

The Curious Case of India's Discoms

How Renewable Energy Could Reduce Their Financial Distress

Executive Summary

Power distribution is the weakest link in the entire value chain of the Indian power sector.

Dominated by conventional sources of energy (coal, diesel, gas, nuclear and large hydro) and a progressive shift towards renewable sources (wind, solar, bio and small hydro), India's power sector is saddled with various issues, including electricity demand slowing in tandem with economic growth during 2019, and exacerbated by the impact of COVID-19 in 2020.

Ailing state-owned power distribution companies (discoms) continue to hamper the efficient functioning of the generation and transmission sectors.

As of May 2020, discoms have accumulated massive overdue payments to generators of Rs116,340 crore (about US\$16bn), creating an immense liquidity crunch across India's entire power sector.

Figure ES1: Snapshot of Discoms' Financial Performance

	Unit	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Discom Loss on subsidy received basis	Rs Crore	71,621	68,257	56,939	48,619	38,745	33,594	61,360
Subsidy received	Rs Crore	36,100	36,758	45,584	74,515	78,938	88,919	98,653
Gap (ACS-ARR) on subsidy received basis	Rs/kWh	0.84	0.78	0.58	0.48	0.37	0.30	0.52
Accumulated Losses as per Balance Sheet	Rs Crore	253,700	306,317	358,581	413,933	411,753	440,826	488,686
Total Outstanding Debt	Rs Crore	304,228	365,066	403,816	421,978	416,957	454,773	478,452
AT&C losses	%	25.48	22.62	25.72	23.96	23.50	22.33	22.01
Outstanding dues by Discoms (As on last month of FY)	Rs Crore	NA	NA	NA	NA	31,704	42,063	66,652

Source: PFC Report on SEBs; MOP FRP Scheme; UDAY portal; PRAAPTI. Data for 2019/20 is not yet available, reflecting the lack of timely disclosure.

Various government reforms have been repeatedly initiated to improve the sector's operational and commercial performance but are yet to make a sizeable or sustained impact. Discoms continue to incur huge financial losses, a clear reflection of massive subsidies, largely unfunded by the state governments. To help state owned discoms pare their mounting losses, the central government has offered financial packages to bail out beleaguered state electricity discoms from time to time. However, success has been limited.

Meanwhile, another bailout package is currently being approved of Rs90,000 crore (about US\$12bn) of subsidised debt funding for the discoms from state-owned lending agencies — the Power Finance Corporation (PFC) and Rural Electrification

Corporation (REC) — which will allow discoms to cover some of their current overdue payments and effectively infuse liquidity into the sector.

The absence of competition, unsustainable cross-subsidies, economically inefficient tariff setting processes, expensive thermal power purchase agreements (PPAs), and a lack of modern technology and infrastructure development are adding to discoms' losses.

India has set ambitious long-term targets for its electricity sector, including 450 gigawatts (GW) of renewables by 2030, representing a total of 55% of planned capacity. As a prerequisite for the country to achieve these renewable targets and sustain its economic growth goals, the crippled power distribution sector must be made profitable.

This dire health of discoms is increasing the risk for renewable energy generators and their financial backers, restricting them to participate only in bids for which they can gain an adequate counter-party risk profile sufficient to raise the capital cost for setting up new domestic energy capacity to meet energy demand growth.

There are policy changes being proposed at the central level which can act as guiding principles for states to adopt. However, power distribution is entirely the states' domain and various states are on different paths of reforms. As such, a state level analysis of issues is required, and solutions ought to be designed to cater to their needs and level of preparedness.

In this report, the three states of Maharashtra, Rajasthan and Madhya Pradesh have been shortlisted for a detailed analysis. These states represent discoms at different stages of operational and financial performance, preparedness and appetite for reforms, penetration of renewable energy, technology adoption, and so on. The states have undertaken various reform measures and have adopted several good practices to improve their operational and financial performance, however, each is still struggling with high aggregate technical & commercial (AT&C) losses and an increased debt burden.

Discoms still struggle with high losses and an increased debt burden.

This report highlights how performance has changed over the years and presents areas where opportunities for reform exist. Further, the analysis provides a benchmark for discoms in other states to replicate the success already demonstrated by these discoms, and/or to implement the recommendations proposed as part of this study.

Based on our state-by-state analysis, we have produced broad recommendations to reduce financial and operational inefficiencies across the Indian discom sector.

(These recommendations are further elaborated in the Conclusion and Recommendations section of this report).

Our recommendations include:

1. Resolve issues surrounding legacy contracts and close inefficient plants.

The closure of inefficient, highly polluting, end-of-life coal plants surplus to a state's needs will result in significant savings from fixed charge payments for such assets and will also reduce pollution and carbon footprints.

A recent report by The Energy Resource Institute (TERI) reveals demand for electricity in India is expected to be 7-17% lower by 2025 due to a downward revision in India's GDP growth on account of the COVID-19 economic shock. This slowdown has major implications for capacity planning, accelerating the need to retire inefficient end-of-life coal plants to reduce carbon emissions and also increase the remaining, efficient, plants' load factors. (PLF)

2. Reduce cross-subsidies.

Discoms needs to address the issue of cross-subsidies and reduce their reliance on recovering revenue from commercial and industrial (C&I) consumers. Increasing cross-subsidies has continued to undermine the competitiveness of industries in India. The implementation of Direct Benefit Transfers (DBTs) and solar irrigation pumps, and the adoption of policies that favour the uptake of solar rooftop systems will help to reduce cross-subsidies.

3. Reduce AT&C losses through digitalisation.

Existing electricity meters must be progressively replaced by smart meters, including smart prepaid meters. This will help discoms understand and manage their load better and will reduce metering and billing losses and theft, while also facilitating distributed rooftop solar and storage.

4. Revise tariffs.

Tariffs must be revised. Not many states have increased their tariffs in the last few years. While a price shock is undesirable, particularly during the COVID-19-induced recession, regulators must require an annual tariff revision to allow discoms to keep up with inflation. The annual revision should continue until aggregate and technical (AT&C) losses are reduced, and ever-lower renewable energy tariffs can come to the rescue at sufficient scale to allow some deflationary offsets on the average cost of generation. Rationalisation to reduce tariffs for high-paying commercial and industrial (C&I) customers could encourage customer retention.

5. Increase competition.

Increased private competition should be promoted to improve the distribution sector's performance. The Government of India (GoI) could mandate discoms with high losses to either privatise operations or allow the entry of suitably qualified and capitalised private distribution entities willing to invest in upgrading infrastructure. Increased competition would encourage generators, distributors, and electricity supply companies to develop technologies to increase efficiency, lower costs, and make supply more reliable.

6. Move to a National Pool Market.

India's electricity market should move gradually to a National Pool Market and optimise generation nationally. This would get the best return from the huge investment in the national generation fleet and drive ACS down, forcing the least efficient and outdated facilities to close, reducing overcapacity clearly evident in the thermal power sector.

7. Implement renewable energy tariffs with indexation.

Discoms could procure new renewable energy capacity by designing a new tariff structure in which the developer bids for levelized tariffs. The initial tariff could start from a lower base in the first year and allow inflation indexation over the length of the contract, in such a way that developers' returns on investment remain entirely unchanged from the current tariff structure with no indexation.

We also offer state-specific recommendations that could assist ailing businesses to turn around and become profitable. (Refer to the table on the following page.)

While most of the recommendations are general, such as the deployment of smart meters, solar for irrigation, and the implementation of policies favouring open access to encourage consumers to switch to renewable energy, we provide three specific recommendations that each state should prioritise to enable discoms to improve their financial viability.

Key Recommendations for States to Improve their Operational and Financial Performance

Maharashtra	Rajasthan	Madhya Pradesh
<p>Power agriculture demand through solar</p> <ul style="list-style-type: none"> • Harness solar for rural electricity use. • Promote the installation of solar water pumps. • Provide farmers subsidies to install solar water pumps to replace subsidised imported diesel fuel. 	<p>Deploy smart meters</p> <ul style="list-style-type: none"> • Progressively deploy smart meters at large scale. • Strengthen implementation of differentiated tariffs, depending on time-of-day, to account for excess rooftop solar generation and effective net-metering policies. 	<p>Reduce AT&C losses</p> <ul style="list-style-type: none"> • Provide financial support and technological intervention to discoms to reduce losses • Implement schemes such as feeder separation, distribution transformers for energy auditing and accounting, and metering of consumers.
<p>Reduce reliance on power purchase from old inefficient plants</p> <ul style="list-style-type: none"> • Cut the buying power from government majority-owned generating plants. • Retire end-of-life, inefficient plants. • Deploy more large-scale grid connected and decentralized renewable energy. 	<p>Adopt solar irrigation pumps</p> <ul style="list-style-type: none"> • Encourage adoption of solar pumps under the KUSUM Scheme. • Adoption of solar pumps will help states alleviate losses by reducing the cross-subsidy burden on C&I and while bringing down discoms' cost of power procurement and transmission losses. 	<p>Reduce power purchase cost</p> <ul style="list-style-type: none"> • Contract new cheaper renewable energy sources with tariffs below Rs3.0/kWh to replace thermal power sources with higher variable charges. • Refrain from entering new high cost thermal power contracts.
<p>Incentivise solar rooftop</p> <ul style="list-style-type: none"> • Encourage solar rooftop installations as they are increasingly viable economically and offer multiple benefits. • Align tariffs of C&I and high-end residential consumers with those of rooftop solar costs. 	<p>Encourage open access</p> <ul style="list-style-type: none"> • Availability of cheaper renewables is already increasing penetration of open access consumers. Discoms are better off having policies that provide an easy entry to the open access mechanism. 	
<p>Deploy analytical tools</p> <ul style="list-style-type: none"> • Deploy analytical tools for projection and forecasting. • Allow renewable energy generators with unanticipated surpluses to sell excess supply, earn revenue and manage intermittence. 		

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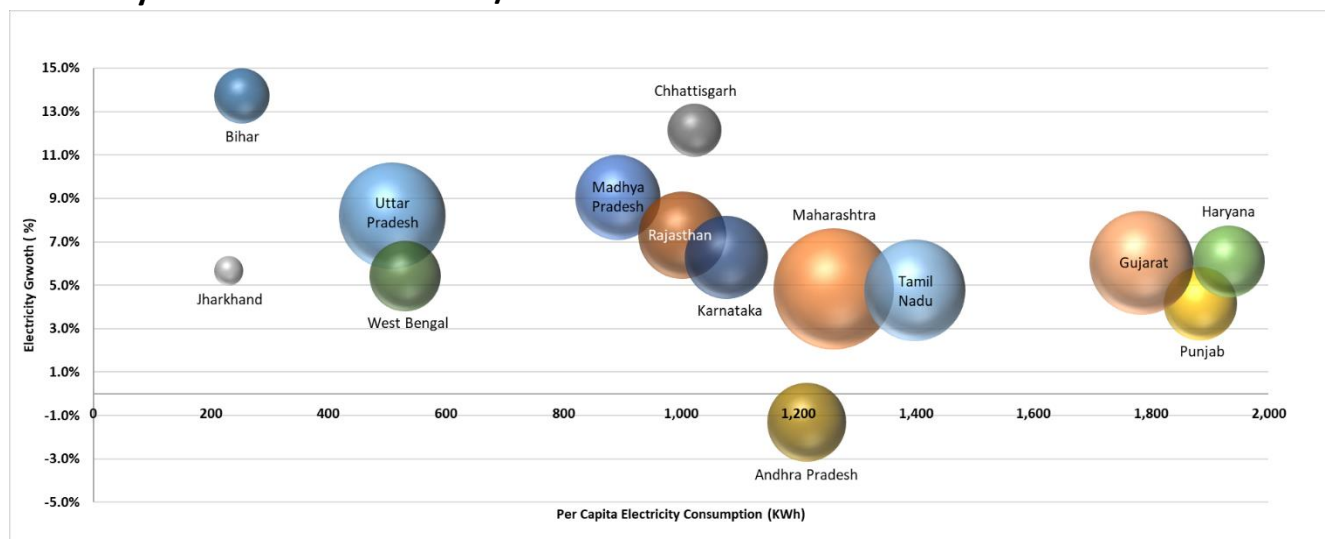
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Introduction

India's power consumption per person is near the lowest among big countries globally. In 2018-19, per capita power consumption was 1,181kWh¹, although in a few states per capita consumption exceeds 1,800kWh a year.

Thanks to strong economic growth over the last decade, India's electricity consumption increased by around 6.2% annually², with some states recording an annual increase of more than 10%. The state of Maharashtra has the highest total electricity consumption, followed by Uttar Pradesh, Gujarat, Tamil Nadu, and Rajasthan.

Figure 1: Electricity Consumption, Per Capita Consumption, and Electricity Decade Growth FY2019/20



Source: CEA, UIDAI Population data, IEEFA calculations.

Electricity consumption per person is an important indicator of economic growth. Per capita consumption in India has increased by 5.4% in the last decade.³ With increased economic growth, per capita consumption will rise, although energy efficient technologies and appliances could reduce overall demand. Nonetheless, a robust power sector is a vital prerequisite for the growing prosperity needed to drive this positive change.

In the past 25 years, India's power sector has struggled with a multitude of serious deficiencies including shortages, peak-time deficits, inadequate tariffs, unsustainably high aggregate technical and commercial (AT&C) losses, poor quality power supply and service, a lack of competition, insufficient investment in infrastructure, and excessive indebtedness. The sector needs to urgently adopt a

¹ CEA. March 2020. [Executive Summary on Power Sector](#).

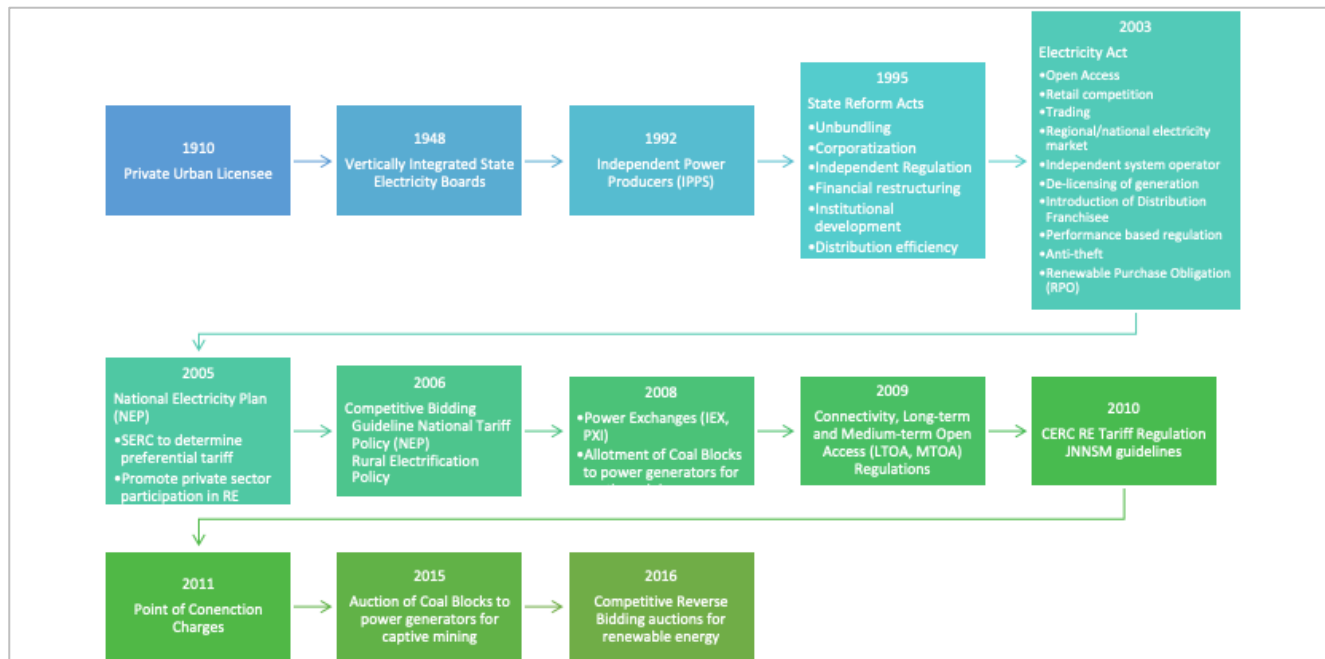
² CEA. Power Supply Position Report. [March 2020](#), [March 2010](#).

³ CEA. March 2020. [Executive Summary on Power Sector](#).

new multi-pronged strategy to sustainably to improve its operational and financial performance.

In the wake of such major challenges, the power sector has undergone a complex process of reform and restructuring with limited success. A summary of events and developments that have shaped the India power sector is presented below.

Figure 2: Events Shaping the Indian Power Sector



Source: IEEFA Analysis.

While various reforms have improved the sector's commercial viability and performance, they are yet to make a sizeable, sustained impact. Discoms in aggregate continue to incur huge financial losses.

To help state-owned discoms pare their mounting losses, the central government has offered financial packages to bail out beleaguered state electricity discoms from time to time, but their success has been limited.

Amendments to the Electricity Act 2003 have also been proposed to improve the structural, operational, and financial performance of discoms. These include introducing competition in the retail sector, notably allowing consumers to choose their retail suppliers, and instituting strict enforcement of renewable purchase obligations (RPOs) that mandate suppliers to buy energy from renewable sources. Other proposed amendments include: minimum percentage of purchase of electricity from hydro power to be supplied by a distribution sub-licensee, subsidies provided through direct benefit transfer (DBT), facilitating open access and

development of the power market, cross-border exchanges of electricity, and setting up an Electricity Contract Enforcement Authority.⁴

Furthermore, amendments to the National Tariff Policy have been proposed. The government aims to end power tariff differentiation among consumers by proposing six categories of consumers on a voltage basis, versus the present 50-60 categories and sub-categories. Other proposed changes also reduce cross-subsidies and instead subsidise agricultural and rural consumers through direct benefit transfer. Further, the policy has laid out service standards for discoms including 24x7 power supply and penalties for load shedding, while prohibiting the passing on of more than 15% of commercial losses to consumer's retail tariffs.⁵

If a centre-state consensus can be reached and there is political will at the state level, IEEFA notes the amendments as highlighted should improve the financial health of the ailing distribution sector.

However, different states are on different reform paths. While these reforms are guiding principles and are in the right direction, a state level analysis of the issues is required. The resulting solutions should then be designed to accommodate each states' specific needs and level of preparedness.

Discoms Are in Distress

Power distribution is the weakest link in the entire value chain of the Indian power sector. Discoms are struggling under massive debt to the thermal power sector.⁶ There are currently some US\$100bn of non-performing or stranded assets shared between discoms and the coal- and gas-fired power plant sectors.

The table below highlights discoms' financial performance over the last few years, indicating that the distribution sector is still struggling with huge losses. While formal data for 2019/20 is not yet available, the evidence shows a material aggregate deterioration in discoms' 2018/19 performance.

Figure 3: Snapshot of Discoms' Financial Performance

	Unit	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Discom Loss on subsidy received basis	Rs Crore	71,621	68,257	56,939	48,619	38,745	33,594	61,360
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Source: PFC Report on SEBs; MOP FRP Scheme; UDAY portal; PRAAPTI.

⁴ JMK Research & Analytics. [Summary of Draft Electricity Amendment Act – 2020](#). May 2020.

⁵ ET EnergyWorld. [In biggest reform, Govt proposes to end power tariff differentiation among consumers](#). June 2, 2020.

⁶ IEEFA. [India's stranded asset risk in thermal power sector underestimated](#). December 2019.

Note: "Subsidy received basis" stands for the subsidy disbursed by the state government against the actual subsidy/grants amount booked by the discoms for the given year.

Extensive investment and reform have already been undertaken in India's generation and transmission business. But unless the distribution sector is also successfully reformed, more power generation and transmission assets are at financial risk of becoming stranded, stalling much needed further investment and technological development.

The financial health of discoms is critical for the country to achieve its ambitious renewable targets and sustain its economic growth goals. The discoms' poor financial health means these companies struggle to make payments to energy generators and often fail to honour their contracts, undermining their ability to invest in technology and modernisation of the grid.

Unless the crippled power distribution sector is made profitable, deployment and despatch of renewable energy generation will be at risk.

There are currently some US\$100bn of non-performing or stranded assets shared between discoms and coal- and gas-fired power plant sectors.

Objective and Scope of our Study

This report builds upon a few positive cases where distribution sector reforms have led to high penetration of renewable energy. IEEFA notes even in those states where this has occurred, there is further scope for reform and consequently drive more absorption of renewable energy.

Finally, we present various reform options that states should undertake to improve their operational and financial performance, and highlight the investments needed to build a sustainable distribution system that can increase the proportion of renewable energy in the system.

We also shortlisted three states for detailed analysis, representing good models for discoms in other states to follow.

Framework for State Selection

Distribution utilities in India reel under huge losses. Some distribution utilities have improved their performance on various parameters in the last few years, but most are still struggling to improve the financial viability of their operations.

A few states have demonstrated leadership in undertaking reforms and have shown improvement, while others have been laggards.

We compiled a shortlist of three states using various quantitative and qualitative parameters. The objective was to choose states at different stages of operational and financial performance, preparedness and appetite for reforms, penetration of renewable energy, and technology adoption.

After analysing data for 14 states for the 2018/19 financial year, we defined the parameters used to select and review the three states for our case study as:

- Renewable energy target as per National Electricity Policy (NEP) 2018. This indicator represents renewable energy potential and what each state can strive to achieve;
- Share of renewable energy in the total energy mix;
- Ease of doing business (EODB);
- Aggregate technical and commercial (AT&C) Loss;
- Revenue Gap (average cost of supply - aggregate revenue requirement);
- Annual financial losses;
- Overdue payments to generators;
- Annual capital expenditure (capex); and
- Government subsidies.

Each parameter was ranked from 1 as the best-performing state to 14 for the worst-performing state. An average ranking was then derived across all the parameters.

Key qualitative parameters were superimposed to select a combination of states that were either high or low share of renewable energy, and either high or low financial and technical losses.

Figure 4: State Performance on Key Parameters in FY2018/19

Indian	RE Target as per NEP 2018	Energy Mix	EODB	AT&C Loss	ACS-ARR Gap	Annual Financial Losses as per ARR	Payments Overdue to Generators	Annual Capex	Govt. Subsidy
	MW	- RE	Ranking	(2018-19)	(2018-19)				
		%	Nos.	%	Rs/ kWh	Rs Crore	Rs Crore	Rs Crore	Rs Crore
Uttar Pradesh	13,221	4.8%	12	21.2	1.77	-9,506	13,327	8,048	8,900
Madhya Pradesh	12,058	3.1%	7	27.7	-0.88	-3,000	594	3,945	15,000
Maharashtra	22,045	14.8%	13	16.9	-0.05	NA	572	5,241	NA
Jharkhand	2,005	1.1%	4	45.9	0.54	-1,470	4,141	2,494	7,800
Punjab	4,376	4.0%	3	19.1	0.36	-906	23	2,490	8,855
Haryana	5,131	10.0%	20	18.3	0.04	-202	46	2,565	7,140
Bihar	2,762	1.2%	18	34.3	0.57	-1,578	627	5,453	2,952
Rajasthan	14,505	38.0%	9	24.3	0.87	NA	1,955	4,632	1,709
Chhattisgarh	2,087	3.6%	6	23.3	0.04	-541	17	997	300
Andhra Pradesh	18,612	31.0%	1	10.9	0.74	1	2,517	3,771	6,030
Karnataka	14,817	52.0%	8	13.9	0.05	78	5,626	6,821	2,195
West Bengal	5,735	3.0%	10	38.1	0.21	-41	24	1,076	912
Tamil Nadu	21,793	43.0%	15	13.5	1.15	-7,761	12,197	2,025	8,430
Gujarat	17,133	11.8%	5	12.6	-0.05	NA	193	4,062	1,100

Source: Tata Power, IEEFA estimates, UDAY.

Figure 5: State Ranking on Key Parameters

State	Renewable Energy Target as per NEP 2018	Energy Mix - RE	EODB Ranking	AT&C Loss (2018-19)	ACS-ARR Gap (2018-19)	Payments Overdue to Generators	Annual Capex	Govt. Subsidy	Average Rank
	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.
Uttar Pradesh	7	8	10	8	14	14	1	13	9
Madhya Pradesh	8	12	6	11	1	7	7	14	8
Maharashtra	1	5	11	5	2	6	4	1	4
Jharkhand	14	14	3	14	9	11	10	10	11
Punjab	11	9	2	7	8	2	11	12	8
Haryana	10	7	14	6	4	4	9	9	8
Bihar	12	13	13	12	10	8	3	7	10
Rajasthan	6	3	8	10	12	9	5	5	7
Chhattisgarh	13	10	5	9	4	1	14	2	7
Andhra Pradesh	3	4	1	1	11	10	8	8	6
Karnataka	5	1	7	4	6	12	2	6	5
West Bengal	9	11	9	13	7	3	13	3	9
Tamilnadu	2	2	12	3	13	13	12	11	9
Gujarat	4	6	4	2	2	5	6	4	4

Source: IEEFA calculations.

In addition to the above ranking based on quantitative parameters, qualitative parameters of regional diversity, political willingness for distribution and energy transition reform, timely revision of tariffs, adoption of renewable energy policies, wheeling charges (transmission charges) and cross-subsidy surcharges were adopted as criteria for finalising the states (Figure 6).

Based on this, the three states selected for detailed analysis were Maharashtra, Rajasthan, and Madhya Pradesh. The table below shows how the selected states varied on key operational, structural, and financial parameters. That variance provides a good mix for similar states to learn from, so that they can adopt effective reforms to improve their financial performance and increase the share of renewables in their total energy mix.

Figure 6: Selected State Ranking on Key Parameters

Parameters	Maharashtra	Rajasthan	Madhya Pradesh
Region Diversity	WR	NR	WR
RE Penetration	High	High	Low
RE Policy	Solar Energy Policy	Net metering solar policy	Policy for rooftop and renewable energy projects, 2016
Capex	High	High	Medium
AT&C Loss	Medium	High	High
Revenue Gap	Low	High	Low
Payment Owed to Generators	Medium	High	Medium
Tariff Revision	Negligible	None	Medium
Cross Subsidy Surcharge	High	High	Medium
Government Subsidy	Low	Medium	High

Source: IEEFA Analysis.

Performance Metrics

The shortlisted states were assessed using key performance indicators.

As per the regulatory system for power distribution businesses in India, the discoms submit an annual revenue requirement based on certain key indicators to the state regulatory commission. These operational and financial parameters include:

1. Energy sales
2. Transmission, distribution, and commercial losses
3. Power purchase cost, including transmission charges and state load dispatch centre (SLDC) charges
4. Operation and maintenance expenses
5. Interest and finance charges and interest on working capital
6. Depreciation of assets
7. Revenue from existing tariff
8. Non-tariff and other income
9. Revenue deficit based on existing tariff

The state regulatory commission, along with other designated public stakeholders, reviews these performance parameters to evaluate annual revenue requirements. Based on this evaluation, the regulatory commission approves subsidy funding from the state government to fill the gap between revenue and expenses.

The state regulatory commission also approves tariffs for each generation source. In the case of thermal power, the commission evaluates and approves a two-part tariff composed of fixed capacity charges and variable fuel-cost charges.

In this report, the performance of state distribution companies in the shortlisted three states is analysed, based on the above identified parameters.

The chosen states have different trajectories of aggregate, technical and commercial (AT&C) losses. Maharashtra's AT&C loss declined until FY2017/18 and then started rising again. Rajasthan's AT&C loss showed a strong reduction, while Madhya Pradesh started with high base and has not made much progress. While the three states each have different AT&C loss reduction trajectories, they are suffering from high power purchase costs and subsidised sales to agricultural consumers.

How the states record their agriculture sales, set tariffs and subsidies for farm consumers, the issue of cross-subsidies and allowances/disallowances by the regulatory commission has a strong bearing on discom finances. These states will provide important take-aways for other states with similar paths to reform.

1. Maharashtra

Structure of the State-owned Discoms

The Maharashtra State Electricity Distribution Company Limited (MSEDCL)⁷ is the distribution company supplying power to the whole of Maharashtra, including a small area of suburban Mumbai. The city of Mumbai is served by three private distribution licensees: Adani Electricity Mumbai Limited (AEML), The Tata Power Co. Ltd. (TPC-D) and the Brihanmumbai Electricity Supply and Transport Undertaking (BEST). MSEDCL is India's largest electricity distribution utility, serving more than 27 million consumers.

Figure 1.1: Map of Maharashtra Discom



Source: UDAY Portal.

Maharashtra's generation mix is dominated by coal-based capacity with approximately 69% share of the total. The share of renewable energy has increased over the years to reach a 9% share in 2019/20.

⁷ This report covers analysis of MSEDCL discom only in the state of Maharashtra.

Figure 1.2: Maharashtra Electricity Generation Mix FY2019/20

Source	Capacity		Generation		Utilisation	Capacity Adds
	(GW)	%	(TWh)	%	%	(GW)
Coal	26.2	59.3%	107.0	69.0%	45.6%	-1.1
Gas	3.5	7.9%	8.0	5.2%	26.0%	0.0
Diesel	0.0	0.0%	0.0	0.0%	0.0%	0.0
Nuclear	1.4	3.2%	10.5	6.8%	85.9%	0.0
Hydro	3.4	7.6%	5.9	3.8%	20.1%	0.0
Renewables	9.7	22.0%	14.0	9.0%	16.8%	0.4
Net imports			9.8	6.3%		
Total	44.2	100.0%	155.2	100.0%		-0.6

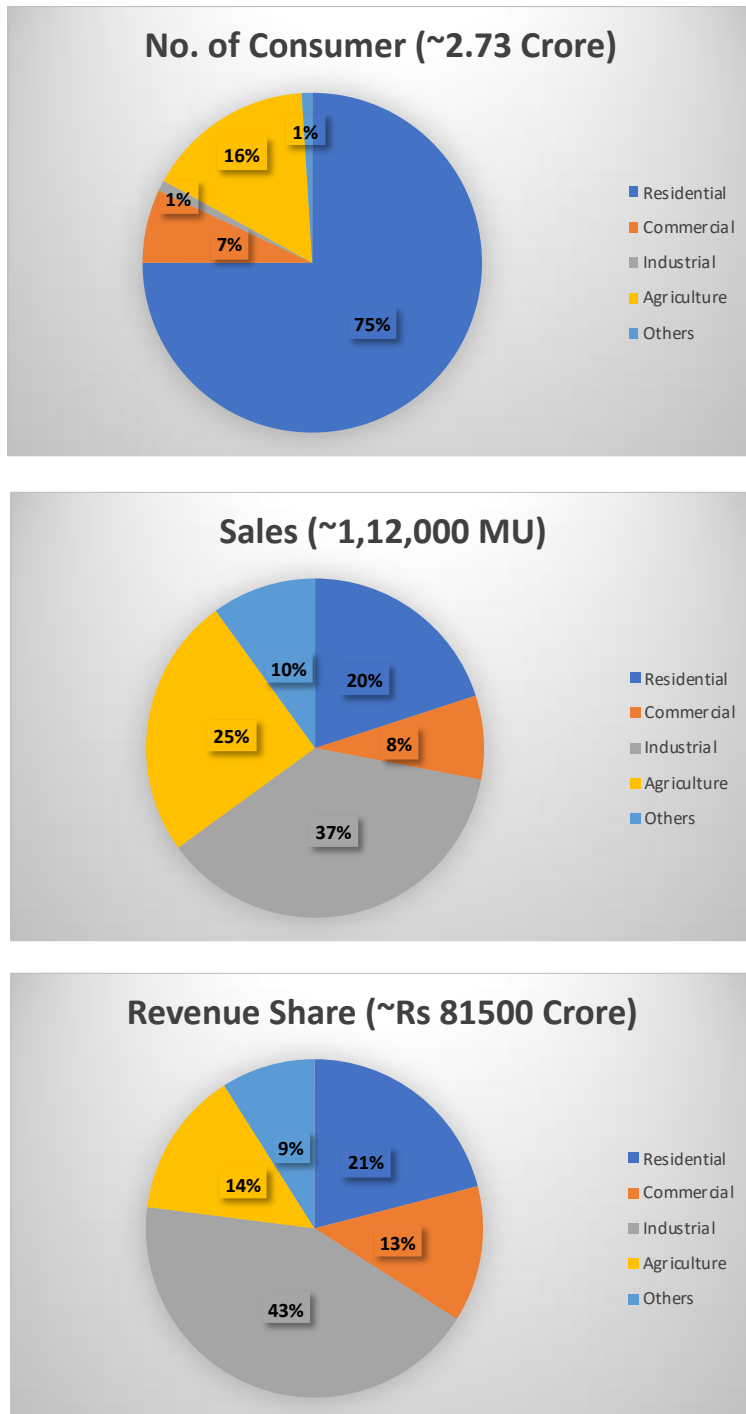
Source: CEA.⁸

Maharashtra is one of India's agrarian states, with agricultural consumers using about 25% of the total power consumption. However, they only account for some 14% of revenue. This is because of a tariff design in which other categories of consumers pay high prices to cross-subsidise electricity for agricultural users.

Even though the share of commercial and industrial consumers in total electricity consumption is 45% by volume, their revenue contribution is a much higher 56%. Residential consumers take 20% of all electricity consumed and provide 20% of discom revenue.

⁸ CEA. [Monthly Generation Report](#). March 2019/20. [Monthly Renewable Energy Generation Report](#). March 2019/20.

Figure 1.3: Consumer Mix, Sales Mix, and Revenue Contribution of Different Consumer Categories in 2018/19



Source: MSEDCL Press Note on Retail Electricity Tariff.⁹

⁹ MSEDCL Press Note. Retail Electricity Tariff of Maharashtra State Electricity Distribution Company Ltd. Applicable from 1 April, 2020.

The tariff in Maharashtra is positively related to volume of consumption and voltage levels. For the same category of consumer, the tariff increases with the rise in consumption and voltage level.

In FY2020/21, the tariffs for residential consumers of Maharashtra are in the range of Rs3.46-11.71/kWh with fixed charges in the range of Rs100-340/month depending on the voltage load levels. C&I consumers pay Rs5.21-12.83/kWh with fixed charges in the range of Rs300-450/month.

Unmetered agricultural consumers pay flat fixed monthly rates in the range of Rs258-405/month with no energy charges for number of units consumed. For metered agriculture consumers, the tariff is in the range of Rs1.85-5.20/kWh with fixed charges in the range of Rs40-110/month. The agriculture tariff is around 50% of ACS. Agriculture consumers are cross-subsidised in the range of Rs2.58-3.11/kWh.

Given the increasing number of electric vehicles in the state, a tariff for electric vehicle charging stations is also included in the recent tariff order. This will help the Maharashtra government promote a sustainable transport system by providing clarity on how the charges apply.

Figure 1.4: Customer Category Tariff for FY2020/21

Category	Energy charge range (Rs/kWh)	Fixed charges range
Residential - BPL	1.12	26 Rs/conn/mth
LT Residential	3.46-11.71	100-340 Rs/conn/mth
Agriculture Unmetered		258-405 Rs/HP/mth
Agriculture Metered	1.85-5.2	LT 41-111 Rs/HP/mth HT 72 Rs/kVA/mth
Commercial	7.36-12.83	LT For 0-20 kW - 403 Rs/conn/mth For >20 kW - 403 Rs/kw/mth HT 411 Rs/kVA/mth
Industrial	5.21-7.28	LT For 0-20 kW - 454 Rs/conn/mth For >20 kW - 303 Rs/kw/mth HT 411 Rs/kVA/mth
Electric Vehicle Charging Station	4.05-4.93	LT 70 Rs/kW/mth HT 70 Rs/kVA/mth

Source: MERC tariff order.¹⁰

¹⁰ MERC Tariff Order, Truing-up of ARR of FY 2017-18 & FY 2018-19, Provisional Truing-up of ARR of FY 2019-20 and Projections of ARR and determination for the 4th Multi Year Tariff Control Period FY 2020-21 to FY 2024-25.

Renewable Energy Policy

Maharashtra has renewable energy potential of 75GW, which is 8.3% of the country's total potential.¹¹ As per the National Electricity Plan 2018, Maharashtra has a renewable energy target of 22GW to be achieved by 2022.¹² As of June 2020, state renewable energy installed capacity was 9.7GW¹³, highlighting the need for a strong policy and investment drive to achieve the target.

To promote deployment of renewable energy in the state, Maharashtra Electricity Regulatory Commission (MERC) has, from time to time, set a renewable purchase obligation (RPO) target. In FY2018/19, the discom was short of its RPO target by 1.5% for solar and non-solar energy, respectively. It filled the gap by buying renewable energy certificates (RECs) worth Rs150 crore.

RPO targets submitted by MSEDCL for the fourth control period are presented below.

Figure 1.5: 4th Control Period RPO Targets as per 2019 RPO Regulations

Quantum of purchase (in %) from renewable energy sources (in terms of energy equivalent in kWh)			
Year	Solar	Non-solar	Total
2020-21	5%	12%	16%
2021-22	6%	12%	18%
2022-23	8%	12%	20%
2023-24	11%	12%	23%
2024-25	14%	12%	25%

Source: MERC tariff order.

The state has adopted a multi-pronged strategy to embrace renewable energy. Some of its key strategies are as follows:

Maharashtra Renewable Energy Policy, 2015

Maharashtra announced an integrated Renewable Energy Policy in 2015, with a focus on developing renewable energy capacity in the state. The policy also emphasized development of hybrid and distributed solar projects.¹⁴

The state has also been instrumental in the promotion of renewable energy by providing various incentives such as an exemption of electricity duty and a capital

¹¹ MERC, [Annual Report, 2017-18](#).

¹² CEA, [NEP 2018](#).

¹³ CEA, [Installed Capacity, June 2020](#).

¹⁴ Niti Aayog, [State Renewable Energy Capacity Addition Roadmap: Action Plan 2022 and Vision 2030: Summary of findings](#).

subsidy for selected technologies under this policy.

Solar Irrigation Pump Scheme for agricultural consumers

The government of Maharashtra has targeted deployment of 1 lakh (100,000) of off-grid solar powered agriculture pumps in phases under the "Mukhyamantri Saur Krushi Pump Yojana" scheme. The government plans to install the pumps within three years starting from 2019:¹⁵

- First Phase – 25,000
- Second Phase – 50,000
- Third Phase – 25,000

Through this solar irrigation scheme, the government plans to:

- Make daytime power available for agricultural pumping
- Decouple the irrigation sector from the power subsidy burden
- Minimize the cross-subsidy burden on commercial and industrial electricity consumers
- Replace diesel pumps to reduce pollution.

This scheme is financed by increasing the electricity duty for all MSEDCL consumers by 10 paise per unit.

Maharashtra is also planning to install solar agricultural feeder-based projects near existing substations to reduce infrastructure costs. The state is identifying land near sub-stations to install solar projects under the scheme.

The state intends to enable development of solar power projects of 2MW to 10MW capacity at 11kV level and above 10MW at 33kV level for Lift Irrigation Scheme (LIS) consumers under Mukhyamantri Saur Krushi Vahini Yojana (MSKY) Stage II. The electricity generated from such solar power projects will be sold by the generators at a feed-in tariff (FiT) of Rs3.30/kWh at 11kV for a period of 25 years. The FiT applicable for solar projects connected at 33kV will be Rs3/kWh for a period of 25 years.¹⁶

Solar Rooftop

To facilitate solar rooftop generation, Maharashtra developed a net metering framework, with the Maharashtra Electricity Regulatory Commission issuing its Grid Interactive Rooftop Renewable Energy Generating Systems Regulations in 2019. These regulations allow for the levy of grid support charges on the generated energy under net metering systems. The charges are intended to recover balancing,

¹⁵ Mahavitrان. [MUKHYAMANTRI SAUR KRUSHI PUMP YOJANA](#).

¹⁶ Draft LIS Scheme.

banking, and wheeling cost after adjusting RPO benefits, avoided distribution losses, and any other benefits accruing to the licensee.

Transmission Infrastructure

Maharashtra has surplus energy and via its immense renewable energy potential can establish itself as an export hub. To ensure offtake of power from renewable energy sources, the state has developed one of the strongest intra-state networks, and its capacity addition planning is in line with proposed renewable energy targets. The state is adding 3.6GW of Interstate Transmission System (ISTS) capacity under the Green Energy Corridor. The state is also planning to add renewable energy projects for the inter-state sale of power to reduce its overall evacuation requirement.

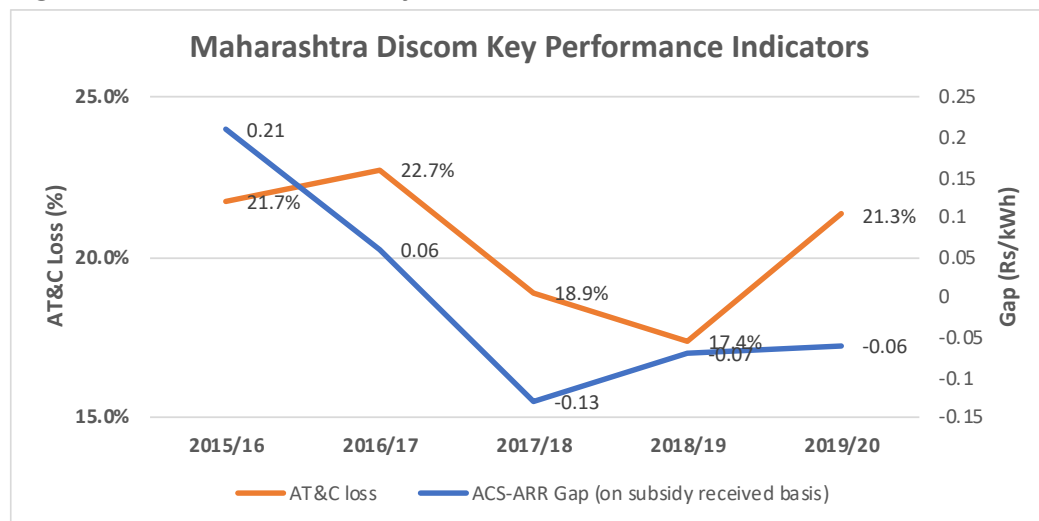
Performance Metrics

AT&C Losses

In FY2015/16, AT&C losses in MSEDCL were high at 21.7%. As per the memorandum of understanding (MoU) signed under UDAY in 2016, the discoms were set a target of reducing their AT&C losses to 14.39% by the end of FY2018/19.

The discom managed to reduce losses by four percentage points in 2017/18, but the losses have since risen and are back to 2015/16 level. As of March 2020, the discom has an AT&C loss of 21.32%.¹⁷ (See figure 1.6)

Figure 1.6: Maharashtra Key Performance Metrics



Source: UDAY dashboard, PFC, Powerline.

¹⁷ UDAY. March 2020.

The state has started excluding losses from farm pump feeders. The high losses in the state can be attributed to power theft in certain areas such as the Nanded district and Jalgaon.¹⁸

Collection efficiency for residential, commercial and industrial categories is in the range of 98-100% while the overall collection efficiency for MSEDCL is around 96% due to inherent difficulties in collecting from agricultural consumers. MSEDCL is working to improve collection efficiency in the agriculture category as well. It has set up a centralized collection and processing department along with an online collection facility to avoid revenue blockages in the system.

In the tariff order submitted by Maharashtra discoms in February 2020 in their annual revenue requirement for control period FY2020/21 to FY2024/25, the Commission set a target of an 18% reduction in distribution losses for financial year 2020-21 and 12% for financial year 2024-25.

MSEDCL has taken various steps to reduce losses. For agricultural consumers, MSEDCL is implementing Mukhyamantri Saur KrishiVahini Yojana (MSKVY) announced by the Government of Maharashtra to encourage the installation of decentralized, grid-connected solar power projects to supply daytime power to farmers. The scheme will benefit agricultural consumers as they will get good quality daytime power supply while helping MSEDCL reduce peak energy demand, lower T&D losses, reduce total power purchase cost and meet its RPO. It will also help the state government to reduce the subsidy burden of providing low-cost power to farmers.

In January 2017, MSEDCL introduced energy accounting in which detailed reports are prepared on a daily and monthly basis. This has helped the discom to analyse data at the feeder level and identify the source of energy leakages. Further, MSEDCL launched Mahavitran, an in-house mobile phone application, that allows consumers to submit meter readings, register complaints and pay bills online.¹⁹

To incentivise consumers to pay on time, MSEDCL offers a 1% payment discount. Also, to reduce T&D losses, the state is encouraging the deployment of prepaid meters with a prepaid meter rebate of 5% to ensure advance payment of electricity bills. However, the number of prepaid consumers has fallen from around 14,000 consumers in 2015/16 to some 10,000 consumers in 2018/19 and the sales to such consumers are minimal.

While MSEDCL has undertaken various initiatives to improve billing and collection efficiency, AT&C losses in the state are unsustainably high. MSEDCL needs to invest to strengthen its current infrastructure, deploy smart meters, and undertake digitalisation and feeder segregation.

The regulator has observed inadvertent delays in completing capital expenditure work by MSEDCL, driving up project costs. It is necessary to impose checks on capex

¹⁸ Times of India. [MSEDCL fails to reduce distribution losses over 7 years](#). June 2018.

¹⁹ Powerline. [MSEDCL: Initiatives to improve its financial and operational performance](#). December 2017.

and encourage MSEDCL to adopt project management best-practice as the key to getting the maximum benefit from its spending on grid system strengthening.

ACS-ARR Gap

The gap between average cost of supply (ACS) per unit and average revenue realised (ARR) per unit is one the most important performance parameters for power distribution in India.

The MoU signed under the UDAY scheme directed the discoms to substantially reduce their ACS-ARR gap. The targets for MSEDCL discoms are as follows:

Figure 1.7: Maharashtra Targeted ACS-ARR Gap Reductions Under UDAY

Rs/kWh	Actual Gap in FY2015/16	Targeted reduction under UDAY by FY 2018/19	Actual gap in FY2018/19
MSEDCL	-0.21	0.39	0.16

Source: UDAY Maharashtra MoU & PFC Report.²⁰

MSEDCL has managed to reduce its losses and is now profitable after accounting for subsidies received from the state government. MSEDCL has been able to recover losses from increased fuel costs in previous years via a fuel adjustment charge (FAC), that is passed on to consumers by raising tariffs.

MSEDCL is adopting initiatives to rationalise tariffs and recover its costs, including:

- **Increasing fixed/demand charges** for various categories of consumers in coming years as a step towards gradual balancing of the fixed charges recovery with a fixed charges obligation. Currently, MSEDCL can only recover 18% through the fixed charges.
- **Levying grid support charges** under the Net Metering Arrangement. The charges are levied on gross generation from renewable energy sources to help the discom to partly recover the cost of network, banking facility, distribution grid balancing provided by the distribution licensee etc. Grid support charges are determined after adjusting RPO benefits, avoided distribution losses and any other benefits accruing to the distribution licensee. However, at present, the Commission has decided to exempt most consumers from these grid support charges, till grid connected net metering solar rooftop capacity reaches 2 GW.

²⁰ UDAY. Maharashtra MoU.

- **Implementing kVAh based billing**²¹ from April 2020 to encourage consumers to maintain an efficient 'near-unity power factor' in their consumption to reduce losses and improve system stability, power quality and voltage profile. This will further help in reducing the consumer's demand and the corresponding kVAh bill due to improved system voltage. The improved power factor will further reduce spending on power purchase, creating the opportunity to lower tariffs.
- **Promoting prepaid meters.** Consumers with prepaid metered connections are entitled to a 5% rebate on the energy charge rate applicable to their consumer category.
- **Encouraging payment discipline.** Consumers paying regular bills on time get a prompt payment discount of 1%. While the cost of a pre-paid meter is high, it reduces the discom's operation and maintenance expenses.
- **Adopting a time of day (ToD) tariff.** MSEDCL levies additional ToD tariffs, and offers rebate and penalties for consumption in different time blocks. ToD tariffs are applicable to load greater than 20KW and optional for load below 20kW.
- **Reducing tariffs.** MERC has approved an average tariff reduction of 7% for the financial year 2020/21. MERC has also approved a tariff reduction of 10 - 15% for C&I customers to boost economic activity in the state.
- **Introducing an incremental consumption rebate** of Rs 0.75/kVAh for high-tension consumers. This measure was proposed by MERC to increase power consumption and sourcing of power from MSEDCL, and to help High Tension (HT) consumers to further reduce their effective tariff.
- **Adopting a fuel adjustment charge (FAC) stabilisation fund.** MERC has approved a FAC stabilisation fund limited to Rs1500 crore (\$200 million) to address the possible variation in power purchase costs because of the FAC. The proposed fund would be created by adding a 3% annual escalation of fuel costs and would promote tariff stability.

Figure 1.8: ToD Tariff Rate Schedule

Consumption Slab (kWh)	ToD charge (Rs./kWh)
2200 Hrs – 0600 Hrs	-1.5
0600 Hrs – 0900 Hrs & 1200 Hrs – 1800 Hrs	0
0900 Hrs – 1200 Hrs	0.8
1800 Hrs – 2200 Hrs	1.1

Source: MERC.

²¹ The kVAh billing system incentivizes or penalizes consumers according to their power factor (PF). Consumers are encouraged to maintain near unity PF to achieve loss reduction, improve system stability, power quality and improve voltage profile.

MSEDCL has undertaken various reform measures but not all of its steps are in the right direction. While time-of-day tariffs can promote a change in consumption patterns, adding new fixed charges may well fail to encourage consumers to adopt energy efficiency measures.

Instead of providing a blanket rebate on incremental consumption, the rebate could have been tied to additional renewable energy generation at a lower rate. The rebate could apply, for example, at times of high renewable energy generation, reducing the need for curtailment.

Despite the measures listed above, MSEDCL still has pending payments due and regulatory assets on its books. There is a gap in previous years from FY2017/18 to FY2019/20 of Rs3,447 crore (US\$492m) and regulatory assets of Rs12,382 crore to be recovered in future years. Moreover, the carrying cost of delays in the recovery of legitimate expenses is adding to the revenue gap.

There are several key structural and operational reasons for the Maharashtra state-owned discoms' unsustainably high cost-of power, notably:

- **Power Purchase Cost**

The major share of power required for MSEDCL is purchased from Maharashtra State Power Generation Co Ltd (MAHAGENCO) under long term PPAs. But the cost of MAHAGENCO power is too high and as there is surplus power available, MSEDCL could reduce its power costs by buying power from other generators.

As per the average revenue requirement order, the Commission approved the power purchase cost of Rs4.35/kWh for FY2019/20.

Figure 1.9 provides the range of contracted tariffs by the discom. The discom procures thermal power in a tariff range of Rs2.19 – 6.72/kWh.²² MSEDCL is paying MAHAGENCO a high tariff for power from old inefficient plants. A fixed charge of Rs21,000 crore (US\$2.8bn) paid for the contracted capacity forms 36% of the discoms' total contracted power purchase cost.

MSEDCL power procurement costs of Rs3.93/kWh for solar is higher than the post-2016 renewable energy tariffs of sub-Rs3/kWh. However, this tariff is a weighted average cost of all the solar PPAs under which MSEDCL procures solar power including higher solar tariffs contracted earlier than 2016. The non-solar renewable energy component's cost is much higher and makes up 11% of total power purchase cost.

²² There are some outliers with discom making very small purchases at high rates, such as from Gadawara, NTPC Solapur and Gandhar power plants.

Figure 1.9: MSEDCL Discom Power Purchase Cost (Total Cost)

	Tariff range (Rs/kWh)	% of total Power Purchase cost
Thermal	2.19-6.72	82.4%
Hydro	0.5-8.11	0.8%
Nuclear	2.13-3.28	3%
Renewable (Solar)	3.93	3%
Renewable (Non-Solar)	5.24	11%

Source: MERC tariff order.

- **Efficiency of Plants**

MAHAGENCO's power plants have low efficiency and MSEDCL must also purchase power from other more costly generators, further increasing its power purchase costs.

MAHAGENCO plants also face water shortages affecting their output. Before 2016, plant closure due to a lack of water was still counted towards plants' availability and operators would recover fixed costs for the duration of non-availability. But since 2016, non-availability of the plant because of a water shortage does not count as a *force majeure*, and therefore MERC will not allow MAHAGENCO to seek payment when a power plant is not available.

This position was first taken by MERC in its MAHAGENCO Tariff Order for FY2015/16. It was subsequently challenged by MAHAGENCO in the Appellate Tribunal for Electricity (APTEL) and the matter remains *sub-judice*. MERC has stuck to its view and has consistently opposed the unavailability principle.

- **Shortage of coal as a fuel**

While shortage of coal resulted in low plant load factor (PLF) for capacity installed in the state few years back, some amount of thermal generating capacity is still subject to fuel shortages and is lying idle. However, MSEDCL has to keep paying high fixed charges for such idle capacity, even if the capacity is not despatched.

The plant load factor (PLF) for state- and privately-owned generation for plants supplying power to MSEDCL in FY2019/20 was extremely low at 51% and 48% respectively. The PLF of state-owned power generators in Maharashtra was higher at around 60%, though not all the power generated from these plants was allocated to MSEDCL.

- **Excess Purchase / Supply**

MSEDCL has been buying electricity from a power exchange and through bilateral contracts at a weighted average price of Rs3.93/kWh in FY2019/20.

The price of power in bilateral contracts is much higher at Rs4.45/kWh, while the power bought at an exchange has a lower average price of Rs3.32/kWh.

MSEDCL also has surplus energy which is not dispatched most of the time. The cost burden of excess supply adds considerably to MSEDCL's overall costs.

- **Burden of Cross-Subsidies**

Figure 1.10 illustrates MSEDCL's voltage-wise cost of supply against average billing rate for various categories of customers for FY2019/20. Although the voltage-wise cost of supply does not vary significantly, there is a wide variation in average billing rates for the various consumer categories thanks to tariff structures based on cross-subsidies.

Reflecting high power procurement costs and unsustainable aggregate and technical loss rates, MSEDCL's average cost of supply is estimated to be Rs7.24/kWh. High-tension commercial and industrial customers are charged much more than actual cost of supply to offset undercharging agricultural users and public water works. The ratio of average billing rate to average cost of supply for residential consumers is 98%.

Maharashtra Electricity Regulatory Commission has approved the cross-subsidy surcharge (CSS) based equal to minimum of the two values: computed CSS and 20% of tariff. This has resulted in lower CSS applicable than current level of cross subsidy leading to incomplete recovery of the cross-subsidy from Open Access consumers. For last 3-4 years, ceiling on CSS resulted has cost MSEDCL an additional financial burden of ~Rs1,600 crore (US\$2.2bn).

Figure 1.10: Cross-subsidy Based on Voltage-wise Cost of Supply

Category	Average Cost of Supply (Rs/kWh)	Average Billing Rate (Rs/kWh)	Ratio of Average Billing Rate to Average Cost of Supply (%)
HT I (A): HT – Industry	7.24	8.42	114%
HT II: HT - Commercial		14.16	191%
HT III: HT - Railways/Metro/Monorail Traction		8.89	120%
HT IV: HT - Public Water Works (PWW)		7.49	101%
HT V: HT - Agriculture		4.27	58%
HT VI: HT - Group Housing Societies (Residential)		7.76	105%
HT VIII: HT - Temporary Supply		13.29	180%
HT IX : HT - Public Services Govt		9.63	130%
HT IX : HT - Public Services Others		11.65	157%
HT Total		8.59	116%
LT I: LT – Residential		7.22	98%
LT II: LT - Non-Residential		11.79	159%
LT III: LT - Public Water Works (PWW)		4.17	56%
LT IV: LT - Agriculture Metered		3.74	50%
LT V (A): LT - Industry - Power Looms		7.12	96%
LT V (B): LT - Industry – General		8.61	116%
LT VI: LT - Street Light		6.58	89%
LT VIII: LT - Advertisements and Hoardings		18.05	244%
LT IX: LT - Crematorium and Burial Grounds		5.04	68%
LT X- Public Services Govt.		8.71	118%
LT X- Public Services Others	8.85	120%	
LT Total	6.12	83%	

Source: MERC tariff order.

Financial Losses

MSEDCL is revenue-neutral company. The discom will recover any under-recovery of approved revenue in future years through revision of its retail supply tariff.

After receiving subsidies and grants from the state government, MSEDCL reported a profit of Rs0.06/kWh in FY2019/20. The Maharashtra state government has had a good record on disbursing subsidies. MSEDCL received slightly more than 100% of its total booked subsidies between FY2015/16 and FY2017/18, as noted by the Power Finance Corporation in its 2017/18 report.

The Maharashtra state government has a good record on disbursing subsidies.

Overdue Payments

MSEDCL had accumulated overdue payments of Rs11,031 crore ((US\$1.6bn) as of May 2020. This is around 9.5% of the total amount of Rs116,340 crore (US\$16bn) of overdue payments to generation companies accumulated by Indian's discom sector.

MSEDCL owes 96% or Rs10,602 crore (US\$1.5bn) of its overdue payments to Adani Power Limited alone. Some of the overdue amount dates to April 2018 and is held back on account of ongoing litigation related to fuel charges on account of change in Indonesian law for imported coal. MSEDCL owes money to the CLP India and GMR Energy companies and owes Rs298 crore to renewable energy generators supplying power to the state.

In May 2020, to address the issue of state discoms' overdue payments to generating stations, the Indian government announced a Rs90,000 crore liquidity injection to the Indian electricity sector through the state-owned Power Finance Corporation (PFC) and Rural Electrification Corporation (REC).²³ In June 2020, Maharashtra discoms were approved Rs2,500 crore as the first tranche of loans designed to be disbursed in two equal halves.²⁴

Further, the state government is issuing a guarantee for the Maharashtra State Electricity Board (MSEB) to undertake a loan of Rs20,000 crore to overcome the resource crunch on account of the COVID-19 lockdown.²⁵

Open Access Charges

Open access charges include transmission charges, wheeling charges, cross subsidy charges, grid support charges, additional surcharges and SLDC charges, and so on.

²³ LiveMint.. [Power discoms get ₹90,000 crore liquiditylifeline](#). May 2020.

²⁴ Financial Express. [Why most discoms are yet to get state govt nod for PFC-REC loans](#). June 2020.

²⁵ ETEnergyWorld. [Hit hard by Covid lockdown, MSEB wants Rs 20,000 crore loan](#). July 2020.

The Madhya Pradesh Electricity Regulatory Commission (MPERC) approved a wheeling charge of Rs0.58/kWh for HT consumers and Rs1.45 for Low Tension (LT) consumers, a cross-subsidy surcharge in the range of Rs0.25 - 6.92/kWh (depending upon the customer category) and an additional surcharge of Rs1.57/kWh for FY2020/21. The cross-subsidy surcharge was approved at 20% of the average tariff for the given category.

Conclusion and Recommendations for MSEDCL

MSEDCL has adopted several good practices for improving its operational and financial performance, but the state discom is still struggling with unsustainably high AT&C losses due to inefficient metering and collection of agriculture consumers' payments, high power purchase costs, and an increased debt burden.

There are large numbers of agricultural consumers that are still unmetered. MSEDCL recently changed its accounting practice of recording agriculture sales. It was thought in previous years that the discom was over-reporting agricultural sales and distribution losses in its supply of power to agricultural consumers. In the recent tariff order, based on the recommendations of a working group commissioned by the regulator, agricultural power sales have been rationalised, reducing the burden of cross-subsidising agriculture consumers on other consumer categories.

MAHAGENCO, the state-owned generating company, operates old and inefficient equipment at high variable cost. This is a legacy issue for MSEDCL, the state discom, which has entered long-term PPAs and is therefore is buying high-cost power from obsolete plants, while there is cheap electricity available in the power market.

Given the high cost, MSEDCL needs to rethink its plans to enter into contracts with new MAHAGENCO plants which are at the 'drawing board' stage, or with plants where not much progress has been made and financial closure has not been achieved. This could be the best time to get out of any future commitments that would increase its financial losses.

The discom has entered long-term PPAs and is buying high-cost power when there is cheap electricity on the market.

We make the following broad recommendations for MSEDCL to turn around its business and reach a profitable position:

- **Power agriculture demand through solar**

MSEDCL should harness solar energy for electricity supply in rural areas to reduce agricultural consumers' dependence on MSEDCL's daytime power

supply. It should promote the installation of solar water pumps, and farmers that install them should be subsidised.

MSEDCL must deploy a combination of both decentralized solar pumps and at feeder level to provide good quality daytime power supply to farmers. In so doing it would reduce both its peak energy demand and technical and distribution losses. It would also reduce its total power purchase cost while meeting its renewable energy purchase obligation. Moreover, these measures would help the discom reduce the cross-subsidy burden on other customers because agricultural consumers would produce their own cheaper power.

According to data compiled by the Ministry of Power, the annual electricity subsidy on agriculture is Rs17,730crore and the investment required for installation and solarisation of pumps is Rs72,835 crore in the state of Maharashtra. The state can recover the cost of free solar pumps in 4.11 years.²⁶

- **Reduce reliance on power purchased from old inefficient plants**

MSEDCL needs to optimise its power purchase costs by taking less power from high-cost state and central owned generators. The state needs to retire its old plants which consume much more coal per kilowatt hour than modern plants, as well as causing air, fly-ash, and water pollution. The central government needs to put a policy framework in place and incentivise states to retire of old thermal plants without putting a financial burden on states.

Given the state's high renewable energy potential, Maharashtra should promote the deployment of more large-scale, grid-connected, renewable energy projects. It should also encourage decentralized renewable energy production through rooftop solar and or solar irrigation pumps, helping MSEDCL to avoid grid losses.

Discoms can progressively reduce their costs by buying more renewable energy.

Because renewable energy is now more competitive than power generation using domestic coal, the discom can progressively reduce its costs by raising the proportion of renewable energy in its power purchasing.

- **Incentivise Solar Rooftop**

MSEDCL levies additional grid support charges for net metering rooftop solar systems. This is done to compensate for under-recovery of its infrastructure costs because rooftop solar reduces the utilization of MSEDCL's distribution network, disrupts power planning, and can leave generation capacity stranded.

²⁶ The Hindu Business Line. [Most States can recover cost of free solar pumps in less than 4 years.](#) July 2020.

It is important to provide policy certainty as many consumers have undertaken material capital expenditure without considering such charges. The state previously enjoyed rapid rooftop solar growth thanks to falling system costs, greater consumer awareness, and awareness of the environmental benefits, but this has now slowed.

States should encourage the installation of grid-connected rooftop solar (RTPV) systems as they are becoming increasingly viable economically and offer multiple benefits. But rather than the state subsidizing RTPV, it should align the tariffs of commercial and high-end residential consumers with those of RTPV costs, thereby incentivising them to shift to solar or pay a higher retail electricity tariff for power from discoms.²⁷

Time-of-day pricing for consumers would incentivise consumers to provide demand side response and shift their demand during times when solar energy is available.

- **Deploy Analytical Tools**

MSEDCL needs to improve internal capability and deploy analytical tools for projection and forecasting to take advantage of market developments and innovations such as real time markets (RTM). This would help MSEDCL and power generators that have long-term PPAs with the state to participate in an exchange where they could sell their un-requisitioned surpluses. Furthermore, it would allow renewable energy generators with unanticipated surpluses to sell such supply, earn revenue and, in turn, obtain renewable energy certificates (RECs).

Deployment of such analytical tools would help the discom to reduce dependence on deviation settlement mechanism (DSM), optimize generation resources, sell surplus power efficiently with a next-day payment cycle, and efficiently manage renewable energy intermittence.²⁸

²⁷ Prayas Energy. [Solar Rooftop PV in India](#). November 2012.

²⁸ Mercom India. [PXIL and IEX Launch Real-Time Market for Electricity Transactions](#). June 2020.

2. Rajasthan

Structure of the State-Owned Discoms

Rajasthan's power distribution business comprises three state-owned discoms and their franchises, namely, Jaipur Vidyut Vitran Nigam Ltd. (JVVNL), Ajmer Vidyut Vitran Nigam Ltd. (AVVNL), and Jodhpur Vidyut Vitran Nigam Ltd. (JdVVNL).

Figure 2.1: Map of Rajasthan Discoms



Source: Government of Rajasthan.

Rajasthan Urja Vikas Nigam Ltd. (RUVNL), a Rajasthan government-owned power generation company is also the authorised licensee that effectively operates as a trader between various generation sources and state-owned discoms.

The discoms procure power based on a differential bulk supply tariff (DBST). It involves a single buyer model in which one buyer buys electricity from different generators under a PPA. In this model, the per-unit cost of electricity on-sold to the discoms by the single buyer (RUVNL) is different for each discom. The differentiation is mainly because of varied sales, the efficiency of the discom, and its consumer mix.

Using this approach, the distribution utility with the customer base that generates low revenues would be charged a lower DBST than charged to the buyer with a more favourable consumer or revenue mix. For example, the Jodhpur discom (JdVVNL) has a higher share of agricultural consumers who receive subsidised tariff rates that undermine the Jodhpur discom's revenue.

For the financial year 2019/20, the Rajasthan Electricity Regulatory Commission (RERC) approved DBST of Rs4.67/kWh for the Jaipur discom, Rs4.18/kWh for the Ajmer discom and Rs3.23/kWh for the Jodhpur discom.²⁹

Figure 2.2: Rajasthan Electricity Sector Generation Mix in 2019/20

Source	Capacity		Generation		Utilisation	Capacity Adds
	(GW)	%	(TWh)	%	%	(GW)
Coal	9.8	44.6%	45.9	56.5%	55.2%	0.7
Gas	1.0	4.6%	1.0	1.3%	11.5%	0.0
Diesel	0.0	0.0%	0.0	0.0%	0.0%	0.0
Nuclear	1.2	5.4%	8.5	10.4%	81.8%	0.0
Hydro	0.4	1.9%	0.6	0.7%	16.8%	0.0
Renewables	9.6	43.5%	14.3	17.6%	19.0%	1.9
Net imports			10.9	13.5%		
Total	22.0	100.0%	81.2	100.0%		2.6

Source: CEA State-wise and plant-wise generation reports, IEEFA estimates

Note: The capacity, generation and utilisation rates are based on capacity monitored by CEA in the state.

As per the Central Electricity Authority (CEA) installed capacity report from March 2020, Rajasthan has 12.4GW of coal-fired installed capacity. However, only 9.8GW of coal-fired capacity is allocated for Rajasthan and the rest of the installed coal capacity is owned by the central government and could be allocated to other states. It could also be potentially mothballed by a lack of coal and water or by maintenance work.

Renewable energy sources such as solar, wind and biomass now form a substantial part of Rajasthan's installed capacity mix. With the addition of 1.9GW of capacity in FY2019/20, Rajasthan's renewable energy capacity reached a total of 9.6GW which formed 43.5% of its total operational installed capacity and 17.6% of its total on-grid generation.³⁰

Rajasthan's thermal fleet (including gas-based generation) provided 57.8% of in-state consumption for FY2019/20. Being in a power deficit position during daytime peak hours, the state depends on electricity imported from other states. We estimate that Rajasthan imported 10.9 terra-watt hours (TWh) of electricity in FY2019/20.

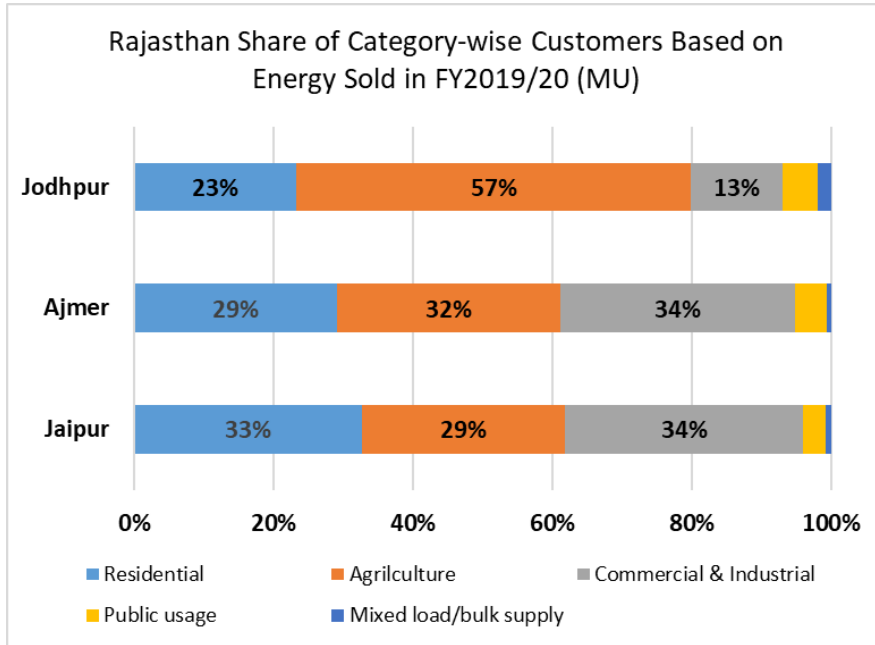
Please note that the above table depicts in-state generation from power plants based in Rajasthan. However, the power they generate could also be consumed in other states. Further in the case study, we analyse the Rajasthan discoms' power

²⁹ RERC. [Tariff order - Approval of ARR and Tariff Petition of Discoms for FY2019/20](#) (Page 70). 06 February 2020.

³⁰ CEA. [Renewable energy generation report](#). March 2020.

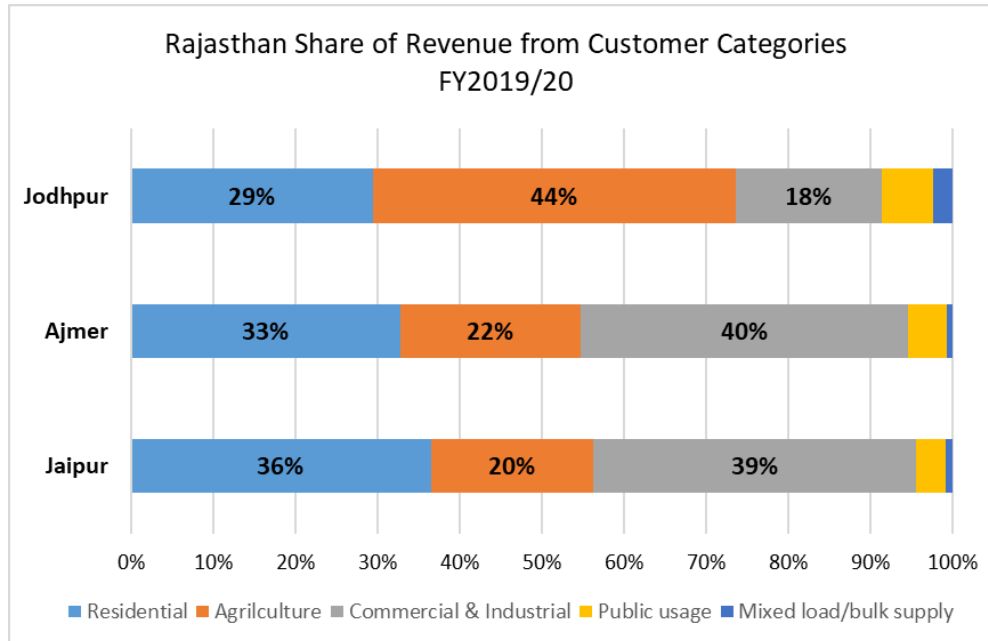
procurement quantity and costs.

Figure 2.3: Rajasthan Discoms' Share of Customers by Category



Source: RERC tariff order.

Figure 2.4: Rajasthan Share of Revenue from Customer Categories



Source: RERC tariff order.

The state-owned discoms broadly cater to three different customer categories with differing tariffs (see Figure 2.5). C&I and residential customers cross-subsidise agricultural customers by paying higher tariffs.

In FY2019/20, the tariffs for residential customers in Rajasthan were in the range of Rs4.75-7.95/kWh with fixed charges in the range of Rs100-400/month depending on the voltage load levels. C&I consumers paid Rs6.00-8.95/kWh with fixed charges in the range of Rs 80-460/month. The state's many agricultural consumers pay flat, fixed, monthly charges in the range of Rs745-895/month with no additional charges for the number of energy units they consume.

Rajasthan discoms are working to convert non-metered agricultural consumers to metered contracts to reduce the burden of cross-subsidies. The metered agricultural customers pay tariffs in the range of Rs5.55-7.10/kWh with lower fixed charges of Rs30-60/month to incentivise efficient electricity use.

Figure 2.5: Customer Category-wise Tariff Approved for FY2019/20

Category	Tariff range (Rs/unit)	Fixed Charges range Rs/month
Residential	4.75 - 7.95	100 - 400
Agriculture (Metered)	5.55 - 7.10	30 - 60
Agriculture (Non metered)	0	745 - 895
Commercial & Industrial	6.00 - 8.95	80 - 460

Source: RERC.³¹

Performance Metrics

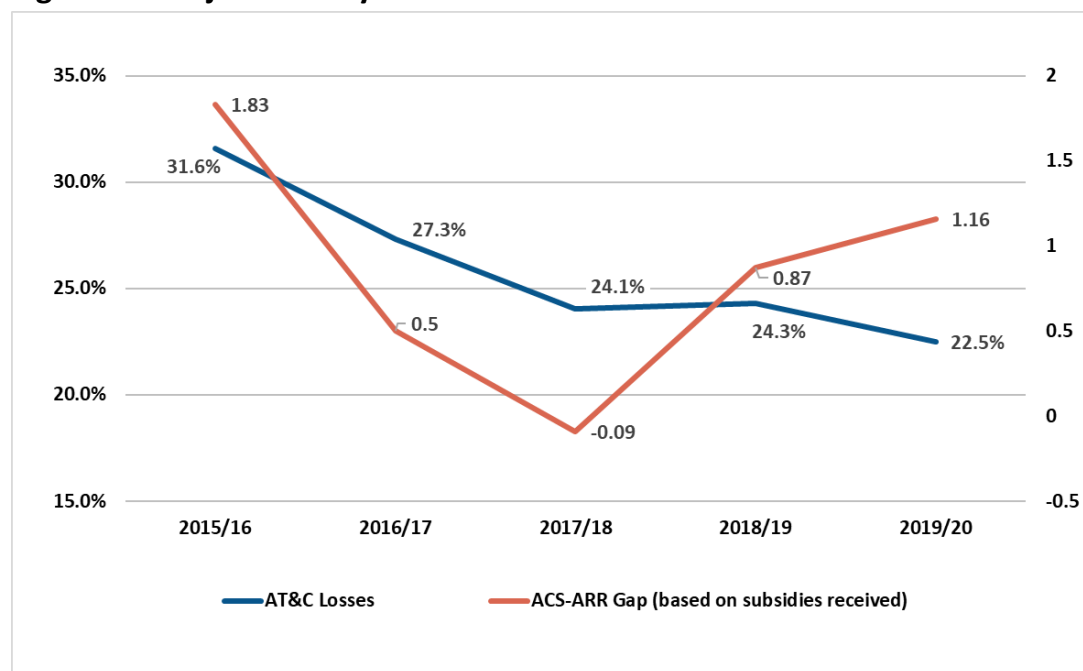
AT&C Losses

In FY2015/16, Rajasthan discoms faced extremely high AT&C losses of around 31.6%. As per the MoU signed under UDAY in 2016, the discoms were given a target of reducing their AT&C losses to 15% by the end of FY2019/20. Although the target has not been achieved, Rajasthan's discoms have managed to significantly reduce the cumulative AT&C losses to 22.5% as of March 2020.³² (See Figure 2.6)

³¹ RERC. [Tariff order - Approval of ARR and Tariff Petition of Discoms for FY2019/20](#) (Annexure-D). 06 February 2020.

³² UDAY. March 2020.

Figure 2.6: Rajasthan Key Performance Metrics



Source: UDAY dashboard, PFC, RERC Tariff orders.

The Jaipur discom had the highest level of AT&C losses of 28% in FY2015/16 with three of its divisions incurring AT&C losses of above 40% — Bharatpur, Dholpur and Karauli.³³ (There is no update available for data on AT&C losses for divisions in FY2019/20.)

In the tariff order dated February 2020, submitted by the Rajasthan discoms for the annual revenue requirement for FY2019/20, the discoms claimed 100% collection efficiency. Discoms have filed intra-state and inter-state transmission losses of 4.25% and 3.15% respectively for FY2019/20.

RERC has observed a continued failure of the Rajasthan discoms to achieve the targeted reduction in AT&C losses below 15% in the last five years despite investment schemes provided by the state and central governments. For FY2019/20, RERC approved AT&C losses of 19% (as opposed to the actual AT&C loss of 22.5% incurred in FY2019/20), leaving the burden of roughly 3.5% of AT&C losses on discoms' financials.

ACS-ARR Gap

The gap between average cost of supply (ACS) per unit and average revenue realised (ARR) per unit is one of the most important performance parameters for power distribution in India. A negative ACS-ARR gap reflects profitability of discoms as they realise higher revenue than the procurement cost.

³³ UDAY. Jaipur MoU.

The MoU signed under the UDAY scheme directed the discoms to substantially reduce their ACS-ARR gap, with targets as follows:

Figure 2.7: Rajasthan Targeted ACS-ARR Gap Reductions under UDAY

(Rs/kWh)	Actual gap in FY2015/16	Targeted reduction under UDAY by FY2018/19	Actual gap in FY2019/20
Ajmer	2.35	-0.15	-0.09
Jaipur	2.04	-0.11	1.15
Jodhpur	1.98	-0.11	2.15

Source: UDAY Rajasthan MoU.^{34 35 36}

The Ajmer discom has managed to become profitable by bringing its ACS-ARR gap to Rs-0.09/kWh in FY2019/20. However, the Jaipur and Jodhpur discoms are still incurring ACS-ARR gaps of Rs1.15/kWh and Rs2.15/kWh for FY2019/20.³⁷

Figure 2.6 illustrates Rajasthan's collective ACS-ARR gap for the years between FY2015/16 to FY2019/20. At the beginning of the UDAY scheme from FY2015/16, the Rajasthan discoms did manage to bring their collective deficit down from Rs1.83/kWh in FY2015/16 to a profitable position in FY2017/18 to Rs-0.09/kWh. However, it has been deteriorating since FY2017/18 to a loss-making position with the gap at Rs1.16/kWh for FY2019/20.

There are several key structural and operational reasons for unsustainably high cost-revenue deficits in Rajasthan state-owned discoms:

- **Lack of in-state coal mining and hydro power**

Rajasthan has no coal reserves and inadequate sources of water to procure in-state hydro power, which increases overall power purchase costs. Available hydropower capacity is primarily utilised only when dam water is released for irrigation. Even though the discoms can buy cheap hydro power from other states, it only accounted for 9% of power procured in FY2019/20 (refer to Figure 2.2).

For FY2019/20, Rajasthan discoms' average thermal power purchase cost was Rs4.20/kWh. It made up roughly 79% of the total power procured by the discoms. The higher average per unit cost of Rs4.80/kWh for renewables suggests the Rajasthan discoms still mainly procure power under contracts signed before 2017. Weak power demand growth since 2019 has reduced the

³⁴ UDAY. [Ajmer MoU](#).

³⁵ UDAY. [Jaipur MoU](#).

³⁶ UDAY. [Jodhpur MoU](#).

³⁷ UDAY. [Rajasthan Dashboard](#). March 2020.

ability of the state to procure new low-cost renewable energy below Rs3.00/kWh and hence progressively lower the average cost of supply.

Legacy thermal contracts with fixed cost charges constrain the discoms from signing new cheaper renewable energy PPAs at below Rs3.0/kwh.

For FY2019/20, IEEFA estimates the average cost of power procurement for Rajasthan was Rs4.10/kWh.

Figure 2.8: Rajasthan Discom Power Purchase Cost for FY2019/20

	MU	Total cost (Rs crore)	Rs/kWh	% of Total power	% of Total power purchase cost
Thermal	61,475	25,637	4.2	79%	81%
Hydro	7,276	1,254	1.7	9%	4%
Nuclear	3,124	1,120	3.6	4%	4%
Renewables	10,291	4,965	4.8	13%	16%
Thermal+RE bundled	2,314	1,009	4.4	3%	3%
Purchased in open market	-6,731	-2,423	3.6	-9%	-8%
Net Total	77,749	31,562	4.1	100%	100%

Source: RERC Annual revenue requirement tariff order, Page 207-208.

Note: The amount of electricity (MU) is forecasted based on 10 months data for FY2019/20.

- **Power deficit during peak hours**

In the recent tariff order for the FY2019/20 average revenue requirement, the discoms noted there was a power supply deficit during daytime, and they depended on power from an open-market exchange during the time. At night, however, there was an off-peak surplus that was sold on the exchange.³⁸

The cost of power sold on the exchange during off-peak hours is significantly lower than the cost of purchase. The average price of power sold on the power exchange by Rajasthan discoms from 12.00AM to 7.00AM was Rs2.11/kWh in FY2018/19. The net average cost of power procured in FY2018/19 was Rs4.27/kWh. In this way, the discoms bear a loss of Rs2.16/kWh on every unit of power sold between midnight and 7am.

- **No tariff hike since FY2015/16**

Rajasthan's electricity tariffs have not risen since FY2015/16. At current tariffs and with the cost of procuring power, Rajasthan discoms have incurred a revenue gap of Rs7,140 crore. The discoms estimate a tariff hike of roughly 13% would be required to bring the revenue gap to zero.

³⁸ RERC. [Tariff order - Approval of ARR and Tariff Petition of Discoms for FY2019/20](#). 06 February 2020.

- **Delays in subsidy disbursements from state government**

Delays in the payment of subsidies from the Rajasthan state government compel discoms to borrow funds, further undermining their poor financial health. Additionally, the Rajasthan discoms carry an interest burden of Rs7,206 crore (about US\$1bn) from loans provided under the UDAY scheme between FY2015/16 and FY2018/19.

Discoms have had to take working capital loans to cope with the interest burden.

This interest debt to the government of Rajasthan caused a severe financial crunch for discoms and has led to an accumulation of overdue payments to power generators, especially RVUNL. The discoms have also had to take working capital loans to cope with the interest burden.

Discoms may not pass interest costs to consumers, and with no tariff hike in sight, discoms have staggered repayment of this interest debt over five years.

Financial Loss

Because of the high cost of buying power, the interest burden, and their inability to raise tariffs, the Rajasthan discoms have booked a loss of Rs6,355 crore (US\$0.9bn) in FY2019/20 after accounting for the state government subsidies.³⁹

The discoms are highly dependent on state government subsidies and other grants. For FY2015/16, FY2016/17 and FY2017/18, state government subsidies and grants received from the Rajasthan government were roughly 26-37% of discoms' total revenue. (Data on subsidies disbursed for FY2018/19 and FY2019/20 is not available.) Moreover, the subsidies and grants received from the Rajasthan government were only 85% of the actual sum of subsidies due to the discoms.

Rajasthan discoms also carry a substantial burden of regulatory assets of Rs0.77/kWh. Regulatory assets are a cost component that a discom must include in its annual revenue requirement filing and are recognised but deferred by the regulator. Generally, these costs are deferred for the year and are considered to be passed on to consumers in revised tariffs for the coming year. Until they are passed on to consumers or funded in the form of subsidy by the state, they are a financial burden for the discoms.

Overdue Payments

As mentioned earlier, delays in subsidy disbursement from state governments, and metering and collection inefficiencies, create cash flow problems for discoms. This further constrains discoms' capacity to pay power generators. As of May 2020, the Rajasthan discoms have Rs32,360 crore (US\$4.4bn) in overdue payments to power

³⁹ UDAY. [Rajasthan Dashboard](#). March 2020.

generators — roughly 28% of the total overdue payments by Indian discoms to power generators.⁴⁰

Reportedly, Rajasthan discoms have applied for Rs4,064 crore (US\$580m) of subsidised loans at an interest rate of 9-9.5% from the PFC and REC under the Rs90,000 crore (US\$12bn) bailout package budgeted by the government of India to help liquidity issues in the power sector that have been exacerbated by the COVID-19 pandemic.⁴¹

Open Access

As large industrial customers who are the discoms biggest revenue source, opt for sourcing of power through open access, the discoms have started levying additional charges to compensate for the substantial reduction in their revenue. These measures include transmission charges, wheeling charges, cross-subsidy charges, and state load dispatch charges.

Cross Subsidy Surcharges

Cross subsidy surcharges form one of the largest components of the overall charges levied by discoms on open access customers.

According to the policy directive from state regulators, the cross-subsidy surcharge should not exceed 20% of the actual tariff approved for the given customer category. Rajasthan discoms this year applied for a cross-subsidy surcharge which was roughly in the range 35-40% of the approved tariff. The regulator, however, only approved a surcharge that was 20% of the actual tariff. The cross-subsidy surcharge for FY2019/20 was in the range of Rs1.70-2.16/kWh, depending upon the customer category and voltage level.⁴²

In FY2016/17, the cross-subsidy surcharges in Rajasthan were in the range of Rs1.63-1.88/kWh — materially lower than FY2019/20. However, these charges were relatively higher because they were roughly 23% of the category tariffs approved for FY2016/17 versus the 20% benchmark set for these charges.

Wheeling Charges

For FY2019/20, Rajasthan discoms levied wheeling charges of Rs1.38/kWh for 11kV voltage level, Rs0.11/kWh for 33kV voltage level, and Rs0.04/kWh for 132kV voltage level.

Open access charges are revised and approved every year by the state regulatory commissions. These charges are supposed to reflect the discom's actual cost of supplying power and relative loss of revenue from customers opting for the open

⁴⁰ PRAAPTI. December 2019.

⁴¹ Business Standard. [Punjab, Rajasthan, Andhra Pradesh seek Rs 14,664 crore to revive discoms](#). 26 June 2020.

⁴² RERC. [Tariff order - Approval of ARR and Tariff Petition of Discoms for FY2019/20 \(page 150-151\)](#). 06 February 2020.

access route. However, open access customers have had to deal with regular changes in, and inappropriate levying of, these charges.

In May 2019, the RERC ruled against the Rajasthan discoms for charging open access customers wheeling charges that claimed a 100% utilisation factor for wind and solar power procurement as opposed to the normative 20% utilisation factor for such projects as per the open access contract.⁴³

Apart from high charges, generators and consumers often cite procedural delays as a critical hurdle to scaling up open access. Regulators often reject applications based on technical constraints, such as a lack of adequate transmission and wheeling capacity on a state's network.

RERC's annual reports suggest that Rajasthan has had varying open access capacity approved for several years. It was 425MW, 600MW and 550MW for the years FY2015/16, FY2016/17, and FY2017/18.

Conclusion and Recommendations for Rajasthan Discoms

The Rajasthan discoms currently struggle with two broad issues – high AT&C losses due to inefficient metering and collection processes, and high power purchase prices.

While various technical interventions have enabled Rajasthan discoms to reduce their distribution losses, they must put greater emphasis on reducing commercial losses.

The discoms will be able to reduce the degree of electricity theft by regularly checking theft-prone installations, installing tamper-proof meters, and making the meters inaccessible. Additionally, discoms could ask local administrations in theft-prone areas to arrange more police support.

The RERC has directed the discoms to display feeder losses on their websites and analyse the feeder losses for last three years. They must then report to the Commission specifying the 25% of feeders that had the biggest losses during the year, along with the steps they took to reduce losses.⁴⁴

RERC suggests that each feeder should be treated as a management and profit centre and a feeder manager should be made fully responsible for each feeder. In theft-prone areas, metering should also be done at the level of distribution transformers to identify theft and commercial losses.

⁴³ Mercom India. [Rajasthan Rules Against Wheeling Charges for Solar and Wind at 100% CUF for Captive Users](#). 01 May 2019.

⁴⁴ RERC. [Tariff order - Approval of ARR and Tariff Petition of Discoms for FY2019/20](#) (Page 21). 06 February 2020.

RERC also notes the discoms have large numbers of defective meters and transformers and has directed discoms to ensure meters and transformers that failed within the warranty period to be replaced.

Discoms have large numbers of defective meters and transformers.

We make the following broad recommendations for Rajasthan to turn around its power distribution business and reach a profitable position:

- **Smart meters**

Smart meters capture a customer's electricity usage at regular intervals and transmit data in real time, eliminating the need for monthly manual meter reading. Smart meters can also enable remote connection and disconnection, and pinpoint abnormal usage or discrepancies between sanctioned load and connected load.

Smart meters could also strengthen implementation of tariffs differentiated on the time-of-day and monitor excess rooftop solar generation and net-metering.

Mercom India recently reported on Energy Efficiency Services Limited's (EESL) progress on smart meter installation. EESL showed that all states where smart meters were installed had good results with an average increase in billing of nearly 25%. In the New Delhi Municipal Council (NDMC) area of the national capital, with improved billing efficiency of over 99%, revenue has gone up by Rs500 (about US\$7) per month per meter.⁴⁵

As of May 2020, EESL has installed 1.24 million smart meters in the five states of Haryana, Delhi, Uttar Pradesh, Bihar, and Andaman & Nicobar Islands.

Rajasthan should actively look to work with EESL to deploy smart meters at large scale.

- **Solar Irrigation Pumps**

The central government's PM KUSUM scheme introduced in 2018 aimed to deploy 2.75 million solar pumps in the first phase of implementation to produce an additional 4GW of installed solar power, a material boost to India's renewable energy deployment.⁴⁶

The distributed generation aspect of such a system provides significant grid network strengthening while avoiding over-reliance on land-intensive utility scale solar projects.

⁴⁵ Mercom India. [Now is the Time for Smart Meters in India](#). 12 June 2020.

⁴⁶ IEEFA. [India: Vast Potential in Solar-Powered Irrigation](#). August 2018.

However, the implementation of this scheme has not gained traction in the state of Rajasthan. In IEEFA's opinion, implementation of solar irrigation pumps will solve two key issues for the Rajasthan discoms. First, it would reduce the cross-subsidy burden on other high-paying customer categories as agricultural consumers produce their own cheaper power. Second, it would bring down discoms' cost of power procurement and avoid the high cost of sub-transmission lines and reduce transmission losses.

According to data from the Ministry of Power, the annual electricity subsidy to agriculture is Rs16,303 crore and the investment required for installation and solarisation of pumps is Rs54,875 crore in the state of Rajasthan. The state can recover the cost of free solar pumps in 3.37 years.⁴⁷

- **Open Access**

In IEEFA's view, open access charges reflect a state's readiness to transform its electricity sector by adopting low-cost, low-emission, renewable energy sources. The proposed amendments to the Electricity Act aim to progressively do away with cross-subsidisation using direct benefit transfers (DBTs) to the lowest-paying consumers.

This will reduce discoms' dependence on high-paying industrial consumers to subsidise lower-paying consumer categories. Additionally, the availability of cheaper renewables is already increasing the penetration of open access consumers. In this scenario, the discoms are better off having policies that support the open access mechanism.

From an economic growth perspective, higher power costs could discourage industrial customers from operating in a given state. Hence, directing discoms to employ open access-friendly policies is in a state government's interest.

⁴⁷ The Hindu Business Line. [Most States can recover cost of free solar pumps in less than 4 years.](#) July 2020.

3. Madhya Pradesh

Structure of the State-owned Discoms

Madhya Pradesh Power Management Company Limited (MPPMCL) is the holding company for Madhya Pradesh's (MP's) three state-owned power distribution companies — Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited (East Discom), Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited (West Discom), Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited (Central Discom).

Figure 3.1 Map of Madhya Pradesh Discoms



Source: MPPMCL.

MPPMCL purchases electricity from generating companies and the supply of electricity in bulk to the state's three discoms.

As per CEA's generation report from March 2020, Madhya Pradesh has 21.2GW of coal-fired installed capacity. However, 6.3GW of this capacity — either owned by the central government or private owners — could be allocated to other states.

Renewable energy sources such as solar, wind and biomass now form 17.2% of Madhya Pradesh's installed capacity mix as of March 2020. With the addition of a

modest 0.4GW of capacity in FY2019/20, MP's renewable energy capacity reached a total of 5GW at the end of March 2020, which provided 10.9% of its total on-grid generation.⁴⁸

Figure 3.2: Madhya Pradesh Electricity Sector Generation Mix in 2019/20

Source	Capacity		Generation		Utilisation	Capacity Adds
	(GW)	%	(TWh)	%	%	(GW)
Coal	21.2	73.0%	114.8	150.7%	64.0%	1.4
Gas	0.3	1.1%	0.0	0.0%	0.0%	0.0
Diesel	0.0	0.0%	0.0	0.0%	0.0%	0.0
Nuclear	0.3	0.9%	0.0	0.0%	0.0%	0.0
Hydro	2.2	7.7%	6.3	8.2%	31.0%	-0.2
Renewables	5.0	17.2%	8.3	10.9%	19.8%	0.4
Net imports			-53.2	-69.9%		
Total	29.0	100.0%	76.2	100.0%		1.6

Source: CEA Installed capacity, and generation and power supply reports.

Note: IEEFA estimates ~53TWh of electricity generated from central and private plants was exported/allocated to other states.⁴⁹

In FY2019/20, Rajasthan's electricity demand was 76.2TWh. The state generated 129.3TWh of electricity. IEEFA estimates a net 53.2TWh of the total power generated in MP was exported inter-state.

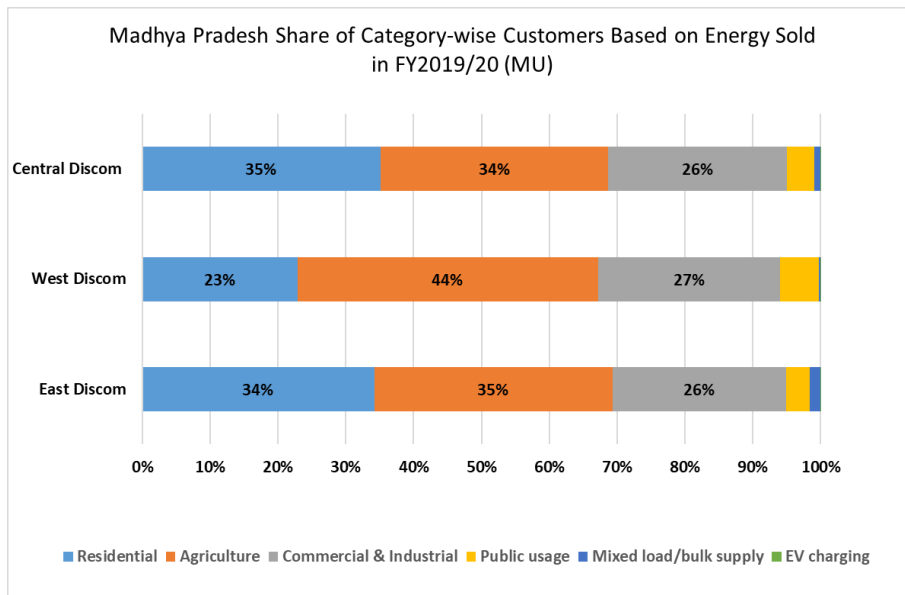
We analyse the composition of the customer base for Madhya Pradesh's discoms based on category-wise power sales projected for FY2019/20 in the aggregate revenue requirement (ARR) order for FY2019/20 approved by the MP Electricity Regulatory Commission (MPERC).⁵⁰ In the ARR order, the Madhya Pradesh's discoms projected sales of 56TWh of power with procurement of ~70TWh for FY2019/20, allowing estimated AT&C losses of 20%. (Please note the ARR approval is based on estimated energy sales. We will discuss the actual AT&C losses and power sale for Madhya Pradesh for FY2019/20 further in the report).

⁴⁸ CEA. [Renewable energy generation report](#). March 2020.

⁴⁹ CEA. [Generation report](#). March 2020.

⁵⁰ MPERC. [Aggregate Revenue Requirement And Retail Supply Tariff Order For FY2019/20](#). August 2019.

Figure 3.3 Madhya Pradesh Category-wise Share of Discom Customers



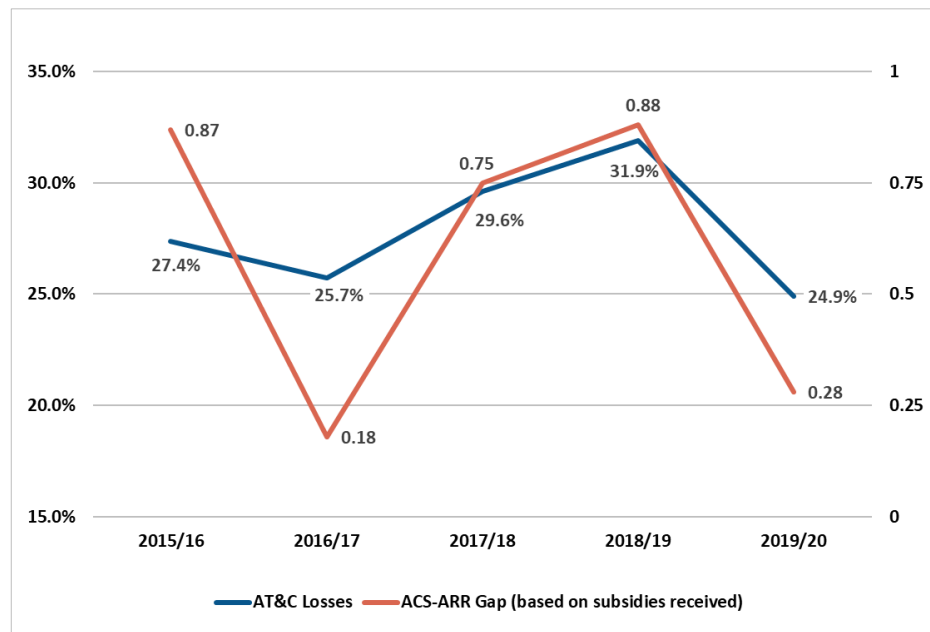
Source: MPERC ARR order for FY2019/20.

MPs three discoms do not vary significantly in their share of the customer base categories of residential, agricultural, and commercial and industrial customers.

Performance Metrics

AT&C Losses

Figure 3.4: Madhya Pradesh Key Performance Metrics



Source: PFC report, UDAY dashboard.

In FY2019/20, the MP discoms managed to significantly reduce AT&C losses to 24.9% from extremely high losses of 29.6% and 31.9% in FY2017/18 and FY2018/19 respectively.⁵¹ The central discom had the highest AT&C losses of 28.8% in FY2015/16 with its more than 10 divisions having AT&C losses of more than 40%.⁵²

Like most other states, MP discoms have failed to reduce AT&C losses to the 15% targeted under the UDAY scheme. Lower AT&C losses would effectively reduce the need for tariff hikes as the revenue requirement gap shrinks.

Tariff hikes only burden honest consumers. If discoms could effectively curb the theft of electricity, tariff hikes would not be necessary. Discoms should be directed to produce a roadmap to ending electricity theft.

Figure 3.5: Madhya Pradesh AT&C Losses and Unmetered Connections

	AT&C losses 2019/20	% of unmetered rural domestic consumers
Central Discom	35.6%	38.2%
Western Discom	13.6%	0.41%
Eastern Discom	25.8%	17.4%

Source: UDAY dashboard, MPERC.

Figure 3.5 shows AT&C losses and the percentage of unmetered rural domestic connections for the three MP discoms. The Central discom incurred massive AT&C losses of 35.6% in FY2019/20 and the western discom was able to keep its AT&C losses under 15% at 13.6%. Although Figure 3.5 only accounts specifically for the percentage of unmetered connections in the rural domestic category, it reflects a strong correlation between high AT&C losses and unmetered connections. The discoms with more unmetered connections incurred higher losses.

ACS-ARR Gap

In FY2019/20, MP discoms significantly managed to reduce their ACS-ARR gap to Rs0.28/kWh from the unsustainably high gap of Rs0.87/kWh in FY2015/16. MP discoms had a promising start under the UDAY scheme with the discoms managing to reduce the gap to Rs0.18/kWh in FY2016/17 (refer figure 3.4). However, it climbed back to pre-UDAY levels of Rs0.75/kWh and Rs0.88/kWh for FY2017/18 and FY2018/19.

In the aggregate revenue requirement order for FY2019/20, the discoms submitted an aggregate revenue gap of Rs4,098 crore (US\$600m). The state commission approved only Rs1,492 crore (US\$213m) through a tariff hike of 7% for the year

⁵¹ UDAY. MP Dashboard. March 2020.

⁵² UDAY. MP MoU.

against 12% requested by the discoms.⁵³ (Please note that these ARR calculations are based on projections and estimations for the year made in advance. These could vary depending on the business performance of discoms for the year.)

- **Power Purchase Costs**

As per the average revenue requirement order, the Commission approved a power purchase cost of Rs4.67/kWh for FY2019/20.

Figure 3.6 provides the range of contracted tariffs by the discoms. The discoms procure thermal power in the tariff range of Rs2.14 – 5.20/kWh. A fixed charge of Rs7,835 crore (US\$1bn) paid for the contracted capacity forms 40% of discoms' total contracted power purchase cost.

MP's power procurement cost of Rs4.87/kWh for solar is significantly higher than the post-2016 renewable energy tariffs of sub-Rs3/kWh. However, Rs4.87/kWh is a weighted average cost of all the solar PPAs under which MP discoms procure solar power, which potentially include tariffs contracted earlier than 2016.

MP discoms buy non-solar renewable power at an expensive rate of Rs5.28/kWh to fulfil their renewable energy purchase obligations. (The ARR order does not specify sources under a non-solar category). This balloons the renewable power purchase obligation cost for the state's discoms.

MPPMCL has contracted to buy 76% of the total power produced from the 750MW Rewa Ultra Mega Solar Park located in Rewa, MP. In February 2017, MPPMCL contracted power purchase from the Rewa Solar Park at a record low tariff of Rs2.97/kWh (US\$42/MWh), which was 30% lower than the previous low of Rs4.34/kWh (US\$62/MWh) recorded in the state of Rajasthan in January 2016.

Figure 3.6: Madhya Pradesh Discom Power Purchase Cost

	Tariff range (Rs/kWh)	Total power purchase cost (Rs crore)	% of total power purchase cost
Thermal	2.14 - 5.20	13,894	71%
Hydro	0.36 - 2.29	1,765	9%
Renewables (solar)	4.87	3,911	20%

Source: CEA executive summary report March 2020, ARR order FY2019/20.

The discoms' have hydro power contracted at a much lower tariff range of Rs0.36 – 2.29/kWh. However, hydro power served only 8% of Madhya Pradesh's total on-grid demand in FY2019/20. The discoms' cost of hydro power for FY2019/20 was estimated to be Rs1,765 crore (US\$250m) of which Rs913 crore were fixed charges

⁵³ MPERC. [Aggregate Revenue Requirement And Retail Supply Tariff Order For FY2019/20](#) (p 15). August 2019.

and Rs853 crore were variable charges. (The tariff range of Rs0.36-2.29/kWh is the limited tariff disclosed in the executive summary of CEA's report from March 2020.)

- **Burden of Cross-Subsidies**

Figure 3.7 illustrates the MP discoms' voltage-wise cost of supply against average billing rate for various categories of customers for FY2019/20. Although the voltage-wise cost of supply is not significantly different, there is a huge variation in average billing rate for various categories owing to cross-subsidy-based tariff structures.

High-tension C&I clients are charged much more than the actual cost of supply to offset undercharging for agriculture and railway connections.

Figure 3.7: Cross-Subsidy Based on Voltage-Wise Cost of Supply

Customer category	Volatge-wise cost of supply (Rs/kWh)	Average billing rate (Rs/kWh)	Ratio of aaverage billing rate to voltage-wise cost of supply
Low Tension Customers			
LV-1 Domestic	6.64	6.41	97%
LV-2: Non-Domestic	6.64	9.40	142%
LV-3: Public Water Works & Street Light	6.64	6.34	95%
LV-4: LT Industrial	6.64	8.78	132%
LV-5: Agriculture Irrigation Pumps	6.64	5.59	84%
LV-6: Electrical Vehicle	6.64	6.02	91%
High Tension Customers			
HV-1: Railway Traction	6.25	4.89	78%
HV-2: Coal Mines	6.38	8.48	133%
HV-3.1: Industrial	6.39	7.86	123%
HV-3.2: Non-Industrial	6.52	8.08	124%
HV-3.3: Shopping Mall*	6.49	8.15	126%
HV-3.4: Power Intensive Industries*	6.41	6.50	101%
HV-4: Seasonal & Non-seasonal	6.50	9.35	144%
HV-5: Public Water Works, Irrigation, Oth	6.40	6.49	101%
HV-6: Bulk Residential Users	6.49	6.65	102%

Source: MPERC ARR order FY2019/20.

IEEFA Note: This table is as per the Discom Tariff Order but makes no disclosure of the average billing rate for the agricultural sector. We strongly doubt the Rs5.59 covers all ag demand.

The proposed amendments in the Electricity Act aim to bring cross-subsidisation down to the 20% level progressively using DBTs for subsidised customers.

In IEEFA's view, a DBT mechanism would require a great deal of groundwork and time because implementing it would face significant operational challenges. In the meantime, the discoms should reduce their power purchase costs through phasing out expensive end-of-life thermal power generation and replace it with cheaper

renewable PPAs. They should also implement the PM KUSUM solar irrigation pump scheme.

Financial Losses

As per the UDAY dashboard, MP discoms incurred a total loss of Rs2,054 crore (US\$290m) after accounting for various state subsidies and grants in FY2019/20.

The state's discoms have also reduced financial losses by half from Rs5,586 crore (~US\$8bn) in FY2015/16 — reflecting reduced AT&C losses and ACS-ARR gap.

Subsidy data for FY2019/20 is not yet available. However, the MP state government has had a good record on disbursing subsidies. As per the PFC report, between FY2015/16 and FY2017/18 MP discoms received slightly more than 100% of their total booked subsidies.

Overdue Payments

MP discoms had accumulated overdue payments of Rs1,187 crore (US\$160m) as of May 2020. This is relatively a much smaller amount compared to discoms in other states and a minute fraction of the Rs116,340 crore (US\$16bn) of overdue payments to generation companies accumulated by the Indian discom sector.

Open Access Charges

Open access charges include transmission charges, wheeling charges, cross- subsidy charges, additional surcharges and SLDC charges.

MPERC approved a wheeling charge of Rs0.24/kWh, a cross-subsidy surcharge in the range of Rs0.98 - 1.87/kWh (depending on the customer category), and an additional surcharge of Rs0.74/kWh for FY2019/20. The cross-subsidy surcharge was approved at 20% of the average tariff for the given category.

Conclusion and Recommendations for MP Discoms

MP discoms have made significant progress by substantially reducing AT&C losses and almost halving financial losses. However, the slow pace of meter installation for its rural feeders and inefficient energy accounting still prevents the discoms from reducing their distribution losses.

Improving billing and collection efficiency with modern metering equipment and progressively reducing power purchase costs through cheaper renewable energy sources should be key priorities for the MP discoms.

- **Reducing AT&C losses**

MPERC in its tariff order notes that one of the reasons for high losses is unmetered connections and improper energy accounting.

Large numbers of unmetered connections and the slow pace of replacing defective meters results in lower billing efficiency. An inadequate energy audit system at the feeder level as well as at distribution transformers hinders the energy audit and accounting process.

Generally, theft of electricity is included and adjusted under distribution losses. This disincentivises discoms to address the theft of electricity as a priority. Loss of energy from theft should be presented as a separate heading and should not be adjusted in distribution losses.

Discoms are disincentivised from treating electricity theft as a priority.

To reduce technical losses, MPERC approved capital investment programs for the discoms in recent years, which included a feeder separation project. The Government of India provided financial support and technological assistance to the discoms via various schemes. The discoms however dawdled in the implementation of these schemes and failed to curb technical as well as commercial losses.

The Commission recommended that MPPMCL and the State Government finalise a comprehensive loss reduction program. They should also work up a plan to meter domestic connections. The Commission recommended an action plan to reduce line losses and to meter predominantly agricultural distribution transformers, along with a system to audit them monthly.

- **Reducing power purchase cost**

MP discoms have also struggled to reduce power purchase costs as 40% of that cost is in the form of fixed charges contracted with thermal power generators. The discoms appear to have tackled the issue of higher power purchase cost by contracting the least amount of energy from plants with higher variable costs. The discoms could further reduce the cost of power purchase by contracting new cheaper renewable energy with tariffs below Rs3.0/kWh to replace thermal power sources with their variable charges above Rs3.0/kWh.

In future, MP should not enter any new thermal power contracts that lock in fixed charges. Instead, the state should draw confidence from the success of the Rewa solar park that delivers power at Rs2.97/kWh with developers protected by a three-tiered payment security mechanism. The state could take advantage of its renewable energy potential and incentivise developers to invest in solar and wind plus battery storage projects that could provide cheaper dispatchable electricity and end the need to buy expensive thermal power.

Conclusion and Recommendations

The Indian power sector is saddled with various issues, including electricity demand slowing in tandem with the deceleration of India's economic growth in 2019. This has been exacerbated by the effects of COVID-19 in 2020.

A recent report by The Energy Resource Institute (TERI)⁵⁴ expects demand for electricity in India to be 7-17% lower by 2025 due to the downward revision in India's GDP growth because of the COVID-19 economic shock. This slowdown has major implications for capacity planning, consequently deepening the need to retire end-of-life coal plants. There is a pressing need to improve the financial health of state discoms and to make them sustainable.

Ailing state-owned discoms continue to hamper the efficient functioning of the generation and transmission sectors. Extensive investment and reform have been undertaken in the generation and transmission business in India. But unless the distribution sector is also reformed, power generation and transmission assets are increasingly at financial risk of becoming stranded, stifling much needed further investment and technological development.

Reforms to improve the sector's commercial viability and performance have been repeatedly initiated but are yet to make a big difference. Discoms continue to incur huge financial losses because of unsustainable cross-subsidies and a lack of political will among state governments to solve the problem. The absence of competition, economically inefficient tariff-setting processes, and a lack of modern technology and infrastructure development add to those losses.

Reforms have been repeatedly initiated but are yet to make a big difference.

For India to achieve its ambitious renewable targets and sustain its economic growth goals, the crippled power distribution sector must be made profitable.

At a state and national level, a flawed regulatory framework, the lack of centre-state coordination and cooperation, the use of discoms as a vehicle for unfunded political subsidies, and a cost plus year-to-year tariff setting processes, all hold back reform.

For India to transition successfully from its present level to where it has a mature market twice the size of the current energy sector, the country must implement more reforms, particularly in the distribution sector — the backbone of the electricity industry.

⁵⁴ Thomas Spencer, (2020). "Bending the Curve: 2025 Forecasts for Electricity Demand by Sector and State in the Light of the COVID-19 Epidemic". TERI Discussion Paper (New Delhi: The Energy and Resources Institute).

The mess in the distribution sector is unsustainable and requires bold policy choices and government expenditure to create an economically sustainable electricity system.

The central government should also prioritise a green stimulus to recover the economic growth smothered by COVID-19. Such growth coupled with the reform measures proposed below could help to extract the distribution companies from their current predicament.

While there is no silver bullet to improve discoms' financial sustainability and viability, we recommend below key measures at the national level that every discom needs to undertake, followed by some state-specific actions that the three selected states should prioritise.

To implement these policies successfully, central and state governments must work together to clean up the mess. While the Centre does not have any authority as electricity is a concurrent responsibility, it must work collaboratively because state governments rely on central-sponsored schemes to invest in technology and the much-needed expansion and modernisation of the country's infrastructure.

National Level

1. Resolve the issue of legacy contracts and closure of inefficient plants.

The distribution companies are saddled with huge losses on account of long term PPAs with costly and inefficient thermal power plants. The discoms need to undertake remedial measures such as:

- Close inefficient, highly polluting, end-of-life coal plants surplus to need. This will result in huge savings from fixed charge payments for such assets and will also reduce pollution and carbon footprints. Further, it would reduce the coal requirement from such plants and improve the load factor of the remaining more efficient thermal power plants.
- Stop entering new PPAs with costly new subsidised thermal plants which are on the drawing board or where financial closure has not been achieved.
- Write off stranded assets. Discoms are burdened with paying fixed charges for stranded capacity while the generators are protected. It is a festering issue for discoms, and they could go bankrupt if they must keep paying power for capacity which is stranded. A plan to either write-off and/or close such stranded capacity needs to be put in place through a consultation that can help discoms ease their financial burden.

2. Reduce cross-subsidies.

Cross subsidy surcharges are a major element of the overall charges levied by discoms on open access customers. According to the Council on Energy, Environment and Water (CEEW), the cross-subsidy burden on C&I customers has increased in the last few years despite policy directions to progressively reduce it.

Discoms needs to address the issue of cross-subsidies and reduce their reliance on recovering revenue from this class of consumers. Increasing cross-subsidies has continued to undermine the competitiveness

of industries in India. This issue has become more pronounced during the COVID-19 crisis, where demand from C&I consumers during the lockdown has fallen drastically, battering discoms' cash flow.

The discoms need to undertake remedial measures such as:

- **Roll-out of Direct Benefit Transfer (DBT-P):** The current subsidies for under-pricing of electricity must be progressively restricted to better target certain categories of consumers who are most in need. DBT-P for subsidies will be a more effective, better costed and targeted mechanism for subsidy disbursal. Prior to this occurring however, DBT-P needs to be carefully designed and road-tested in a few cities to ensure the complexities surrounding the targeting of subsidies are resolved before widespread implementation.
- **Solar irrigation pumps:** Encourage adoption of solar pumps under the KUSUM Scheme. This will help states in alleviating losses by reducing the cross-subsidy burden on other high-paying customer categories. It would bring down discoms' cost of power procurement and transmission losses by building domestic distributed generation capacity at the end of the grid. It will also progressively reduce the centre's imported diesel subsidy burden.
- **Rooftop Solar:** Sustained power demand growth will return into 2021, so states should not discourage distributed rooftop solar deployments by increasing fixed charges. Creating policy certainty and an environment where self-generation is promoted will help reduce total system AT&C losses and reduce the burden of funding massive grid T&D infrastructure that is needed over coming decades as electricity demand doubles.

States should encourage installation of smart meter, grid-connected rooftop solar systems and prepare for rooftop solar with behind-the-meter storage as it becomes increasingly viable economically and offers multiple benefits, despite the need to understand and counter the perverse discom disincentive to prevent the loss of their highest-paying C&I customers.

3. Reduction in AT&C losses through digitalisation.

There is a need to progressively replace existing electricity meters with smart meters, including smart prepaid meters. This will help discoms understand and manage their load better while also reducing metering and billing losses and theft, while facilitating distributed rooftop solar and storage.

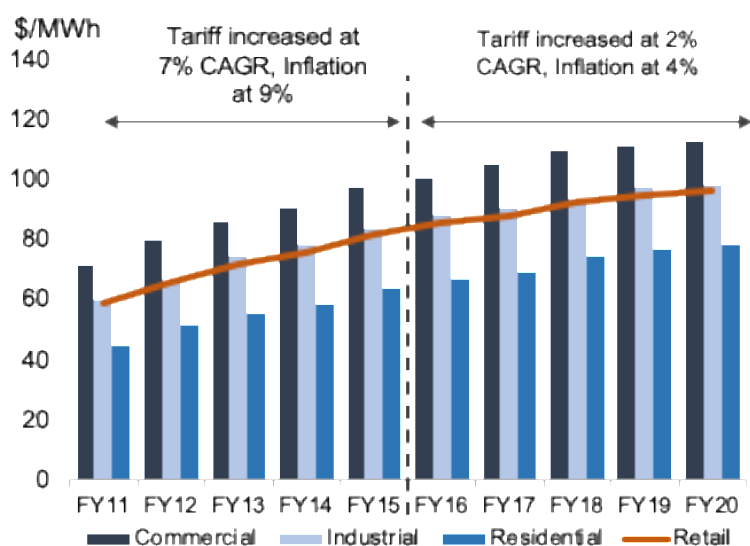
Smart meters allow the introduction of a differentiated time-of-day tariff structure to manage expensive peak demand loads proactively and better. Introducing them would give consumers the freedom to choose and change their supplier and rate as per their requirements, as well as encouraging demand response management (DRM) and time-shifting electricity loads.

Given the high upfront cost of smart meters and split incentives involved, the central government needs to drive states' adoption of smart meters by providing subsidies, as well as enabling policies to promote domestic manufacturing of smart meters at scale that will help drive unit costs down. Given a strong push by Prime Minister Modi on digitalisation to stimulate the economy, the electricity sector also needs to make a step change and digitalise its operations to sustainably reduce losses.

4. Increase tariffs.

The Electricity Act 2003 mandates that tariffs should reflect costs. However, due to several factors—including strong political vote-buying pressure for low tariffs, perceptions of discoms' inefficiencies, and disagreements on the accuracy of subsidy claims—regulators have in general failed to allow prices to rise in line with inflation in total power supply costs over time.

Figure 7: National Average Retail Tariff and Consumer Price Inflation in India: FY2011-FY2020



Source: BNEF Analysis & Statista.

The above figure illustrates that tariffs have increased at rates lower than the inflation rate. There is a need for timely revision of tariffs by the states as several states have not increased their tariffs at all in the last few years.

While a price shock is not desirable, particularly during the COVID-19-induced recession, regulators must require annual tariff revision to allow discoms to recover inflation, at least until AT&C losses are reduced and ever-lower renewable energy tariffs can come to the rescue at sufficient scale to allow some deflationary offsets on average cost of generation.

5. Increase competition.

To improve the performance of the distribution sector, increased private competition should be promoted. The Government of India could mandate discoms with high losses to either privatise operations or allow the entry of suitably qualified / capitalised private distribution entities willing to invest in upgrading infrastructure. Increased competition would inspire generators, distributors, and electricity supply companies to develop technologies to increase efficiency, lower costs and increase the reliability of supply. Privatisation alone won't fix the problem but selling some discom areas could provide the capital

infusion needed to help alleviate hemorrhaging cash deficits and repay otherwise out of control off-state balance sheet debt.

6. Move to a National Pool Market.

India's electricity market should gradually move to a national pool market and optimise generation nationally, allowing the optimisation of the huge investment in the national generation fleet and drive ACS down, forcing the least-efficient and most-outdated facilities to close, and reducing the overcapacity clearly evident in the thermal power sector.

On June 1, 2020, the two power exchanges started real-time market (RTM) trading platforms for electricity transactions. States should deploy analytical tools for projection and forecasting and make use of new products such as RTM. They would help the discoms reduce dependence on the deviation settlement mechanism (DSM), optimise generation resources nationally, sell surplus power efficiently with the next-day payment cycle, and efficiently manage renewable energy intermittence.

In July 2020, the Central Electricity Regulatory Commission (CERC) and the Securities & Exchange Board of India (Sebi) reached a settlement to resolve regulatory conflicts over trade of electricity in the open market with forward and derivative contracts. Delivery-based long-term contracts are likely to be traded on power exchanges under CERC's jurisdiction, while the derivative contracts are likely to be traded on commodity exchanges under Sebi.

This will allow discoms to have the flexibility of longer-term contracts in the open market as opposed to an 11-day restriction in the current framework.

7. Implement renewable energy tariffs with indexation.

In the last three years, renewable energy auctions by SECI, NTPC and other state discoms have delivered Rs2.36-3.00/kWh wholesale electricity tariffs in the first year, but then fixed at this rate over the life of the contract. These tariffs appear to be unique as they come with zero inflation indexation for 25 years. In other words, the tariffs are deflationary in real terms as there is no escalation mandated to account for indexation.

The discoms could procure new renewable energy capacity through the design of new tariff structure in which the developer bids for levelized tariffs. The tariff could start from a lower base in the first year and allow inflation indexation over the length of the contract in such a way that the developers' return on investment remain entirely unchanged from the current tariff structure with no indexation.

Although this has not been done in the Indian market yet, it is an idea that could be explored. This will provide discoms with an option of 20-30% lower Year 1 solar tariffs, which would immediately undercut even the variable charges of most thermal power plants today. The long-term financial merits of zero indexation are extraordinary, but the discoms need financial relief now. Introducing renewable energy tariff inflation would see solar tariffs today below Rs2.00/kWh in the first year of the PPA.

State Level		
Maharashtra	Rajasthan	Madhya Pradesh
<p>Power agriculture demand through solar</p> <ul style="list-style-type: none"> • Harness solar for rural electricity use. • Installations of solar water pumps should be promoted. • Provide subsidies to farmers for installation of solar water pumps to replace subsidised imported diesel fuel. 	<p>Deploy smart meters</p> <ul style="list-style-type: none"> • Progressively deploy smart meters at large scale. • Strengthen implementation of differentiated tariffs, depending on time-of-day, to account for excess rooftop solar generation and effective net-metering policies. 	<p>Reduce AT&C losses</p> <ul style="list-style-type: none"> • Provide financial support and technological intervention to the discoms for reduction in losses • Schemes such as feeder and distribution transformer separation for energy auditing and accounting, metering of consumers and so on to be implemented
<p>Reduce reliance on power purchase from old inefficient plants</p> <ul style="list-style-type: none"> • Cut purchase of power from high government owned generating plants. • Retire end-of-life, inefficient plants. • Deploy more large-scale grid connected + decentralized RE. 	<p>Adopt solar irrigation pumps</p> <ul style="list-style-type: none"> • Encourage adoption of solar pumps under the KUSUM Scheme. • Adoption of solar pumps will help states alleviate losses by reducing the cross-subsidy burden on C&I and bring down discoms' cost of power procurement and transmission losses 	<p>Reduce power purchase cost</p> <ul style="list-style-type: none"> • Contract new cheaper renewable energy sources with tariffs below Rs3.0/kWh to replace thermal power sources with higher variable charges. • Don't enter new high cost thermal power contracts.
<p>Incentivise solar rooftop</p> <ul style="list-style-type: none"> • Encourage solar rooftop systems installs as they are increasingly viable economically and offer multiple benefits • Align tariffs of C&I + high-end residential consumers with those of solar rooftop costs 	<p>Open access</p> <ul style="list-style-type: none"> • Availability of cheaper renewables is already increasing penetration of open access consumers. Discoms are better off having policies that provide an ease to the open access mechanism. 	
<p>Deploy analytical tools</p> <ul style="list-style-type: none"> • Analytical tools for projection and forecasting • Allow RE generators with unanticipated surpluses to sell such supply and earn revenues and manage intermittence 		

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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