21, five states had tightened the supply and service quality benchmarks in the Standards of Performance (SoP) regulations in the preceding five years. Despite legal requirements, only four states published quarterly reports on SoP performance. Actions to hold discoms accountable based on the reports and benchmarks or through directives have been limited.
- Reporting of crucial metrics such as hours of supply, reliability indices, distribution transformer failure rates, and the number of accidents has been limited, making consistent tracking of improvement challenging.



E9 : ACCESS TO COMPETITIVE SUPPLY OPTIONS FOR INDUSTRIAL AND COMMERCIAL CONSUMERS



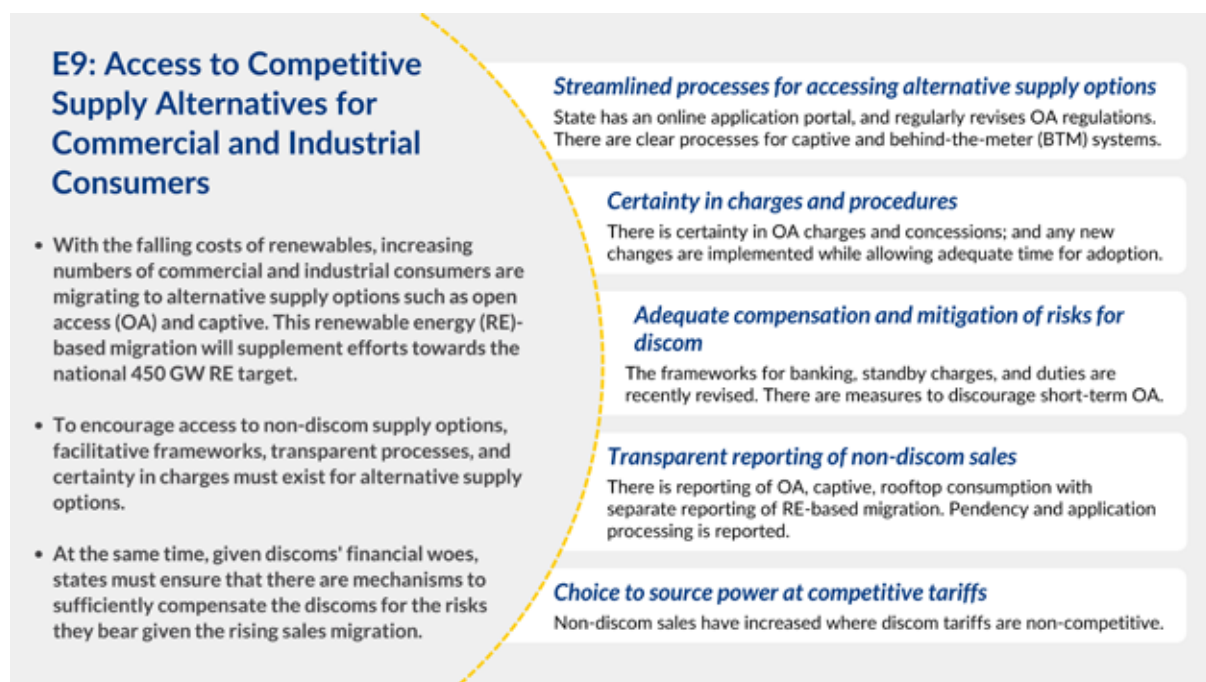
Some states have successfully adopted regulatory and policy frameworks to encourage consumer choice and adequately compensate discoms for services provided to OA consumers and prosumers.

Overview

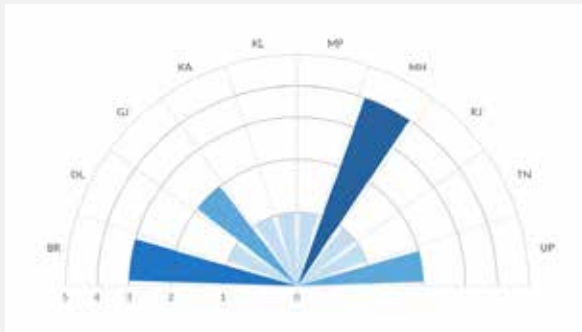
OA,⁵¹ captive, and grid-interactive solar are typically used by commercial and industrial (C&I) consumers; however, a mix of industrialised and

non-industrialised states have shown significant developments in this indicator. This is attributed to the indicator or theme design, which is framed

Figure 19. Access to Competitive Supply Alternatives for Commercial and Industrial Consumers



Source: (ETPI 2023).



- In FY 2020–21, Maharashtra showed developments in four of the five attributes in this indicator. Bihar showed developments in areas covered in three attributes, Gujarat and Uttar Pradesh in two attributes, and the remaining six states in one attribute.
- Annexure E-9 gives more details on the attributes, 16 sub-attributes, and methodology used.⁵²
- The data collection sheets are available on the website. (<http://etpi.in>)

to capture whether the existing processes, charges, and frameworks facilitate long-term non-discom procurement in a smooth manner and also compensate discoms for various services provided to facilitate this non-discom supply. Figure 19 describes the indicator with details of its

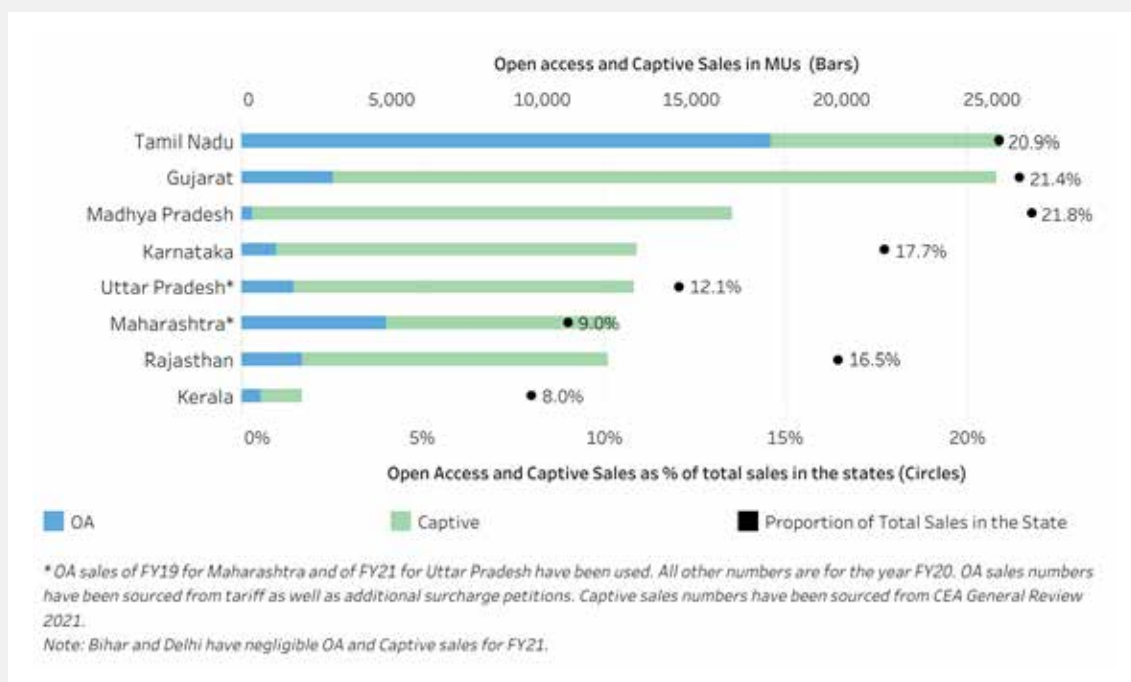
attributes and their sub-attributes.

See Box 2 on recent developments related to OA and captive consumption that provide the context necessary to understand state-level trends at the attribute level.

Box 2. The Inevitability of Sales Migration (Especially via Captive Options)

In FY 2020–21, open access (OA)⁵³ and captive consumption contributed to 15% of the electricity consumption on average in the states, as shown in Figure 20.

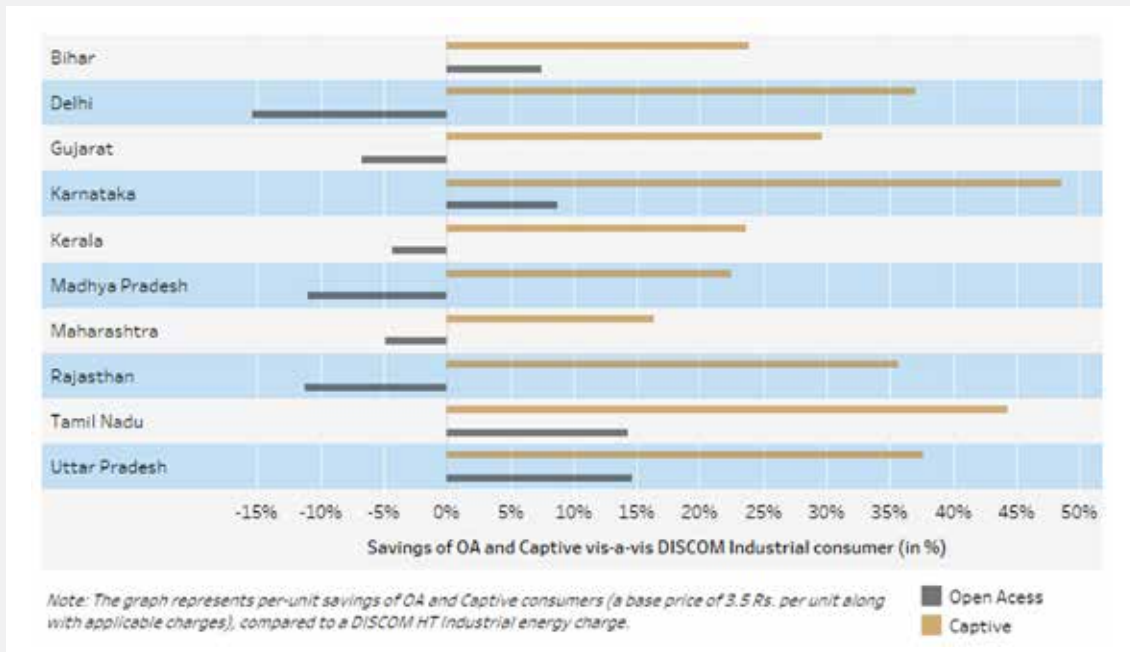
Figure 20. Open Access (OA) and Captive Sales in FY 2019-20



Source: Compiled by the authors from regulatory filings and CEA reports.

The current economics of alternative supply hugely favours captive consumers because unlike OA consumers they are exempt from additional surcharge (AS) and cross-subsidy surcharge (CSS). On average, captive consumers save 30% of discom energy charges, whereas the savings are marginal via OA for the same consumer (see Figure 21). OA was viable as a supply option in four of the ten states in FY 2020–21.

Figure 21. Savings of OA and Captive Consumers Compared to Industrial Category Energy Charges and Duties for FY 2020-21



Source: Compiled by the authors from regulatory filings.

With the falling cost of RE and with C&I consumers keen to step up their efforts towards net zero and 100% RE, RE-based sales migration will increase. C&I deployment of RE via OA and captive is estimated to contribute 75 GW to the national 450 GW RE target.⁵⁴ Two developments after 2021 will accelerate the shift to renewables-based sales migration:

- The Ministry of Power notified the Green Open Access Rules in 2022: The rules reduced the eligibility limit for RE-based OA to 100 kW from 1 MW. It also provided an enabling framework for third-party RE procurement.
- The National Load Dispatch Centre (NLDC) launched the Green Open Access Registry in 2023: The portal enables consumers to apply for green OA through a centralised portal, potentially reducing procedural barriers.

Though these developments are at the nascent stage, it is certain that this segment will grow, and discoms will need to accept that they will continue to lose a substantial chunk of their C&I consumer revenue.

To provide access to consumer choice, an enabling framework (clarity in processes, certainty in charges, reduced procedural barriers) is required at the state level. At the same time, grid-based services provided by discoms are central to facilitating OA. Thus, mechanisms should be instituted to adequately compensate discoms for their services (PEG 2018).

E9.1: STREAMLINED PROCESSES TO ENABLE ACCESS TO ALTERNATIVE SUPPLY OPTIONS

Maharashtra was a clear front-runner in this respect because OA regulations in the state were recently revised. Maharashtra State Electricity Distribution Company Limited (MSEDCL) has an online option for applications for OA, captive, and grid-interactive RE systems, and there are clearly specified guidelines for captive status verification and provisions for registration of behind the meter (BTM) systems. Bihar and Uttar Pradesh have online portals for processing OA applications, although more industrialised states such as Gujarat, Kerala, Rajasthan, and Tamil Nadu continue with offline processes.

Acknowledging the changing market realities, many states have revised OA regulations in the past three years, as shown in Figure 22. The exceptions are Gujarat, Kerala, and Rajasthan. Madhya Pradesh revised its OA regulations in FY 2021–22, albeit after a gap of 15 years. It is hoped

that subsequent revisions will take place within at least three years to account for the changing techno-economic and policy landscape.

Along with the Maharashtra ERC, the Delhi and Tamil Nadu ERCs have specified clear procedures for the assessment of captive status. This is crucial because consumers are exempted from OA charges (CSS and AS) only if they retain their captive status. Clarity on this front is required with the rise in captive sales.

Following Maharashtra's example, the Rajasthan ERC specified procedures for the registration of BTM systems (including penalties for non-compliance) in FY 2021–22. It is hoped that other states will follow suit to track the proliferation of such systems (especially with the fall in solar and storage costs) because they impact discom operations and need to be managed.⁵⁵

Figure 22. Latest Revision of OA Regulations by SERCs by Year of Notification



Source: Compiled by the authors from the State Electricity Regulatory Commission (SERC) regulations and amendments.

E9.2: CERTAINTY IN CHARGES AND PROCESSES, PROVISION OF CONCESSIONS

Delhi, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu have revised charges and frameworks without retrospective applicability. These states have also provided a period of non-applicability when introducing new frameworks to allow consumers and generators to make adaptive changes. Further, these states also removed concessions on OA charges for RE or provided clear sunset clauses for concessions.

Six of the ten states have provided sunset clauses on RE concessions in their RE policies, and Maharashtra, Karnataka, and Tamil Nadu have discontinued concessions on OA charges. This move acknowledges the rapid fall in RE prices in the past five years and that the market for renewables can now function as an independent economic proposition, without RE concessions. This is in sharp contrast with the green OA rules

notified in 2022, which provide concessions on AS for partial OA consumers as a measure to encourage OA and captive consumption.

In the ten states, the applicable AS and CSS together saw a variation of more than 5% on a year-on-year basis in the past five years. As this variation is more than the average inflation during this period, it indicates uncertainty in charges. Between FY 2018–19 and FY 2020–21, the year-on-year variation in charges was more than 30% in Gujarat, Karnataka, Kerala, and Uttar Pradesh.

There are also notable periods of non-applicability of policies and regulatory changes.

For example, in Rajasthan, Gujarat, and Tamil Nadu, there was a period of non-applicability of the forecasting and scheduling regulations applicable to OA and captive RE generators. Maharashtra's RE Policy 2020 allowed three months for developers to register their projects under the previous policy (GoM 2020). For rooftop consumers, the Maharashtra ERC has allowed for a period of non-applicability of grid support charges (GSC) until the installed capacity in the state reaches 2,000 MW (MERC 2020b). Providing a period of non-applicability allows sufficient buffer time for consumers to take actions to accommodate the changes.

E9.3: ADEQUATE COMPENSATION AND MITIGATING RISKS TO DISCOMS

Bihar, Gujarat, and Maharashtra have recently revised their banking frameworks and standby charges for captive consumers. They have also revised the electricity duty applicable to captive consumers. Maharashtra and Gujarat have also undertaken measures to discourage short-term open access (STOA) as it makes power procurement and grid operations challenging for discoms. Table 10 details some measures taken by

the ERCs in the states to mitigate the risks faced by discoms due to OA and compensate them for services rendered.

In the absence of compensatory mechanisms, the burden of these costs will fall on the remaining small consumers of the discom or further worsen discom viability.

Table 10. State Measures to Compensate Discoms Adequately in FY 2020-21

Measures/Charges	Background	State Examples
Measures to discourage short-term open access (OA)	Consumers switching between discom and short-term OA (STOA) supply can affect both discoms' power procurement planning processes and grid operations.	Maharashtra ERC: Punitive charges for repeated applications for STOA (MERC 2019b). Gujarat ERC: The transmission charge for STOA is double that of long-term OA (LTOA).
Banking charges not at high concessional rates to avoid affecting discom finances	Banking charges have been ad hoc and nominal (2–5% of the banked energy); they do not reflect discom costs that are undertaken to provide the energy banking facility.	Gujarat ERC: Levied a banking charge of Rs. 1.5 per unit on solar energy consumed (GERC 2022).

Measures/Charges	Background	State Examples
Standby charges, especially for captive consumers who may not have contracted demand with the discom	Standby service affects discoms' power procurement, and they should compensate for provided planned and unplanned standby service.	<p>Maharashtra ERC: Specified a four-tier, differential standby demand charge on captive consumers in 2020. This includes the following:</p> <ul style="list-style-type: none"> • 25% of the monthly demand charges when standby is not utilised • 100% of the demand charges when standby is requested but not used • 150% of the demand charges if the recorded demand exceeds the contracted demand • 200% of the demand charges if standby service is not opted for, but the service is provided (MERC 2020b).
Revision of electricity duty (ED) levied on captive consumers	Duty falls under the purview of state governments and is being used by states as an additional source of revenue to compensate discoms for their losses. Differential duty on captive consumers is being levied in this context. This, of course, is not a charge but a mechanism used by states to compensate for revenue loss.	<p>Maharashtra, Bihar, and Madhya Pradesh have revised their ED for captive consumers to more than Rs. 1 per unit.</p> <p>Karnataka, Tamil Nadu, and Kerala are charging merely 20 paise per unit or below as the electricity duty on captive consumers.</p>

Source: Compiled by the authors from various reports and regulatory orders.

E9.4: TRANSPARENT REPORTING OF NON-DISCOM SALES

Gujarat and Maharashtra were the only states that reported data on OA, captive consumption, and rooftop solar capacity. This reporting was verified from varied sources, including filings in regulatory submissions. Rajasthan and Karnataka report details as part of their tariff processes, but

the information provided is not enough to paint a comprehensive picture. Maharashtra and Rajasthan report RE and non-RE-based OA consumption separately, a practice that needs to be adopted in other states with the rise in green OA.

Reporting Open Access and Captive Data

State Electricity Regulatory Commissions and State Load Dispatch Centres need to lead the effort in tracking and transparently reporting non-discom sales (based on the technology used, duration of contract, and operative business model: captive, open access, etc.) because this information is crucial to understand emerging trends and should be part of demand projections and infrastructure planning processes.

E9.5: CHOICE TO SOURCE POWER AT COMPETITIVE TARIFFS

With discom energy charges being much higher than the landed cost of power from alternative sources (leading to significant savings for captive consumers, as seen in Figure 21, there has been a steady year-on-year increase in captive consumption in Bihar, Kerala, Madhya Pradesh, and Uttar Pradesh. This implies that consumers exercised their choice to migrate to captive sources when discom tariffs were

non-competitive. In sharp contrast, even with competitive captive rates, the industrialised states of Delhi, Gujarat, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu did not see an increase in captive consumption. In the absence of other information, this could indicate other barriers, especially procedural hassles. This should be investigated further.

Highlights

- Maharashtra has taken positive steps towards establishing clarity and certainty in charges and procedures, ensuring equitable risk sharing between discoms and non-discom consumers, as well as transparent reporting of renewable energy (RE) and non-RE-based sales migration. Bihar, despite its small quantum of non-discom sales, has taken active steps towards building a conducive environment for alternative supply options to grow.
- Green Open Access Rules, notified by the Ministry of Power in 2022, provide an enabling framework for market development by reducing the eligibility criteria for applicants to 100 kW (from 1 MW) and providing for a national open portal. Yet, ambiguity remains between the processes mandated by the rules and those specified in the existing State Electricity Regulatory Commission regulations.
- The Maharashtra Electricity Regulatory Commission initiated processes for the registration of behind the meter systems. This was also adopted by Rajasthan in FY 2021–22. With solar and storage becoming economically viable, more states should track the proliferation of such systems.
- The practice of having a period of non-applicability before the introduction of a new framework or charges provides clarity and certainty and allows for adaptive changes by developers, consumers, and investors. Three states have such a period for forecasting and scheduling (F&S) regulations. For rooftop consumers, the Maharashtra ERC has allowed for a period of non-applicability for grid support charges (GSC) until the installed capacity in the state reaches 2,000 MW.
- In recognition of the competitive prices of RE in the recent past, six of the ten states have provided sunset clauses on RE concessions in their RE policies, and Maharashtra, Karnataka, and Tamil Nadu have discontinued concessions on open access charges.
- Five states are adopting ways to ensure a level playing field for discoms such as charging a differential and substantial electricity duty on captive consumers, revising their banking charges to reflect discom costs, or issuing regulatory mandates to discourage short-term open access and frequent switching between discom and non-discom supply options.
- With the price competitiveness of RE, it is inevitable that the share of non-discom sales, especially captive consumption, will increase. However, in six of the ten states, which also happen to have a significant number of commercial and industrial consumers, captive power consumption has not been rising, which perhaps indicates procedural barriers.
- Increase in non-discom sales through multiple avenues is a game-changing development for India, yet consistent and comprehensive tracking is absent at the central and state levels. Maharashtra and Gujarat were better than other states at reporting this information.



E10 : PREPAREDNESS OF STATE-LEVEL TRANSMISSION AND DISTRIBUTION NETWORK



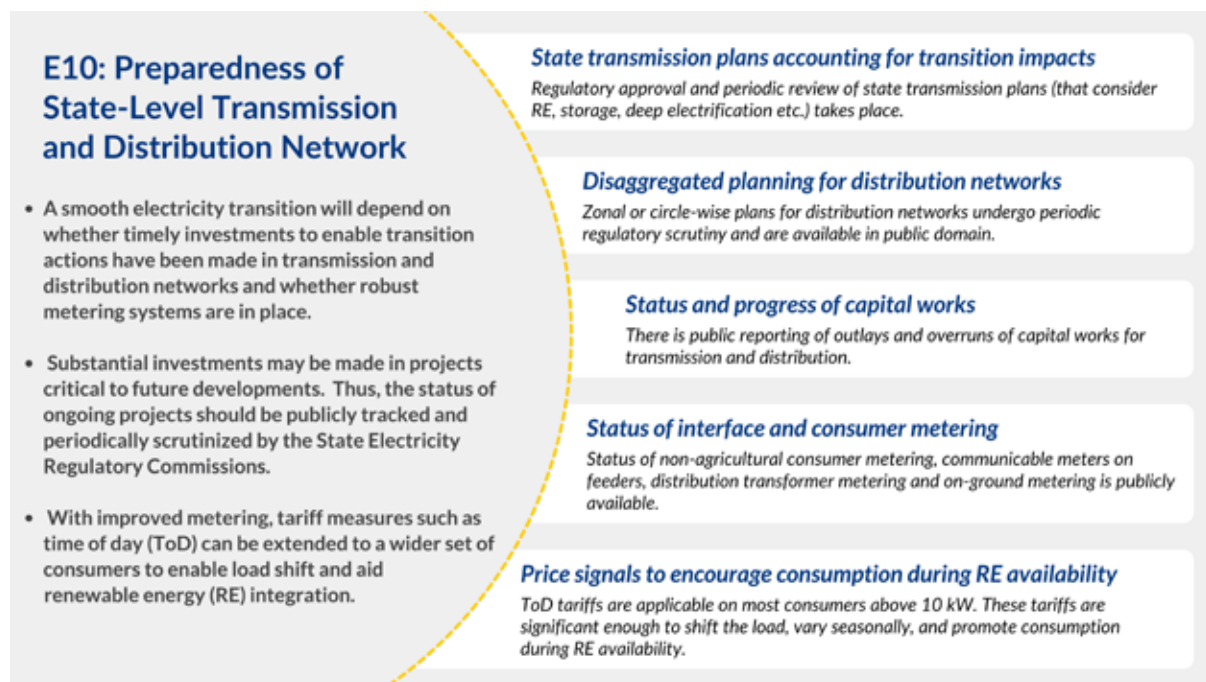
States are making progress in the foundational aspects of metering and network planning, which can facilitate innovative approaches to accelerating and enabling transitions in the future.

Overview

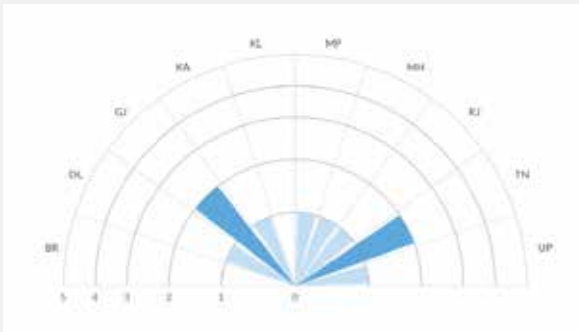
Network strengthening and robust metering are aspects where central and state actors have

channelled significant investments through various schemes over decades. Yet, further actions

Figure 23. Preparedness of State-Level Transmission and Distribution Network



Source: (ETPI 2023).



- In 2020–21, Gujarat and Tamil Nadu showed developments in areas covered in two attributes, and Delhi, Karnataka, Maharashtra, Rajasthan, Madhya Pradesh, and Uttar Pradesh in one attribute.
- Annexure E-10 gives more details of the attributes, sub-attributes, and methodology used.⁵⁶
- The data collection sheets are available on the website. (<http://etpi.in>)

will be needed to cope with the decentralised and large-scale deployment of RE and the possibility of multiple suppliers and new load centres.

Figure 23 describes the indicator with details of its 5 attributes and their 14 sub-attributes.

E10.1: STATE TRANSMISSION PLANS THAT ACCOUNT FOR ENERGY TRANSITION IMPACTS

Detailed transmission perspective plans covering energy-transition-related concerns were available only in Gujarat and Maharashtra. However, these have not been submitted to the regulator or reviewed at least once in three years.

In fact, in Karnataka, Kerala, Madhya Pradesh, and Bihar, a regulatory mandate for approval and review of these plans exists, but perspective plans applicable for FY 2020–21 were not available as

part of any dedicated regulatory processes.

In addition to perspective plans for the state, state transmission utilities (STUs) also provide investment plans in their MYT petitions. These were available in almost all the states. The transmission investment plans in Tamil Nadu, Kerala, Madhya Pradesh, Maharashtra, and Gujarat provide disaggregated (zone/circle-level) details.

E10.2: DISAGGREGATED PLANNING FOR THE DISTRIBUTION NETWORK

The Tamil Nadu (TNERC 2021) and Madhya Pradesh (MPPKVCL 2020) discoms submitted circle-wise distribution capital investment plans for regulatory approval. This practice will contribute to decentralised planning, siting RE and storage, and planning investments in the case of multiple suppliers. It will also help identify whether investments are addressing

priority requirements in those circles (such as loss reduction and reliability improvement).

Similar to the STUs, discoms in nine states (exception: Delhi) have been submitting investment plans for regulatory approval, including for the year FY 2020–21.

E10.3: STATUS AND PROGRESS OF CAPITAL WORKS

The Karnataka ERC, during its annual prudence check, tracks delays and cost overruns for ongoing transmission and distribution capital works.

The status of projects along with delays and cost overruns is shared as part of every distribution and transmission tariff process, but this process does not take place annually. In its tariff processes, the Uttar Pradesh ERC tracks zone-wise progress and delays for transmission projects.

Most states track cost outlays for ongoing transmission and distribution (T&D) projects. The impact of delays and the consequent cost overruns requires more attention, public reporting, and scrutiny. Going forward, periodic reporting on the status of transmission and distribution projects, on the lines of the monthly reports prepared by the CEA for inter-state transmission projects (CEA n.d.), will be crucial to monitor the progress of network investments that are critical to the energy transition at the state level.

E10.4: STATUS OF INTERFACE AND CONSUMER METERING

Maharashtra, Rajasthan, Gujarat, and Delhi do not have unmetered non-agricultural consumer categories. In addition, Delhi and Gujarat have high DT metering rates. Gujarat has reported having completed 100% DT metering in its regulatory filings. The status of, and experience with, DT metering in Gujarat needs to be studied further based on the status of on-ground metering.

Maharashtra and Rajasthan have been reporting the on-ground status of meters to the regulator. Further, Maharashtra and Delhi report that more than 90% of their feeder meters are communicable (AMR/AMI).



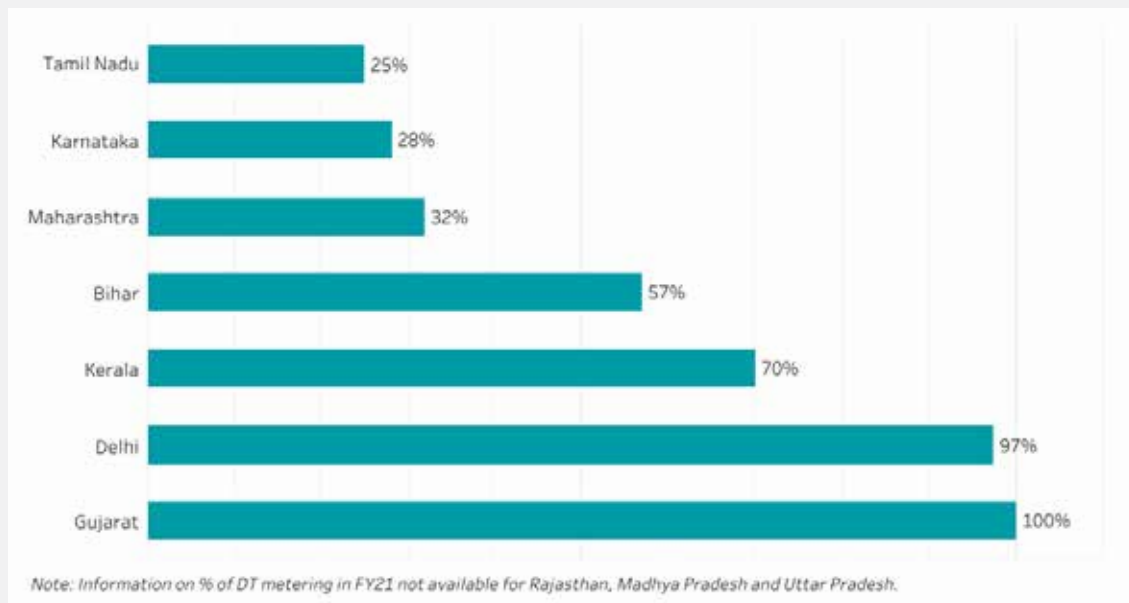
■ Metering Status across States

The reporting⁵⁷ of feeder, distribution transformer (DT), and consumer metering shows some interesting trends.

Four states (Maharashtra, Delhi, Tamil Nadu, and Karnataka) report that more than 90% of their feeder meters are Automated Meter Reading/Advanced Metering Infrastructure (AMR/AMI) enabled. These states can initiate efforts to provide disaggregated data on outages and improve energy audits.

As shown in Figure 24, DT metering status was available for seven states.⁵⁸ Only Delhi has reported high DT metering along with AMR/AMI for most feeders.

Figure 24. Percentage of Distribution Transformers Reported as Metered for FY 2020-21



Source: Compiled by the authors from regulatory filings and statutory filings to the Bureau of Energy Efficiency (BEE).

Unmetered categories (apart from agriculture) persist in the other five states, but they are limited to a few categories (typically residential

and streetlights) as shown in Table 11. Concerted efforts in Bihar reduced the number of unmetered categories within five years.

Table 11. Unmetered Consumer Categories (Other than Agriculture) in States (FY 2021)

State	Unmetered Categories
Uttar Pradesh	Rural Residential, Commercial, Streetlights, Temporary Supply
Bihar	Rural Residential, Streetlights
Madhya Pradesh	Rural Residential
Tamil Nadu	Huts (BPL Homes)
Kerala	Streetlights

Source: Compiled by the authors from various tariff orders.

In addition to reducing the number of tariff categories for unmetered consumers, it is important to ensure that meters are working on the ground. Rajasthan conducted regulatory scrutiny of the category-wise

number of defective consumer meters and their replacement status. Bihar reported bills generated based on actual meter readings for each category. Both practices should be adopted by other states.

E10.5: TOD-BASED PRICE SIGNALS TO ENCOURAGE CONSUMPTION DURING RE AVAILABILITY

Uttar Pradesh, Tamil Nadu, and Gujarat have incentives or penalties for ToD tariffs of at least 15%, which is substantial enough to shift the load. In addition, both Tamil Nadu and Gujarat charged normal tariffs during solar hours; thus, consumption during solar availability was not discouraged with the levy of penalties. Uttar Pradesh was the only state in FY 2020–21 where ToD tariffs varied on a seasonal basis.

ToD tariffs are effective when

- the incentive or penalty is high enough to result in load-shifting behaviour,
- incentives encourage consumption when low-cost renewable energy is available,
- penalties discourage consumption during stress periods in the system when the system cost is high,
- the tariffs and even the time slots vary seasonally to account for seasonal changes in load and system costs, and
- such tariffs are applicable to a wide range of consumers, not just high-tension consumers.

Recognising this, the central government's Rights of Consumers Rules was recently amended to institute ToD tariffs for C&I consumers whose demand exceeds 10 kW as of April 2024 (MoP 2023b). Further, penalties and incentives should not be less than 20% and 10%, respectively, of

the tariff. Further, during solar availability, an incentive of 20% of the tariff should be provided to consumers.

Many states already have begun instituting measures towards levying ToD tariffs on a wide range of consumers:

- ToD tariffs have been applicable in the states for a long time, and by FY 2020–21, they were applicable for HT consumer categories in all the states.
- Six states levied ToD tariffs for certain low tension (LT) categories, as shown in Table 12.
- None of the states levied ToD tariffs on grid-interactive rooftop solar consumers in the state.
- Delhi stands out as it was the only state where ToD tariffs are applicable on most consumers with a connected load greater than 10 kW.
- Interestingly, Uttar Pradesh levies ToD tariffs on streetlights, a category with many reported unmetered connections.
- Since 2022–23, ToD tariffs have been made applicable to all LT C&I consumers in Tamil Nadu. If meters equipped for ToD tariffs are not present, peak charges are levied on 20% of the total consumption until such time as meters are installed (TNERC 2022).

Table 12. ToD Tariff Applicability for LT Consumers in FY 2020-21

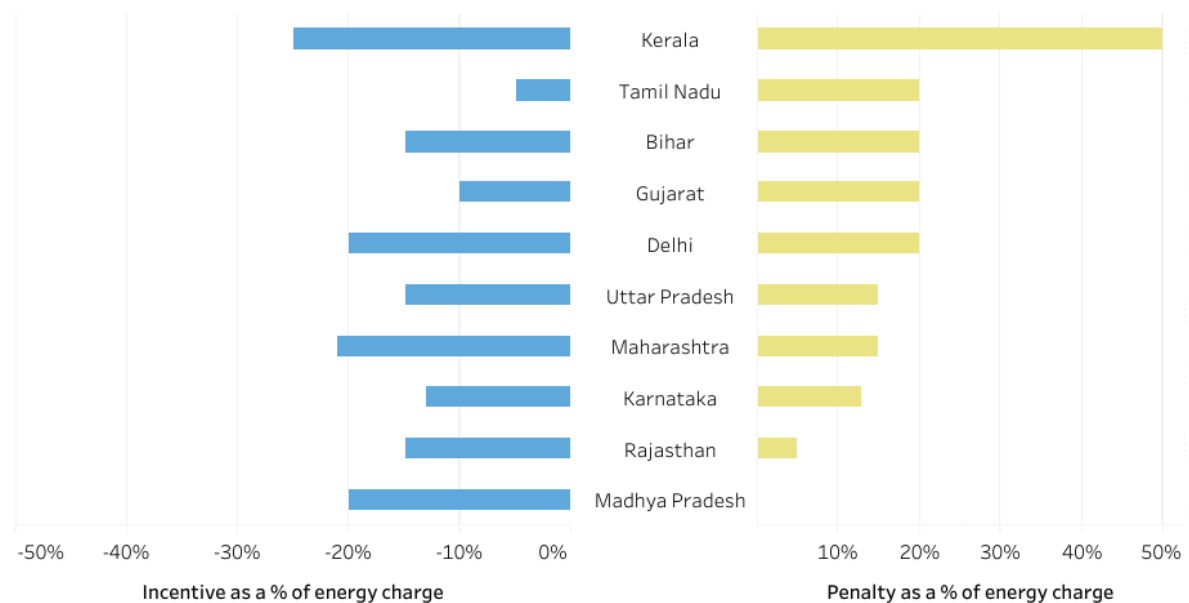
State	Consumer Category	Load Threshold for Tariff Applicability
Delhi	All categories (except Residential)	10 kW
Gujarat	Waterworks	36 kW
Kerala	Industries LT-I, 3-Phase Residential Consumers	20 kW for industries, 500 units for domestic
Maharashtra	Industry, Commercial, Public Services, Waterworks, Power Loom	20 kW
Rajasthan	Electric Vehicle (EV) Charging Stations	No limit specified
Uttar Pradesh	Streetlights, Industries, EV Charging Stations	No limit specified

Source: Compiled by the authors from tariff orders.

Most states provide incentives and levy penalties in the range of 15% to 20% of the applicable energy charges, as shown in Figure 25. This translates to a penalty of more than Rs. 1/unit in most states. This is much higher than the prescribed 20% penalty on the total tariffs in the

recent central government rules. The penalties were levied during 'stress' periods in the morning and evening when the demand picks up. The demand-supply mismatches in these periods will likely intensify with increased solar adoption and the rise in residential consumption.

Figure 25. Incentives and Penalties within the ToD Tariff Framework Applicable in FY 2020-21



Note: The rebates and incentives shown here are for HT Industrial categories as approved by the respective State Electricity Regulatory Co..

Source: Compiled by the authors from tariff orders.

There were no penalties, only off-peak incentives in Madhya Pradesh. Kerala's penalties were as high as 50%, and its incentives were 25% of the energy charges. With 70% of sales in Kerala attributable to residential consumers, such ToD tariffs are required to manage the demand. With the changing demand-supply considerations, other states would also have to consider increasing their incentives and penalties.

Incentives for daytime consumption were not yet provided, but this may change with increased solar procurement. During solar hours, consumption was neither penalised nor encouraged in eight states. Delhi and Maharashtra levied penalties in daytime slots. This is perhaps based on the load shapes when the ToD tariffs were last revised.

All the states offered nighttime incentives; however, as mentioned earlier, only Uttar Pradesh had seasonal variation in tariffs, which would be required with seasonal variation in wind profiles and changes in demand.

ToD tariff design in most states is based on studies from more than five years ago, which may not be relevant for future demand-supply shifts. Maharashtra and Tamil Nadu have recently conducted studies to revisit charges, applicability, and ToD slots. Similar studies are being conducted in Rajasthan and Uttar Pradesh.

Going forward, with high solar and wind dependent systems, uncertainty in demand, and increase in power prices due to periodic coal shortages, the incurred system costs will vary diurnally and seasonally. The tariffs should also change consider the variation in system costs. Encouraging consumption during high wind and solar availability and levying penalties to account for the rise in costs during stress periods is critical for grid integration of RE and revenue recovery of discoms.



Highlights

- Detailed transmission perspective plans covering energy-transition-related concerns were available only in Gujarat and Maharashtra, despite the mandate to prepare these plans in all the states and the stipulation to submit the plans for regulatory approval in six states.
- Tamil Nadu and Madhya Pradesh prepared circle-wise disaggregated distribution network investment plans that would be relevant for decentralised planning.
- Monitoring of delays and cost overruns of transmission and distribution projects takes place annually in Karnataka. This practice is also present for transmission projects in Uttar Pradesh.
- Although consumer metering is a persistent challenge, five states have been able to limit unmetered consumer categories to agriculture alone.
- Regulatory scrutiny of consumer category-wise defective meters as seen in Rajasthan and Bihar would be necessary going forward, especially with the advent of smart meters.
- Delhi, Maharashtra, Karnataka, and Tamil Nadu consistently report that more than 90% of their 11 kV feeder meters are Automated Meter Reading/Advanced Metering Infrastructure (AMR/AMI) enabled. Kerala, Delhi, and Gujarat report that more 70% of than their distribution transformers (DTs) are metered. These states should lead the efforts towards tracking reliability and energy losses at the feeder level.
- All the states levy time of day (ToD) tariffs on high tension (HT) consumers, and about six states levy ToD tariffs on low tension (LT) consumers as well. Delhi is the only state that levies ToD tariffs on most consumers with a connected load as low as 10 kW.
- None of the states levy ToD tariffs on consumers with net metering, regardless of the tariff category. Increased demand from these consumers, especially during non-solar periods such as morning and evening peaks, would lead to an increase in costs. This can be compensated for by levying ToD tariffs.
- ToD incentives or penalties were high enough (15% to 20%) to shift the load in six states. Gujarat, Kerala, and Tamil Nadu incentivise consumption during high solar/wind availability and penalise consumption during morning and evening 'shoulder periods' when demand is high and solar availability is low. Uttar Pradesh has ToD tariffs that vary seasonally, which other states should adopt because seasonal variation in demand and supply is expected going forward.



E11 : REGULATORY GOVERNANCE AND PROCESSES



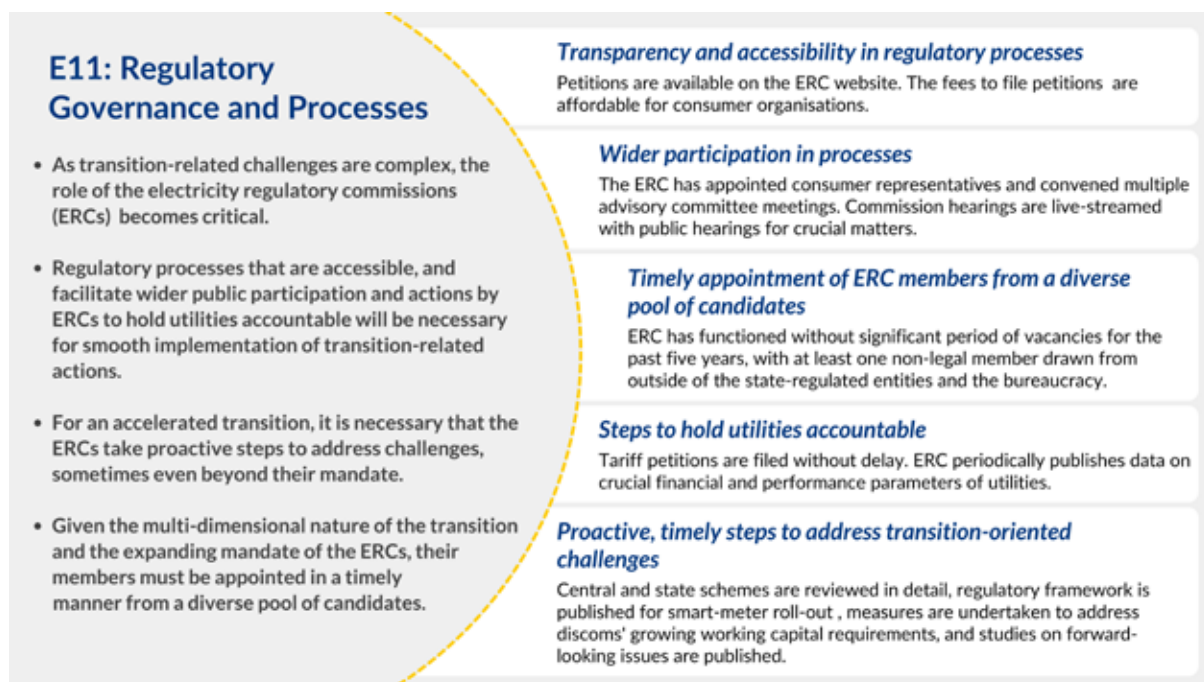
Regulatory commissions can learn from each other's practices to preserve and expand spaces for informed participation, but the real test remains proactiveness in developing frameworks and holding utilities accountable for taking forward-looking decisions.

Overview

Over the past two decades, SERCs have played a crucial role in facilitating accountability of utility performance, safeguarding consumer interest, and balancing various stakeholder interests in the sector. With the rapid shifts in energy demand

and supply, the SERCs' role would be critical in planning and developing frameworks to foster competition, adopt technology, and incorporate equity concerns.

Figure 26. Regulatory Governance and Processes



Source: (ETPI 2023).

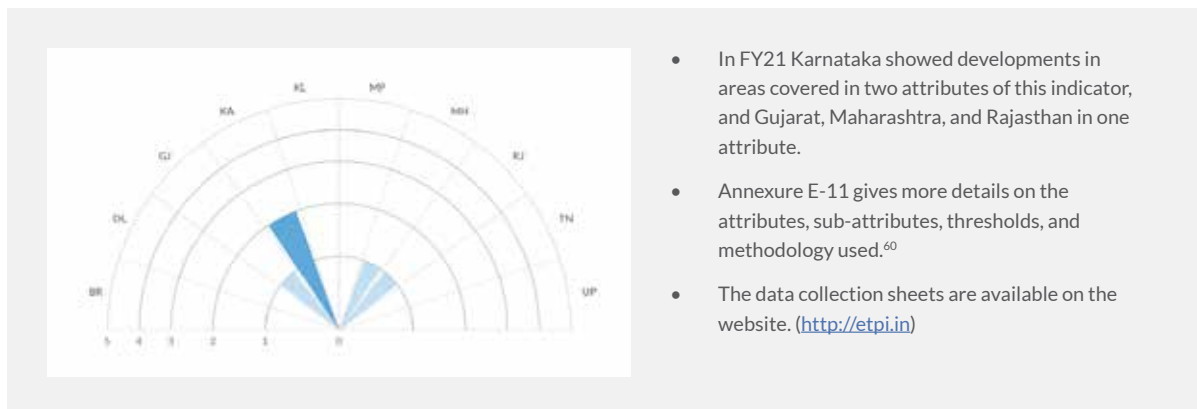


Figure 26 describes the indicator with details of its 5 attributes and their 14 sub-attributes.

E11.1: TRANSPARENCY AND ACCESSIBILITY IN REGULATORY PROCESSES

For FY 2020–21, petitions regarding tariff and other crucial matters are available on the Karnataka ERC’s website. Further, consumer and consumer groups could file applications before the commission by submitting fees of less than Rs. 5,000 in the state.

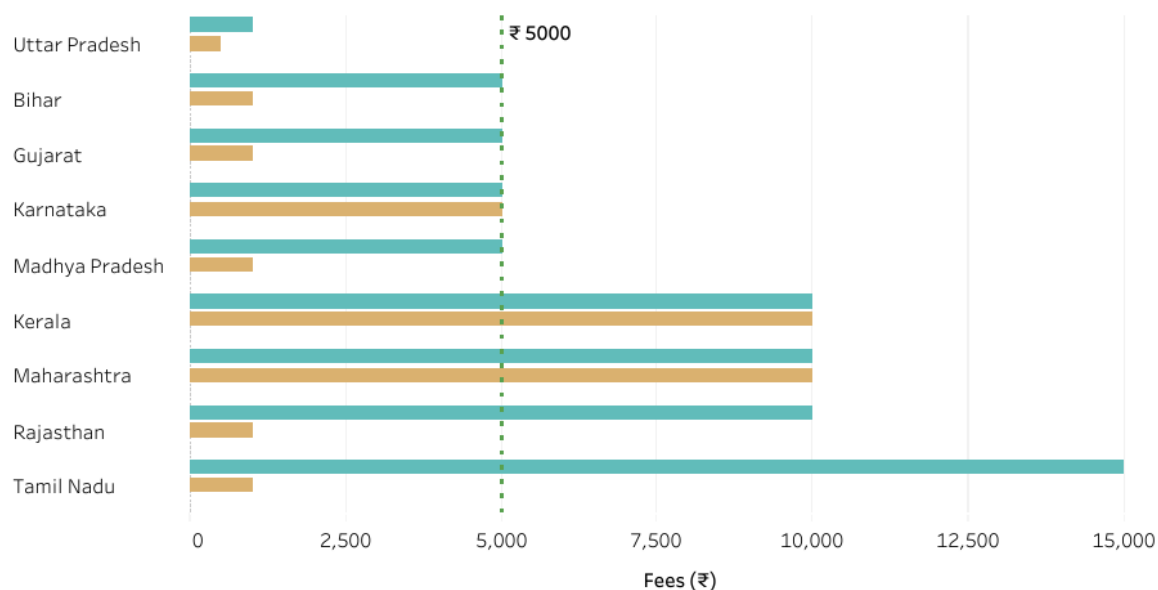
The ERCs in half of the ten states – Bihar, Delhi, Karnataka, Kerala, and Madhya Pradesh – make the tariff petitions of licensees available on their websites. In Maharashtra, although such petitions are not available on the commission’s website, the MSEDCL follows the good practice of uploading all its petitions and submissions related to regulatory and policy processes.⁶¹

Only the Bihar and Karnataka ERCs publish crucial petitions other than tariff-related ones that impact consumer tariff and service quality.⁶² For example, in FY 2021, Karnataka published

petitions related to transmission connectivity and pricing, and Bihar published documents related to the adoption of competitive bidding for transmission projects.] In a step towards demystifying tariff determination processes, the Delhi and Maharashtra ERCs publish executive summaries of each utility’s petition.

Applications before the SERCs are typically filed by licensees, large generators, and large industrial consumers. To assess if fees are a barrier for small consumers and consumer groups, the study checks whether the fees exceeded Rs. 5,000. As seen in Figure 27, in FY 2020–21, five of the ten states did not have fees over Rs.5,000 with Uttar Pradesh having the lowest fees for individuals and consumer groups.⁶³ Except for Tamil Nadu, none of the assessed states charged more than Rs. 10,000 in FY 2020–21.

Figure 27. SERC Fees and Charges for Individual and Consumer Groups to File Applications



Note: The Delhi ERC Comprehensive Conduct of Business Regulations, 2001 states that the fees are to be determined on a case-to-case basis. Thus, they are not included in Figure.

Consumer groups
Individuals

Source: Compiled by the authors from the State Electricity Regulatory Commission (SERC) regulations.

E11.2: STEPS TO HOLD DISCOMS ACCOUNTABLE

The Gujarat ERC tracks and reports utility performance on their website on a quarterly basis as part of the Regulatory Information Management Systems (GERC 2021). These data include sales and revenue, expenditure and investment, metering and zone/circle wise feeder-level loss reduction, etc.

Based on the FoR recommendation, many ERCs had initiated efforts from 2009–10 towards such proactive reporting, but these have been discontinued (FoR 2009).

Gujarat also ensured that tariff determination and true-up processes were conducted without delay in FY 2020–21.

Regulatory Actions in the Case of Delay in Filing Tariff Petition

Licenseses in the studied states submitted their tariff petitions without significant delay for FY 2020–21, except for discoms in Uttar Pradesh and Tamil Nadu. In Tamil Nadu, no tariff petitions were admitted for the state-owned utility, TANGEDCO,⁶⁴ between FY 2016–17 and FY 2022–23, resulting in a six-year delay and no regulatory action towards ensuring timely filing.

In contrast, the Uttar Pradesh ERC, which also faced delay in filings by utilities, undertook suo moto proceedings and did not condone the delay. This is a welcome development, because delays in filing tariff petitions were rampant in many states a decade ago when the Appellate Tribunal for Electricity (APTEL) issued directions in this regard in O.P 1 of 2011.⁶⁵

E11.3: PROACTIVE, TIMELY STEPS TO ADDRESS ENERGY-TRANSITION-ORIENTED CHALLENGES

States have undertaken proactive energy-transition-oriented efforts in various forward-looking areas in FY 2020–21.

The Karnataka ERC disallowed smart meter rollout proposals in FY 2020–21 due to the absence of a rigorous study or plans by discoms to address implementation challenges. The Delhi and Uttar Pradesh ERCs approved a rollout plan and also specified a model for sharing gains and losses with consumers. The Uttar Pradesh ERC has not been allowing pass-through of costs based on estimated savings and plans; rather, approval is based on the actuals provided in the true-up process.

In June 2020, the Bihar ERC, in response to the state government’s policy decision to not opt for tariff-based competitive bidding (TBCB) for any intra-state transmission projects, floated a

discussion paper and conducted a public hearing to consider projects above Rs. 100 crores for TBCB adoption. This is significant, given the Supreme Court’s subsequent judgement in 2022 on competitive bidding for transmission, underscoring the commission’s role in fixing the threshold for TBCB (SCI 2022).

In FY 2020–21, the Rajasthan ERC floated a discussion paper on large-scale storage systems, inviting public comments.

Despite impacts on tariffs, service quality, and utility performance, a review of state and central schemes has not been undertaken by the ERCs. With schemes such as RDSS and KUSUM in the early stages, the implementation of large-scale central government schemes in the state by the ERC must be comprehensively reviewed in the near future.

The Critical Role of the Forum of Regulators

The Forum of Regulators (FoR), which comprises all state regulators and the central Electricity Regulatory Commission (ERC), has played a crucial role in establishing frameworks, standardising practices, and undertaking studies on various issues. Some of the FoR’s recent contributions are listed in Table 13.

Table 13. The FoR’s Recent Contributions to Energy Transition Aspects

Model Regulations/Guidelines	Year
Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations	2015
Deviation Settlement Mechanism Regulations	2017
Power Quality Regulations	2018
Regulations for Grid-Interactive Distributed Renewable Energy Sources	2019
Intra-State Essential Reliability Services (Ancillary Services) Operations Regulations	2020
Model Guidelines for Management of Renewable Energy Curtailment	2022

Model Regulations/Guidelines	Year
Regulations on Verification of Status of Generating Plants and Captive Users	2023

Study Reports on Various Techno-Economic Issues

Since 2019, FoR has published study reports on a metering framework for rooftop solar, issues related to the implementation of forecasting and scheduling regulations, intra-state reserves, the role of ancillary services in balancing, financial norms for distribution, and import of power for captive generators using open access. It has also recently issued a Regulatory Framework for Energy Storage and Electric Vehicles and a report on developing model regulations for calculating open access and banking charges for green open access consumers.

Source: Compiled by the authors from the FoR website.

Going forward, the For will play a critical role in building consensus and shaping transition actions in states. Therefore, it is critical to strengthen this institution and widen its mandate.

E11.4: WIDER PARTICIPATION IN PROCESSES

The Karnataka ERC conducts public hearings on crucial issues other than tariff. The State Advisory Committee (SAC) in Karnataka, which represents a wide set of stakeholders, convenes regularly. In FY 2020–21, the Maharashtra ERC had a consumer representative under Section 94(3) of

of major consumer categories in the state. Maharashtra, which had a rich tradition of wide and diverse SAC representation, was the notable exception: the SAC was reconstituted in 2021 without any consumer representation. Despite COVID-19-related restrictions, the SACs of

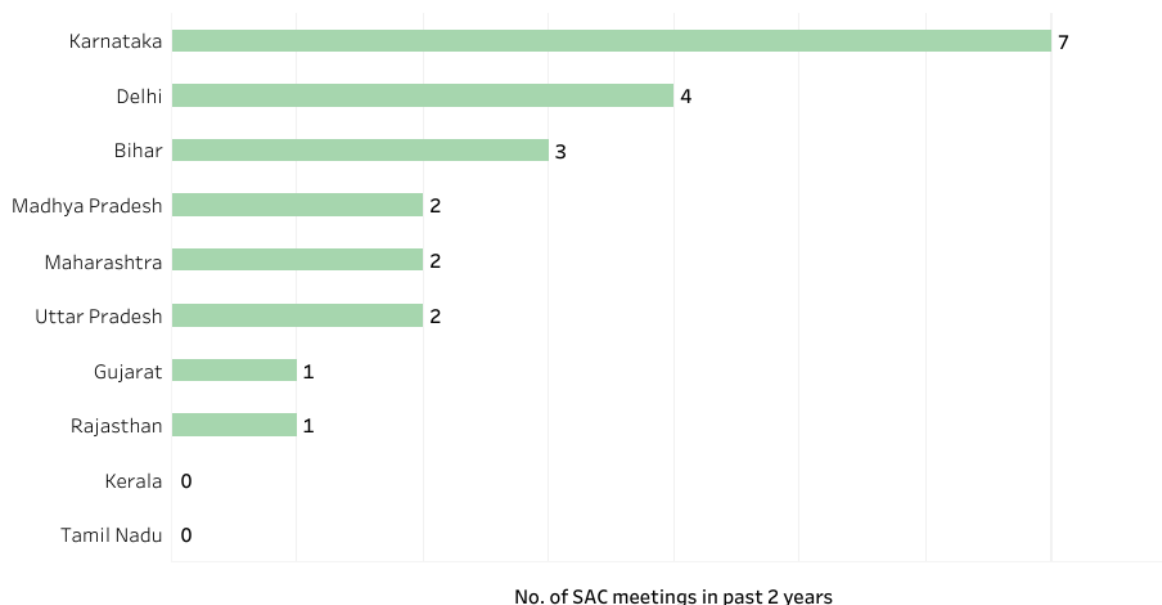
Consumer Representatives in Maharashtra

Appointing consumer representatives in Maharashtra and making them a party to crucial proceedings of the commission is a good practice. However, by FY 2020–21 this was practically discontinued, and there was only one consumer group whose tenure had not yet been completed. Without appointments, by FY 2022–23 there were no authorised representatives before the commission. Some states have consumer advocates, but these are appointed on an ad hoc basis and not according to the stipulations of the Electricity Act.

the Electricity Act, 2003. The ERC also livestreams all hearings before it, not just proceedings with public hearings. State Advisory Committees (SACs) in nine of the ten states are constituted with a diverse membership that is fairly representative

Karnataka and Delhi ERCs met multiple times in FY 2019–20 and FY 2020–21. Bihar held three meetings in the same period, and the other seven SERCs managed to convene one or two SAC meetings during that time (Figure 28).

Figure 28. SAC Meetings Conducted by ERCs in FY 2019-20 and FY 2020-21



Source: Compiled by the authors from annual reports, websites, and other reports of the regulatory commissions.

In addition to Karnataka, seven of the ten states (the exceptions are Maharashtra, Uttar Pradesh, and Delhi) have been conducting public hearings not just for tariff determination but also for other

crucial processes. These include issues such as captive status verification, banking, smart meter rollout, and competitive bidding for transmission. This is an encouraging trend.

E11.5: TIMELY APPOINTMENT OF ERC MEMBERS FROM A DIVERSE POOL OF CANDIDATES

In FY 2020–21, Rajasthan was the only state where the commission operated without prolonged vacancies and included members (other than the legal member) who were not from the regulated utilities or the state bureaucracy.

Between FY 2016–17 and FY 2021–22, the Rajasthan and Karnataka ERCs functioned at full capacity for at least 90% of the time. However, there were instances of prolonged vacancies in other states. The Delhi ERC had multiple vacancies between FY 2016–17 and FY 2019–20, the Uttar Pradesh ERC had no chairperson for 11 months in FY 2017–18, and in the Gujarat ERC, the position for a member was vacant for a year in FY 2020–21.

In addition to the Rajasthan ERC, the ERCs of Bihar, Delhi, Gujarat, Madhya Pradesh, and Uttar

Pradesh included at least one non-legal member who was not from the state bureaucracy or the regulated utility. These members typically have prior experience as bureaucrats in other states or have had previous experience in NTPC Limited, NHPC Limited, REC Limited, etc.⁶⁶

The ERCs can play a crucial role in consensus building and in facilitating the smooth rollout and adoption of critical technologies and streamlining of crucial investments. However, to play this role, the ERCs have to retain their legitimacy, expand spaces for informed public participation and deliberation, and hold licensees, especially utilities, accountable for their performance.

Highlights

- Over the next decade, several decisions regarding crucial investments, governance and accountability frameworks, and resource utilisation will be made by the regulators, and it is critical that regulatory proceedings should be accessible, have spaces for informed participation, and safeguard consumer interests.
- From a transparency perspective, states follow several good practices such as publishing tariff and other crucial petitions (Bihar and Karnataka) and quarterly performance data (Gujarat) and livestreaming all hearings (Maharashtra).
- Bihar and Karnataka have public consultations for non-tariff proceedings. Almost all the ERCs constitute State Advisory Committees (SACs) with diverse participation, but only SACs in a few states meet on a regular basis (Karnataka and Delhi).
- Licensees submitted their tariff petitions without a significant delay in FY 2020–21, with the exception of discoms in Uttar Pradesh and Tamil Nadu.
- An encouraging trend is that seven of the ten states (the exceptions being Maharashtra, Uttar Pradesh, and Delhi) have been conducting public hearings not just for tariff determination but also for other crucial processes.
- The State Electricity Regulatory Commissions (SERCs) have been taking forward-looking measures. Notable examples include competitive bidding for transmission (Bihar), regulatory scrutiny of smart metering investments (Karnataka, Uttar Pradesh, and Delhi, storage (Rajasthan), and discom finances (Maharashtra).
- The Forum of Regulators plays a crucial role in shaping the energy transition agenda in states by issuing model regulations, conducting studies, and holding regular convenings on various issues. The mandate of this institution should be increased, and it must be strengthened to increase its future effectiveness.
- The Rajasthan and Karnataka ERCs have functioned at full capacity for at least 90% of the past five years, and five of the ten states have had members who were not part of the state bureaucracy or regulated utilities in the recent past.

INSIGHTS

India's electricity sector has made progress towards a green future despite facing legacy challenges. This theme-based study covering 11 indicators for FY 2020–21 shows that action is underway towards promoting RE, increasing consumer choice, and investing in metering and network infrastructure. Some of these advances occurred in the states despite the poor financial health of the discoms and weak institutional capacity. At the same time, DSM, adoption of comprehensive planning processes, and accountability for supply and service quality

remained neglected in FY 2020–21. Some actions on these fronts have been initiated since then. Future action at the central and state levels can build on these developments and prioritise the areas that need attention.

From this study of ten states, certain broad observations emerge that provide learnings for the future. Based on the indicator framework in the guidebook, the study provides broad insights towards forward-looking steps to accelerate the transition.

States are on the transition path. Articulation of long-term objectives and pathways can help accelerate the pace.

This study shows that the states have demonstrated noteworthy progress in the development of RE (E2) and access to alternative supply options for commercial and industrial consumers (E9). This progress has been driven both by techno-economic changes and by proactive actions such as providing clarity in regulatory frameworks (E2) and policy support for grid integration and RE deployment (E9). However, there has been limited action in the development of a long-term vision (E1), and IRP (E4). Overall,

the states are on the transition path, and action on multiple fronts is well underway. However, clear long-term objectives and a pathway to achieve them is yet to be defined in many states. Well-articulated long-term objectives and pathways can help coordinate efforts and reduce the risk of ad hoc and issue-based responses. Such long-term clarity at the state level is also necessary for investors and other stakeholders to help them better prepare for the ambitious and complex transition in the coming decades.

Expanding and effectively exercising the regulatory mandate is necessary to meet the complex requirements of the transition.

Most of the ERCs were created in the 2000s. These commissions were primarily designed to address the legacy challenges of inefficiency and inadequate, skewed tariffs. Thus, regulatory commissions are empowered with strong legal mandates to hold utilities accountable and can exercise wide authority over sectoral decisions. This has also enabled the ERCs to take steps related to the transition, such as setting up RPO targets and providing banking, forecasting, and scheduling frameworks. However, the study

shows that there are several instances where such existing mandates have not been exercised. For example, state ERCs have the mandate to specify and monitor RPO compliance, but the study indicates that six of the ten ERCs studied have either undertaken very limited scrutiny of RPO compliance or have not taken any penal action for RPO non-compliance. Long-term planning and demand-side measures are two other important aspects of the transition where regulatory action is inadequate. For example, most states do not

have clear regulations to ensure IRP-based power procurement and investment. In the case of DSM, eight states have notified DSM regulations, but there was no regulatory action towards implementing the framework in five of these states. The study also indicates areas crucial to the transition where progress is inadequate and there is limited regulatory mandate (e.g., performance monitoring of state and national schemes, tracking of discom financial health).

Further, regulatory commissions have spaces for public participation, and they need to be used effectively to ensure inclusive and people-centric decision-making in energy transition issues. In fact, the study shows that seven of the ten states held public hearings for tariff determination as well as for other crucial matters.

Electricity regulators must play a crucial role in planning, energy accounting, providing frameworks for technology rollout, market development, and accountability for utility performance. Regulatory oversight of smart meter rollout, supply and service quality, development of innovative tariff design, evolution of regulatory approaches for energy storage, and estimation of agricultural demand are some examples from the study. Such oversight also needs to be sustained. A good example of this is the levy of penalties in each year of RPO shortfall in Delhi, in contrast to the practice of allowing carryforward of the shortfall to unsustainable levels in other states. Regulatory oversight can enable timely implementation of crucial aspects of the transition such as the adoption of a resource adequacy framework, acceleration of green OA, and accountability for subsidy payments.

Forward-looking, techno-economic frameworks and coordinated actions will help achieve the speed and scale required for the energy transition.

There are multiple instances where policy and regulatory frameworks on critical matters have been developed in response to litigation on issues such as banking, captive status verification (E9), and RE curtailment (E2). The pace of evolution of policy and regulatory frameworks has not been keeping up with sectoral developments such as addition of RE capacity, increase in the share of non-discom supply, improvement of metering infrastructure, and the emergence of new technologies (e.g., battery-based energy storage). This highlights the need for state governments, the central government, and regulators to play crucial and distinct roles in providing clear, forward-looking frameworks and actions. For example, three of the four states that managed to initiate

solar deployment for agriculture were able to do so because the state governments provided clear frameworks in the form of policies and schemes. Efforts undertaken in these states have informed the national-level enabling policy framework under the KUSUM scheme. In Maharashtra, the rapid evolution of the regulatory framework was instrumental in supplementing the existing policies and aiding the on-ground implementation of feeder-level MW-scale solar deployment. Such forward-looking frameworks developed through coordinated actions will be required to meet several transition-related requirements such as RPO compliance, operationalizing green OA, and scaling storage deployment.

Discom finances continue to be a challenge; still, several pro-transition actions are being implemented in some cases.

At Rs. 5.16 lakh crores by FY 2020–21, the cumulative losses of discoms are certainly a matter of concern. As noted in the observations for E6, there is a steady build-up of working capital

loans and revenue gaps because the revenues are unable to keep pace with the rising discom costs. This build-up will likely increase across discoms with coal price shocks, issues of timely recovery

from consumers and state governments, and revenue attrition due to sales migration.

Poor discom finances are a challenge and need to be addressed on a priority basis. Despite this, discoms with poor finances are undertaking some actions to accelerate the transition. Tamil Nadu, Uttar Pradesh, Maharashtra, Madhya Pradesh, and Rajasthan accounted for about 67% of the total outstanding discom losses at the national level in FY 2020–21. However, these states also have instituted ongoing measures to accelerate the transition:

- All five states have issued tenders for battery-based storage deployment. Madhya Pradesh and Rajasthan were among the first states to propose storage purchase obligations.
- Regulators in Uttar Pradesh and Maharashtra

initiated steps towards pipeline coal capacity review and deferral for a specified time period. The regulators have also initiated actions towards DSM.

- Uttar Pradesh is the only state where ToD tariffs vary seasonally, which can improve the utilisation and integration of RE.
- Maharashtra and Tamil Nadu have reported that most of their feeders have communicable metering technology, enabling several decentralised initiatives and better energy accounting.
- Despite the high cost of supply, Rajasthan and Madhya Pradesh have taken steps to limit cross-subsidy requirements for agricultural consumers.

Sales migration is likely to be inevitable, and a streamlined approach is needed to address its diverse implications.

With the steep reduction in RE generation cost in the last decade and an expected similar trend for battery storage in the coming decade, sales migration through OA and the captive route looks inevitable. As shown in Section E9, OA and captive consumption contributed to 15% of the state-level electricity consumption on average. The recently notified Green Open Access Rules could accelerate sales migration away from discoms to RE-based OA and captive consumption.

This development is already affecting the tariff design of discoms because the revenue requirement from cross-subsidy is being reduced by regulators. This is in response to revenue attrition because cross-subsidising C&I consumers can typically access alternative supply options. With the potential increase in the demand for such options, regulatory commissions and state governments must evolve a balanced framework to enable consumer choice. Some options for this purpose include the following:

- Streamlining application processes and providing investor certainty: This study shows that Uttar Pradesh and Bihar have taken steps in this direction through well-functioning online portals. In sharp contrast, more industrialised states with a larger number of consumers still use offline processes. Maharashtra has been providing clarity and certainty regarding various charges and processes.
- Compensating discoms adequately: Maharashtra and Gujarat have evolved frameworks to ensure that discoms are adequately compensated for services provided to migrating consumers. These services include banking, standby services, and additional operational and procurement measures due to short-term OA.

In addition, with the increase in non-discom sales, these trends need to be tracked and incorporated

in planning and decision-making processes. Gujarat and Maharashtra track crucial trends in OA and captive migration, and Rajasthan and Maharashtra report trends in green OA separately. However, these trends are not comprehensively incorporated into planning processes.

Incorporating and accounting for such trends is critical with respect to the implementation of the resource adequacy framework going forward, because such planning can no longer assume that discom demand is the same as state demand.

Sustained actions, which build on past initiatives and outcomes, have enabled transition-related progress in the states.

Sustained actions and early investments can translate to substantial progress only when states capitalise on these investments and actions towards future developments. For example, many states undertook early, proactive efforts towards feeder segregation and the installation of communicable metering infrastructure on 11 kV feeders. However, in Maharashtra, this investment laid the foundations for actions towards feeder-level solarisation, feeder-level group metering for agriculture, improved estimation of

unmetered demand, and feeder-level reporting of outages. Similarly, policy and regulatory frameworks in RE that provided clear sunset clauses for concessions aided the development of frameworks for adequate compensation for services provided by the discoms in Gujarat and Maharashtra. Building on this, early action towards the deployment of storage and wider implementation of ToD tariffs could help states innovate in a future RE-heavy system.

An institutionalised approach towards data reporting and analysis would help timely and coordinated actions.

Compared to the allied transport and building sectors, substantial data were available on various electricity sector developments in FY 2020–21. This is primarily due to the extent of information submitted in regulatory filings and data collected by central sector agencies such as the BEE, Power Finance Corporation (PFC), REC, and the CEA. In fact, over the past five years, central and state efforts have improved reporting on various fronts, such as the following:

- Detailed information on payments and pending dues of discoms to generators (other than state-owned generating companies) on the PRAAPTI portal
- Reporting on subsidies booked and received

on an annual basis in the PFC annual reports on the performance of state power utilities

- Reporting of average state-level hours of supply and DT failure rates in the Consumer Service Rating of discoms (REC n.d.)

However, limited information across many states on several critical transition trends and utility performance parameters hinders timely understanding of the specific energy transition developments.

Some of the data-related issues that span the elements of the energy transition and relate to accessibility of the sector are summarised in Table 14.

Table 14. Data Availability Challenges

Data-Related Issue	Examples from This Study
Limited information on crucial parameters	<ul style="list-style-type: none"> • Station-wise thermal plant availability and data on coal quality and costs. • Working capital borrowing by discoms and pending dues of public bodies. • Circle-wise distribution transformer failure rate. • Details of open access and captive demand by duration of contract, source of power, etc.
Inconsistency in data availability	Data were not available in a consistent manner across the states for some parameters. In some cases (e.g., subsidy, working capital borrowing), data were not available for the same state consistently across years. In some cases (e.g., hours of supply, metering status), data were submitted by some utilities but not by others.
Terminological or methodological issues	<ul style="list-style-type: none"> • Variation in the methodology used to the estimation of reliability indices. • Variation in the terminology used for reporting un-requisitioned capacity. • Lack of clarity in the treatment of off-site captive consumption. It is not clear if this was accounted as captive or open access because offsite would require open access use of the network. • Category-wise subsidy and tracking of delays in payments. • Variation in reporting practices for borrowing to meet working capital requirements.
Verification of data veracity	Especially with reporting of metering status, hours of supply, and distribution losses. In some cases, data submitted to various agencies are different, which makes reconciling information a challenge.

Centralised collation of such data is important and should be encouraged because it enables a comprehensive understanding of state-level developments. Efforts to ensure the vetting and veracity of the data submitted by various agencies and standardisation of methodologies for data submission are needed. Scrutiny of data submissions should also be included in the regulatory processes. The recent efforts of the PFC (changes in the annual report on utility

performance) and the BEE (regarding energy audit of discoms) to improve data reporting and standardise methodologies are important measures and should be strengthened. Regulatory agencies can be more proactive not just in directing discoms to submit data but also in ensuring data adequacy, consistency, and transparency in compliance with directives and regulations.

Central and state agencies have unique and complementary roles in shaping the energy transition. Better-aligned plans and actions will create the foundation for a successful transition.

Concurrent jurisdiction of the electricity sector in India implies that both central and state governments have important and unique roles to play in the energy transition.

It is essential that the actions of both the central government and state governments should be complementary, aligned, and coordinated. Without this, the scale and speed of development required for the electricity sector transition is unlikely to be achieved. Central sector agencies are best placed to provide a guiding and enabling

framework that not only provides clear directional certainty but also fosters cross-learning and innovation in states.

The central government has released several policies, rules, and schemes. Many of these, instituted after FY 2020–21, are mentioned in the indicator chapters.⁶⁷ Some are collated in Table 15 to highlight the extent of such central sector initiatives. These developments are nascent, and their impacts and implementation need to be studied.

Table 15. Recent Actions by the Central Government and Their Relevance to State-Level Developments

Central Sector Action	Relevance of Central Sector Action from a Transition Perspective	Importance of This Action in Accelerating Developments in States
Long-term renewable purchase obligations (RPO) and storage trajectory guidelines	Prescribed to guide state ambitions for renewable energy (RE) deployment and storage.	Many states have not specified RE trajectories beyond 2025, and no state has specified a storage purchase obligation prior to the guidelines.
Late payment surcharge rules	<p>Specification of strict timelines and penalties (up to revocation of access to inter-state transmission lines) in the case of delays in payments to generators.</p> <p>Enables the sale of capacity un-requisitioned by discoms (on a day-ahead basis) by generators.</p>	<p>Despite contractual provisions, ensuring payment discipline of discoms to generators was a challenge.</p> <p>Generators were unable to sell power un-requisitioned by discoms on a day-ahead basis without explicit consent from the discoms. This consent was seldom given, leading to suboptimal utilisation of capacity.</p>
Electricity Rules	<p>Specification for detailed integrated resource planning (IRP) exercise towards resource adequacy.</p> <p>Standardization of subsidy accounting practices.</p>	<p>IRP for procurement was absent in the states studied in FY 2020–21 based on the indicator framework.</p> <p>Subsidy accounting practices varied significantly across states and across years, as seen in the study.</p>

Central Sector Action	Relevance of Central Sector Action from a Transition Perspective	Importance of This Action in Accelerating Developments in States
Green Open Access Rules	Reduction in eligibility limit for those using open access through RE sources for ≥ 100 kW Centralised portal for processing applications.	Eligibility limit for open access at 1 MW in most states since 2008. Transparency with centralised processing will reduce the existing state-level procedural barriers to using open access.
Consumer rules	Time of day (ToD) tariff proposal for incentivising consumption during hours when solar is available.	None of the ten states offered ToD incentives during solar hours in FY 2020–21. Such tariffs are essential to increase RE utilisation.
Revamped Distribution Sector Scheme (RDSS)	Grant-based capital investments for feeder segregation and feeder-level metering are prioritised, especially to enable solarisation. Grants are allocated to strengthen the grid.	Many states were unable to prioritise feeder segregation, metering, and backbone infrastructure development.
Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana (KUSUM) scheme	Provides a framework for accelerating the solarisation of agriculture at the pump and feeder levels.	Prior to the scheme, Maharashtra, Gujarat, and Rajasthan had initiated action through various models, but adoption in the other states was limited.
Energy audits conducted by the Bureau of Energy Efficiency (BEE)	Detailed quarterly and annual audits of consumer and interface metering status and loss accounting.	Vetting and verification on an ad hoc basis by regulatory commissions. Lack of sustained reporting or accountability.
Development of markets	Introduction of RE-specific day-ahead and term-ahead products on power exchanges. Introduction of up to three months ahead contracts on the exchanges	States had limited avenues to meet RPO shortfall. Further, short-term procurement was limited to the DEEP (Discovery of Efficient Electricity Price) portal.

Although many of these actions and frameworks promote developments in the states, some are more binding and exact, which might not speak to specific state contexts, constraints, and emerging trends. A few examples are detailed below:

- Green OA rules provide concessions or caps on charges for green OA even though

many states have decided to remove such concessions. Such concessions would affect the already strained finances of discoms.

- Timely payment to generators would imply significant working capital borrowing because similar measures are not in place for timely clearance of discom dues, especially by public

bodies and government departments.

- Setting a national ambition for renewables is necessary to inform state actions. However, states should have the flexibility to determine which RE technology to procure based on their load shapes and system requirements.

In some cases, incentive-based opt-in schemes rather than binding rules are perhaps better to align state priorities where there are significant impacts on the finances and operations of state agencies. Further, a guiding and enabling framework can also promote innovation that can inform national-level policies and schemes (as was the case with KUSUM).

To accelerate the adoption of good practices and clear frameworks, standardisation of processes and guidelines for implementation are important.

This also helps set a clear baseline for actions across states. With respect to regulatory developments, the FoR, which comprises central and state regulators, has been playing a critical role, as highlighted in Section E11. Going forward, the role and mandate of the For should be expanded.

This study shows that coordinated efforts are needed on multiple fronts to accelerate the pace of the transition. Multiple good practices and innovations in various states need to be further studied and replicated, and there is also significant potential for cross-learning. Similarly, central agencies play a crucial role in creating enabling frameworks to scale up necessary actions. Alignment of central and state policy outlooks and actions will enable a transition that is not just dominated by techno-economic changes but is also in the public interest and that aims to address pressing challenges for a better future.



ANNEXURES E1 TO E11 (EXPLANATORY NOTES ON ATTRIBUTES AND SUB-ATTRIBUTES)

Annexure E-1 Long-Term Vision for the Electricity Transition

Attribute	Sub-Attribute	Notes
<p>1) The state has a long-term vision for the electricity sector</p> <p>(Yes, if both are met)</p>	<p>a. The state government/cabinet has approved a long-term vision or policy within the past five years.</p> <p>b. The vision covers topics such as long-term policy approaches on power procurement, demand-side management, clean energy transition, adoption and promotion of new technologies, emissions reduction, affordability, safety and quality of supply, and service to consumers.</p>	<p>To understand whether states have a long-term vision that is approved by the state cabinet until at least 2030. The vision should be specific to the power sector. Long-term power infrastructure aspects in master plans and plans that are a part of memorandums of understanding under specific central government schemes are not considered.</p>
<p>2) The vision is backed by clearly identified goals, strategies, and government support</p> <p>(Yes, if any two are met)</p>	<p>a. The state has set targets toward the long-term vision.</p> <p>b. There are specific milestones for the financial turnaround of discoms or the state electricity sector.</p> <p>c. The functions/responsibilities of various state institutions (government departments, state-owned utilities, regulatory commissions) in achieving the specified goals or the vision are clearly articulated.</p> <p>d. Broad direction of government support (e.g., in terms of tax incentives, tariff support, grants, investment support, measures for enabling markets, competitive bidding) to meet goals of the transition-oriented vision is specified.</p>	<p>The vision document should be publicly available and provide sufficient details on targets, investment requirements etc.</p>

Attribute	Sub-Attribute	Notes
<p>3) The vision was developed through a public consultation process.</p> <p>(Yes, if both are met)</p>	<p>a. The draft vision document was put together by a committee which included non-governmental representatives, or stakeholder consultations were held as part of draft vision development.</p> <p>b. Written responses were provided to comments raised during the public consultation and both are available in the public domain.</p>	<p>Mention of a consultation process in the vision document or conversations with those involved in the vision process to ascertain participation.</p>
<p>4) The long-term vision has mechanisms to monitor its progress.</p> <p>(Yes, if both are met)</p>	<p>a. Monitoring mechanisms are specified in the vision document to track progress and for annual public reporting of specific parameters for achieving the long-term vision.</p> <p>b. The State Electricity Regulatory Commission (SERC) or the state energy department plays a major role in the monitoring process.</p>	
<p>5) The state has progressive medium-term policies with specific goals and targets:</p> <p>(Yes, if all are met)</p>	<p>a. The state has introduced sectoral/ sub-sectoral policies with specific goals and targets.</p> <p>b. There are provisions to review the sectoral/ sub-sectoral policies to assess progress and make mid-course corrections if necessary.</p> <p>c. Public or stakeholder consultations were held for some of these medium-term sectoral/ sub-sectoral policies.</p>	<p>Applicable policies such as state renewable (solar, wind, Hybrid, rooftop) energy policies, and energy efficiency policies were looked at in detail. Electric vehicle policy has been assessed in detail in “Transport” indicators and thus not considered here.</p>

Annexure E-2: Development of Renewable Energy and Electricity Storage

Attribute	Sub-Attribute	Notes
<p>1) Commitment to renewable energy (RE) procurement in the assessment year is comparable to the national aspiration</p> <p>(Yes, if met)</p>	<p>a. RPO targets set by the State Electricity Regulatory Commissions (SERCs) are at least 90% of the national-level renewable purchase obligations (RPO) target for the assessment year.</p>	<p>The state-level target specified by the commission is compared with the national target as a percentage. Differences in methodology may result in variation, but this is not tracked.</p>

Attribute	Sub-Attribute	Notes
<p>2) RE procurement by the discoms complies with the state target.</p> <p>(Yes, if met)</p>	<p>a. Discoms comply with at least 90% of the target set by the SERC.</p>	<p>The assessment does not focus on the RPO methodology, which varies across states. Compliance is noted per the methodology adopted by the respective SERC.</p>
<p>3) In the case of non-compliance, the SERC has taken necessary action as stipulated in the regulations.</p> <p>(Yes, if either is met)</p>	<p>a. The assessed discoms comply with targets in accordance with SERC regulations.</p> <p>b. The SERC has imposed penalties in the case of non-compliance by discoms in accordance with the regulations.</p>	<p>Compliance is studied for each year, including purchase of renewable energy certificate (REC) or through participation in green market options. The practice is considered in case RPO compliance is not conducted for the study year but the regulatory commission has imposed penalties consistently (at least for the three years preceding the study year).</p>
<p>4) Steps/policies to encourage better utilisation of wind and solar exist.</p> <p>(Yes, if any two are met)</p>	<p>a. The SERC has notified forecasting and scheduling (F&S) regulations.</p> <p>b. The State Load Dispatch Centre or the SERC has taken steps to ease implementation or issued reports on the status of implementation of F&S regulations for wind and solar.</p> <p>c. The SERC has provided a clear framework regarding the process for curtailment, its necessity, and its reporting.</p> <p>d. There is tracking and transparent public reporting of instances of curtailment in the state by the State Load Despatch Centre, discoms, or the SERC.</p>	<p>‘Ease of implementation’ refers to steps such as non-applicability of demand-side management (DSM) charges for a certain time period, consultations with stakeholders, and issuance of practice directions.</p>
<p>5) Steps have been taken to encourage the adoption of storage.</p> <p>(Yes, if either is met)</p>	<p>a. The SERC has published draft/finalised regulations that specify storage purchase obligations.</p> <p>b. The state has undertaken pilot projects to establish battery-based energy storage systems.</p>	<p>Pilot projects are captured only for battery-based energy storage systems. Storage obligation includes pumped storage.</p>

Annexure E-3: Management of Coal Thermal Capacity

Attribute	Sub-Attribute	Notes
<p>1) Regulatory measures exist to encourage cost-optimal and flexible operation of contracted coal-based power stations.</p> <p>(Yes, if all are met)</p>	<p>a. There is a framework for Merit Order Dispatch specified by the regulator and the merit order is periodically reported on discom/ State Load Despatch Centre websites in a transparent manner.</p> <p>b. The appropriate commission has specified a compensation framework for part load operation of contracted coal-based plants.</p> <p>c. There is regulatory scrutiny (cost, tariff impacts, impact on the demand-supply mix due to unrequisioned capacity) reported by discoms under assessment.</p> <p>d. The appropriate commission has stipulated that coal-based generation capacity is to be able to operate at a technical minimum of 55% or below.</p>	<p>The state-level target specified by the commission is compared with the national target as a percentage. Differences in methodology may result in variation, but this is not tracked.</p>
<p>2) Assessed coal thermal plants in the state operate in an efficient manner.</p> <p>(Yes, if both are met)</p>	<p>a. At least 90% of the contracted capacity by assessed discoms shows availability greater than or equal to the normative availability stipulated by the appropriate regulator</p> <p>b. Regulatory vetting of coal quality, availability, and costs takes place for the majority of the cost-plus contracted generating stations.</p>	<p>The following coal-related factors should undergo regulatory scrutiny in the tariff process: amount of coal purchased, gross calorific value of coal, cost of purchasing coal, source of coal, and transport costs.</p>
<p>3) There are actions toward adhering to emission norms stipulated by the Ministry of Environment, Forest and Climate Change.</p> <p>(Yes, if both are met)</p>	<p>a. In the past two years, most of the coal capacity contracted by the assessed discoms has a new/revised plan for the installation of pollution control equipment submitted to the appropriate regulatory commission and is available in the public domain.</p> <p>b. The appropriate commission has provided regulatory dispensation to address cost impacts due to the installation of pollution control equipment for both cost-plus and competitive projects under its jurisdiction.</p>	<p>The plan should include technology being installed, a timeline for installation, and cost outlay. Regulatory Dispensation should ideally address compensation mechanisms to address capital and variable cost impacts due to the installation of pollution control equipment.</p>

Attribute	Sub-Attribute	Notes
<p>4) Actions have been taken to limit future addition of coal-based capacity.</p> <p>(Yes, if any two are met)</p>	<p>a. The coal-based capacity in the pipeline is limited to replacement capacity such that the net capacity addition is limited or negative.</p> <p>b. The state government has announced that there will be no more coal-based capacity addition beyond the existing pipeline, or the SERC has decided to defer approval of capacity addition based on the current demand-supply situation.</p> <p>c. In the past three years, the state government or the SERC has formally abandoned coal power plants at the pre-construction stage where not much progress has been made.</p> <p>d. Discoms have taken steps to surrender central/state sector coal-based capacity from upcoming plants.</p>	<p>Pipeline capacity includes contracted capacity proposed capacity as well as capacity under construction. Those plants which were commissioned in the assessed Year have not been considered. Only official press releases, Government order/resolutions are taken into consideration to mean state government announcements.</p>
<p>5) Plans for capacity retirement are analysis-based.</p> <p>(Yes, if both are met)</p>	<p>a. There is a comprehensive, publicly available framework in the state being used for the techno-economic assessment of value of cost and alternatives for those units which have completed 25 years or the PPA term, whichever is later.</p> <p>b. There is a framework or mandate in the state for provision of a publicly available action plan or there is documented clarity on the retirement schedule and how site restoration and repurposing as well as socioeconomic impacts will be addressed.</p>	<p>Any policy or regulatory framework which details the techno-economic principles, plans, actions and considerations for thermal plant retirement or site restoration and repurposing have been studied.</p>

Annexure E-4: Integrated Resource Planning

Attribute	Sub-Attribute	Notes
<p>1) The regulatory mandate and process for the IRP are clear if regulations stipulate the following:</p>	<p>a. Mandate for all distribution licensees to provide a resource plan (or demand and supply projections) for 10 years for SERC approval</p> <p>b. Stipulation that all assumptions and data used in the resource plan are available in the public domain</p>	<p>SERC regulations or guidelines for power purchase, tariff, and investment were studied.</p>

Attribute	Sub-Attribute	Notes
(Yes, if all are met)	<p>c. Requirement that the resource plan is revised at least every three years and approved by the commission</p> <p>d. Specification that all long-term power procurement would be based on an approved, periodically monitored plan from the SERC</p>	
<p>2) The plan has recently been approved through a transparent, participatory process and is used for procurement decisions in the state.</p> <p>(Yes, if all are met)</p>	<p>a. The resource plan has been approved or revised in the past three years.</p> <p>b. Petition, data, and assumptions are publicly available for the resource plan and approval takes place through a public consultation process.</p> <p>c. Ten-year demand and supply projections in the resource plan include source-based supply projections as well as separate projections for base and peak load.</p> <p>d. No approval for power procurement is provided by the SERC unless the project is part of the approved plan.</p>	<p>Only ten-year plans have been considered. Five-year plans especially for capital investments have been studied in Indicator 10. Ad-hoc plans submitted as part of regulatory proceedings for approval of new plants have not been considered.</p>
<p>3) The latest approved resource plan is based on transition-oriented assessment methodologies and clearly articulates potential options.</p> <p>(Yes, if all are met)</p>	<p>a. The resource plan states well-defined priority areas, targets, and goals which it would seek to achieve.</p> <p>b. Scenario building and sensitivity analysis for demand and supply projections based on advanced modelling techniques are part of the plan.</p> <p>c. Demand and supply projections incorporate RPO targets, variability of RE, projection of various new end uses, operational characteristics of different resources, the impact of sales migration or solarisation of agriculture, use of storage options, capacity planned/contracted/under construction in the pipeline, and capacity retirement schedules.</p> <p>d. The decisions recorded in the approval order are based on the assessments and adequate evidence and justification is provided.</p>	

Attribute	Sub-Attribute	Notes
<p>4) To articulate the result of the IRP exercise, the order clearly states the following:</p> <p>(Yes, if all are met)</p>	<p>a. Capacity requirement, if any, along with technology type/source requirements</p> <p>b. Estimate of investment requirements and/or potential tariff impact due to investment requirements</p> <p>c. Directives, targets, or measures toward meeting future requirements in a cost-optimal manner</p> <p>b. Provision for monitoring progress vis-à-vis plans</p>	
<p>5) Future power procurement is based on transparent, competitive processes.</p> <p>(Yes, if both are met)</p>	<p>a. All power purchase agreements (PPAs) (except in the case of nuclear and hydropower) signed in the assessment year are procured based on competitive bidding.</p> <p>b. Regulatory approval of contracts signed in the assessment year has undergone a public consultation process.</p>	<p>Annual reports and regulatory proceedings regarding power purchase before the Commission in the assessed year have been considered.</p>

Annexure E-5: Demand-Side Management

Attribute	Sub-Attribute	Notes
<p>1) Energy efficiency (EE)/ DSM plans have specific targets.</p> <p>(Yes, if both are met)</p>	<p>a. The state government or SERC has prescribed specific targets for all the discoms in terms of avoiding peak capacity and/or savings in energy.</p> <p>b. Discoms have submitted DSM plans in their latest MYT petitions with clear targets.</p>	<p>This is tracked either in a policy notified by the state, the state energy department website, or the state-designated agency.</p>
<p>2) Regulations exist to facilitate EE/DSM. These should cover the following:</p> <p>(Yes, if any two are met)</p>	<p>a. Broad DSM implementation framework</p> <p>b. Cost-effectiveness framework</p> <p>c. Evaluation, monitoring, and verification framework</p> <p>d. Mandate for consumer engagement for DSM programmes requiring consumer participation</p>	<p>Most regulations mention the following only in passing. The assessment tracks whether states have issued detailed and clear guidelines for these frameworks, post the notification of the regulations.</p>

Attribute	Sub-Attribute	Notes
<p>3) Adequate financial resources are available to meet the EE/DSM targets.</p> <p>(Yes, if either is met)</p>	<p>a. The state has identified the budget required to meet the targets and allotted at least 75% of the annual requirement identified in the energy efficiency policy to the State Designated Agency.</p> <p>b. Discoms have spent (consider whichever is higher):</p> <p>i) At least 0.2% of their annual revenues toward DSM programmes</p> <p>or</p> <p>ii) 75% of the annual requirement identified to meet their DSM target</p>	<p>SDA annual reports, if available were used for budgetary outlays and expenditures for EE.</p>
<p>4) Targets are being tracked and non-compliance is penalised.</p> <p>(Yes, if both are met)</p>	<p>a. The discoms have submitted a report on their EE/ DSM programmes and compliance report on evaluated savings with the targets.</p> <p>b. The SERC has assessed the reported savings by the discoms and imposed penalties in case of discom noncompliance.</p>	
<p>5) Periodic end-use research is being conducted, enabling better design of DSM programmes.</p> <p>(Yes, if either is met)</p>	<p>a. SDAs/discoms are conducting load research at least once every three years to assess consumer category load profiles.</p> <p>b. SDAs/discoms are conducting market research and/or incentivising energy audits of consumers.</p>	

Annexure E-6: Financial Health of Electricity Distribution Companies

Attribute	Sub-Attribute	Notes
<p>1) There is transparent reporting and management of short-term debt.</p> <p>(Yes, if both are met)</p>	<p>a. There is clear and consistent reporting of working capital borrowing by the assessed discoms to the regulator.</p> <p>b. Borrowing to meet working capital requirements of all assessed discoms together is less than 25% of their annual expenses.</p>	<p>The actual borrowing to meet the working capital requirements of all the discoms studied in the state is less than 25% of their annual expenses. Regulatory documents be it tariff filings or separate petitions are important sources to ascertain this. Along with this,</p>

Attribute	Sub-Attribute	Notes
		filings in financial audit reports have this information in audit notes. However, this may not be reported in a standardised form.s.
<p>2) There is transparent reporting and management of accumulated losses.</p> <p>(Yes, if both are met)</p>	<p>a. Regulatory approval of past revenue gaps has taken place in a clear and consistent manner in the study year</p> <p>b. The cumulative revenue gap together for all assessed discoms in the assessment year, carried over from previous years, is less than 15% of the annual expenses in the assessment year.</p>	<p>The regulatory process for computing and approving cumulative revenue gaps should have taken place as part of the latest MYT process or as part of existing regulatory practice. The cumulative revenue gap along with applicable carrying cost is to be considered. Annual expenses implies the net ARR approved as part of the true-up process by the Commission.</p>
<p>3) Discoms' dependence on subsidy revenue sources and annual losses are in check.</p> <p>(Yes, if both are met)</p>	<p>a. The subsidy contribution (government subsidy plus cross-subsidy) is less than 25% of the annual expenses of all assessed discoms taken together.</p> <p>b. The annual revenue gap is less than 5% of the annual expenses of all discoms assessed together.</p>	<p>Total Subsidy = State Government Subsidy as promised + Cross Subsidy Contribution (Based on Actual Sales and Revenue reported by DISCOMs for each consumer category). Subsidy noted in state-level documents and verified based on reporting by PFC. The average cost of supply is estimated based on total sales by the DISCOM.</p>
<p>4) Energy losses are decreasing and there is sustained collection efficiency for revenue.</p> <p>(Yes, if both are met)</p>	<p>a. The sum of unaccounted energy (distribution losses and sales to unmetered categories) as a proportion of total power procured input has consistently reduced over the last three years for assessed discoms.</p> <p>b. The collection efficiency of all non-agricultural consumer categories over the past three years is on average more than 90%.</p>	<p>Unaccounted Energy = Total Input Energy - Metered Sales (Actual data as reported by DISCOMs) In categories with poor metering, such as agriculture, in case bifurcation of metered and unmetered sales for a particular category is not reported, sales to the entire category are considered as 'unmetered'. Study contingent on reporting style and formula used by the DISCOMs as well as the assumptions made, especially with respect to the treatment of arrears.</p>

Attribute	Sub-Attribute	Notes
<p>5) Government payments to discoms are disbursed in a timely manner.</p> <p>(Yes, if both are met)</p>	<p>a. Pending payments from public bodies are less than 10% of total consumer arrears in the assessment year.</p> <p>b) At least 90% of the subsidy promised by the state government in the assessment year was paid in that year.</p>	<p>Data reported in the PFC report has been used in case state sources are ambiguous or show discrepancies.</p>

Annexure E-7: Electricity Demand and Supply for Agriculture

Attribute	Sub-Attribute	Notes
<p>1) Progress in feeder segregation and metering is on track.</p> <p>(Yes, if both are met)</p>	<p>a. More than 80% of identified feeders have been separated to ensure dedicated feeders for agricultural supply.</p> <p>b. More than 80% of the dedicated agricultural feeders are Advanced Metering Interface/ Automatic Meter Reading (AMI/AMR) enabled.</p>	<p>Number of identified feeders' based on the latest reported by DISCOM and could be from multiple sources. It could be revised under RDSS where more feeders were identified for separation. Details of AMR/ AMI metering obtained from DISCOM filings in compliance with BEE regulations on DISCOM energy audits.</p>
<p>2) The estimation of unmetered agricultural demand is based on a rigorous scientific study using metered data.</p> <p>(Yes, if one is met)</p>	<p>a. Feeder-level AMI/AMR readings from segregated/dedicated agricultural feeders; a widespread agricultural consumer survey conducted at least once in the past five years; or data from consumer-level meter readings of agricultural consumers</p>	<p>Studies with less than 5% of agricultural sales as sample size are not considered. The basis of estimation of unmetered consumption in the study year and the methodology used by the Commission for approval is being studied.</p>
<p>3) The dependence of low-tension (LT) agriculture category consumers on subsidy and cross-subsidy is balanced.</p> <p>(Yes, if met)</p>	<p>a. The regulated tariff (including subsidy) for LT agriculture in the assessment year is at least 80% of the average cost of supply, in line with the national Tariff Policy.</p>	<p>ACOS and ABR calculations are based on actual aggregate revenue requirement net of non-tariff income, actual sales and the tariff revenue (with subsidy) as reported in True-Up Formats.</p> <p>The entire LT AG category (Metered + Unmetered) is considered.</p>

Attribute	Sub-Attribute	Notes
<p>4) Progress in the solarisation of the agricultural supply is on track.</p> <p>(Yes, if either is met)</p>	<p>a. At least 2% of the total grid-connected agricultural connections in the state have been solarised through decentralised Schemes.</p> <p>b. There is a state scheme to shift agricultural demand toward daytime solar power through centralised RE procurement for agriculture.</p>	<p>In case the progress is given in capacity terms, it was converted into the number of connections by using (Actual / projected approved) number of consumers and connected load data. Only grid-connected capacity is considered.</p>
<p>5) There is public reporting of parameters regarding the quality of supply to agriculture.</p> <p>(Yes, if both are met)</p>	<p>a. There is public reporting of the DT failure rate for predominantly agricultural areas/ circles by all assessed discoms.</p> <p>b. There is public reporting of hours of supply to agricultural feeders in the discoms' areas.</p>	<p>Hours of supply tracked is actual rather than scheduled hours of supply. The information for DT failure rate should be reported at least at the circle level.</p>

Annexure E-8: Affordable and Reliable Supply for Small Consumers

Attribute	Sub-Attribute	Notes
<p>1) Power supplied to small enterprises is affordable.</p> <p>(Yes, if either is met)</p>	<p>a. All low-tension commercial and industrial consumers using less than 300 units per month are subject to the same tariffs (after subsidy) as all low-tension residential consumers.</p> <p>b. All low-tension commercial and industrial consumers using less than 300 units per month are charged tariffs (after subsidy) not higher than the cost of supply.</p>	<p>The per unit calculation considers all slab-wise charges (post-subsidy)</p> <p>For the purposes of this study, it is assumed that each consumer category using 300 Units per month has a connected load of 5 kW.</p>
<p>2) Power supplied to small domestic consumers is affordable.</p> <p>(Yes, if either is met)</p>	<p>a. All low-tension residential consumers, and not just Below-Poverty-Line (BPL) cardholders, using less than 30 units per month are eligible for lifeline, concessional tariffs.</p> <p>b. Tariffs (after subsidy) for all low-tension residential consumers using up to 100 units per month are less than the average cost of supply but more than 80% of the average cost of supply of the assessed discoms.</p>	<p>The projected approved sales and ARR numbers of the studied DISCOMs are aggregated to calculate ACoS. For the purposes of this study, it is assumed that:</p> <p>LT Residential consumers using 30 Units per month have a connected load of 0.25 kW. LT Residential consumers using 100 Units per month have a connected load of 1 kW.</p>

Attribute	Sub-Attribute	Notes
<p>3) The regulator periodically evaluates supply and service quality and revises benchmarks.</p> <p>(Yes, if both are met)</p>	<p>a. In the past three years, the SERC or assessed discoms have conducted studies including consumer surveys to assess metering and billing issues, supply challenges, and other issues, and these studies are publicly available.</p> <p>b. The Standards of Performance (SoP) regulations have been revised or amended in the last five years to tighten standards/ benchmarks.</p>	<p>Revision should ideally have taken place between April 2018 to March 2021 with at least more than half of the benchmarks tightened. (Benefiting small consumers and rural areas.)</p>
<p>4) SoP compliance is reported regularly, and the regulator uses reported data to hold discoms accountable.</p> <p>(Yes, if both are met)</p>	<p>a. The discoms under assessment publish compliance reports for SoP every quarter or as stipulated in the applicable regulations.</p> <p>b. The SERC uses SoP data reported by assessed discoms to hold them accountable for supply and service quality.</p>	
<p>5) Supply and service quality has been improving for the past three years.</p> <p>(Yes, if any two are met)</p>	<p>a. There has been an improvement in reliability indices at the feeder level.</p> <p>b. There has been an improvement in hours of supply as measured at the feeder/DT level.</p> <p>c. There has been a state-level decrease in fatal human accidents per 100,000 mid-year Population.</p> <p>d. There has been a decrease in the DT failure rate.</p>	<p>Parameter should showcase clear trend of improvement on year-on-year basis in past three years.</p> <p>‘Fatal human accidents’ are tracked as per ADSI reports</p>

Annexure E-9: Access to Competitive Supply Alternatives for Industrial and Commercial Consumers

Attribute	Sub-Attribute	Notes
<p>1) Processes to facilitate access to competitive options for electricity consumers are streamlined.</p>	<p>a. The option of filing applications online exists for open access, captive and kW-scale grid-interactive RE systems.</p>	<p>The national portal for rooftop solar has links to various state portals which has been considered for this study.</p>

Attribute	Sub-Attribute	Notes
(Yes, if any two are met)	<p>b. Open access regulations have been revised within the past three years to account for recent changes in the sector.</p> <p>c. The SERC has a clearly outlined process for assessing captive status.</p> <p>d. There is a clearly outlined process for registering all behind-the-meter systems.</p>	
<p>2) There is certainty in charges and procedures applicable for open access, captive, and rooftop consumers.</p> <p>(Yes, if either is met)</p>	<p>a. There has been certainty regarding open access charges (on a ₹/kWh basis) for the last five years.</p> <p>b. All of the following are satisfied:</p> <ul style="list-style-type: none"> • There are no instances of retrospective applicability of charges and processes by the regulator, utilities, or state government. • Introduction of new charges or procedures is preceded by a period of non-applicability post-announcement to allow for adaptive changes. • There is clarity on the period for which concessions are provided with a clear sunset clause for applicability. 	<p>Within the past five years, it is seen if there is a more than 5% year-on-year change in the sum of AS and CSS.</p>
<p>3) Price signals exist to ensure equitable sharing of risk between consumers and utilities.</p> <p>(Yes, if either is met)</p>	<p>a. The banking charge and framework, electricity duty, and standby charge/parallel operation charges applicable for captive power plants have been revised within the past 5 years.</p> <p>b. There are regulatory measures in place to discourage short-term open access.</p>	<p>We consider if</p> <p>a. the state has undertaken a revision in each of these:</p> <p>i) Banking charge and framework ii) Electricity duty on captive iii) Standby/parallel operation charges</p>
<p>4) There is transparent reporting of sales migration trends by some state-level agencies.</p>	<p>a. There is reporting on the status of open access, captive, and grid-connected rooftop systems by consumers in the assessed discoms' areas of supply.</p>	

Attribute	Sub-Attribute	Notes
(Yes, if any two are met)	<p>b. There is reporting on the number and capacity of behind-the-meter systems in assessed discoms' areas of supply.</p> <p>c. There is separate reporting for RE- and non-RE-based sales migration in assessed discoms' areas of supply.</p> <p>d. There is reporting on pendency and average time taken to process applications (for, e.g., open access, captive, kW-scale grid-interactive RE) in the assessment year and consumers can track their applications online.</p>	
<p>5) Consumers can exercise choice to source power at competitive tariffs.</p> <p>(Yes, if any one of two is met)</p>	<p>a. Discom energy charges for industrial consumers are lower than the cost of power (including applicable charges) for open access and captive consumers.</p> <p>b. There is a year-on-year increase in cumulative sales to open access and captive consumers in the state.</p>	<p>Cost of power for HT DISCOM Industrial consumer is assumed to be the energy charge for the purposes of this sub-attribute. Cost of power for open access and captive consumers is assumed to be Rs 3.5/unit. Over and above this, applicable charges - such as AS, CSS, wheeling and transmission charges, and electricity duties are applied.</p> <p>Due to unavailability of consistent data for FY2020-21, only captive sales (from CEA General Review) have been considered.</p>

Annexure E-10: Preparedness of State-Level Transmission and Distribution Network

Attribute	Sub-Attribute	Notes
<p>1) Transmission planning in the state accounts for transition-related impacts and has regulatory oversight.</p>	<p>a. The state transmission perspective planning process accounts for aspects such as RE capacity addition, change in load patterns due to electrification of new uses and the potential role of storage applications.</p>	<p>Regulations were also studied to assess if there was a mandate for regulatory approval of perspective plans.</p>

Attribute	Sub-Attribute	Notes
(Yes, if both are met)	b. The perspective plan is approved by the SERC and reviewed every three years in a transparent manner.	
2) Discoms have undertaken disaggregated planning to strengthen the distribution network, which has regulatory oversight.	<p>a. There are zone or circle-based plans for distribution capital investment which include plans for load growth, rural network strengthening, role of storage applications and decentralised renewable energy generation growth amongst others.</p> <p>b. The plan is approved by the SERC and is reviewed every three years in a transparent manner.</p>	
(Yes, if both are met)	<p>a. There is public reporting of the status of all intra-state transmission projects including cost outlay, delays, and cost overruns, at least once a year.</p> <p>b. There is public reporting on the status of all DISCOM capital investment projects including cost outlay, delays and cost overruns, at least once a year.</p>	Time and cost overruns should be specified along with financial outlays.
3) Status and progress of capital works in transmission and distribution in the state are publicly disclosed.		
(Yes, if any two are met)	<p>a. All non-agricultural consumers in the DISCOMs' areas of supply are metered.</p> <p>b. There is 90% AMI/AMR Feeder metering in the areas of supply of assessed DISCOMs.</p> <p>c. At least 70% of all distribution transformers are metered.</p> <p>d. There is periodic reporting of consumer-level metering status in the public domain</p>	The presence of un-metered consumer categories other than agriculture is considered rather than actual on-ground metering status.
4) Progress in consumer and interface metering is on track.		
(Yes, if any two are met)	<p>a. Time-of-day tariffs are applicable for consumers who have connected load as low as 10 kW and also for consumers with kW scale grid-interactive RE systems.</p> <p>b. The time-of-day tariff design approved by the SERC encourages consumption during solar hours and high wind periods and disincentivises consumption during stress periods.</p>	At least one consumer category (or sub-category) with a connected load as low as 10 kW should be covered under the ToD regime. There should be no penalty during solar hours (6 a.m. to 6 p.m.).
5) Price signals exist to encourage shifting of load for better RE integration.		

c. Time-of-day tariffs vary on a seasonal basis.

d. Incentives and disincentives in time-of-day pricing are significant enough to encourage shift in load (at least 15% penalty/rebate of the applicable tariff for the category).

Annexure E-11: Regulatory Governance and Processes

Attribute	Sub-Attribute	Notes
<p>1) Regulatory processes are transparent and easy to access.</p> <p>(Yes, if both are met)</p>	<p>a. All petitions and submissions by licensees are publicly available on the commission's website.</p> <p>b. Charges for individuals or consumer organisations to apply for a petition are not more than ₹5,000.</p>	<p>These include not just tariff petitions, but any crucial petition filed by the utilities. Crucial petitions include those on quality of supply and service, power procurement, approval of large investments etc.</p>
<p>2) The SERC encourages wider participation in decision-making processes.</p> <p>(Yes, if any two are met)</p>	<p>a. Consumer representatives are appointed for the assessed year as prescribed under Section 94 (3) of the Electricity Act of 2003, and they are a party to crucial proceedings before the commission.</p> <p>b. The State Advisory Committee has non-governmental representatives from all major consumer categories and has convened at least four meetings in the past two years.</p> <p>c. The commission has conducted public hearings for not just the latest tariff determination but other crucial matters which impact costs, supply, and tariffs for consumers.</p> <p>d. Hearings before the commission are live-streamed or available on the SERC website for the public.</p>	<p>'Major consumer categories' are judged on the basis of the specific states' electricity sales mix.</p> <p>The study tracks whether the Commission has conducted hearings for crucial matters (large investment, smart meter rollout, change in regulations etc.) within the past two years.</p>

3) The commission members are appointed on a timely basis from a diverse pool of candidates.

(Yes, if both are met)

a. In the past 60 months, the commission has been functioning without any vacancies for at least 54 months.

b. Among working commission members in the past 60 months, at least one non-legal member was appointed from outside of senior state bureaucracy or regulated utilities in the assessed state.

4) The commission takes steps to ensure accountability of utilities.

(Yes, if both are met)

a. The commission has gathered and published data on crucial financial and performance parameters of the utilities on an annual basis for the assessment period, irrespective of whether a tariff order was issued that year.

b. There was no delay in filing of the last tariff and true-up petitions. Alternatively, in cases where there is a delay of more than five months, the commission had initiated a suo moto process for tariff determination and true-up instead of condoning the delay.

5) The commission has taken proactive, timely actions to address critical challenges and developments facing the state sector. There has been regulatory action on the following issues in the past two years:

(Yes, if any two are met)

a. The commission has conducted a detailed review and evaluation of how central and state government schemes have been implemented.

b. A regulatory framework for roll-out, cost-benefit assessment, and cost sharing of smart meters has been provided.

c. Measures to address cumulative revenue gaps or a growing working capital requirement for discoms are under assessment.

d. Studies on various forward-looking, transition-oriented issues and challenges have been commissioned or published.

LIST OF ABBREVIATIONS

ABR:	average billing rate
ACoS:	average cost of supply
AMR:	Automated Meter Reading
AMI:	Advanced Metering Infrastructure
APPC:	average power purchase cost
APTEL:	Appellate Tribunal for Electricity
ARR:	annual revenue requirement
AT&C Loss:	Aggregate Technical and Commercial Loss
BEE:	Bureau of Energy Efficiency
BESCOM:	Bangalore Electricity Supply Company Limited
BPL:	Below Poverty Line
BU:	Billion Units
CEA:	Central Electricity Authority
CERC:	Central Electricity Regulatory Commission
C&I:	Commercial & Industrial
CPP:	captive power plant
CUF:	capacity utilisation factor
DDUGJY:	Deen Dayal Upadhyaya Gram Jyoti Yojana
discom:	electricity distribution company
DSM:	demand-side management
DT:	distribution transformer
E Act:	Electricity Act, 2003
EA, 2003:	Electricity Act, 2003
ED:	electricity duty
ERC:	Electricity Regulatory Commission
FoR:	Forum of Regulators
GCV:	gross calorific value
GoI:	Government of India
GW:	gigawatt
LT:	low tension
MNRE:	Ministry of New and Renewable Energy
MoD:	Merit Order Dispatch
MoP:	Ministry of Power
MoU:	memorandum of understanding
MSEDCL:	Maharashtra State Electricity Distribution Company Limited
MW:	megawatt

MYT: Multi Year Tariff
NBPDCL: North Bihar Power Distribution Company Limited
NTP: National Tariff Policy
NTPC: National Thermal Power Corporation
OA: open access
O&M: operation and maintenance
PCE: pollution control equipment
PFC: Power Finance Corporation
PLF: plant load factor
PPA: power purchase agreement
PXIL: Power Exchange India Limited
RE: renewable energy
RDSS: Revamped Distribution Sector Scheme
RTI: Right to Information Act
RPO: renewable purchase obligations
RGVY: Rajiv Gandhi Grameen Vidyutikaran Yojana
SAIDI: system average interruption duration index
SAIFI: system average interruption frequency index
SBPDCL: South Bihar Power Distribution Company Limited
SDA: State Designated Agency
SDG: Sustainable Development Goals
SECI: Solar Energy Corporation of India
GHG: greenhouse gas
HT: high tension
HESCOM: Hubli Electricity Supply Company Limited
IEGC: Indian Electricity Grid Code
IEX: India Energy Exchange
IRP: integrated resource planning
kV: kilovolt
SERC: State Electricity Regulatory Commission
SLDC: State Load Dispatch Centre
SoP: Standards of Performance
T&D: transmission and distribution
TVS: technical validation session
UDAY: Ujwal Discom Assurance Yojana
USO: Universal Service Obligation

ENDNOTES

¹ The amount sanctioned under the flagship central sector rural electricity and rural backbone network development schemes was about Rs. 59,567 crores. 48% of this was released under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY, 2005–13), 52% under Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY, 2014–21), and 15% under SAUBHAGYA (2018–21) ((PIB 2022); (MoP 2014), (MoP 2017)).

² <https://etpi.in/dashboard>.

³ To ensure clear visual representation, the scales of these fan charts are not proportionate.

⁴ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-1.pdf>.

⁵ Seven states (Maharashtra, Karnataka, Tamil Nadu, Uttar Pradesh, Delhi, Kerala, and Madhya Pradesh) had operative electric vehicle policies in FY 2020–21. In 2022, Rajasthan and Gujarat also notified EV policies. Bihar's policy is still in the draft stage. The transport sector study covers these developments in greater detail.

⁶ According to the 20th Electric Power Survey, discoms' energy requirement would be at about 2,279 BU by 2029–30 (CEA 2022a). In July 2022, the Ministry of Power (MoP) notified a revised trajectory for RPOs until 2029–30 specifying that 43.33% of the discoms' consumption should be met through RE (MoP 2022a). With improvements in the capacity utilisation factor (CUF), discom procurement can account for 85% to 98% of the national target of 450 GW by 2030.

⁷ The guidelines specify long-term RPO trajectories for wind commissioned after 2022 and hydropower commissioned after 2019. It also has an 'Other RPO' category that includes solar and existing wind as well as energy from large hydropower plants commissioned before 2019. ESOs have been set at 1% of the energy consumed in 2023–24 and gradually rise to 4% by 2030 (MoP 2022a). This ESO is to be met only if 85% of the energy stored is from RE.

⁸ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-2.pdf>.

⁹ For the year FY 2020–21, the Delhi ERC did not issue a true-up order, which is typically where the penalties for RPO non-compliance are specified. However, the Delhi ERC has been consistently levying penalties for many years as part of the true-up processes. Other states do not do this consistently.

¹⁰ RPO regulations in many states provide for a penalty in the case of non-compliance, where the penal fees have to be deposited in a dedicated RPO fund that is to be used for either future RE procurement or to improve the existing transmission and distribution infrastructure.

¹¹ The Rajasthan ERC notified a discussion paper on Energy Storage Systems in March 2021 (RERC 2021).

¹² <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-3.pdf>.

¹³ Thermal power plants are designed to operate at full load. At any time, when they operate at part load, the cost increases. This could be due to many reasons including degradation of the heat rate, efficiency reduction, and reduction in available output due to higher consumption by supporting equipment the use of costly secondary fuel (fuel oil). This increase in cost should be compensated through regulatory measures to encourage part load operation.

¹⁴ Technical Minimum refers to the loading threshold for the thermal generating unit below which operation is not recommended as per prudent operating practice. Investments and efforts to lower the technical minimum would increase the flexibility with which thermal plants can operate. This is particularly crucial with increased utilisation of RE resources. The technical minimum for much of the capacity was considered 70% loading until it was revised to 55% of the maximum continuous rating in 2016 for inter-state generating capacity governed by central ERC regulations. This improved the utilisation of thermal generating stations. Now this practice and is being adopted by the state ERCs for thermal units capacity in their states.

¹⁵ The CERC formalised a framework detailing this procedure in CERC Detailed Operating Procedure and the Compensation Mechanism, 2017 which could be adopted by the states (CERC 2017).

¹⁶ MoD or Merit Order Dispatch orders thermal capacity based on the short-term marginal cost of generation to ensure economic optimisation of dispatch. Regulatory frameworks help standardise this process and reduce instances of deviation.

¹⁷ In Madhya Pradesh, the True-Up order for FY21 for state owned generating company was not available as on October 2023.

¹⁸ The Government of Maharashtra issued a letter dated 17 June 2020 stating that no thermal power plant would be proposed in the next five years.

¹⁹ The 1980 Report of the Committee on Power, headed by Mr. V.G Rajadhyaksha, strongly advocated for moving beyond five-year demand–supply projections and instead using scenario-based approaches for planning, considering resource constraints, and evaluating the potential for managing demand through energy efficiency, which are all important elements of Integrated Resource Planning (MoP 1980).

²⁰ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-4.pdf>.

²¹ According to Regulations 5 and 6 of the BERC Power Purchase and Procurement Process of Licensee Regulations, 2018 (BERC 2018a).

²² The explanatory memorandum of the commission stated that the provision existed only to address the abrupt expiry of PPAs in the middle of the control period in Mumbai, which was no longer a concern.

²³ Kerala procured 16 MW of wind via the cost-plus route.

²⁴ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-5.pdf>.

²⁵ The Delhi ERC proposed constituting a consultation committee in its 2012 draft regulations, but it was not notified in the final regulations (DERC 2012).

²⁶ The MEDA Annual Report for FY2020–21 is unavailable in the public domain, a feature common in most SDAs, making tracking of funding and schemes difficult.

²⁷ The SDAs developed comprehensive EE state action plans and state-level EE policies.

²⁸ As reported by Ministry of Power for FY 2020–21 in the Ministers Conference on Power and RE held in October 2022.

²⁹ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-6.pdf>.

³⁰ Based on reporting by discoms in various states as part of the Memorandums of Understanding (MoUs) signed under the UDAY scheme.

³¹ For example, even though working capital borrowing is typically for shorter durations, Maharashtra State Electricity Distribution Company Limited has taken medium and long-term loans for this purpose (MSEDCL 2022).

³² Less than 10% of the subsidy committed was not paid for the year.

³³ As reported by the MoP for FY 2020–21 in the Ministers Conference on Power and Renewable Energy held in October 2022 and data accessed from the Ministry of Power's PRAAPTI (Payment Ratification and Analysis in Power procurement for bringing Transparency in Invoicing of generators) portal (MoP 2021a).

³⁴ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-7.pdf>.

³⁵ Because only a few periodic and annual filings are available in the public domain, quarterly and annual reports were used where available across states for the assessment.

³⁶ Kerala and Delhi report that all of their agricultural consumers are metered; thus, they rely on metered data.

³⁷ The estimation is based on actual average costs and tariffs for all the states. In Bihar, the ERC-approved tariff for FY 2020–21 was 80% of the estimated ACoS. However, the actual average tariff during true-up was only 64% of the actual ACoS because the actual costs increased significantly compared with the ERC projections for the year.

³⁸ The estimation is based on actual average tariffs and the actual cost of supply rather than on the approved projections used while setting the tariffs.

³⁹ The status in Uttar Pradesh is not included in this graph because though there is a gap between the cost of supply and tariffs, the difference is not explained by cross subsidy or losses. For subsidised categories like agriculture, the regulator classifies this as “additional subsidy” to be recovered from the state government. However, the state government which decides subsidy, has not included these amounts in their budgetary approvals. Thus, this amount, sits as losses on the books of the discom. The discoms, have been contesting this treatment by the ERC due to the financial impacts (PEG 2020a)

⁴⁰ Telangana, a state that is not part of the assessment, has also committed to 24×7 power to agriculture, a move that will have a substantial impact on discom operations, subsidy requirements, and water resources in the state (PEG 2020b).

⁴¹ MSEDCL reporting of 11 kV feeder-level outage data is available here: <https://reshorttermc.mahadiscom.in/SolarDTC/feederOutage>.

⁴² Feeder interruption details of all Karnataka discoms are available here: <https://kptcl.karnataka.gov.in/page/SLDC/Feeders+Interruption+Details+of+all+ESCOMs/en>.

⁴³ Available at <https://reshorttermc.mahadiscom.in/SolarDTC/>.

⁴⁴ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-8.pdf>.

⁴⁵ Small residential consumers are those whose basic electricity requirements are met through appliances such as bulbs, ceiling fans, and television sets, which would require about 30 units per month. In addition to these requirements, those with appliances such as refrigerators and basic induction stoves would require about 100 units per month. These requirements could reduce over time with greater adoption of energy-efficient appliances.

⁴⁶ Authors’ compilation based on progress reports from various years under RGGVY, DDUGJY, SAUBHAGYA, and Census reports on the number of households using electricity as the primary source of lighting.

⁴⁷ Consumption of 30 units a month would be from usage of basic appliances such as lights, fans, and television. With the present levels of energy efficiency of appliances, such consumption will not support the use of induction stoves or refrigerators.

⁴⁸ Reliability indices tracked include the System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI).

⁴⁹ CEA’s format (Format 52) that aims to capture circle-wise DT failure rates is available here: <https://cea.nic.in/wp-content/uploads/2020/02/format-52.pdf>.

⁵⁰ A committee called the “Committee to bring Uniformity in Reliability Indices in Power Distribution across the country” was constituted under the Chairmanship of the Chief Engineer (Distribution Policy and Regulations) of the CEA with representation from ten discoms and the FoR.

⁵¹ Open access here refers to a consumer signing a bilateral contract with a party other than discoms (generators or traders) for power purchase. Captive/Group Captive refers to a consumer or group of consumers setting up their own power plant such that most of the power generated is used by the investing consumers. With the modularity and low gestation periods of solar, captive investments are financially viable for a large set of consumers.

⁵² <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-9.pdf>.

⁵³ The reporting convention is that “open access” refers to sales via third-party direct contracts between consumers and generators. This takes place through open access (i.e., the non-discriminatory use of the transmission and distribution network of the utilities). Captive consumers can also utilise open access to the network, especially if the consumer and the generator are not co-located.

⁵⁴ According to ICRA, the C&I segment itself accounts for about 40–45% of India’s demand; assuming 20% of the requirement is through RE, the RE capacity addition requirement is estimated to be 75 GW by 2030 (ICRA 2022).

⁵⁵ With solar and storage opportunities, this is a budding segment. Providing a framework for registration of BTM systems and tracking them can help mitigate impacts and streamline investments in the future.

⁵⁶ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-10.pdf>.

⁵⁷ Reporting is undertaken for compliance with specific commission directives or with the mandate for quarterly and annual reporting under the BEE energy audit regulations.

⁵⁸ The BEE energy audit regulations were introduced in FY 2020–21, but many states have not consistently reported data as required by the regulations. Thus, on-ground progress could not be captured consistently for Madhya Pradesh, Rajasthan, and Uttar Pradesh.

⁵⁹ The Bihar ERC provided a 15% incentive to consumers for daytime slots (11 AM to 5 PM) for FY 2021–22. However, this was removed in FY 2022–23 because meters could not be recalibrated effectively owing to the COVID-related lockdowns.

⁶⁰ <https://etpi.in/sites/default/files/indicator-results/Annexure%20E-11.pdf>.

⁶¹ “Petitions Filed by MSEDCL,” Maharashtra State Electricity Distribution Company Ltd, n.d., <https://www.mahadiscom.in/en/petitions-filed-by-msedcl/>.

⁶² For example, in FY 2021, Karnataka published petitions related to transmission connectivity and pricing, and Bihar published documents related to the adoption of competitive bidding for transmission projects.

⁶³ In FY 2022, the Maharashtra ERC revised the fees for miscellaneous applications applicable to individuals and consumer groups (entities other than licensees, generating companies, and individuals) to Rs. 500 and Rs. 1,000, respectively.

⁶⁴ Tamil Nadu Generation and Distribution Corporation.

⁶⁵ APTEL directed that every ERC should ensure an annual performance review, true-up of past expenses, and determination of revenue requirement and tariff on a year-to-year basis in compliance with ERC regulations and initiate suo motu proceedings in the event of a delay (APTEL 2011).

⁶⁶ NTPC is a central-government-owned power generating company, and it also happens to be India’s largest power generating company. REC is a central-government-owned company that finances power generation and transmission distribution investments in India.

⁶⁷ There is significant flux and change in the sector. As we write this report, several new rules and regulations are being notified related to green open access, multiple supply licensees, pooling of power, etc., and the implications, impacts, and implementation status of these rules in the states will be covered in subsequent reports.

REFERENCES

- APTEL. 2021. "Appeal No. 197 of 2019." Appellate Tribunal For Electricity. <https://aptel.gov.in/sites/default/files/Jud2021/A197of1902.08.2021.pdf>.
- APTEL. 2011. "O.P No. 1 of 2011." <https://aptel.gov.in/judgements/OP%20NO.1%20OF%202011.pdf>.
- BEE. n.d. "Capacity Building of DISCOMs." Bureau of Energy Efficiency. <https://beeindia.gov.in/en/programmesdemand-side-managementdiscom/capacity-building-of-discoms>.
- BEE. 2023. "Compendium on DSM measures by Electricity Distribution Companies (DISCOMs)." Bureau of Energy Efficiency. https://beeindia.gov.in/sites/default/files/publications/files/Compendium_on_DSM_measures_by_DISCOMs_BEE.pdf.
- BEE. 2021. "Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit in Electricity Distribution Companies) Regulations." <https://beeindia.gov.in/sites/default/files/Gazette%20Notification%207th%20Oct%202021%20for%20Energy%20Audit%20and%20Accounting%20in%20DISCOM-%20Regulation%202021.pdf>.
- BERC. 2018a. "BERC (Power Purchase and Procurement Process of Licensee) Regulations." <https://berc.co.in/rules-regulations/regulations/consolidated-regulations/1468-power-purchase-and-procurement-process-of-licensee-regulations-2019>.
- BERC. 2018b. "Multi Year Distribution Tariff Regulations, 2018." Bihar Electricity Regulatory Commission. <https://berc.co.in/rules-regulations/regulations/consolidated-regulations/1618-multi-year-distribution-tariff-regulations-2018>.
- CAG. 2020. "Functioning of State Public Sector Undertakings." https://cag.gov.in/uploads/download_audit_report/2017/3%20Overview-05fce732f2847c8.50659894.pdf.
- CEA. 2023a. "Flexible Operation of Coal-based Thermal Power Generation Units Regulations."
- CEA. 2023b. "Phasing plan for implementation of 40% technical minimum load." Central Electricity Authority. https://cea.nic.in/wp-content/uploads/news_live/2023/05/Draft_phasing_plan_merged_letter.pdf.
- CEA. 2023c. "Draft Guidelines for Medium and Long-Term Power Demand Forecast."
- CEA. 2023d. "Report on Optimal Generation Mix by 2030." https://cea.nic.in/wp-content/uploads/notification/2023/05/Optimal_mix_report_2029_30_Version_2.0_For_Uploading.pdf.
- CEA. 2022a. "Report on Twentieth Electric Power Survey of India - Volume I." https://cea.nic.in/wp-content/uploads/ps_if/2023/02/Volume_I_Report_of_20th_Electric_Power_Survey.pdf.
- CEA. 2022b. "General Review 2022." https://cea.nic.in/wp-content/uploads/general/2022/GR_2022_FINAL.pdf.
- CEA. 2021. "Electricity Tariff & Duty and Average Rates of Electricity Supply in India." https://cea.nic.in/wp-content/uploads/fs_a/2023/02/Book_2021.pdf.

CEA. n.d. "Transmission Reports." Central Electricity Authority. <https://cea.nic.in/transmission-reports/?lang=en>.

CERC. 2017. "Detailed Operating Procedure and the Compensation Mechanism ." <https://cercind.gov.in/2017/regulation/SOR132.pdf>.

DERC. 2012. "Draft DERC (Demand Side Management Implementation Framework) Regulations, 2012." https://www.derc.gov.in/sites/default/files/Draft-DECR-Demand-Side-Management-Implementation-Framework-Regulations2012_0.pdf.

ETPI . 2023. "Indicator Guidebook - Energy Transition Preparedness Initiative."

FoR. 2022. "Model Guidelines for Management of RE Curtailment for Wind and Solar Generation." Forum of Regulators. <http://www.forumofregulators.gov.in/Data/study/FOR-Report-RE-Curtailment-Guidelines-Nov-2022.pdf>.

FoR. 2017. "Report of the Working Group on Demand Side Management." <http://www.forumofregulators.gov.in/Data/WhatsNew/DSM.pdf>.

FoR. 2010. "Model Demand Side Management Regulations." Forum of Regulators. <http://www.forumofregulators.gov.in/Data/study/Model%20DSM%20Regulations.pdf>.

FoR. 2009. "Minutes of the meeting regarding "Operationalisation of Regulatory Information Systems (RIMS)"" Forum of Regulators. http://forumofregulators.gov.in/Data/RIMS/Minutes_of_Meeting_on_RIMS_Final.doc.

GERC. 2022. "Net Metering Rooftop Solar PV Grid Interactive Systems (Third Amendment) Regulations, 2022." Gujarat Electricity Regulatory Commission. <https://gercin.org/wp-content/uploads/2022/05/Notification-No.-02-of-2022.pdf>.

GERC. 2021. "Quarterly Regulatory Information Reports." Gujarat Electricity Regulatory Commission. <https://gercin.org/quarter-year-discom/>.

GoK. 2022. "Karnataka Energy Conservation and Energy Efficiency Policy 2022-27." Government of Karnataka. <https://kredl.karnataka.gov.in/storage/pdf-files/EC/Karnataka%20EC&EE%20Policy%202022-27.pdf>.

GoM. 2020. "Maharashtra Renewable Energy Policy 2020." Government of Maharashtra. <https://www.mahaurja.com/meda/data/other/Policy2020GridAndOffGrid.pdf>.

GoM. 2017a. "State Energy Conservation Policy, 2017." Government of Maharashtra. https://www.mahaurja.com/meda/data/energy_conservation/EC%20Policy%202017%20G.R-English.pdf.

GoM. 2017b. "Government Resolution on Mukhyamantri Saur Krishi Vahini Yojana (MSKVY)." Government of Maharashtra. https://www.mahadiscom.in/solar-mskvvy/media/GR_Solar_140617.pdf.

ICRA. 2022. "Press Release 2022: Strong demand prospects for renewable energy (RE) projects in C&I segment, however regulatory risks a key challenge." ICRA Limited. <https://www.icra.in/Media/OpenMedia?Key=61ba0c8c-ded6-45d6-8ea2-741fb321216f>.

Idam Infra. 2023a. "Least Cost Pathway for Power Sector Investments in Gujarat through 2030." Idam Infrastructure Advisory Private Limited. https://idaminfra.com/wp-content/uploads/2023/02/Gujarat-Report-Final_060223_v1.0.pdf.

Idam Infra. 2023b. "Least Cost Pathway for Power Sector Investments in Karnataka through 2030." Idam Infrastructure Advisory Private Limited. https://idaminfra.com/wp-content/uploads/2023/02/Karnataka-Report-Final_060223_v1.0.pdf.

Idam Infra. 2023c. "Least Cost Pathway for Power Sector Investments in Maharashtra through 2030." Idam Infrastructure Advisory Private Limited. https://idaminfra.com/wp-content/uploads/2023/02/Maharashtra-Report-Final_060223_v1.0.pdf.

Idam Infra. 2023d. "Least Cost Pathway for Power Sector Investments in Rajasthan through 2030." Idam Infrastructure Advisory Private Limited. https://idaminfra.com/wp-content/uploads/2023/02/Rajasthan-Report-Final_060223_v1.0.pdf.

IEA. 2021. "India Energy Outlook 2021." https://iea.blob.core.windows.net/assets/1de6d91e-e23f-4e02-b1fb-51fdd6283b22/India_Energy_Outlook_2021.pdf.

JVVNL. n.d. "Feeder Segregation - Objective, Conventional Method, Challenges." <https://pmkusum.mnre.gov.in/pdf/Ag%20feeder%20segregation%20-%20JVNL%20Pilot%20Project%20-%20Short%20Version%20Final.pptx>.

KERC. 2022. "8th Amendment to KERC Procurement of Energy from Renewable Sources Regulations, 2022." Karnataka Electricity Regulatory Commission. https://kerc.karnataka.gov.in/uploads/media_to_upload1658303233.pdf.

KSEBL. n.d. "Filament Free Kerala." Kerala State Electricity Board Ltd. <https://wss.kseb.in/selfservices/ffk>.

KSEBL. 2020. "Budget Estimates 2020-2021 and Supplementary Financial Statement for 2019-20." https://www.kseb.in/index.php?option=com_jdownloads&view=download&id=13727:budget-estimates-2020-2021-and-supplementary-financial-statement-for-2019-20&catid=70&Itemid=811&lang=en.

MERC. 2023. "Order No. 226 of 2022." Maharashtra Electricity Regulatory Commission. <https://merc.gov.in/wp-content/uploads/2023/04/Order-226-of-2022.pdf>.

MERC. 2020a. "Final Report of Working Group for Agricultural Consumption Study." https://www.mahadiscom.in/wp-content/uploads/2020/07/32_11.03.2020_Final_Report_AG-Working-Group.pdf.

MERC. 2020b. "Order 322 of 2019." Maharashtra Electricity Regulatory Commission. <https://www.mahadiscom.in/consumer/wp-content/uploads/2020/03/Order-322-of-2019.pdf>.

MERC. 2019a. "Renewable Purchase Obligation, its Compliance and Implementation of Renewable Energy Certificate Framework Regulations, 2019." Maharashtra Electricity Regulatory Commission. <https://merc.gov.in/wp-content/uploads/2022/07/Gazatte-Notification-RPO-REC-Regulation-2019.pdf>.

MERC. 2019b. "Distribution Open Access (First Amendment) Regulations, 2019." Maharashtra Electricity Regulatory Commission. https://merc.gov.in/regulation_type/current-regulations-open-access/.

MNRE. n.d. “Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan.” Ministry of New and Renewable Energy. <https://pmkusum.mnre.gov.in/landing.html>.

MoEFCC. 2021. “India: Third Biennial Update Report to United Nations Framework Convention on Climate Change.” Ministry of Environment, Forest and Climate Change. <https://unfccc.int/documents/268470>.

MoLJ. 2022. “https://powermin.gov.in/sites/default/files/The_Energy_Conservation_Amendment_Act_2022_0.pdf.” Ministry of Law and Justice. [https://prsindia.org/files/bills_acts/bills_parliament/2022/The%20Energy%20Conservation%20\(Amendment\)%20Act.%202022.pdf](https://prsindia.org/files/bills_acts/bills_parliament/2022/The%20Energy%20Conservation%20(Amendment)%20Act.%202022.pdf).

MoP. 2023a. “Guidelines for Resource Adequacy Planning Framework for India.” 28 June. <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/jun/doc2023628218801.pdf>.

MoP. 2023b. “Electricity (Rights of Consumers) Amendment Rules,2023.” Ministry of Power. https://powermin.gov.in/sites/default/files/webform/notices/30_d_Electricity_Rights_of_Consumers_Amendment_Rules_2023..pdf.

MoP. 2022a. “Renewable Purchase Obligation (RPO) and Energy Storage Obligation Trajectory till 2029-30.” Ministry of Power. https://www.recregistryindia.nic.in/pdf/REC_Regulation/Renewable_Purchase_Obligation_and_Energy_Storage_Obligation_Trajectory_till_2029_30.pdf.

MoP. 2022b. Conference of Power and Renewable Energy Ministers of States and UTs. Conference Proceedings, Udaipur: Ministry of Power.

MoP. 2021a. “PRAAPTI Portal.” Ministry of Power. <http://praapti.in/>.

MoP. 2021b. “Guidelines - Revamped Distribution Sector Scheme.” Ministry of Power. https://powermin.gov.in/sites/default/files/uploads/Final_Revamped_Scheme_Guidelines.pdf.

MoP. 2017. “Office Memorandum on Saubhagya Scheme.” Ministry of Power. https://powermin.gov.in/sites/default/files/webform/notices/OM_SAUBHAGYA_SIGNED_COPY.pdf.

MoP. 2016. “National Tariff Policy.” Ministry of Power. https://cercind.gov.in/2018/whatsnew/Tariff_Policy-Resolution_Dated_28012016.pdf.

MoP. 2014. “Office Memorandum on Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY).” Ministry of Power. https://powermin.gov.in/sites/default/files/uploads/Deendayal_Upadhyaya_Gram_Jyoti_Yojana.pdf.

MoP. 2005. “National Electricity Policy.” Ministry of Power. <https://powermin.gov.in/en/content/national-electricity-policy>.

MoP. 1980. Report of the Committee on Power under the Chairmanship of Shri. V. G. Rajadhyaksha. Committee Report, New Delhi: Ministry of Power.

MPPKVCL. 2020. “Petition for Approval of Investment Plan of INR 2698 Cr. FY 2020-21 to FY 2024-25.” Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited. <https://mperc.in/22102021-PNo.11-2021-Capex%20Plan%20FY%2022%20to%20FY%2025-EZ.pdf>.

MSEDCL. n.d. “Fuel Adjustment Cost of MSEDCL.” Maharashtra State Electricity Distribution Company Ltd. <https://www.mahadiscom.in/consumer/en/fac-of-msedcl/>.

MSEDCL. 2022. "Tariff Filings by MSEDCL in Case No. 226 of 2022." Maharashtra State Electricity Distribution Company Ltd. <https://www.mahadiscom.in/en/maharashtra-state-electricity-distribution-company-limiteds-mid-term-review-tariff-petition-for-truing-up-of-fy-2019-20-fy-2020-21-and-fy-2021-22-provisional-truing-up-for-fy-2022-23-a/>.

MSPGCL. n.d. "Monthly Fuel Cost and CV Data." Maharashtra State Power Generation Co. Ltd. <https://www.mahagenco.in/monthly-fuel-cost-and-cv-data/>.

Nhalur, Sreekumar, and Ann Josey. 2021. "Free power at a big price: The promise of free power to households cannot be sustained." <https://www.thehindu.com/opinion/op-ed/free-power-at-a-big-price/article36972944.ece>.

PEG. n.d. "Renewable Energy Data Portal." Prayas (Energy Group). <https://energy.prayaspune.org/renewable-energy-data-portal>.

PEG. 2022. "India's journey towards 175 GW Renewables by 2022: A September 2021 Update." Prayas (Energy Group). <https://energy.prayaspune.org/our-work/research-report/indias-journey-towards-175-gw-renewables-by-2022-a-september-2021-update>.

PEG. 2021a. "Maharashtra's Electricity Supply Mix by 2030: Cost and Reliability Insights from a GridPath Production Cost Modelling Exercise." Prayas (Energy Group). <https://energy.prayaspune.org/images/pdf/maharashtras-electricity-supply-mix-by-2030.pdf>.

PEG 2021b. "Virtual Net Metering for Public Bodies: an innovative solution for improving payment discipline." Prayas (Energy Group). [https://energy.prayaspune.org/power-perspectives/virtual-net-metering-for-public-bodies-an-innovative-solution-for-improving-payment-discipline?filter_tag\[0\]=2](https://energy.prayaspune.org/power-perspectives/virtual-net-metering-for-public-bodies-an-innovative-solution-for-improving-payment-discipline?filter_tag[0]=2).

PEG. 2020a. "State Overview: Uttar Pradesh (Part of Power Perspectives)." Prayas (Energy Group). http://energy.prayaspune.org/images/Power_Perspectives_Portal/Uttar_Pradesh/UP_Overview.pdf.

PEG. 2020b. "Power Perspectives: 24 x 7 free agriculture supply - Telangana's unique initiative." Prayas (Energy Group). [https://energy.prayaspune.org/power-perspectives/24-x-7-free-agriculture-supply-telangana-s-unique-initiative?filter_tag\[0\]=2](https://energy.prayaspune.org/power-perspectives/24-x-7-free-agriculture-supply-telangana-s-unique-initiative?filter_tag[0]=2).

PEG. 2018. "Electricity Distribution Companies in India: Preparing for an uncertain future." Prayas (Energy Group). <https://energy.prayaspune.org/our-work/research-report/electricity-distribution-companies-in-india-preparing-for-an-uncertain-future>.

PEG. 2017a. "Many Sparks but Little Light: The rhetoric and practice of electricity sector reforms in India." Prayas (Energy Group). https://energy.prayaspune.org/images/pdf/many_sparks_but_little_light_809533331_epub.

PEG. 2017b. "The Price of Plenty: Insights from 'surplus' power in Indian States." Prayas (Energy Group). <https://energy.prayaspune.org/our-work/research-report/the-price-of-plenty-insights-from-surplus-power-in-indian-states>.

PEG. 2010. "Electricity for All: Ten Ideas towards Turning Rhetoric into Reality - A Discussion Paper." Prayas (Energy Group). <https://energy.prayaspune.org/our-work/policy-regulatory-engagements/electricity-for-all-ten-ideas-towards-turning-rhetoric-into-reality-a-discussion-paper>.

- PFC. 2022. "Report on Performance of Power Utilities 2020-21." Power Finance Corporation. [https://www.pfcindia.com/DocumentRepository/ckfinder/files/Operations/Performance_Reports_of_State_Power_Utilities/Report%20on%20Performance%20of%20Power%20Utilities%202020-21%20\(1\).pdf](https://www.pfcindia.com/DocumentRepository/ckfinder/files/Operations/Performance_Reports_of_State_Power_Utilities/Report%20on%20Performance%20of%20Power%20Utilities%202020-21%20(1).pdf).
- Phadke, Manasi. 2023. Maharashtra Farmers to Get Solar-Powered Agricultural Feeders for 'Uninterrupted Day-Time Power Supply. <https://theprint.in/india/maharashtra-farmers-to-get-solar-powered-agricultural-feeders-for-uninterrupted-day-time-power-supply/1528013/>.
- PIB. 2022. "Cabinet approves India's Updated Nationally Determined Contribution to be communicated to the United Nations Framework Convention on Climate Change." Press Information Bureau. <https://pib.gov.in/PressReleaselframePage.aspx?PRID=1847812>.
- PIB. 2014. "Capital subsidy of more than Rs. 28,000 crore disbursed by Centre to the States under RGGVY." Press Information Bureau. <https://pib.gov.in/newsite/PrintRelease.aspx?relid=103169>.
- REC. n.d. "Consumer Service Rating of DISCOMs." Rural Electrification Corporation. <https://recindia.nic.in/consumer-service-rating-of-discoms>.
- REC India. 2023. "Consumer Service Rating of DISCOMs 2021-22." <https://recindia.nic.in/uploads/files/co-usri-crsd-report-fy-21-22-dt120423.pdf>.
- NERC. 2021. "Discussion Paper on Framework For Large Scale Integration of Renewable Energy using Energy Storage Systems and its impact on Tariffs ." https://india-re-navigator.com/public/uploads/1623670434-NERC_Discussion%20paper%20on%20energy%20storage%20framework_Mar%202021.pdf.
- SCI. 2022. "Civil Appeal No. 1933 of 2022." Supreme Court of India. https://main.sci.gov.in/supremecourt/2022/7499/7499_2022_1_1501_39982_Judgement_23-Nov-2022.pdf.
- Swain, Ashwini K, and Daljit Singh. 2018. "Fixated on Megawatts: Urgent Need to Improve Power Procurement and Resource Planning by Distribution Companies in India." <https://cprindia.org/briefsreports/fixated-on-megawatts-urgent-need-to-improve-power-procurement-and-resource-planning-by-distribution-companies-in-india/>.
- TNERC. 2022. "Order No, 07 of 2022." Tamil Nadu Electricity Regulatory Commission. <https://www.tnerc.gov.in/Orders/files/TO-Order%20No%200300920220439.pdf>.
- TNERC. 2021. "Capital Investment Plan (CIP) for the MYT Control Period from FY 2019-20 to FY 2021-22 in M.P. No. 18 of 2019." Tamil Nadu Electricity Regulatory Commission. <https://www.tnerc.gov.in/Orders/files/CO-M%20P%20No%2018%20131020211616.pdf>.



ACKNOWLEDGEMENTS

The authors are grateful to Gireesh Pradhan (former chairperson, CERC), Ajit Pandit (IDAM Infra), Daljit Singh (CSEP), and Ashok Pendse (consumer representative and regulatory expert from Maharashtra) for their valuable comments and suggestions on the draft of this report. We are also grateful to Anish De (KPMG) and Sushanta Chatterjee (CERC) for their valuable comments on the early study findings and to Anand Jha (Blackstone) and B.B. Mehta (OPTCL) for support and feedback on the study findings. We would also like to thank the officials of electricity distribution companies, state energy departments, regulatory commissions, and central sector agencies who provided us with information and context on state-level developments.

We are extremely grateful to Navroz Dubash (CPR) for his comments, which helped us focus on the key messages from this vast exercise. We thank our colleagues Sreekumar Nhalur, Ashwin Gambhir, Sandhya Sundararagavan, Deepak Krishnan, Vandita Sahay, and Manu Mathai for their review comments and constant support during this exercise. We thank colleagues from WRI, especially Namrata Ginoya, for her assistance. We thank colleagues at Prayas, especially Narendra Pai, Aditya Chuneekar, Shweta Kulkarni, Maria Chirayil, Saumendra Agrawal, Sneha Mannur, Abhiram Sahasrabudhe, Sharmila Ghodke, Ajit Pilane, Shilpa Kelkar, Amruta Wanjale, Kailas Kulkarni, Anirudhha Ketkar, and Bhakti Kelkar, for their support and assistance with this report and the ETPI project. We also thank Santhosh Matthew Paul of Feather Touch Editing for copy edit support with this report.

Photo Credits:

Page 10, 24 and 26 : Image used under license from
Shutterstock.com

All other Image used under license from
unsplash.com

Visualisation & Infographics:

Abhiram Sahasrabudhe and Manasi Jog, Prayas (Energy Group)

Layout & Template Design:

Poorva Kelkar

Gati Narvekar

Disclaimer: The report represents analysis and views of the authors alone, who also are responsible for accuracy and interpretation.



© 2023. This work is openly licensed via CC BY 4.0.
To view a copy of the license, visit <http://creativecommons.org/licenses/by/4.0/>



Energy Transition Preparedness Initiative (ETPI) is a consortium of Prayas (Energy Group), Centre for Policy Research and World Resources Institute, India.

