

Breaking Down the Gap in DisCom Finances

Explaining the Causes of Missing Money



RAJASEKHAR DEVAGUPTAPU & RAHUL TONGIA

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Table of Contents

Acknowledgements	7
Abbreviations and Acronyms	8
1. Executive Summary	10
1.1. DisComs are Regulated Entities who Shouldn't be Loss-making, if they Perform	10
1.2. Despite Relative Improvements, Large Financial Gap Remains	10
1.3. Operating Financial Gaps Accumulate in the Balance Sheet	12
1.4. Fixing the Problem: Without an Operational Turnaround, a Balance Sheet Clean-up won't Last	13
2. Introduction	15
3. Objective and Methodology	18
4. Background on DisCom Operations	21
4.1 Cash Flows and Losses	21
4.2. DisCom Operations and Finances.....	23
5. Equilibrium and Critical Components Responsible for Operational Losses	28
5.1. The Complex Link Between Plans and Reality—Tariffs as Envisaged (<i>ex-ante</i>) Versus Realised (<i>ex-post</i>).....	28
5.2. Causes of the Gap: Unmet AT&C Loss Targets.....	32
5.2.1 Components of AT&C	32
5.2.2. Financial performance depends on AT&C Targets achievement, not absolute levels.....	34
5.3. Causes of the Gap: Un-realised Subsidy.....	38
5.4. Causes of the Gap: Un-recovered Regulatory Income	41
5.5. Putting it all together: Unexplained Gap between Average Cost of Supply (ACS) and Average Revenue Realised (ARR)	41
5.6. Time Series Analysis of how the ACS-ARR Gap Evolved	44
6. Implications of the Financial Deficits	49
7. Measure of the Actual Financial Deficit	51
8. Equity and Reserves within the Balance Sheet as a Marker of Accumulated Financials	54
8.1. Implications of Growing Negative Reserves – Coping Strategies.....	55
8.2. What Does Book Equity Tell Us?	61
9. Fixing DisCom Finances	65
9.1 National Aggregates are Misleading – Profit of one DisCom does not Offset Loss of Another.....	67
9.2 Two levels of Fixing DisCom Finances – Operational and Balance Sheet	67
9.3. Fixing the Operational Problem.....	69
9.4. Fixing the Balance Sheet Problem.....	71
10. Discussion and Recommendations	74
10.1. What Causes the Gap?.....	74
10.2. Who Bears Responsibility for the Gap?	77
10.3. Fixing the Issues	79
10.4. Other Reasons Fixing the Gap is not Easy.....	87
10.5. Early Actions and Credible Pathways – But External Support May Still be Needed	89
10.6. This is not just a Financial Problem.....	90
References	94

List of Figures

Figure ES 1: Cash flow of public DisComs and power departments in FY2020-21	11
Figure ES 2: Annual operating gap (costs–revenues) on cash basis, broken down by explanatory components.....	12
Figure 1: Cumulative expenditure and income flow statement as-realised for all public distribution utilities (excluding private utilities) for FY2020-21	25
Figure 2: Total cost of supply vs revenue (from FY2006-07 to FY2020-21).....	26
Figure 3: Expenditure, income flows along with break-ups of all distribution utilities (excluding private utilities) for FY2020-21	31
Figure 4: Aggregate technical and commercial (AT&C) losses from FY2006-07 to FY2020-21 as achieved	33
Figure 5: Summary of AT&C loss targets vs achieved (weighted average of the DisComs under study) from FY2006–07 to FY2020–21	35
Figure 6: AT&C targets versus achievements by component FY2006–07 to FY2020–21.....	36
Figure 7: Accumulation of regulatory assets from FY2015-16 to FY2020-21	42
Figure 8: Break-up of cost-revenue gap from FY2006-07 to FY2020-21	43
Figure 9: Growth of final ACS-ARR Gap – absolute and relative – between FY2006-07 and FY2020-21	46
Figure 10: Annual share of components of the gap as-realised (public utilities and power departments).....	47
Figure 11: Components of the gap on a cumulative basis (public utilities and power departments)	47
Figure 12: Flow statement showing effects of operational and financial inefficiency on the viability of the distribution business	50
Figure 13: Link between operations (residual loss + unpaid subsidy) and balance sheet (annual change in accumulated deficit).....	53
Figure 14: Total equity* and components as of March 31, 2021 (public utilities and power departments).....	55
Figure 15: Performance of DGVCL (accumulated surplus vs book equity vs total borrowings) from FY2006–07 to FY2020–21	57
Figure 16: Performance of DHBVNL (accumulated surplus vs book equity vs total borrowings) from FY2006-07 to FY2020-21.....	58
Figure 17: Performance of TANGEDCO (accumulated surplus vs book equity vs total borrowings) from FY2010-11 to FY2020-21.....	59
Figure 18: Annual change (Year-on-Year difference) in book equity, tangible assets, liabilities, and so on from FY2016-17 to FY2019-20 (all governmental utilities and power departments)	60
Figure 19: Growth of book equity vs book-basis return on equity (RoE) from FY2013-14 to FY2018-19 (Rs crore) (39 utilities)	62
Figure 20: Operational performance (as-realised) FY2019–20 and accumulated surplus/(deficit) as of March 31, 2020.....	66
Figure 21: Operating gap and components for FY2019-20	70
Figure 22: Impact of interventions (all four ongoing components) versus adding two of the accumulated components (S, RI) on operating surplus/(deficit)	72
Figure 23: Regulator tariffs and their shortfall—with vs without grants and other income	75
Figure 24: True-up life cycle for Paschimanchal Vidyut Vitran Nigam Limited (PVVNL) of Uttar Pradesh (ACoS from FY2014-15 to FY2018-19 in Rs/kWh)	76
Figure 25: Ownership and control linkages of DisComs	91

List of Tables

Table 1: DisCom Financials FY2020-21 (operating income statement plus short-term payables minus receivables)	16
Table 2: Heterogeneity of distribution utilities by ownership, energy share, and cash-basis profit / (loss) FY2019-20	22
Table 3: Discrepancy of DisCom unpaid power purchase payables (Rs crore) between PFC Reports and PRAAPTI Portal (April, 2017 -March, 2022).....	23
Table 4: Receivables in Rs crore and no. of days for state-owned GenCos	23
Table 5: Key summary statistics as measured by growth between FY2006-07 and FY2020-21	27
Table 6: Impact of technical and commercial losses over and above the targets, in terms of energy and revenue (public utilities and state power departments)	39
Table 7: Unpaid subsidy and its impact per unit energy (net energy sold basis) (public utilities)	40
Table 8: Stage-wise growth of gap between cost and revenue (ACS-ARR gap) from FY2006-07 to FY2020-21 (public utilities and power departments).....	45
Table 9: Components of the gap (cumulative) over FY2006-07 to FY2020-21 (public utilities and power departments)	48
Table 10: Book equity vs tariff order return on equity (RoE) of Madhya Pradesh-based DisComs from FY2013-14 to FY2018-19	56
Table 11: Impact of various gap component fixes on the operating gap (FY2019-20 data)	71
Table 12: Stakeholder roles in gap components and their options for avoidance.....	78

List of Appendices

Appendix 1: List of distribution utilities, integrated utilities, and power departments.....	96
Appendix 2: Central government schemes for infrastructure development and financial restructuring	99
Appendix 3: Aggregate technical and commercial (AT&C) losses.....	101
Figure A1: DisCom-wise aggregate technical and commercial (AT&C) losses FY2019-20.....	101
Appendix 4: Billing loss targets vs achievement.....	102
Figure A2: DisCom-wise billing loss target vs billing loss achieved FY2019-20	102
Appendix 5: Collection loss targets vs achievement.....	103
Figure A3: DisCom-wise total collection loss target vs collection loss achieved FY2019-20	103
Appendix 6: Accumulated unpaid subsidies.....	104
Figure A4: Accumulated unpaid Subsidy (Rs crore and as share of subsidy booked) through FY2019-20.....	104
Figure A5: Accumulated unpaid subsidy vs. dues to GenCos (Rs crore) and the impact of operational clearing the unpaid subsidy on cash flow (Rs/kWh) through FY2019-20.....	105
Appendix 7: Regulatory assets	106
Figure A6: Regulatory assets (Rs crore) and impact of its liquidation on tariff (Rs per kWh, FY2019-20 basis)	106
Appendix 8: Trends in Net Worth.....	107
Figure A7: DisCom-wise Total Equity* (Book Equity + General Reserves + Accumulated Surplus / (Deficit)) for FY2020-21	107
Appendix 9: Recent initiatives of the Central Government to contain DisCom losses	108
Appendix 10: Disputed Costs and Issues Sub-Judice	110
Table A1: Accumulation of disputed costs (including matters sub judice before APTEL and review by the regulator) as claimed by BRPL in its FY2020-21 Tariff Petition	111

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Abbreviations and Acronyms

Abbreviations and acronyms introduced in this paper

C	Consumer non-collection loss
D	(excess) Distribution network loss (compared to target)
RI	Regulatory Income
S	Subsidy non-payment

Traditional abbreviations and acronyms

ABR	Average Billing Rate
ACS or ACoS	Average Cost of Supply
APDP	Accelerated Power Development Programme
APDRP	Accelerated Power Development and Reforms Programme
APPC	Average Power Procurement Cost
ARR	Annual Revenue Requirement / Aggregate Revenue Realised (as per context)
AT&C	Aggregate Technical and Commercial (loss)
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
cr.	crore (1,00,00,000 or 10 million)
DDUGJY	Deendayal Upadhyay Gram Jyoti Yojana
DisCom	Distribution Company
EBR	Extra Budgetary Resources
FoR	Forum of Regulators
FY	Financial Year (April 1st–March 31st)
GAAP	Generally Accepted Accounting Principles
GBS	Gross Budgetary Support
GenCo	Generating Company
GoI	Government of India
IPDS	Integrated Power Development Scheme
JERC	Joint Electricity Regulatory Commission
kW	Kilowatt
kWh	Kilowatt-hour
LPSC or LPS	Late Payment Surcharge

MCA	Ministry of Corporate Affairs
MoF	Ministry of Finance
MoP	Ministry of Power
MU	Million Units or (million kWh)
MW	Megawatt
P&L	Profit and Loss (annual statement)
PFC	Power Finance Corporation (a Central Public Sector Unit)
PPA	Power Purchase Agreement
PRAAPTI	Payment Ratification and Analysis in Power procurement for bringing Transparency in Invoicing of Generators (Govt. of India web portal)
PSU	Public Sector Undertaking
RA	Regulatory Asset
R-APDRP	Restructured – Accelerated Power Development Reforms Programme
RDSS	Revamped Distribution Sector Scheme
RE	Renewable Energy
REC	Rural Electrification Corporation (a Central Public Sector Unit)
RGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RoE	Return on Equity
Rs	Rupees
SAUBHAGYA	Pradhan Mantri Sahaj Bijli Har Ghar Yojana
SERC	State Electricity Regulatory Commission
TransCo	Transmission Company
UDAY	Ujjwal DisCom Assurance Yojana
UT	Union Territory

DisCom abbreviated names are given in Appendix 1.

1. Executive Summary

1.1. DisComs are Regulated Entities who Shouldn't be Loss-making, if they Perform

Electricity distribution companies (DisComs) are the last leg in the vertically integrated chain of electricity sector that starts with generation. In India, they are also responsible for retailing power to consumers. Independent State Electricity Regulatory Commissions (SERCs) set retail tariffs (prices) meant to balance DisCom viability with consumer interest. Unfortunately, DisComs have sustained substantial financial and electricity losses for many years.

Barring Mumbai, which has retail competition, electricity distribution in India is a regulated, geographic monopoly; and DisComs operate on a costs-plus regulation model that is based on performance norms. If they perform, in theory, they should make the specified statutory rate of return. So, are their financial losses thus just a failure of performance? (Tyagi & Tongia, 2023) (in press)

In this paper, we comprehensively analyse DisCom finances using a long time series that aims to examine and answer the following questions using disaggregated and bottom-up numbers:

1. What are the operational losses of DisComs and what are their causes?
2. How much of the gap between costs and revenues is apportionable to different stakeholders (DisCom, regulator, and state government) or not apportionable?
3. How do the operational (annual) losses link to the DisCom balance sheets?
4. What are the steps needed to fix the financial health of the DisComs, especially for a turnaround (on the basis of operational basis viability)?

This paper builds on a complementary analysis by Tyagi and Tongia (2023) (in press) that compares the planned costs and revenues as per *ex-ante* tariff orders versus the actual realisations *ex-post*. They found that *ex-ante* retail tariffs (consumer prices) are set with virtually no gap between costs and revenues. However, in practice (after the year goes by when the tariffs are in force), an enormous gap appears, of around Rs 1.64 per kWh for FY2018-19 (prior to the provisioning of any grants or other income not planned by regulators).

We extend this analysis across 15 years, covering virtually all of India's public DisComs, integrated utilities, and power departments.¹ By examining financial details over time, we automatically capture true-up adjustments, which are the formal process for reconciling allowed changes from tariff order plans through subsequent tariff revisions. Failure to perform, such as lower-than-notified operating efficiency, is not meant to be adjusted in true-up tariff orders.

1.2. Despite Relative Improvements, Large Financial Gap Remains

Over a 15-year period, with few exceptions, all DisComs have had revenues lower than costs. Consumers don't pay all the costs directly, and state governments routinely offer tariff subsidies

¹ The basis for the *a priori* (tariff order) benchmarks was manual compilation across the DisComs, while *post facto* results can be found in Power Finance Corporation (PFC)'s report on DisComs performance, DisCom filings with Ministry of Corporate Affairs, and Audited Annual Reports.

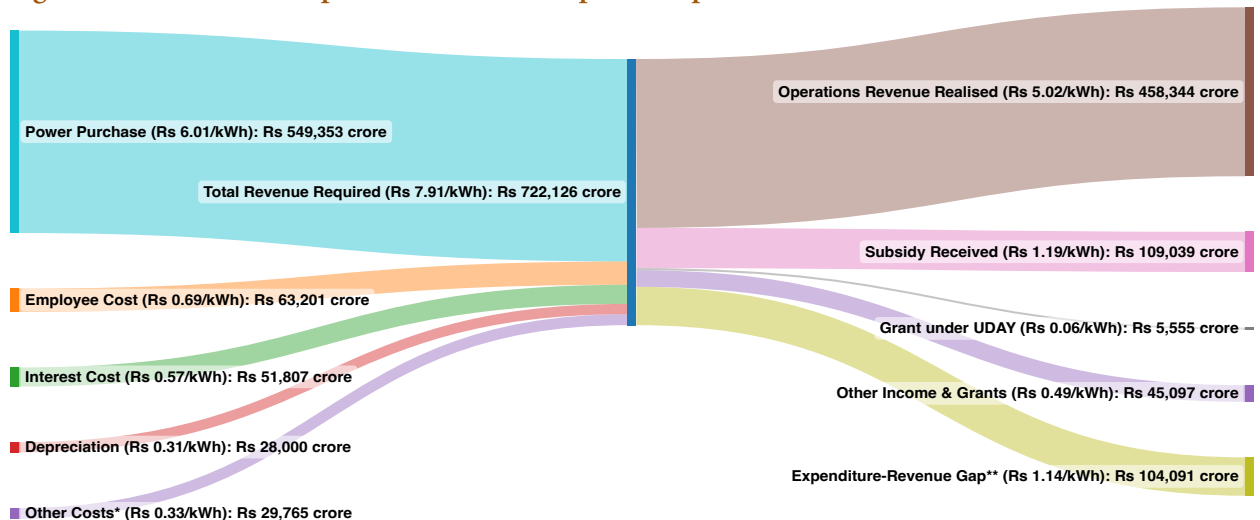
on top of the regulator-set prices (tariffs). Outside these combined revenues, DisComs also rely on significant Other Income and Grants, but this still left a cash-basis gap of Rs 1,04,091 crore in FY2020-21, or Rs 1.14 per kWh sold (Figure ES 1).²

Our focus is on understanding the breakdown of this financial gap. Explanatory factors include DisCom performance lapses, non-payment of subsidies, and regulators explicitly not setting a high enough tariff (instead, creating an IOU called a ‘Regulatory Asset’).

Conventional wisdom is that losses are overwhelmingly due to DisCom non-performance. We find this to be incorrect. While they have failed to meet performance targets, both in terms of billing and collection efficiencies, this amounts

to only about 30% of the cumulative gap over 15 years. Unfortunately, DisCom non-performance has grown in recent years. Even within non-collection from consumers, a substantial fraction (estimated at over a third and perhaps closer to one-half) is from governmental entities/consumers. We segregate non-payment of subsidies from the widely cited measure AT&C (aggregate technical and commercial) losses since this is not the fault of the DisCom. Subsidy non-payment and the creation of regulatory assets together explain 13% of the cumulative gap, but this still leaves a “residual gap” of about 59% which is not attributable to any of these causes. Figure ES 2 shows the split of the financial gap’s components over time.

Figure ES 1: Cash flow of public DisComs and power departments in FY2020-21



Source: PFC Report on Performance of Power Utilities (2020-21).

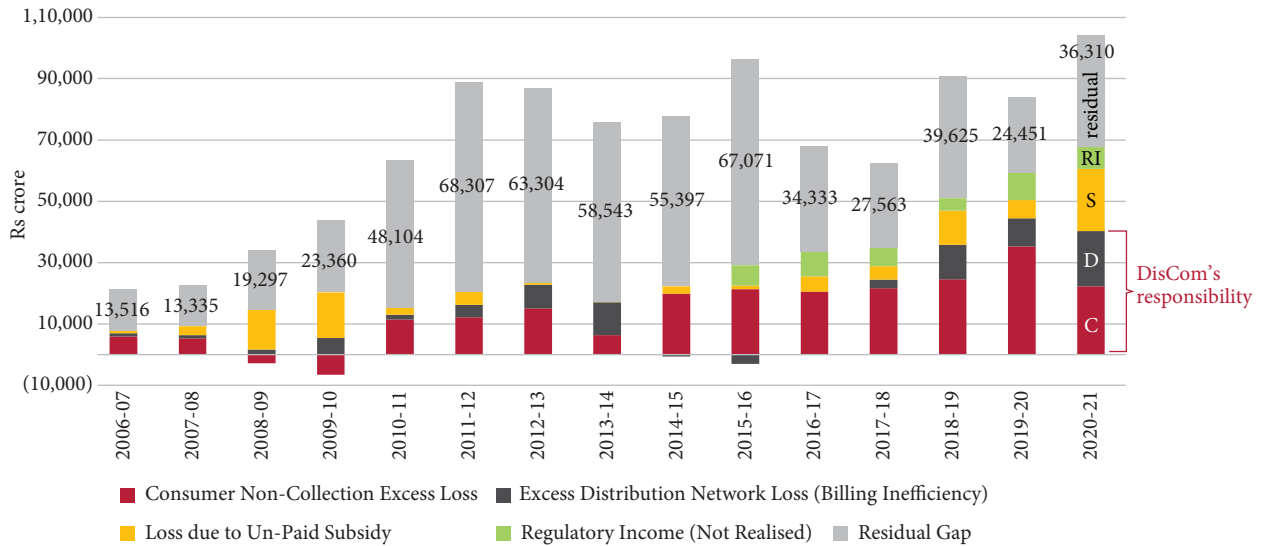
Notes: The per unit costs are per kWh sold. The power purchase costs are the actuals as booked by DisComs, and thus include any additional purchase of power due to higher system losses than allowed by the regulator. Thus, the total revenue required shown here isn't the same as what the regulator would set as the annual revenue requirement, which is based on target AT&C losses.

* Other costs cover repairs and maintenance, administrative and general provisions and other expenses (which include finance costs).

** Expenditure–Revenue gap includes regulatory income (cost approved but recovery deferred) of Rs 7,236 crore (Rs 0.08 per kWh).

² This figure differs from some official publications because we correct for “regulatory income”—that which isn't received but leads to Regulatory Assets. We also base the kWh calculations on the units sold, instead of units received by the DisCom.

Figure ES 2: Annual operating gap (costs–revenues) on cash basis, broken down by explanatory components



Source: Calculated for public utilities based on data of PFC (2007-2021) Report on Performance of Power Utilities (2007 - 2021), with author segregation.

Notes: Regulatory income may have been there in prior years, but is not well documented. To the extent present, it would slightly reduce the residual gap.

This residual gap effectively means that we have a tariff that is too low to cover costs even after accounting for the factors above, but why this happens is not conclusive. Questions that need to be considered include: Is it because DisComs are not asking for the right tariffs, including in the true-up (reconciliation) process? Are they being denied by the regulator? Or are there deeper issues in the process? We identify additional partial causes, such as the two-year delay for true-ups, which creates a pipeline problem and carrying costs for the DisComs. However, it would be wrong to place primary responsibility on the DisComs for this residual gap.

1.3. Operating Financial Gaps Accumulate in the Balance Sheet

Not only are direct DisCom failures only a fraction of the operating gap, a much larger

share of the lapse comes from consumer non-collection, which, unfortunately, is growing (even after the leeway given for FY2020-21 due to the effects of COVID-19). The “good” news is such a gap isn’t lost forever; consumer non-collection is theoretically recoverable and remains on the balance sheet as a trade receivable. Balance sheets also show “regulatory assets,” but, surprisingly, don’t visibly separate subsidy non-payment!

As we break down the numbers, the true financial picture is better seen in cash flow accounting, since accrual-based accounting, like what the Power Finance Corporation (PFC) compiles annually, (PFC FY21 report indicates a few cash based statements for recent years) understates the problem. These show revenues as-booked, but much of the cash doesn’t come into DisCom coffers, showing up as an asset like a receivable instead.

Because DisComs are cash-strapped, they are forced to resort to various coping mechanisms. First, they delay payments to suppliers, both generators (Rs 2,52,736 crore on the balance sheet³) and other short-term dues to vendors (Rs 2,53,040 crore), some of which entail penalties. They also are forced to take on more debt, and we find that States have pumped in significant equity. Unfortunately, much of this isn't for asset creation, but simply as a fill-up. Regulators have routinely disallowed returns on the full equity base, and the booked return on equity (RoE) has fallen to 3.28%.⁴ Even worse, in a few cases, DisComs are waiving RoE, ostensibly to keep tariffs low. This is a poor and non-scalable means of lowering consumer tariffs. This is nowhere near the hurdle rate of 10% notified by the Ministry of Finance for calculating financial internal rate of return in respect of projects which have identifiable stream of financial returns.

Accumulated deficits are enormous, in lakhs of crores of rupees, and visible on the balance sheet as a part of the total equity. These have, by far, eroded the (book) equity. These deficits closely track the annual “residual” operating gap we identified plus the unpaid subsidy—other components of the operating gap⁵ show up elsewhere on the balance sheet (as trade receivables and regulatory assets of Rs 2,34,072 crore and Rs 45,907 crore, respectively, for the public DisComs covered). Billing efficiency losses were worse than targets, by 3.53% in FY2020-21, and are a permanent loss that doesn't remain in the books.⁶

1.4. Fixing the Problem: Without an Operational Turnaround, a Balance Sheet Clean-up won't Last

There has been a range of instruments used to bail out or prop up DisComs over the decades. While some have focused on fixing the balance sheet, many were conditional on achieving lower losses, requiring a reduction in the AT&C losses or even eliminating the ACS-ARR gap (‘average cost of supply’ minus ‘aggregate revenue realised’). However, as Tyagi and Tongia (2023) (in press) first showed, the ACS-ARR gap at the time of tariff order setting is virtually non-existent. Much of the problem happens *ex-post*, and the subsequent true-up processes are not effective.

Fixing operating problems is the first step, and seven utilities are already operationally cash positive (based on FY2019-20 data). We find that 18 out of the 43 public distribution utilities studied for clean-up⁷ can resolve the gap by “merely” addressing the known components of the gap (excess billing losses aka excess distribution losses, consumer non-collection, subsidy non-payment, and creation of regulatory assets). We recognise that this is easier said than done. The harder challenge is figuring out how to fix the remaining 18 DisComs that have a residual gap and need more fundamental changes. Addressing regulatory assets requires a tariff rise, while other known components require increased compliance. However, addressing the residual gap will also require a tariff increase. For most DisComs, this should be manageable, but in a few cases, the required rise

³ By the end of FY2020–21 in public DisComs.

⁴ Aggregate FY2018-19 value for 39 key public DisComs for which we have consistent time series data.

⁵ With respect to public DisComs, integrated utilities, and power departments (excluding private DisComs) by the end of FY2020-21.

⁶ From a DisCom financial perspective, what matters is the relative performance compared to billing efficiency targets and not the absolute billed energy losses. We have manually compiled the targets across DisComs over the years to determine the performance gap.

⁷ Clean-up analysis focused on 42 public DisComs and integrated utilities plus one power department (totalling 43), which collectively sold 89.1% of the units sold in FY2020-21.

will be unreasonably high (when benchmarked to average annual tariff rises, which are typically up to 5% or near about inflation).

Operational improvements can improve the balance sheet (or at least prevent further deterioration). The central government has already initiated a range of steps to reduce operational losses and improve cash flows, many of them after COVID struck, ranging from liquidity support, schemes for paying off generators, installation of smart meters, and oversight of timeliness for statutory regulatory and discom filings of tariff petitions, orders, and accounts. However, these do not address the issue of the residual gap in tariffs.

This study also investigates the other direction, i.e., the balance sheet clean-ups that can help fix the operational gap. We focus on unpaid subsidies and regulatory assets since addressing trade receivables from lakhs or perhaps millions of consumers is a diffuse problem that cannot be fixed by policy (except dues from governmental consumers, both state and local). These components are also ostensibly not the fault of the DisCom. With this cash in hand, it could be used to repay generating companies (GenCos) or other liabilities, which would lower carrying costs and improve operations. Unfortunately, adding this step doesn't help too many more DisComs cross over into profitability as the residual losses are too high.

We conclude with an analysis of both high-level and specific suggestions in order to move the needle towards closing the gap component-wise. The first step is to improve accounting and nomenclature, and introduce greater standardisation in processes (including the

segregation of AT&C losses into its components). This applies not just to annual statements but also to balance sheets. We also need to revamp the tariff-setting process, especially the true-up process, to close the residual gap. Lastly, we examine a range of additional issues outside the direct issues of tariffs and tariff setting that need to be addressed to achieve operational viability. These include improvements in planning (especially for power procurement but also in terms of expected consumer mix over time), and in DisCom management. Planning will be especially important in a future with increasing decarbonisation and market-structure redesign. For example, consumer-owned solar (rooftop solar) not only changes the net demand pattern seen by the utility (with an additional time-of-day implication), but it also changes their ability to rely on cross-subsidies from premium customers.

Ultimately, several improvements will rely not only on managerial efficiency but also on addressing issues of political economy and politics. This isn't just for raising tariffs, but even for enforcing existing norms and regulations. The good news is that the problems aren't universal or equal. By focusing on relevant components of the gap more intensely, the problem can be addressed in about half the DisComs, more so without significant tariff rises. However, for several DisComs, we may need external support and new or more innovative instruments. The residual gap identified and quantified in this paper is a serious challenge, not merely because of its vast scale, but also because fixing the known causes of the financial gap is "not enough". The sector needs—and deserves—new kinds of regulatory principles and processes.

2. Introduction⁸

Out of the vertical chain of the power sector, spanning generation, transmission, and distribution (which includes retailing power), the distribution business in India is and has long been financially stressed. This makes it a weak link impacting the entire sector. This paper examines the root causes of financial losses through a long time series disaggregation analysis of all public distribution utilities.

It is widely accepted that electricity distribution companies (DisComs) are the weakest link in India's electricity chain; several studies and reports have examined how to turn around the distribution sector, e.g., NITI Aayog (2021). Generation capacity has increased measurably to the extent that there is no shortfall of capacity.⁹ Virtually all homes are now connected to the grid, though the quality of supply is often poor, with uninterrupted supply not yet having reached all homes. Part of the reason for this is the poor financial health of the DisComs and the associated challenges in power procurement to provide 24x7 supply. Another issue with the quality of supply is in rural areas, where not only are investments in infrastructure lagging, but much of the consumption is highly cross-subsidised and thus non-remunerative for the DisCom.

Very few studies have done a careful in-depth analysis of DisCom financials, more so at a causal or component level over a long time series. In a previous paper (Devaguptapu & Tongia, 2020), we examined the operations and cash flows of DisComs through FY2018-19 (aka FY19 or FY18-19), and found that the operating gap was partly due to the non-receipt of subsidies promised by the state governments, but also due to other factors that reduced incoming revenues. Conventional wisdom also points out that the high operational losses (aggregate technical and commercial, or

AT&C losses) are a major contributor.

Losses show up in both the annual financials (through profit and loss (P&L) accounting) and in the balance sheets. To cope with cash shortfalls, DisComs have delayed payments to their suppliers, both generators and other vendors/suppliers, leading to short-term liabilities and payables. In essence, this has become another loan, even if it isn't formally characterised as debt. Generators charge late payment surcharges (LPSC), previously at 18% as per CERC norms, lowered for a brief period during COVID-19 to 12% per annum. These show up as liabilities on the books. On the flip side, DisComs are also owed increasing amounts of money, not just for subsidies, but also from consumers. However, the payables far outstrip the receivables. Table 1 displays a summary of the situation. This excludes overall (long-term) debt, and focuses on a subset one-year snapshot. Table 1(a) is a near-national snapshot, with virtually all DisComs covered, while (b) excludes private utilities and is the base for most of the analysis in this paper. Table 1(b) covers 59 public utilities (DisComs, integrated utilities (which may also handle generation and/or transmission in addition to distribution), and power departments), which supplied 93.3% of the power sold in the country per Power Finance Corporation (PFC) aggregation accounts.¹⁰

⁸ We suggest reading a complementary paper by Tyagi and Tongia (2023) (in press) first, "Getting India's Electricity Prices 'Right': It's More Than Just Violations of the 20% Cross-Subsidy Limit," or at least its summary, as this work builds on portions of that study.

⁹ The recent Fall 2021 and early Summer 2022 power supply crises were more about fuel availability than capacity shortfall.

¹⁰ The Central Electricity Authority's General Review is complementary to PFC's annual reports on utilities, and has a few more DisComs covered, but PFC has more financial data and also longer time series data across multiple publications.

Table 1: DisCom Financials FY2020-21 (operating income statement plus short-term payables minus receivables)**a. All Public DisComs, Utilities under Power Departments and Private Utilities**

Revenue (Rs crore)		Expenses (Rs crore)	
Revenue received from operations	4,92,548	Cost of Power (incl. own generation)	5,79,696
Tariff subsidy received	1,11,949	Employee Cost	66,637
Revenue Grant under UDAY	5,555	Interest Cost	55,773
Other Income and Revenue Grants	45,848	Depreciation	30,243
		Other Costs	32,853
Total Revenue	6,55,900	Total Expenses	7,65,202
Annual basis running loss on operations (expenses > revenue) 1,09,302			

Receivables + Short term assets (Rs crore)		Short-Term Liabilities and Payables (Rs crore)	
Regulatory Assets	75,543	Short-Term Borrowings	56,524
Trade Receivables	2,37,848	Maturities and Interest due on Long Term Borrowings	66,506
Other Current Assets	2,88,151	Payables for Purchase of Power and Fuel	2,73,030
		Other Current Liabilities	2,60,902
Total Receivables	6,01,542	Total Short-Term Payables	6,56,962
Book-Basis Balance Sheet 'Deficit' = Short-Term Payables – Receivables 55,420			

b. All Public DisComs + Utilities under Power Departments (excludes Private Utilities)

Revenue (Rs crore)		Expenses (Rs crore)	
Revenue Received from Operations	4,58,344	Cost of Power (incl. own generation)	5,49,353
Tariff Subsidy Received	1,09,039	Employee Cost	63,201
Revenue Grand under UDAY	5,555	Interest Cost	52,807
Other Income and Revenue Grants	45,097	Depreciation	28,000
		Other Costs	29,765
Total Revenue	6,18,035	Total Expenses	7,22,126
Annual basis running loss on operations (expenses > revenue) 1,04,091			
Receivables + Short term assets (Rs crore)		Short-Term Liabilities and Payables (Rs crore)	
Regulatory Assets	45,907	Short-Term Borrowings	53,329
Trade Receivables	2,34,072	Maturities and Interest due on Long Term Borrowings	64,162
Other Current Assets	2,80,289	Payables for Purchase of Power and Fuel	2,52,736
		Other Current Liabilities	2,53,040
Total Receivables	5,60,268	Total Short-Term Payables	6,23,267
Book-Basis Balance Sheet 'Deficit' = Short-Term Payables – Receivables 62,999			

Source: Compiled from PFC Report on Power Utilities for FY2020-21.

Notes: This "deficit" listed isn't the formal deficit, which we examine subsequently based on the balance sheet, but a stylised version as defined in the table. While we show other current assets as part of 1-year positive balance sheet items, it is not clear how liquid and unencumbered they are. Removing them would sharply increase this stylised operating deficit.

The paper focuses on (b) all public utilities such as DisComs, integrated utilities, and power departments, which are 59 in total.

At an operating level, on a cash basis, the all-India¹¹ FY2020-21 gap was at least Rs 1,09,302 crore, *after* including UDAY and other grants,¹² and other income not planned in the tariff orders. For just public DisComs, the gap was slightly lower (as we will detail subsequently), at Rs 1,04,091 crore (shown in Table 1(b)).

Why do DisComs lose money on an operating basis? In a complementary paper, Tyagi and Tongia (2023) (in press) examine FY2018-19's tariff orders by state regulators which set retail consumer prices *ex-ante*, ostensibly to cover all DisCom costs, and compare these with what actually transpired *ex-post* to try and understand the source or cause of any operational gaps. They find that the initial consumer tariffs (i.e., the notified prices) were overly optimistic on cost assumptions, and actual costs were much higher, and even revenues fell short from the tariff orders that are notified in advance. This is what led to the significant gross gap in per kilowatt-hour or per unit revenues, reaching as high as Rs 1.64 per kilowatt-hour sold, and totalling up to Rs 1,39,924 crore. The gap was partly reduced due to support from grants, including the UDAY scheme grants, and from extra income that was not planned (such as penalties from consumers and consulting income). However, a net gap of Rs 1.01 per kWh remained. This gap was also not covered through the reconciliation process—the tariff true-up mechanism.

They then partitioned the *ex-post* (as-realised cash basis) gap across causes, and *found that this*

gap persists even after adjusting for DisCom non-performance in terms of controlling AT&C losses compared to the targets set by regulators. While there is measurable DisCom non-performance, as of FY2020-21, most of the DisCom's lapse is in rupee terms for collection, and not energy terms (i.e., energy not billed compared to benchmark targets). As we show in more detail subsequently, there is a larger gap between tariffs (plans) and actual financial operations that cannot be the fault of the DisCom alone.

The first part of this paper studies the gap between costs and revenues, both using book accounting (accrual accounting) and actuals (cash basis, or as-realised). For any gap, we tease apart the causes across various factors, including DisCom non-performance, states not paying subsidies on time, etc., and determine if there is any residual gap that cannot be explained by known factors. We then examine the operating (annual) gap and compare it to the balance sheet over time, hypothesising which factors lead to how much of the current poor balance sheet situation. We also examine issues like equity returns and equity infusion as a means of managing the gap. Lastly, examine instruments or steps to fix the financials of DisComs, both at an operating level (annual basis) as well as for accumulated balance-sheet losses. This is done by segregating and clustering DisComs based on the root causes of the gaps (both operational and in the balance sheet).

¹¹ Public utilities, government power departments, integrated utilities, and private utilities combined.

¹² In this report we considered the money booked under 'Other Income and Revenue Grants' as received. However, PFC's '11th Annual Integrated Rating & Ranking: Power Distribution Utilities, April, 2023' (PFC, 2023) indicated a shortfall in actual receipt of such non-tariff subsidies vis-a-vis their booked value for three consecutive years FY2019-20 to FY2021-22. Owing to a lack of detailed break-up of these figures over the longer time series, cash-basis receipts under this head are not reflected in the summary figures in Table 1. If we assume there is a gap in the range of 10-20% of booked non-tariff subsidies, then the cash-basis operating loss would widen further, e.g., in FY2020-21 this additional gap was approximately Rs 3,000 crore.

3. Objective and Methodology

We examine the cash-basis financial losses of public distribution utilities (DisComs and power departments) over 15 years, which is distinct from typical accrual accounting. Given the heterogeneity of DisComs, we break down the all-India figures, which is important since the profits of one DisCom cannot offset the losses of another. Specific analyses and details include:

- Identification of the critical reasons for net operating losses, the role of DisComs' non-performance in total financial losses, and how other factors (and stakeholders) stand responsible for what fraction of the losses.
- Interplay between annual operating losses and accumulations on the balance-sheet.
- Analysis of nuanced issues like regulatory assets, return on equity, impact of 'technical and commercial losses' on the gap between cost of supply and revenue realized, non-receipt of subsidies, impacts of UDAY grants etc.
- Segregation of Discoms across dimensions of operational and balance sheet profiles in terms of appropriate instruments for overcoming the losses and also cleaning the balance sheets.
- The study relies on manual compilation and harmonization of disparate data available in the public domain, including Tariff Orders, annual balance sheets, compilations from PFC and REC, and profit and loss statements of utilities submitted to the Ministry of Corporate Affairs.

The financial and operational poor performance is well known, but the question remains: how long can they muddle along on the current trajectory? What would it take to make them financially stable and competitive? We examine such issues at the DisCom level, while underscoring the importance of heterogeneity of both performance and causal factors across India.

In this paper, we examine annual operations and finances over time, extending Tyagi and Tongia's FY2018-19 work through prior years and up to FY2020-21, and then examine the balance sheets of DisComs in detail, linking these to operations. Key questions include: (1) What caused the net losses in DisComs? (2) How much was due to the DisComs' failure to meet performance targets, versus other contributing factors? (3) How do operating losses connect to balance sheet issues?

If the objective is a financial turnaround of the DisComs, the first step remains closing any operating deficit on an annual basis. As this isn't sufficient to overcome accumulated losses, we also examine the volume of losses, their causes, and possible options for fixing DisCom balance sheets. This includes not just financial instruments, but also the prerequisite steps that must be undertaken at the regulatory level (such as in consumer price-setting aka tariff-setting). Out of the total 68 distribution utilities (covering public utilities, state power departments, integrated utilities, and private utilities), unless stated otherwise, this paper explores in detail the financial position and trends of either 59 public utilities, which includes most public utilities and state power departments, or, when we consider the balance sheets, the 43 larger public utilities, which accounted for 89.1% of energy

sold by distribution utilities during FY2020-21.¹³ Appendix 1 explains the coverage and rationale in more detail. Consistent time series data weren't available for all the utilities across India, and hence our time series is limited to almost all the public-sector distribution utilities.

The study relies on data available in the public domain in the form of reports published and information provided in the websites of Power Finance Corporation Limited, REC Limited, State Electricity Regulatory Commissions, Joint Electricity Regulatory Commissions, various DisComs, Forum of Regulators, Central Electricity Regulatory Commission, etc. The study also relies on annual balance sheets and profit and loss statements of DisComs as submitted to Ministry of Corporate Affairs, Government of India, and their annual (audited) reports.

It is worth mentioning that not only are the various data sources not consistent across their headings and metadata, even the same data sets (like PFC) have evolved over the years. We have attempted the best possible segregation and standardisation across cost and revenue components. Some of these are straightforward, such as costs incurred for power purchase, employee costs, loan servicing, depreciation, etc., but others are more complex. Given data limitations and inconsistencies, our focus is on trends and big-picture findings as opposed to final digit-level accuracy.

A nuanced issue is how official data treat the creation of “regulatory assets” as “regulatory

income,” but this is a relatively new terminology. Regulatory assets are a “due” to the utility based on the state regulator not raising tariffs sufficiently to cover recognised costs (ostensibly to avoid a tariff shock). The “regulatory income” on P&L books is the operational side of what on the balance sheet becomes the regulatory asset. It is booked income in most official DisCom accounts, but on a cash basis, it is actually something *not* received. Regulatory assets are the sum of annual regulatory income, less any recovery of dues through tariff hikes over time. Since we focus on cash-basis accounting, we have adjusted such revenues when calculating DisCom losses, unlike official documents which don't show these as a loss. Similar to Tyagi and Tongia (2023) (in press), we also factor in but still segregate non-operational “revenue” on the books of utilities coming from government grants and other income (ostensibly outside the regulatory tariff-setting purview, including consulting and penalties charged to consumers).¹⁴

Most cost components are standard for companies, such as input costs (which in this case is predominantly the cost of power purchase from generators), labour costs, loan servicing, depreciation, etc. Since DisComs are regulated entities, their cost structure—which is used to determine the tariffs to recover costs—includes a return on equity (RoE) as allowed by the regulator, and is typically in the range of 14–16%. Hence, as an objective, bridging the deficit for the 43 utilities considered is sufficient based on this accounting method and no additional profit is required.

¹³ As per PFC Report on Performance of Power Utilities (2020-21).

¹⁴ Per PFC, the underlying data are not directly published in their final reports but are available online under the templates, “other income” out of “other income and grants” has varied significantly over the years, averaging about 17% in recent years (only a few years' data are available), so, much of this heading is not grants per se. However, given that it was not part of the regulatory tariff-setting process, it is treated separately.

How can regulated entities have different profits if an RoE is already covered in their cost structure, to be recovered via an appropriate tariff? This is because they might either have some non-regulated income (e.g., income earned through consulting services), or because they exceed their operational targets, such as by reducing aggregate technical and commercial (AT&C) losses beyond targets. We note that the AT&C losses are disproportionately high in power departments located in Union Territories, the North-east or in hilly regions. However, strong generalisations are difficult because of the heterogeneity across DisComs.

On the revenue side, the inflow of cash from operations (revenue realised, after factoring in collection losses), and the subsidy and grants received (including UDAY) are considered. As explained above, regulatory income (which leads to the formation of regulatory assets) is treated as

money *not* received and hence is not treated as part of revenues.

After we understand the losses and the causes of these losses, which are on an annual basis, we examine the balance sheets over time, and try and connect operational gaps with accumulated losses. While DisCom debt has received extensive coverage (and that was the focus of the UDAY scheme), there has been very little analysis on equity, which we study in both absolute terms and relative terms across utilities.

In the final section, we combine operational and balance-sheet profiles to segregate DisComs in terms of appropriate instruments for overcoming losses and cleaning the balance sheets. In some cases, operational improvements (such as lowering of AT&C losses) can suffice, while in other cases, even “reasonable” tariff increases aren’t enough.

4. Background on DisCom Operations

A snapshot of utilities' performance shows enormous financial losses, with only a handful of distribution utilities breaking even. Such losses propagate up the vertical chain, including to generators and other suppliers who aren't paid on time.

- Before teasing apart the causes, the reality from *ex-post* financials shows an enormous loss, typically in the range of 10-20% gross losses (before grants and other income) over the years.
- Over these 15 years, costs have grown at a CAGR of 11.7%, while revenue as recovered from consumers has only grown at 10.2% CAGR. Support through subsidies and other grants/income grew the most, at 18.6% CAGR, which helped to contain the gap, which, nonetheless, grew at 12.1% CAGR. Had the grants and other income not been realized, the gap would have grown by 14.6% CAGR.

4.1 Cash Flows and Losses

The aggregate financial picture given in Table 1 doesn't capture the heterogeneity across India. This is because a national aggregate blends profits and losses, masking the true picture. Based on the calculations using the PFC Report on Performance of Distribution Utilities (2019-20), out of the 68 distribution utilities (which includes public utilities, power departments, integrated utilities, and private utilities), only 9 utilities (which had a share of around 12.1% of net energy supplied), recorded a combined cash-basis profit of Rs 1,434 crore, while 50 utilities (that supplied 84.1% of net energy), incurred a loss of Rs 85,468 crore.¹⁵ Due to non-availability of data, information for about 18 utilities could not be included (mostly smaller power departments or city-sized private utilities). The losses are *after* availing support via grants like UDAY and other measures. Purely

from operations as we'll detail shortly, the losses were far higher.

It is worth mentioning that the losses per unit or kWh are per unit *sold*, and not per unit gross (input) energy, which is the methodology used by many official sources in reporting losses. Hence, the figures in Table 2 appear higher than some official government data on losses per unit. However, we posit that per unit sold is a more accurate measure since any increase in tariff, if chosen, would apply to units sold.

Notwithstanding the profit or loss earned by the respective utilities, the majority of the utilities are saddled with significant dues payable to GenCos and other suppliers, which have both grown over time. However, only the dues to GenCos have garnered sizeable public attention, thanks to the collective voice of GenCos and the primacy of supply in the value chain.

¹⁵ A full comparison with historical CEA General Reviews shows a very small number of utilities are not covered, and the CEA data are the source for total units sold in the country (leaving a gap after adding the profitable and loss-making utilities above). Our subsequent time series analysis focuses on governmental or public DisComs—ones for which multi-year data are available.

Table 2: Heterogeneity of distribution utilities by ownership, energy share, and cash-basis profit / (loss) FY2019-20

	Public utilities & integrated utilities		Power Departments		Private Utilities		All Utilities + Power Departments	
	Profit	(Loss)	Profit	(Loss)	Profit	(Loss)	Profit	(Loss)
No. of Utilities	7	39	1	9	1	2	9	50
Profit / (Loss) (as-realised) (Rs. Cr.)	1,243	(79,351)	59	(5,230)	132	(887)	1,434	(85,468)
Profit / (Loss) per kWh supplied (Rs)	0.11	(1.00)	0.40	(2.85)	0.14	(0.46)	0.12	(1.03)
Net Energy Supplied (Million kWh)	109,131	793,755	1,596	18,347	9,086	19,174	119,813	831,276
Share of National Net Energy Supplied	11%	80.3%	0.2%	1.9%	0.9%	1.9%	12.1%	84.1%

Source: Calculated from PFC Report on Performance of Power Utilities (2020-21).

Notes: PFC lists book values (not as-realised) in their annual reports on DisComs. We apply conversions from book (accrual basis) to realised (cash) financials, and also correct for regulatory income (not realised).

Due to non-availability of data, information related to 18 utilities could not be included in Table 2 above.

Total share of net energy supplied by the number of utilities indicated in the table does not add up to 100% as this table does not include data for Arunachal Power Department. and six private utilities (Torrent Ahmedabad, Torrent Surat, AEML, NPCL, CESC, and IPCL) which were part of Table 1. A few private DisComs are not part of either Table, e.g., Tata Power Mumbai.

The power purchase dues as declared in the generator-focused Payment Ratification and Analysis in Power procurement for bringing Transparency in Invoicing of Generators (PRAAPTI) portal differ widely from those found in the yearly reports published by PFC on the performance of power utilities. The GenCo dues as indicated by the PRAAPTI portal (a Ministry of Power, Government of India initiative) are only 33.1% of the total dues shown by reports of Power Finance Corporation (PFC), as Table 3 shows.

Although PRAAPTI is a useful initiative, Devaguptapu and Tongia (2020) showed its multiple limitations, the most predominant being the fact that it only includes voluntarily reported dues. Since all GenCos are not on the platform, especially the state-owned units, the figures in PRAAPTI only partially portray the true picture of dues.

Table 4 shows just the state GenCo *receivables* as per PFC, the dual of payables by the DisComs, measured both in rupees and days of receivables, which shows the worsening picture over time.

Table 3: Discrepancy of DisCom unpaid power purchase payables (Rs crore) between PFC Reports and PRAAPTI Portal (April, 2017 -March, 2022)

	April 2017	March 2018	March 2019	March 2020	March 2021	March 2022
PFC Reports ¹⁶	1,52,402	1,55,105	2,09,376	2,36,430	2,52,736	Not Available
PRAAPTI Portal ¹⁷	17,806	19,618	40,620	78,541	83,716	1,02,936
PRAAPTI as % of PFC Data	11.7%	12.6%	19.4%	33.2%	33.1%	Not Available

Source: Compiled from PFC Reports on Performance of Power Utilities for financial years 2017–18, 2018–19, 2019–20 and 2020–21 and PRAAPTI Portal (n.d.; accessed over time).

Notes: Covers all public DisComs, integrated utilities, and government power departments (while excluding private DisComs).

Table 4: Receivables in Rs crore and no. of days for state-owned GenCos

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Receivables for Sale of Power (Rs. crore)	64,895	70,758	71,477	87,874	98,736	117,057
Receivables for Sale of Power (Days)	238	243	238	265	292	380

Source: Compiled from PFC Reports on Performance of Power Utilities for financial years 2017-18, 2018-19, 2019-20, and 2020-21.

Considering the deteriorating performance and increasing operating losses (as shown in Table 2), even before the full impact of COVID-19 is considered, it is imperative to examine the root causes of DisComs' business losses and subsequent inability to pay power purchase debts. This analysis is aimed at determining if the issues stem from business inefficiency, lack of regulatory oversight, lack of political will, or a combination of these factors.

4.2. DisCom Operations and Finances

Electricity flows down a chain from a generator (often a generation company, or GenCo) through transmission (often through a transmission company, or TransCo), to the distribution company (DisCom), the utility which also retails the power to consumers. In some countries or jurisdictions, the DisCom is separated between the wires company and the retailer; while in others all the segments are vertically integrated.

¹⁶ PFC Report on Performance of Distribution Utilities FY 2020–21, Annexure-1.5; PFC Report on Performance of Distribution Utilities FY 2019–20, Annexure-1.5; PFC Report on Performance of Distribution Utilities FY 2018-19, Annexure-1.5.

¹⁷ Accessed from <https://www.praapti.in/>.

While there is competition for power at the generation level in India,¹⁸ at a distribution level, almost all DisComs operate with a geographic monopoly and regulated pricing. Bulk consumers (above 1 MW in size) can obtain power supply from any source, not just their local utility. Despite the provisions in the Electricity Act 2003, many eligible consumers do not take advantage of this option for a range of reasons including uncertainty, hassle, and DisCom resistance to facilitating (as they still provide their network to wheel the power). The only exception to this monopoly distribution is in Mumbai, where DisComs compete directly for retail consumers of any size.¹⁹

Given that the distribution business is regulated by the state electricity regulatory commissions (SERCs), in theory, there should not be any losses for a DisCom as they face little risk in the conventional sense that most companies face. We subsequently revisit why they might have losses within this system.

Regulators set tariffs *ex-ante*, based on estimations of costs and volumes of sales. This starts with a calculation of the annual revenue requirement to cover costs, inclusive of statutory equity returns. Assuming performance as planned (cost structure

and revenues), the utility covers all their costs, the largest component of which is paying generators. However, as we've seen, utilities have dramatically fallen behind in paying generators (and other vendors/suppliers as well).

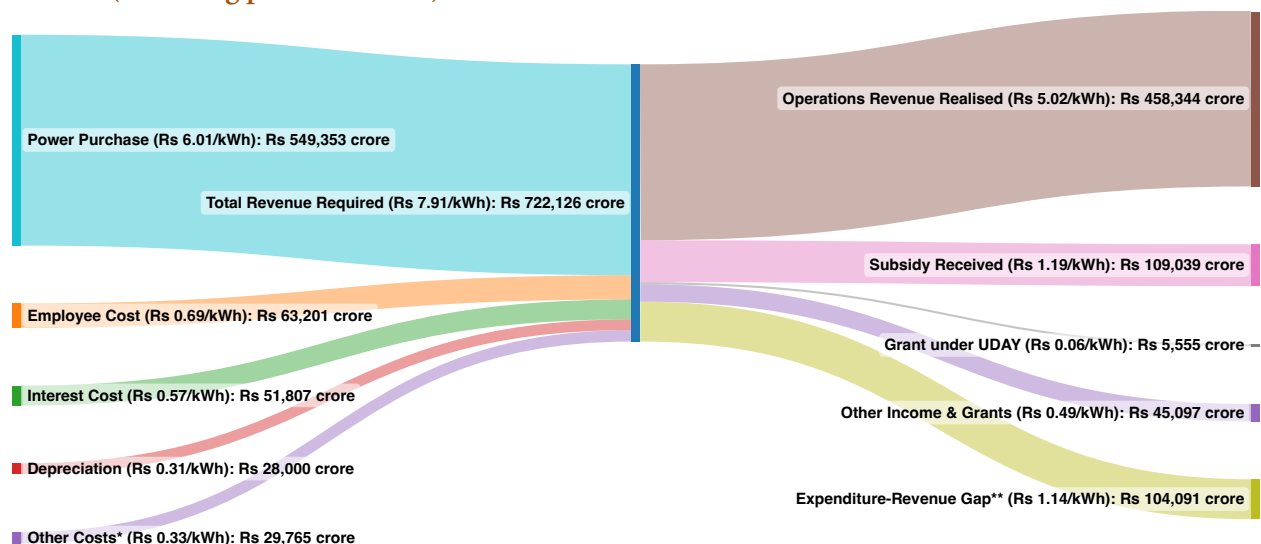
Figure 1 shows the flow of money for FY2020-21 across components, starting with costs, and seeing how those costs were covered (or not). Tariffs (retail prices) are determined based on projected expenses, which lead to revenues. Because of how expenses determine revenues, this differs from a traditional Sankey diagram which normally shows flows like of money from “input” to “output.” As previously mentioned, these data are for all the 59 public distribution utilities, which are the focus of most of our analysis in this paper since we have their time series data, and since these utilities accounted for 93.3% of units sold in FY2020-21.

Importantly, these figures are according to actuals as realised, and not based on tariff orders (thus, *ex-ante* plans), which were a starting point for analysis by Tyagi and Tongia (2023) (in press). We also adjust for revenues that were booked but not received on cash basis, like regulatory income (detailed later), which raises the losses. These are for public utilities; adding private utilities would raise the total losses by a little over Rs 3,000 crore.

¹⁸ Most competition for generation in India is at the time of setting up the power plant and not directly for power on a power market or exchange. On the order of 90% of power procurement in India happens through power purchase agreements (PPAs), which often have a multi-decade timeframe. Power exchange markets aren't all of the balance as power exchanges also handle bilateral trades not part of real-time/day-ahead/term-ahead markets.

¹⁹ We find a mix of regulatory structures globally, and the US is the best example where unbundling, retail competition, and vertical integration are present in different states. For retail competition, many countries started with bulk consumers being eligible to choose their suppliers. India recently notified “Green Open Access” eligibility for 100 kW sized consumers, a much lower threshold than the normal 1 MW Open Access (ability to choose a supplier) eligibility threshold (PIB, 2022b).

Figure 1: Cumulative expenditure and income flow statement as-realised for all public distribution utilities (excluding private utilities) for FY2020-21



Source: PFC Report on Performance of Power Utilities for FY2020-21.

Notes: The per unit costs are per kWh sold. The power purchase costs are the actuals as booked by DisComs, and thus include any additional purchase of power due to higher system losses than allowed per regulator. Thus, total revenue required shown here isn't the same as what the regulator would put as the annual revenue requirement, which is based on target AT&C losses. This includes Odisha DisComs which were privatised during FY2020-21.

* Other costs cover repairs and maintenance, administrative and general provisions and other expenses.

** Expenditure minus Revenue gap includes regulatory income (cost approved but recovery deferred) of Rs 7,236 crore (0.08 Rs/kWh).

We note that the largest component of the expenses was power procurement. The sum of revenues from consumers for power used (on a cash basis), plus other operational revenue such as for network access and wheeling of power together barely covered 63% of the total costs. This is one reason the cost of power (7.91 Rs/kWh in FY2020-21)²⁰ isn't fully recovered. Even after adding in tariff subsidies, which are payments by states to reduce payments required from consumers, the revenues still barely cover

just the power procurement or fuel costs.²¹ Even with additional subsidies, grants, and other support schemes like UDAY, there was a massive loss of Rs 1,04,091 crore,²² or Rs 1.14 for each kWh sold. Thus, all sources of revenues put together only covered 85.3% of costs, which is after receiving grants and other income not part of regulatory tariff-setting. This annual operating deficit includes Rs 7,236 crore marked as regulatory income.

²⁰ Other income is kept separate from planned or regulated revenues, and hence is calculated separately. It includes things like penalties on consumers, consulting income, etc.

²¹ Fuel costs are relevant for the utilities which are vertically integrated from generation to retail supply, like TANGEDCO (Tamil Nadu Generation and Distribution Company).

²² This FY2020-21 gap would further increase to Rs 1,07,874 crore if we add just the regulatory income of private DisComs (Rs 3,783 crore). This is ignoring excess distribution network loss (D), consumer non-collection loss (C), loss due to subsidy non-payment (S) for them, which we expect to be low. Historical regulatory income for private discoms has been much higher in previous years.

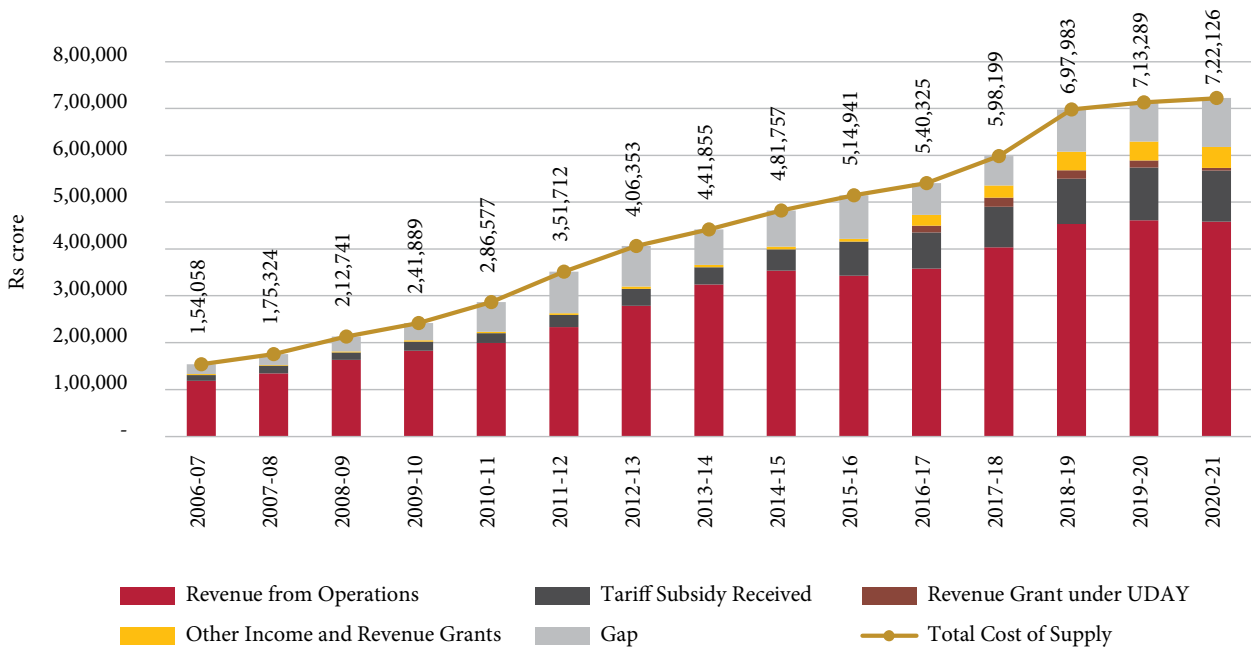
Our analysis focuses on these public DisComs, unless otherwise stated. If we include all the DisComs, the revenues might scale slightly more than costs since we have excluded private DisComs here, some of which are profitable.

The central government recently expressed its displeasure about the poor financial health of DisComs and their continued financial and operational losses, and categorically observed that they do not object to initiation of insolvency proceedings against state-owned electricity distribution as well as generation companies in case of default of payment to their creditors (PTI, 2021). In other words, the

central government withdrew its protection to DisComs, which makes solving their financial problems an urgent issue. This is separate from the challenges that COVID-19 raised, where demand fell while DisComs were still obligated to pay fixed costs to generators, and revenues fell disproportionately from commercial and industrial users—the higher-paying categories of consumers.

Figure 2 shows the time series of the costs versus revenues on an as-realised basis. We subsequently show how these differ from booked values, and why, but these reflect the actual position, not just on-paper position.

Figure 2: Total cost of supply vs revenue (from FY2006-07 to FY2020-21)



Source: PFC Report on Performance of Power Utilities (2007-2021).

Notes: Only the gap is labelled here within histogram components. Revenues are from all sources, i.e., “revenue from operations” + “subsidy received” + “revenue grant under UDAY” + “other income and revenue grants”.

These cover all public distribution utilities, i.e., they exclude private utilities.

Table 5 summarises key trends over these 15 years, many of which are worrying, especially the rising gap (which is rising faster than growth in operational revenues) and exceptionally higher

reliance on support (including tariff subsidies). Rising tariff subsidies are the only reason the gap is growing relatively slower than the costs or total revenues.

Table 5: Key summary statistics as measured by growth between FY2006–07 and FY2020–21

Description	CAGR
Total Costs	11.7%
(of which) Cost of power procurement	10.2%
Total Revenues (including support)	11.6%
(of which) Revenue from Consumers plus Operations	10.2%
(of which) Support and other sources (such as Tariff Subsidies, Grants and Other Income, etc.)	18.6%
Gap as-realised	12.1%
Volume of Sales (kWh)	6.2%
Average Billing Rate (nominal Rupees per kWh)	4.7%

Source: Calculated from PFC Reports on Performance of Power Utilities (2007-2021), for all public distribution utilities, i.e., excluding private utilities.

Notes: Revenues from consumers is as paid by them, and thus excludes (tariff) subsidies. Average billing rate (ABR) is the booked rate for consumers and operations, and thus includes portions that may be paid out via tariff subsidies. Support includes support for sale of power (like tariff subsidies) and other operational grants, plus other income as shown in Figure 1.²³

²³ Grants and subsidies for capital works show up separately on the balance sheet, but there is always a chance that some may be utilised for more immediate capital needs, more so with liquidity problems due to cash shortfalls.

5. Equilibrium and Critical Components Responsible for Operational Losses

The electricity distribution business is highly regulated, where state electricity regulators approve all costs and rates of revenue recovery. In such a case, DisComs ideally should not incur losses, more so if they perform as per targets set ex-ante. But losses are a reality. We tease apart why they have enormous cash losses.

- Against the normally projected (*ex-ante*) revenue-expenditure gap, meant to be zero in theory, the actual expenditure-revenue gap on cash realized basis is substantial, Rs 1,04,091 crore in FY2020-21 for the 59 public distribution utilities across India.
- There are two types of causes for the gap – failures to perform as per targets, or deviations *ex-post* from *ex-ante* assumptions (which include cost structure, consumer mix, etc.). The reality is a mix of both causes, but DisCom failures to perform are a minority subset of the cause of the gap.
- Attributable causes of the gap (excessive distribution losses, non-collection from consumers, purposely insufficient tariffs explicitly set as such by Regulators (creating Regulatory Assets), and promised subsidies from the state not being paid on time) only cover a minority of the aggregate financial gap. The difference is a substantial residual gap identified for the first time in this paper.
- The residual gap constitutes 59% of the total gap (on a cumulative basis over 15 years) which indicates non-cost reflective tariffs. This also highlights a failure of the true-up mechanism meant to reconcile and cover unplanned shifts between *ex-ante* tariff orders and *ex-post* performance.

5.1. The Complex Link Between Plans and Reality—Tariffs as Envisaged (*ex-ante*) Versus Realised (*ex-post*)

There are three stages of DisCom accounting. First, regulators set tariffs in advance across consumer categories (and tiers or slabs) such that these should cover expected costs for the year, or the annual revenue requirement (ARR). These also assume normative levels of AT&C losses. When the year goes by, we first end up with booked accounts on an accrual basis. Say a DisCom sells 100,000 units or kWh at 2 Rs/kWh. It would book Rs 2,00,000 as revenues from the sale of power, regardless of whether such money was actually paid by the consumer. What they actually receive is the last layer of accounting, the as-realised (cash) basis accounting. Booked

accounts can reflect actual AT&C loss numbers in terms of billing efficiency, but other aspects may be booked but not realised, e.g., if a subsidy isn't paid out. Booked based accounts are also termed accrual accounting.

Tyagi and Tongia (2023) (in press) focus on the cost-revenue gap (the average cost of supply or ACoS or ACS, versus the annual revenue requirements or ARR, which is often at the tariff order stage, or the average revenues realised, which is at the booked accounts stage post-facto; both are called ARR²⁴) and how the gap evolves from the tariff order stage to as-realised *post-facto*. Their study, which is focused on FY2018-19, shows that when regulators set tariffs *ex-ante*, in tariff orders have virtually no gap between costs and revenues.²⁵ However, the as-realised (*ex-post*)

²⁴ PFC terms ARR as “aggregate revenues realised,” while regulators call ARR as the “annual revenue requirement based on costs,” typically used when setting tariffs. Context is required to distinguish the two forms of ARR.

²⁵ A few regulators take cognizance of subsidies when setting tariffs, but this is rare and not the norm. Tyagi and Tongia (2023) (in press) adjust for this.

financials show an enormous gap, which, for their sample (almost all-India, and larger than ours) came to 1.01 Rs/kWh sold, even after including other support (like grants), which providing 0.63 Rs/kWh. This translated to a net gap of Rs 85,329 crore (including grants), or a gap of Rs 1,39,925 crore without the UDAY or other income/grant support. Much of the gap came from changes in costs (*ex-ante* versus *ex-post*), but there was also a change in the average billing rate (ABR, in Rs/kWh, often due to a change in consumer mix from plans).

There were also other shifts from plans that are related to operational performance that increase the ACS-ARR gap on an as-realised basis, including shortfalls in subsidy payment, non-collection from consumers, and a fall in billing efficiency (a measure of losses of energy between input energy to the DisCom and that which is sold) on the revenue side.

On the cost side, there may be changes in power procurement or other costs. In principle, these are not the fault of the DisComs, and are predominantly adjusted in the reconciliation “true-up” mechanisms about two years later.²⁶

Importantly, the power procurement costs that are passed through to consumers include fuel costs that are passed through by generators. Thus, even generators have little incentive to find cheaper fuel supply as long as it is part of an approved PPA. Fuel price hikes, as long as they are part of PPAs, are typically passed through to

consumers quarterly, through fuel adjustment charges (FACs) or power purchase adjustment charges (PPACs), and hence don't need to wait for true-ups. This actually means the gross change in power procurement costs is higher than what accounts show because a portion of the difference, the fuel adjustment charge, has already been realised and is part of the average billing rate (ABR), at least in part.

On the revenue side, there are several known components of why the *ex-post* revenues can be lower than planned:

1. Change in consumption patterns, e.g., between over- vs under-paying categories of consumers → meant to be adjusted in the true-up.
2. AT&C losses beyond the approved norm → borne by the DisCom; these span two types:
 - a. Failure to bill kWh as per norms (higher distribution losses) → borne by the DisCom.
 - b. Failure to collect billed amounts from consumers → borne by the DisCom (on the balance sheet as a “trade receivable”).
3. Unrealised subsidies from the State Government → a due to (i.e., receivable by) the DisCom (which should ideally show up on the balance sheet); this is technically a collection loss, but we isolate this since it is not directly the fault of the DisCom.

²⁶ The true-up process is a multi-year regulatory process as follows: tariff orders are notified in advance of the year they are meant to come into force (thus being assumption heavy), and after that year passes, it takes about a year to receive the audited results with actuals values. Based on these, the DisCom files a true-up petition, which is reviewed, subjected to public hearings (like all tariff processes are), and then notified. Only after these steps does it come into force, and hence there is a minimum two-year gap, which can be longer if any step is delayed. However, there are often lump-sum adjustments done instead of following this process annually, and in the tariff orders listed, regulators may line-item the true-up amount, but they often do not list the amount claimed by the DisCom, nor any amount recognised as due but not yet put into tariff (essentially, it is carried forward).

4. Regulatory income (creation of regulatory assets) → a due to (i.e., receivable by) the DisCom (on the balance sheet)—created by regulators.

Point (1) should be reconciled in true-up tariff adjustments (albeit after two years), and point (3) is the fault of the state government. Point 4 is directly in the hands of the regulators. Only point (2), higher-than-stipulated AT&C losses, is directly the fault of the DisCom. Even a substantial fraction of non-collection of bills from consumers is actually the fault of the state (or local) government, since a measurable fraction, reportedly at least Rs 62,931 crore (Sidhartha & Dutta, 2022), is from government departments and local government bodies. The prime minister stated at the *Ujjwal Bharat Ujjwal Bhavishya*—*Power@2047* event that governmental dues (from departments and local bodies) are about Rs 1 lakh crore (Parashar, 2022). At the same event, UP governmental dues were stated to be about Rs 12,000 crore. For this paper, we keep consumer non-collection losses as being the DisCom's responsibility, both as a bounding exercise and also since that is the responsibility borne by them as per the regulators.

Tyagi and Tongia (2023) (in press) observe that the tariffs set by regulators leave a large *ex-post* gap, *even when we correct for higher AT&C than targeted*, or isolate non-payment of subsidies or creation of regulatory assets. Their focus was on the shift between plans and reality, and much of the gap stemmed from things like changes in costs or ABR. Many of these should, in principle, be reconciled during the true-up process.

While there is a time lag in the true-up process, it is a continual pipeline. FY2018-19's tariff order includes the true-up of FY2016-17 when calculating the cost structure. Thus, if we look at the time series of actual performance and attempt to isolate causes such as (1) AT&C non-performance; (2) subsidy non-

payment; (3) regulatory income (and the creation of regulatory assets), then we should roughly have no remaining loss, assuming true-ups allow all changes in cost or revenues to ultimately be recovered.

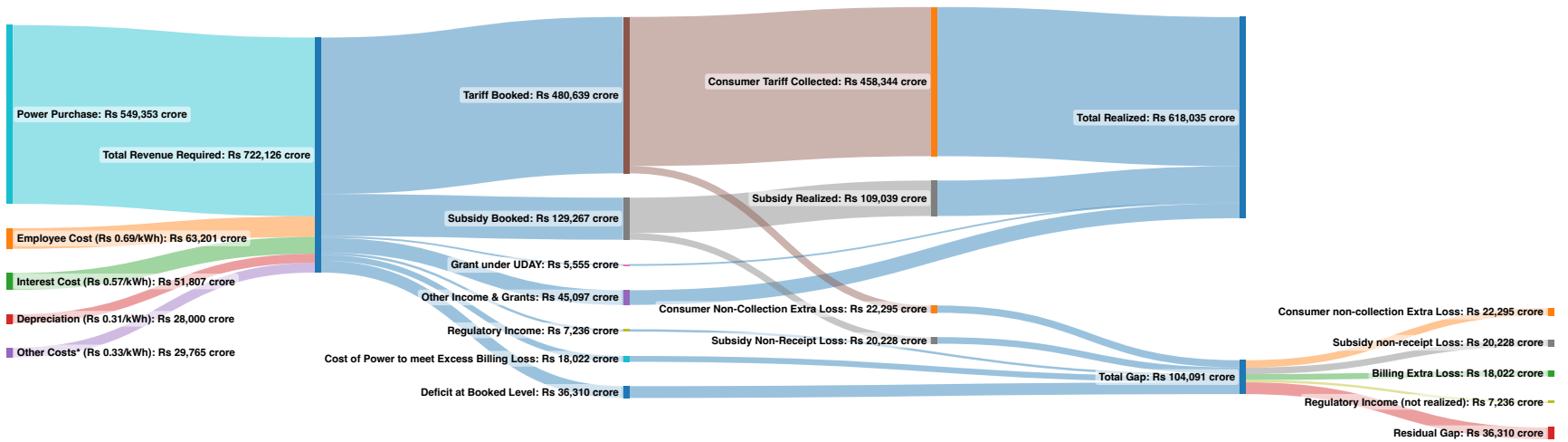
Unfortunately, as will see in detail, even after accounting for all such factors, there remains a residual deficit that is effectively a tariff that is set too low to cover costs. Tyagi and Tongia (2023) (in press) only considered one year's data, but, by examining the time series, we account for true-ups over time. As detailed subsequently, we still find a residual deficit which is not explainable by any of the aforementioned points.

The cash-basis gap shown in Figure 3 is a more nuanced version of that in Figure 1 for FY2020-21, showing all stages of accounting and a summary breakdown of the ACS-ARR gap. Subsequent sections detail all these segments, such as the breakdown of AT&C losses into the further components listed and the methodology for calculations. Even at this high-level aggregate picture, we can see that not only is there a gap due to DisCom non-performance and other factors, even booked values that match performance targets and plans have a deficit.

The left side of the graph shows the actual power purchase amounts booked. This is naturally different from the tariff order since the volumes changed, but even purchase costs have shifted. What is also booked by DisComs but will (rather, should) ultimately not be allowed to be recovered is the additional power purchased to cover higher billing losses than allowed, in this case, Rs 18,022 crore.

These booked revenues are segregated based on realisations (as received), leading to the total gap of Rs 1,04,091 crore. We also show the components of this gap, each of which we explain in the next section (section 5.2) in detail.

Figure 3: Expenditure, income flows along with break-ups of all distribution utilities (excluding private utilities) for FY2020-21



Source: PFC Report on Performance of Power Utilities for FY2020-21 data, with bifurcations by the authors.

Notes: Statutory return on equity (RoE) is part of the tariff-setting process under costs, and part of other costs. The revenues required are a combination of the tariff order ARR, which assumes normative DisCom performance, plus the extra power procurement costs due to failure to meet billing efficiency targets.

5.2. Causes of the Gap: Unmet AT&C Loss Targets

5.2.1 Components of AT&C

AT&C (aggregate technical and commercial) losses have been a long-standing challenge for DisComs. AT&C is a uniquely Indian framing for losses of distribution utilities, which combines physical losses (energy in terms of kWh) and financial losses (in rupees). What is colloquially or euphemistically called a commercial loss can include both theft and non-payment of the bills. However, the former is typically a loss of energy (kWh) while the latter is strictly a loss of revenue (rupees). Theft is more complicated than just stealing energy—even unofficial or wrong-category consumption is theft, e.g., using subsidised household electricity connections for commercial use, but such a theft doesn't show up in energy terms.

Official financial data and methodologies have two main components of losses—losses due to lack of billing (in kWh) and rupee losses due to non-collection of money for the energy billed. Billing efficiency is the measure of how many units are billed by the DisCom compared to the input energy, and so, billing inefficiency is simply (1 minus billing efficiency), which can also be termed billing loss. Billing losses can be due to technical reasons (like heating losses on the

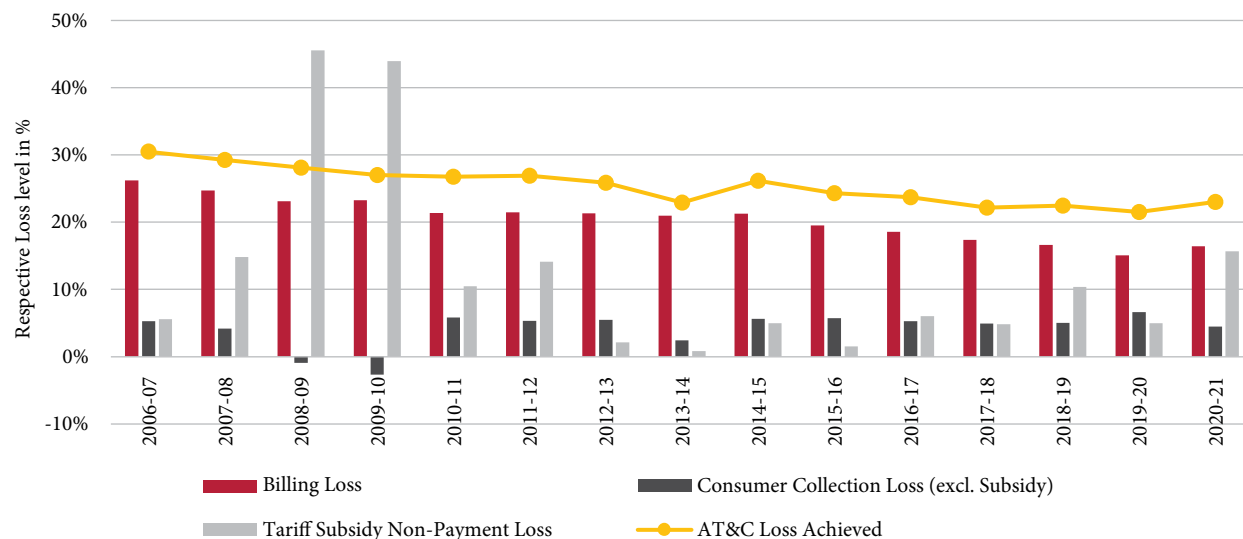
wire or the transformer) or theft. It's difficult to segregate between the two. Billing losses can also be termed distribution network losses (in kWh).

Collection efficiency in official books actually has two components which we segregate—non-collection from end-consumers, and non-collection of subsidies to be paid by the state governments. These subsidies are almost always outside the regulatory process.²⁷ The regulator sets retail prices (tariffs) and the DisCom is supposed to get paid for the consumption. Subsidies are a choice some states make to reduce the burden on chosen categories of consumers, but they are not supposed to impact the DisCom's aggregate revenues. They only change who is paying.

Figure 4 shows the trend of AT&C losses broken down into the key components, viz., (1) billing inefficiency; (2) collection failures split between (2a) non-payment by consumers and (2b) non-payment of subsidies by state governments. The breakdowns are shown as relative performance compared to the “no loss” for each component; only if they were absolute performance levels could we add them up to equal the total AT&C losses. Figure A1 Aggregate technical and commercial (AT&C) losses shows more details on AT&C performance across DisComs, as well as the formula for AT&C, which shows its non-additive nature across the components.

²⁷ Tyagi and Tongia (2023) (in press) show that a few regulators do take cognizance of subsidies and accordingly set a lower tariff, but this is rare, and we do not recommend such tariff setting because of the other distortions it creates.

Figure 4: Aggregate technical and commercial (AT&C) losses from FY2006-07 to FY2020-21 as achieved



Source: Calculated using data on net input, sold and realised energy as well as subsidy data as given in PFC Reports on Performance of Power Utilities (2007-2019).

Notes: Consumer collection losses are based on units billed to them to pay versus those paid by them, and thus exclude any portion of their consumption meant to be paid via subsidies. Unpaid electricity goes on the books as “trade receivables.” The subsidy loss is relative to the promised subsidy, and is not absolute. Hence, we cannot add these components as shown to total the AT&C loss. This covers all public utilities.

Methodologically, there are wide uncertainties associated with accounting for billed energy since a large number of consumers (including most agricultural consumers) have no electricity meters and their consumption is officially calculated based on assumptions such as estimates on hours of supply, the capacity of the pump, and the number of pumps connected to the feeder line. Even for consumers with meters, there are often bills raised based on “estimated readings” instead of measured readings due to various reasons. DisComs don’t disclose the scale of such readings consistently, but proper meter readings are increasing. One useful facet of the

SAUBHAGYA²⁸ electrification scheme was the mandate that all connections must have a meter. In the past, some low-income subsidised supply schemes assumed low consumption, and thus often didn’t have meters.

We can see in Figure 4 that while the national aggregate AT&C loss has shown a mostly steady decline, its components have jumped around. Even AT&C losses have worsened in some years, more so when we consider the individual DisComs that have declared increases in AT&C losses occasionally. This could be due to improved measurements and accounting,

²⁸ Sahaj Bijli Har Ghar Yojana (SAUBHAGYA), a Government of India initiative launched in October 2017, aimed at providing last-mile connectivity and electricity connections to all the unelectrified households in the country. With a few exceptions, this was achieved in one-and-a-half years, which was much faster than the target.

but there is also the risk that upward revisions are part of an incentive structure to increase the losses as a baseline in order to show positive trends down the road, more so as new government schemes or programmes start. There is a visible increase for FY2020–21, but this is due to an increase in unpaid subsidies, which might be due to the strain that COVID-19 has placed on state finances.

These losses are certainly high—the US has *total* system losses closer to 5% (EIA, 2022), including during transmission. In India, transmission losses alone, which are before power reaches the DisCom periphery station from generators, were about 6.5% in FY2019-20 (calculated from CEA (2021)). Even within India, we can see the heterogeneity of AT&C losses (Figure A1: DisCom-wise aggregate technical and commercial (AT&C) losses FY2019-20)—the lowest losses are, naturally, in urban DisComs like in Mumbai and Delhi. In contrast, there are still utilities with AT&C losses over 40%, such as Andaman and Nicobar, Arunachal Pradesh, Jharkhand, MP Madhya Kshetra, Nagaland, Jammu and Kashmir, etc.

5.2.2. Financial performance depends on AT&C Targets achievement, not absolute levels

While lowered losses and lowering system costs are always welcome, *from a DisCom financial perspective what matters is not the absolute loss,*

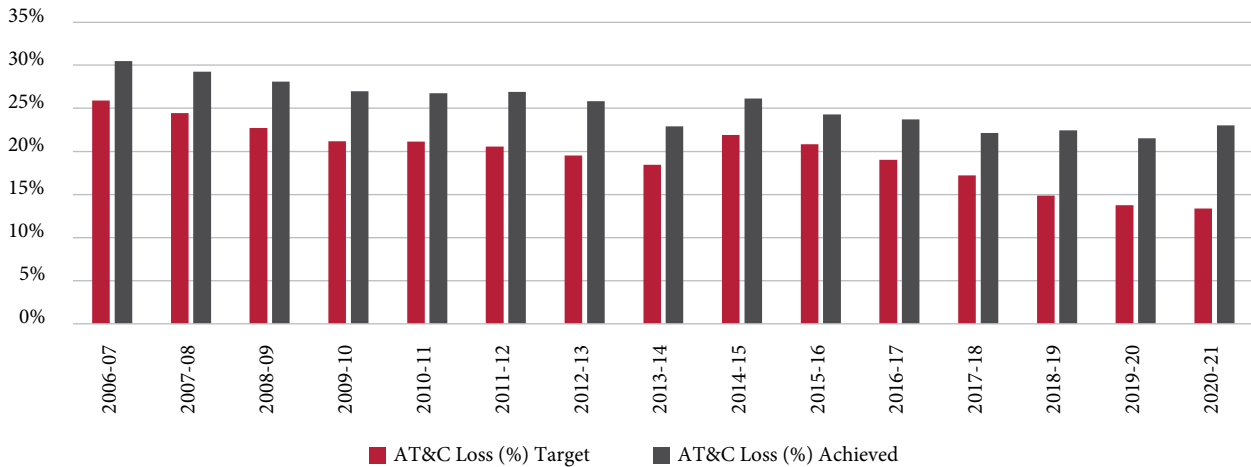
but the loss compared to the target loss level, which is used to set tariffs and set up DisCom profitability. A DisCom with 20% billing inefficiency can have extra revenues if their target was 22%, while a DisCom that has achieved 14% AT&C would bear a financial loss if their target was 13%. The implications of these targets are most relevant at the time of setting tariffs.

To understand the financial impact of (non-) achievement of targets, we manually compile the target AT&C losses across DisComs for these 15 years using the respective tariff orders and compare them with the actual losses. Figure 5 shows the national aggregate targets (which, as per official methodology, includes all collection, including from tariff subsidies) and the corresponding achievements as per official methodology; Figure A2: DisCom-wise billing loss target vs billing loss achieved FY2019-20 provide more details of the components of AT&C losses, broken down by DisComs.

We note that when setting targets, there was broad awareness of the need to lower losses even from 2005 onwards, e.g., the Energy Minister's Conference in 2007 which focused on this. While not all regulators appeared to follow the Abraham Committee (2006) recommendations on accelerated but graded AT&C loss reductions and improvements, there was nonetheless a general tightening of targets (and achievements), though a gap persisted throughout.²⁹

²⁹ The Abraham Committee recommended a 4% annual decline in AT&C losses for high-loss DisComs, reducing to 3%, 2%, and 1% annually by the time the DisCom approached 15%. From our examination, which misses a few of the smaller and private DisComs, only a few DisComs had tariff orders that mentioned these plans, and even fewer implemented them directly.

Figure 5: Summary of AT&C loss targets vs achieved (weighted average of the DisComs under study) from FY2006–07 to FY2020–21



Notes: From 2014–15 to 2017–18, we have data from the IPDS portal, which we assume matches the UDAY trajectories. For 2018–19 to 2020–21, we use the REC (multiple dates)³⁰ compilation of AT&C targets. Earlier data are our compilations from respective tariff orders. We manually added in an allowed (consumer) collection loss, even though many older tariff orders didn't split up the total AT&C loss targets. This covers all public utilities.

Preliminary data for FY22 from PFC (2023) indicate much lower AT&C losses, as low as 16.5%, but most of the improvements appear to be a correction from FY21's lower collection rates, especially a payment of 109% of booked subsidy, which reflects past underpayment.

We see that it's not just the achieved AT&C losses but even the AT&C loss targets haven't been consistently declining over time. FY2014-15 saw a rise in target losses, which then inherently reduces some of the burdens in the cost-revenues gap away from the DisComs. The achieved rise was likely a combination of improved measurements and a "reset" for the ongoing and planned programmes or government schemes.³¹

The FY2020-21 benchmark was that the total AT&C losses should not exceed 13.35%, which was still high by global standards, more so since AT&C losses were only for the DisCom, and thus

excluded transmission losses. In comparison, the achieved AT&C loss level in FY2020-21 was 23.02%, which was still an improvement from 30.47% in FY2006–07, but a measurable worsening from the previous year.

Putting targets and achievements together, we can see that the gap between the two is what causes the financial gap, and this has varied in relative share over the years (Figure 6). Absolute distribution losses in kWh (billing efficiency losses) as achieved have decreased measurably, but so have the targets.

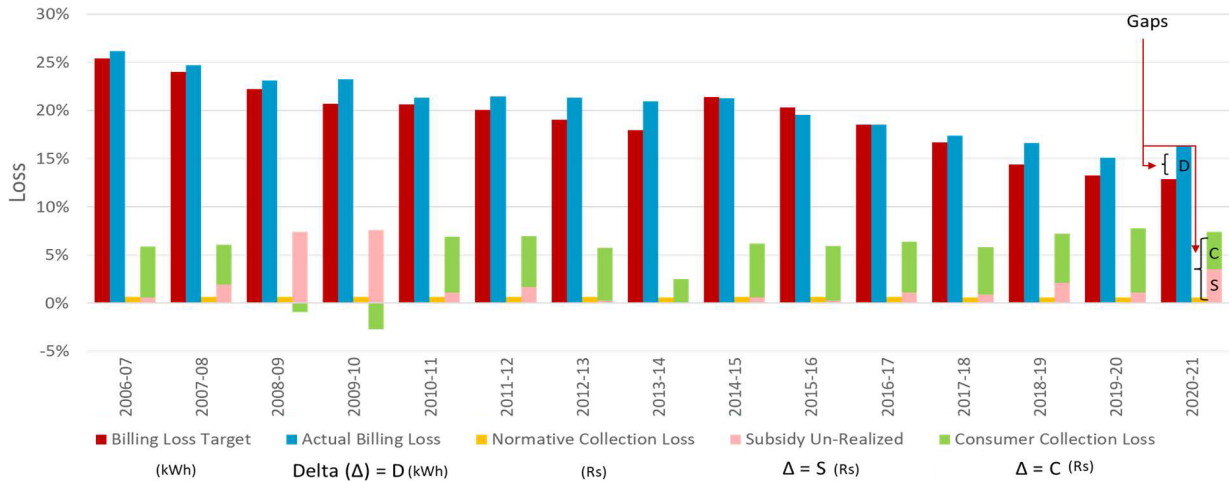
³⁰ We used REC's Reports on Key Regulatory Parameters of Power Utilities November 2021 and June 2022.

³¹ While the UDAY scheme came into force after the FY2014-15 tariff orders were in effect, the UDAY targets superseded them, and thus are visible in official targets at these higher values, which are, in effect, a new baseline.

Similar to Tyagi and Tongia (2023) (in press), we split AT&C loss achievements versus targets based on change in or extra billing inefficiency versus targets (“D”), consumer non-collection compared to targets (“C”), and subsidy non-payment (“S”). As a reference, the all-India benchmark billing inefficiency for FY2020–21 was 12.85% (a weighted average of these DisComs), while put together, S and C should only be about 0.5%; without any further bifurcation mentioned; we assume it should be only in C.

If DisComs over-achieve their billing efficiency targets, regulators typically allow them to retain 50% of the over-achieved value, with the remainder accruing to consumers. Overachievement of collection targets—even efficiency greater than 100%—is possible, as this may be simply rectification of past under-recovery, as seen in some cases in Figure 4. There is also a chance that some of this was gaming in accounting; note how many of the booked subsidies weren’t received in those periods.

Figure 6: AT&C targets versus achievements by component FY2006–07 to FY2020–21



Source: Author compilations and calculations based on tariff orders and REC data.

Notes: These are the weighted averages across all public utilities.

The gaps are the change (or Delta, Δ) between targets and achievements, broken down into components as below:

D = (excess) Distribution network loss = excess billing loss (kWh)

S = Subsidy non-payment loss (Rs)

C = Consumer non-collection loss (Rs)

Splitting up AT&C losses into components is important as, at a policy level, the instruments to tackle each of these types of losses differ. The implications of performance gaps in distribution or billing losses (D), consumer collection (C), or subsidy non-payment (S) also differ.

If the billing inefficiency is high, then the DisCom needs to procure extra power from generators to serve the same load. We, like many regulators, estimate the impact based on extra procurement at the average power procurement cost (APPC). The actual increased procurement cost may vary from this average-based calculation, but there isn't sufficient data available to calculate this more precisely. In reality, the extra power is usually procured from a combination of the short-term market and from existing suppliers, e.g., through PPAs. If it is through the short-term market, the cost need not necessarily conform to APPC, and could be higher for many time blocks. On the other hand, if a generator with whom the DisCom has a PPA has sufficient additional supply (at the right time) to meet incremental demand, the cost to the DisCom is only the variable cost (fuel cost) of the two-part tariff (which segregates fixed and variable charges). Conversely, lowered demand doesn't lower costs equal to the total price in the PPA since they still have to pay fixed costs.³² This highlights the challenge upon DisComs if they have "surplus PPAs."

If the collection losses from consumers ("C") are high, they suffer from cash flow losses, even though the books show revenues under accrual accounting. These are parked as asset "receivables," specifically as "trade receivables" in

the balance sheet. Interestingly, DisCom official accounts don't separately list unpaid subsidies ("S") as a receivable, and, as best as we can tell, their accumulation is not a listed sub-component of any other asset or receivable. Trade receivables do not include unpaid subsidies, since DisComs only measure what was billed to consumers versus what was received (JVVNL, 2017).

Billing inefficiency (i.e., the absolute distribution network loss) improved from 26.2% to 15.1% between FY2006-07 and FY2019-20, but witnessed a rise to 16.4% in FY2020-21, due to the impact of COVID-19 lockdowns during this period. There have been significant improvements in billing efficiency, though they have not been consistent during the period from FY2006-07 to FY2020-21. There is an uptick observed in 2014-15, which is aligned with the overall AT&C uptick we saw before, which might also have been due to improved measurements and accounting. The recent uptick in D losses (the gap between target vs achieved distribution network or billing losses) is also driven by tightened targets in the last two years. As mentioned before, AT&C loss calculations are fraught with assumptions, lending themselves to reverse engineering.

Note that these numbers are in nominal or current rupee terms, and on a much smaller total volume of sales than in FY07, so AT&C losses used to be a far bigger relative financial hit to DisComs in the past.

In contrast to billing efficiency, the total collection loss during the same period compared to units billed actually increased from 5.83% in FY2006-07 to 7.94% in FY2020-21, with the volume of total

³² As Tyagi and Tongia (2023) (in press) note, there is a substantial change in power procurement cost for most DisComs between *ex-ante* (tariff orders) and *ex-post* (as realised). Much of this may stem from changes in volume, which is separate from the billing inefficiency caused increased procurement. There is no easy way to segregate these factors, not without contract-level data for power procurement.

sales from these public utilities growing almost 2.5 times from 392 BU (billion units, or kWh) to 913 BU. (Figure A3 provides DisCom-wise total collection loss target vs collection loss achieved FY2019-20). In the past, many regulators either didn't segregate collection losses from billing inefficiency or simply assumed 100% collection efficiency. However, more recent explicit norms factor in a small (0.5% or so) allowed collection loss for tariff-setting, and so we also use this level for historical analysis when setting targets. This keeps any "residual loss" (which is unexplainable even after accounting for DisCom failure to perform to meet the targets or other explainable factors) as a conservative calculation.

Not only have consumer collection losses grown, they have also varied significantly over time. Officially, such losses even briefly turned negative. From a low level a few years back, there has been a rise of consumer collection losses in recent years, especially in FY2018-19 and FY2019-20 (even before the full effects of COVID-19). This loss level, against the prototypical level of 0.5%, is significant, and has grown from Rs 6,688 crore in FY2006-07 to Rs 42,523 crore in FY2020-21. Table 6 shows the trends of D and C (the components of AT&C losses directly under DisCom responsibility) compared to their targets. We can also see the impact per unit sold (Rs/kWh). D has grown measurably, but this is largely because of tightened billing efficiency targets; the absolute billing rates have improved over time.

Given that different tools are required to address each area of lapses—technical losses, non-collection, and theft (often due to hooking or meter tampering)—each DisCom will need distinct strategies and instruments to address them.

5.3. Causes of the Gap: Un-realised Subsidy

Tariff subsidies are not a loss to the DisCom, unless unpaid—they are simply a shift in who pays the regulator-established tariff. State governments often announce subsidies in order to help consumers who have low-paying capacity. Though subsidies are also announced for electoral reasons, they are predominantly targeted at selected categories of households and almost all agricultural consumers. This means that the DisCom is meant to recover a part of its revenue directly from consumers through tariff collection and another part from the state government as subsidy. Importantly, such support is distinct from any cross-subsidy the regulator may set within tariffs, where some consumers over-pay and others under-pay.

Table 7 shows the tariff subsidies over time across India, both booked (promised) and realised (paid by the State). The gap, "S," is a subset of official total collection losses under official AT&C reporting, the other component being collection from consumers. We segregate these. National data mask heterogeneity, where some states are especially behind in paying subsidies. For e.g., the unrealised subsidy in case of Madhya Pradesh Madhya Kshetra Vidyut Vitran Nigam Limited (MPMaKVVNL) in FY2020-21 was Rs 1.05 per kWh, compared to the national average of Rs 0.22 per kWh.

While unpaid subsidies are clearly an issue, even the reliance on subsidies is a worrying trend. Subsidies as share of cost of supply have doubled over these 15 years (as can be seen in Figure 2).

Table 6: Impact of technical and commercial losses over and above the targets, in terms of energy and revenue (public utilities and state power departments)

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
AT&C Loss Achieved (%)	30.47%	29.26%	28.08%	26.99%	26.74%	26.90%	25.82%	22.91%	26.12%	24.30%	23.72%	22.15%	22.44%	21.50%	23.02%
Average Power Purchase Cost (Rs/kWh)	2.47	2.68	3.16	3.21	3.49	3.95	4.37	4.49	4.40	4.09	4.13	4.19	4.63	4.70	4.68
Average Cost of Supply (ACoS) (Rs/kWh)	3.93	4.10	4.68	4.88	5.36	6.07	6.71	6.93	6.96	7.02	7.04	7.12	7.73	7.69	7.91
Average Billing Rate (Rs/kWh) inclusive of subsidies booked	3.30	3.51	3.90	3.99	4.12	4.48	5.11	5.48	5.78	5.75	5.77	5.97	6.16	6.30	6.32
Billing Inefficiency															
Billing Inefficiency (%) = (1 – billing efficiency)	26.17%	24.69%	23.10%	23.25%	21.33%	21.44%	21.31%	20.93%	21.24%	19.52%	18.54%	17.36%	16.58%	15.04%	16.38%
Billing Inefficiency Beyond Target (%)	0.75%	0.73%	0.88%	2.59%	0.68%	1.37%	2.30%	2.97%	-0.16%	-0.81%	0.01%	0.66%	2.22%	1.80%	3.53%
Billing Inefficiency Beyond Target (million kWh)	3,975	4,128	5,186	16,764	4,651	10,122	17,696	23,914	-1,439	-7,403	122	6,757	24,065	19,625	38,511
Excess Billing Inefficiency (Beyond Target) (Rs crore) (Basis Gross Input Energy at APPC)	980	1,107	1,637	5,387	1,623	4,000	7,735	10,744	-633	-3,024	51	2,829	11,150	9,223	18,022
Impact of Excess Billing Inefficiency (Beyond Target) (Rs/kWh sold)	0.02	0.02	0.03	0.08	0.02	0.05	0.10	0.13	-0.01	-0.03	0.00	0.03	0.10	0.08	0.16
Total Collection Loss (consumer + subsidy)															
Total Collection Loss as fraction of billed (%)	5.83%	6.07%	6.48%	4.86%	6.87%	6.95%	5.73%	2.51%	6.20%	5.94%	6.35%	5.79%	7.02%	7.61%	7.94%
Total Collection Loss (Beyond Target) (%)	5.16%	5.41%	5.84%	4.23%	6.24%	6.32%	5.11%	1.90%	5.56%	5.32%	5.74%	5.19%	6.44%	7.03%	7.37%
Excess Collection Loss (Beyond Target) (Rs crore) (Basis Gross Energy Sold)	6,688	8,121	10,354	8,366	13,754	16,410	15,823	6,631	22,271	22,454	25,411	26,036	35,799	41,113	42,523
Impact of Excess Collection Loss (Beyond Target) (Rs/kWh sold)	0.17	0.19	0.23	0.17	0.26	0.28	0.26	0.10	0.32	0.31	0.33	0.31	0.40	0.44	0.47

Note: Official government collection losses include non-payment of subsidies, which we segregate and do not include as part of the consumer collection losses as shown here. We do not know the split of which consumers (with what billing rate) didn't pay, and hence use the average billing rate (ABR) of the DisCom to calculate the rupee losses for cases where collection losses are given in units basis instead of in rupees. Collection loss calculations here include subsidy not received, which aligns with the government methodology. Hence, this differs from Figure 4, which indicates consumer collection loss and loss due to unpaid subsidies separately.

Table 7: Unpaid subsidy and its impact per unit energy (net energy sold basis) (public utilities)

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Subsidy Booked (Rs Cr.)	13,590	19,386	28,877	34,014	22,705	30,009	36,885	37,052	47,965	74,160	82,326	90,917	1,08,147	1,18,391	1,29,267
Subsidy Booked as share of cost of supply	8.82%	11.06%	13.57%	14.06%	7.92%	8.53%	9.08%	8.39%	9.96%	14.40%	15.24%	15.20%	15.49%	16.60%	17.90%
Subsidy Realized (Rs Cr.)	12,836	16,517	15,722	19,074	20,334	25,771	36,100	36,758	45,584	73,061	77,386	86,544	96,951	1,12,505	1,09,039
Subsidy Un-Realised (Rs Cr.)	754	2,869	13,155	14,940	2,371	4,238	785	294	2,381	1,099	4,940	4,373	11,196	5,886	20,228
Subsidy Un-Realized as fraction of subsidy booked (%)	5.55%	14.80%	45.56%	43.92%	10.44%	14.12%	2.13%	0.79%	4.96%	1.48%	6.00%	4.81%	10.35%	4.97%	15.65%
Subsidy Un-Realised (Rs/kWh sold)	0.02	0.07	0.29	0.30	0.04	0.07	0.01	0.00	0.03	0.01	0.06	0.05	0.12	0.06	0.22

Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2007 - 2021).

During the period between FY2006-07 and FY2020-21, the unrealised subsidy increased from Rs 754 crore to Rs 20,228 crore. On normalisation, the subsidy non-realisation increased from 2 paise per kWh in 2006-07 to 6 paise per kWh in 2019-20, with swings as high as 0.30 Rs/kWh, which in 2009-10 was 14% of the total cost of supply. While the non-realised revenue may appear small per unit, especially today, the cumulative effect is substantial, as we show subsequently, more so when benchmarked against dues to generators instead of costs. The impact on selected states also varies enormously, as shown in Appendix 6.³³

5.4. Causes of the Gap: Un-recovered Regulatory Income

In the case of some distribution utilities, even though regulators agree to a set cost of supply, they do not set full-recovery level tariffs, ostensibly because this may subject consumers to a tariff shock. Regulators thereby defer recovery of a part of the costs, categorising it as “regulatory income”. Such regulatory income (RI) leads to “regulatory assets” (RA) on the balance sheets, which are the aggregation of money due to the DisCom through future tariff recovery but not yet operationalised.³⁴ In theory, based on rulings by the super-regulator APTEL, state regulators should not be building up any regulatory assets, and for those DisComs that have regulatory assets, these are meant to be liquidated via tariff hikes in a short and “reasonable” time period, conventionally believed to be five years.

While deferring recovery to a future period, the regulator allows interest costs on the deferred amount as part of annual revenue requirement leading to the tariff. While the creation of regulatory assets is an old practice in the electricity industry, consistent data are available only for the last six years, shown in Figure 7. We also show, as a reference, private utilities in this figure since the regulatory income problem impacts private utilities significantly.

Appendix 7 has the per-state breakdowns.

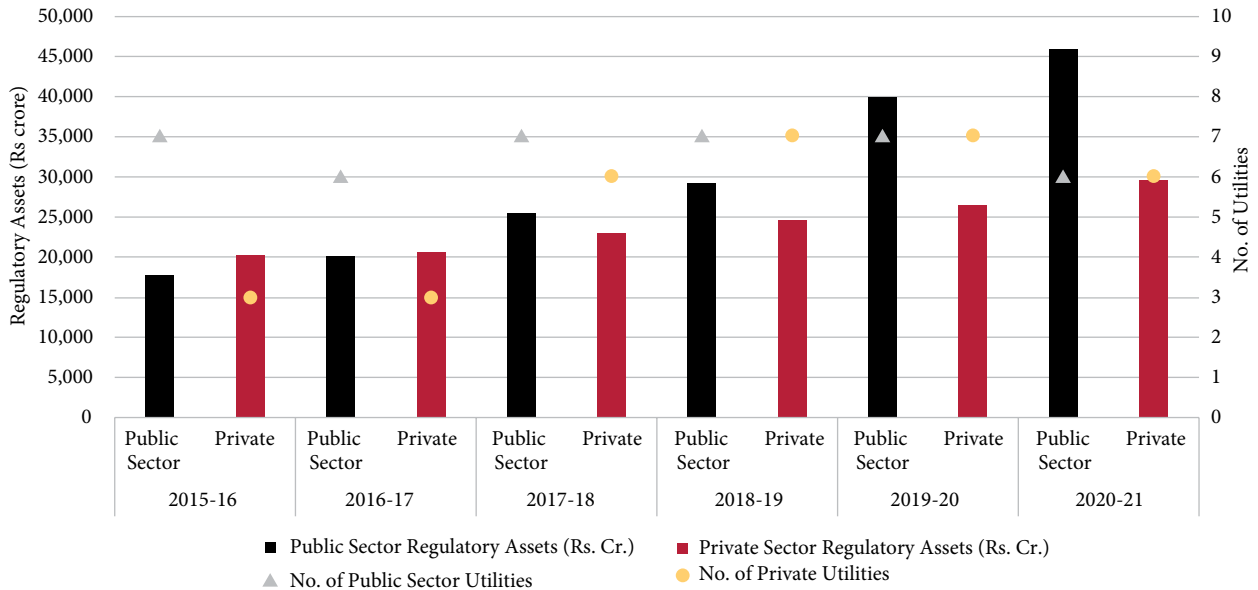
5.5. Putting it all together: Unexplained Gap between Average Cost of Supply (ACS) and Average Revenue Realised (ARR)

Given that electricity distribution is a regulated business, in the normal course of operations, any gap between cost of supply and revenue recovery should be explained through unmet AT&C loss targets, un-realised subsidy, and unrecovered regulatory income. In other words, if a DisCom achieves normative AT&C loss targets and fully receives the subsidy while having no regulatory income, it shouldn't have any gap between the cost of supply and revenue recovery. *This assumes tariffs were set commensurate with costs, and that there weren't any other hidden causes for gaps.*

However, even when we account for all the above factors like excess distribution loss beyond targets (D), consumer non-collection beyond targets (C), subsidy non-payment (S), and the provision of regulatory income (RI), there still remains a substantial gap between costs and revenues, a key question examined in this paper.

³³ Just like with consumer collection, in some cases, subsidy realised can exceed 100% of the target or booked value—this is likely simply based on past arrears being covered.

³⁴ The sum of regulatory income doesn't equal the accumulated regulatory assets on the books since some of those are liquidated as theoretically required, but we don't have breakdowns on gross regulatory asset declines across all years. It might also potentially reflect limited adjustment for changes in consumer mix, but data on this are not broken down.

Figure 7: Accumulation of regulatory assets from FY2015-16 to FY2020-21

Source: Authors' compilation from PFC Reports on Performance of Power Utilities (2015-2021).

Notes: The lighter shade triangles are for public utilities, and lighter shade circles are for private utilities.

Regulatory assets (RA) have grown by 75%, from 38,040 crore to Rs 75,544 crore, in a span of just five years. The national average impact of regulatory income (RI) generated in FY2020-21 was an average gap of Rs 0.08 per kWh (net energy sold basis), but this figure is misleading since most DisComs have zero regulatory assets. We note that this issue impacts not just public DisComs but also private ones, especially in Delhi (which are not part of general sample of public utilities in this paper's time series). Delhi's Rs 25,906 crore regulatory assets are equal to a whopping 10.27 Rs/kWh for a one-time conversion (based on net energy sold in FY2020-21), while in Maharashtra (MSEDCL), the regulatory assets stood at Rs 1.75/kWh in FY2020-21.

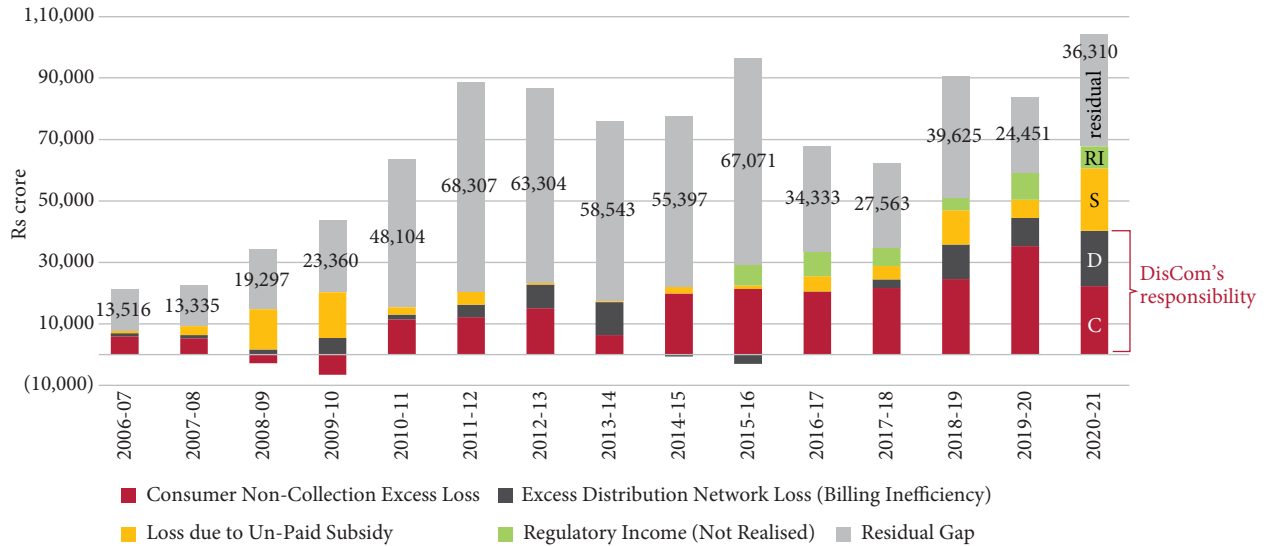
Tyagi and Tongia (2023) (in press) show that there are enormous gaps between *ex-ante* plans (as envisaged in tariff orders) and *ex-post* reality, a good part of which is not attributable to DisComs' performance. As we will see subsequently, even true-ups that should correct for changes in costs or revenues compared to plans don't bridge the gap entirely. The failure to have a sufficient tariff after accounting for all explainable reasons leads to a *residual gap*, a large fraction of whose responsibility falls upon the regulators, but also on the regulatory process.

In this section, we segregate the explainable factors and residual gap in more detail.

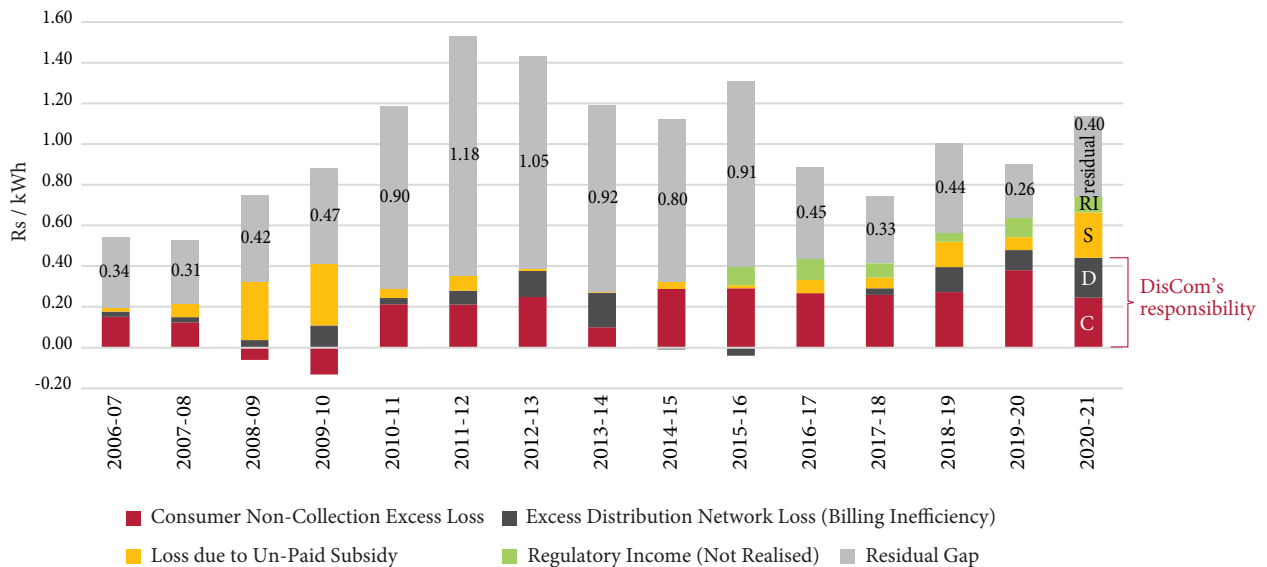
Figure 8 shows a compilation of the various components of the gap as realised. Given that this is the compilation for around 90% of the energy (units in kWh) sold in the country, the actual total gap might be higher. However, what is missing are predominantly the smaller suppliers like in the northeast or private (urban) DisComs, so the actual national gap is expected to be only a bit higher.

Figure 8: Break-up of cost-revenue gap from FY2006-07 to FY2020-21

a. Cost-Revenue gap components in Rs crore



b. Cost-Revenue gap components in Rs/kWh



Source: Calculated for public utilities based on PFC Reports on Performance of Power Utilities (2007-2021) data, with author bifurcations.

Notes: (a) is the absolute gap in Rs crore, which reflects rising volumes (a 2.32-fold growth in 15 years). (b) shows the gap in per unit terms, which highlights more of an improvement over the last 8 years, especially in terms of residual gap (excluding FY2020-21 which may be an outlier).

The negative impact of the COVID-19 lockdown (24th March, 2020 onwards) on revenue collections and the consequent rise in “consumer non-collection extra loss” in FY2019-20 cannot be calculated since granular billing and collection data are not available. But the impact is non-zero given that February’s consumption isn’t billed till the next month, and would be due only subsequently.

Regulatory income may have been there in prior years, but is not well documented. To the extent present, it would reduce the residual gap.

We show the same trend on a per-unit basis in part (b) of Figure 8, which inherently adjusts the Rs crore totals from Figure 8 (a) for rising volume.

On a per-unit basis, the net gap between costs and revenues for FY2020-21 was 1.14 Rs/kWh. The sum of the explainable components, i.e., the un-met AT&C loss target (specifically, billing inefficiency and consumer collection loss beyond targets, i.e., D and C), un-realised subsidy (S), and un-recovered regulatory income (RI) together stood at 0.74 Rs/kWh. This left a residual gap of 0.40 Rs/kWh or 3.43% of the total cost. In absolute terms, the residual gap remaining was Rs 36,310 crore. This is visible in the Sankey diagram even at the booked level (Figure 3).

Importantly, this is the calculation for net residual gap *after* including unplanned other income and grants, or support beyond formal subsidies.³⁵ Tariff setting doesn't assume such support, so the true financial gap would be even higher if one didn't have such support. If one considers the gross gap for FY2020-21, before grants, it is even higher at 1.69 Rs/kWh or Rs 1,54,743 crore. This indicates that grants and other income alone have reduced the impact on gap by 0.55 Rs/kWh, of which approximately 20% might be grants in a given year.³⁶

In an ideal world, any fix for the financial gap should also cover such support and other revenues

such that we wouldn't need taxpayer support, but, for most of the remaining paper, we treat such support as incoming revenue to DisComs, leaving a commensurately smaller gap.³⁷ However, it is worth emphasising that at the tariff order stage, such revenues are not taken into consideration.

5.6. Time Series Analysis of how the ACS-ARR Gap Evolved

The ACS-ARR (cost-revenues) net gap (which includes grants and other income) as a share of the total costs has halved from its peak in FY2011-12 (Figure 9). However, the rising volume means the absolute gap remains similar in the most recent two years, despite some improvement in between. The overall share of the gap in FY2019-20 is not much better compared to 14 years ago, even treating FY2020-21 as an outlier due to COVID-19. This equilibrium is heavily driven by rising revenues not coming from consumers (mainly tariff subsidies) as Table 5 shows.

Table 8 shows the time series trend at several levels of revenues and accounting. We first have the book based gap, which excludes grants and other income. We then see the gap on an as-realised basis, also excluding grants and other income. We then add those in to find the net total gap inclusive of grants and other income, which are treated as revenues.

³⁵ Support has come from a range of operational grants, which are distinct from capital grants under central schemes, and post FY2014-15 has included measurable support through UDAY scheme grants. Other income that is not planned by regulators, for the most part, includes penalties paid by consumers or consulting services income, but in a few cases can include "fixed charges" compiled by PFC that ideally should have been part of operational revenues.

³⁶ Official data combines other income and grants outside the tariff order headings, and we assume that grants account for 20% of the total, but this varies over time. We only have a few years of data, and this is a conservative estimate.

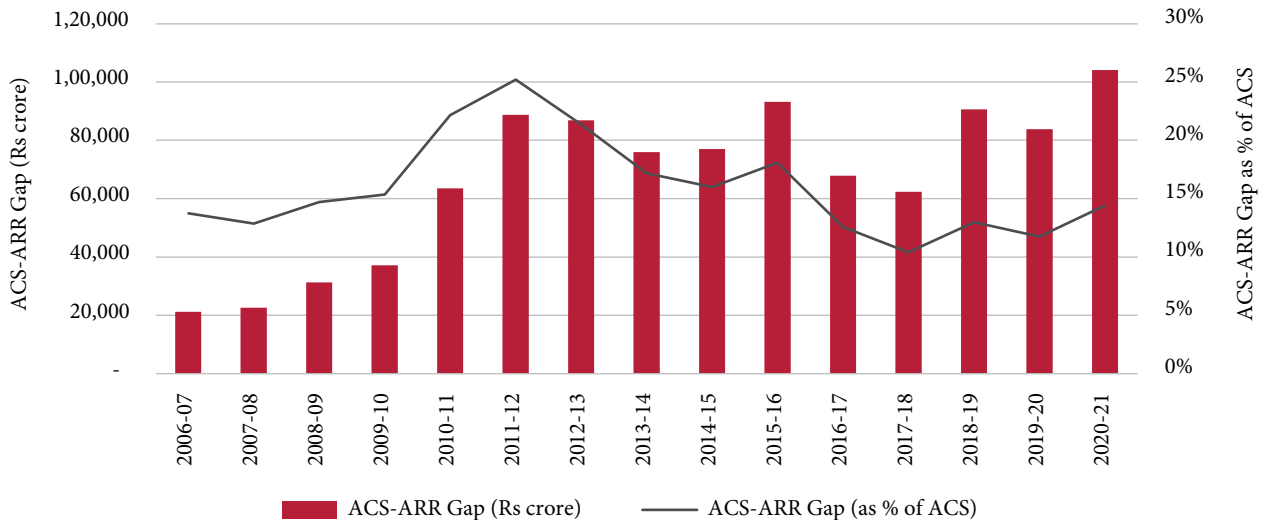
³⁷ These grants are typically meant for specific purposes, including infrastructure development or financial restructuring. They are incoming funds to the DisCom, but if they create value over time, they should be amortised when considering annual P&L statements or otherwise adjusted. Since we don't have details on these funds, we keep them as is, and their addition reduces the net losses targeted for improvement.

Table 8: Stage-wise growth of gap between cost and revenue (ACS-ARR gap) from FY2006-07 to FY2020-21 (public utilities and power departments)

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Cost of Supply (Rs Cr.)	1,54,058	1,75,324	2,12,741	2,41,889	2,86,577	3,51,712	4,06,353	4,41,855	4,81,757	5,14,941	5,40,325	5,98,199	6,97,983	7,13,289	7,22,126
Net Energy Sold (million kWh)	3,92,357	4,27,473	4,54,784	4,95,850	5,34,841	5,79,597	6,05,425	6,37,368	6,92,475	7,33,958	7,67,923	8,40,653	9,03,279	9,27,858	9,13,475
Avg. Cost of Supply (ACoS, aka ACS) (Rs/kWh sold)	3.93	4.10	4.68	4.88	5.36	6.07	6.71	6.93	6.96	7.02	7.04	7.12	7.73	7.69	7.91
Revenue (ARR) (Booked) from Consumers and other Operations (Rs Cr.)	1,24,082	1,39,374	1,60,486	1,76,441	2,10,933	2,45,655	2,93,953	3,30,483	3,73,343	3,64,016	3,78,544	4,25,151	4,77,689	4,96,554	4,80,639
Revenue (ARR) (Booked) from Consumers and other Operations + Subsidy Booked (excl. Grants) (Rs. Cr.)	1,37,672	1,58,760	1,89,363	2,10,455	2,33,638	2,75,664	3,30,838	3,67,535	4,21,308	4,38,176	4,60,870	5,16,068	5,85,836	6,14,945	6,09,906
Cost-Revenue Gap (Rs. Cr.) (Booked Basis, excl. Grants)	16,386	16,564	23,378	31,434	52,939	76,048	75,515	74,320	60,449	76,765	79,455	82,131	1,12,147	98,344	1,12,220
Revenue Realized (Revenue from Operations + Tariff Subsidy) (Rs Cr.)	1,30,985	1,50,638	1,79,009	2,02,089	2,19,884	2,59,254	3,15,014	3,60,904	3,99,036	4,15,722	4,35,459	4,90,032	5,50,037	5,73,832	5,67,383
Cost-Revenue Gap (Rs. Cr.) (Realized Basis, excl. Grants)	23,073	24,686	33,732	39,800	66,693	92,458	91,339	80,951	82,721	99,219	1,04,866	1,08,167	1,47,946	1,39,457	1,54,743
UDAY Grant (Rs Cr.) (Realised)	0	0	0	0	0	0	0	0	0	0	13,833	19,676	17,878	15,281	5,555
Other Income & Revenue Grants (Rs Cr.) (Realised)	1,890	2,122	2,444	2,687	3,212	3,741	4,476	5,033	5,685	6,082	23,194	26,130	39,440	40,347	45,097
Cost-Revenue Gap (Rs. Cr.) (Realised Basis, Incl. Grants)	21,184	22,563	31,288	37,113	63,481	88,717	86,862	75,918	77,035	93,137	67,839	62,361	90,628	83,829	1,04,091
Cost-Revenue Gap as percentage of GDP (%)	0.0051	0.0047	0.0058	0.0059	0.0084	0.0107	0.0092	0.0071	0.0066	0.0071	0.0046	0.0038	0.0050	0.0043	0.0052
ACS-ARR Gap (Rs/kWh) (net energy sold basis)	0.54	0.53	0.69	0.75	1.19	1.53	1.43	1.19	1.11	1.27	0.88	0.74	1.00	0.90	1.14
ACS-ARR Gap as share of total cost of supply (Realised Basis, incl. Grants)	13.75%	12.87%	14.71%	15.34%	22.15%	25.22%	21.38%	17.18%	15.99%	18.09%	12.56%	10.42%	12.98%	11.75%	14.41%

Source: Calculated using data cited in PFC reports on performance of power utilities (2007-2021).

Notes: The break-up of income as revenue from consumers, other operations, other income & revenue grants was not available for FY2006-07 to FY2014-15. Hence, revenue from consumers and other operations (booked values) for FY2006-07 to FY2014-15 considered as 98.5% of the total income booked. For the same period, revenue under "other income & revenue grants" considered as 1.5% of total income.

Figure 9: Growth of final ACS-ARR Gap – absolute and relative – between FY2006-07 and FY2020-21

Source: Calculated for public utilities based on PFC Reports on Performance of Power Utilities (2007-2021) data.

Notes: These are the total gaps as realised, after including revenue from tariff subsidy, grants and support such as from the UDAY scheme, but excluding regulatory income, which are revenues not realised.

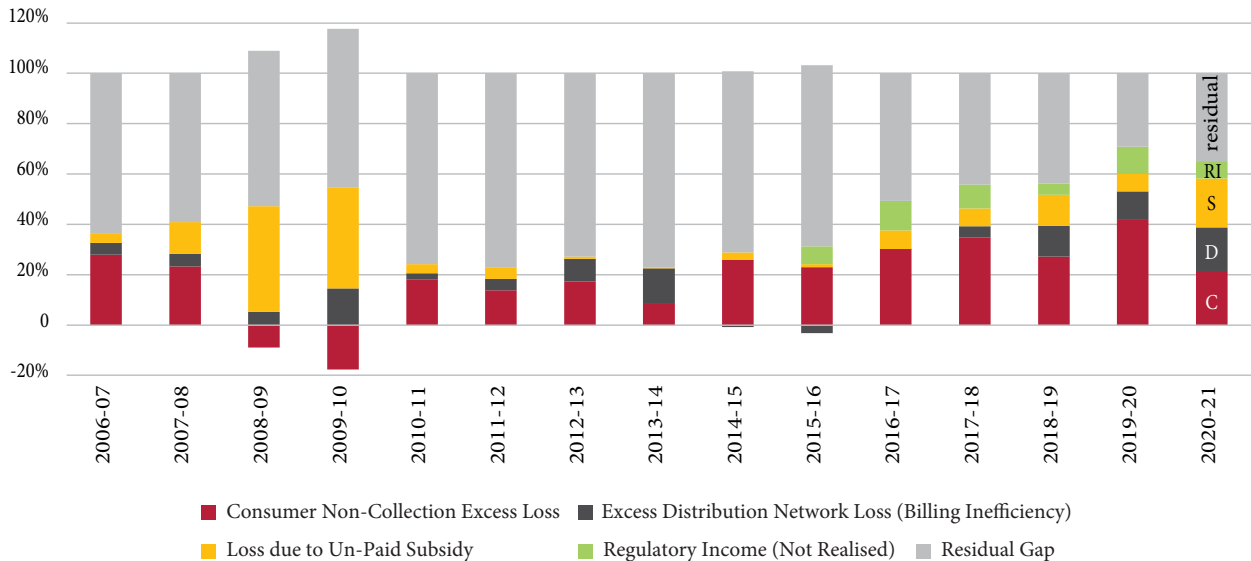
The growth in overall gap in absolute terms is partly explained by the rising volume of sales, so normalising for the share of gap across the components is useful (Figure 10). While the residual gap used to account for the highest share of the gap; non-collection from consumers not only ranks as the second highest overall across the period, but, by FY2019-20, it has grown to the largest individual component. Note that based on the targets set, there were periods of negative gap for some components, like consumer collection in FY2010. This might have been due to compensation for past under-collection, and it's also possible there were other accounting manoeuvres at play. Note that the subsidy non-collection jumped higher in that period. It's worth reiterating these are the gaps post including grants and other income (non-tariff-subsidy support).

To smoothen out the effect of volatility, we can examine the cumulate gap and respective cumulative contributions across components over time (Figure 11). We see that residual gap

is around 59% of the total gap over these 15 years for public utilities, but other components are gaining share, especially consumer non-collection.

Given that the financial gap results in a cash-flow burden on the DisCom, which might require more working capital (or loans, equity, or delaying payments to suppliers), one could assign a notional carrying cost to this gap, more so for gaps that aren't the fault of the DisCom. However, when they do take more debt or fail to pay a generator, they are already paying interest or an equivalent late payment surcharge (LPSC). Even regulatory assets are given an interest charge by the regulator when they set the annual revenue requirement (cost structure of the rate base). Thus, we don't add carrying costs to these accumulations. Interestingly, virtually none of the non-payment of subsidies by the state attracts interest (Punjab State Power Corporation Limited (PSPCL) is an exception).

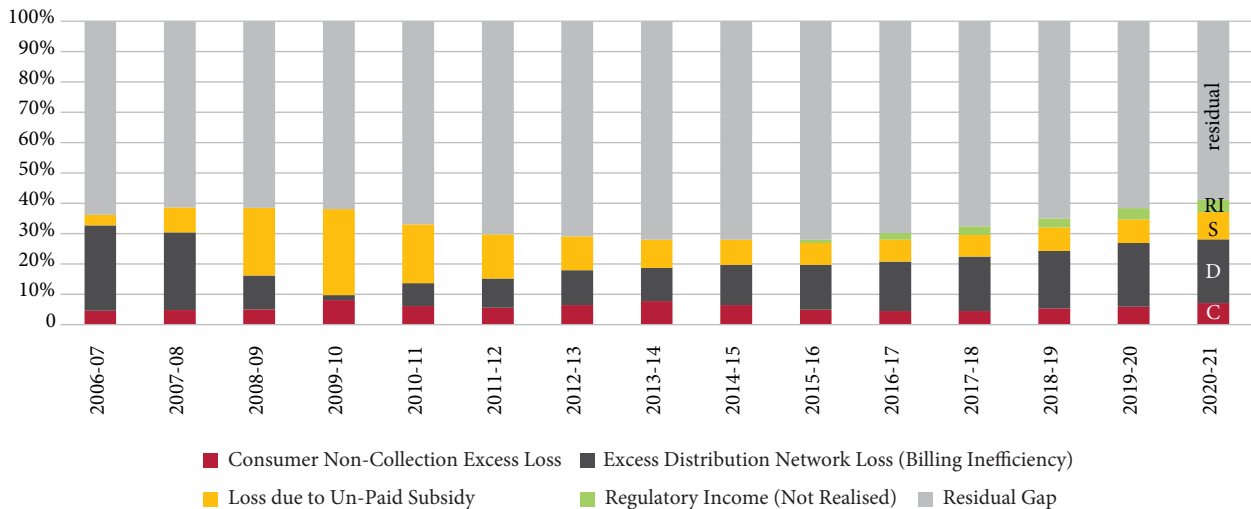
Figure 10: Annual share of components of the gap as-realised (public utilities and power departments)



Source: Calculated using data cited in PFC reports on performance of power utilities (2006-2021).

Notes: These are as-realised, instead of book values (accrual basis). Data on regulatory income (not realised) prior to FY16 aren't well compiled, but it was likely small.

Figure 11: Components of the gap on a cumulative basis (public utilities and power departments)



Source: Calculated using data cited in PFC reports on performance of power utilities (2007-2021).

A summary of the gap components, their sum along with implications are given in Table 9.

Table 9: Components of the gap (cumulative) over FY2006-07 to FY2020-21 (public utilities and power departments)

	Cumulative Loss (Rs crore) and Share of total gap	Implications	Financial Remedy	
DisCom responsibility	D = Excess billing inefficiency	70,829 (7.1%)	Operational loss – book basis (and cash basis)	Nil
	C = Excess consumer non-collection	2,12,247 (21.1%)	Operational loss – cash basis; balance sheet asset (“Trade Receivable”)	Theoretically recoverable
	S = Subsidy non-payment (by the state)	89,509 (8.9%)	Operational loss – cash basis; doesn’t appear to show up as an asset	Theoretically recoverable but low likelihood; isn’t separate on DisCom books
	RI = Regulatory Income	40,945 (4.1%)	Operational loss – cash basis; balance sheet asset	Meant to be recovered in a “reasonable” timeframe via tariff increases
	Residual gap	5,92,518 (58.9%)	Missing source of financial problems	Regulators need to recognise the gap and raise tariffs accordingly
Total Gap	10,06,048 (100%)			

Source: Calculated using data cited in PFC reports on performance of power utilities (2007-2021).

Notes: This is based on the gap as-realised, based on revenue including grants like UDAY and other non-operational income. Even within consumer non-collection, a measurable fraction comes from governmental (State and local) consumers, so it’s a stretch to call it entirely the DisCom’s responsibility.

If we only look at a single year in isolation, some of the gap between the *ex-ante* tariff order and the *ex-post* actuals is recovered via the true-up, but this year’s revenues also included extra costs allowed to cover the true-up from two years ago. Assuming the pipeline of true-ups stays relatively proportional, the true-up coverage

percentage of the spread between *ex-ante* and *ex-post* isn’t a major factor for considering the year’s residual gap, which is only a function of the annual operating gap and the extent that is not explainable by the four listed factors (D, C, S, RI). We dig into the implications of the listed factors and the residual gap in subsequent sections.

6. Implications of the Financial Deficits

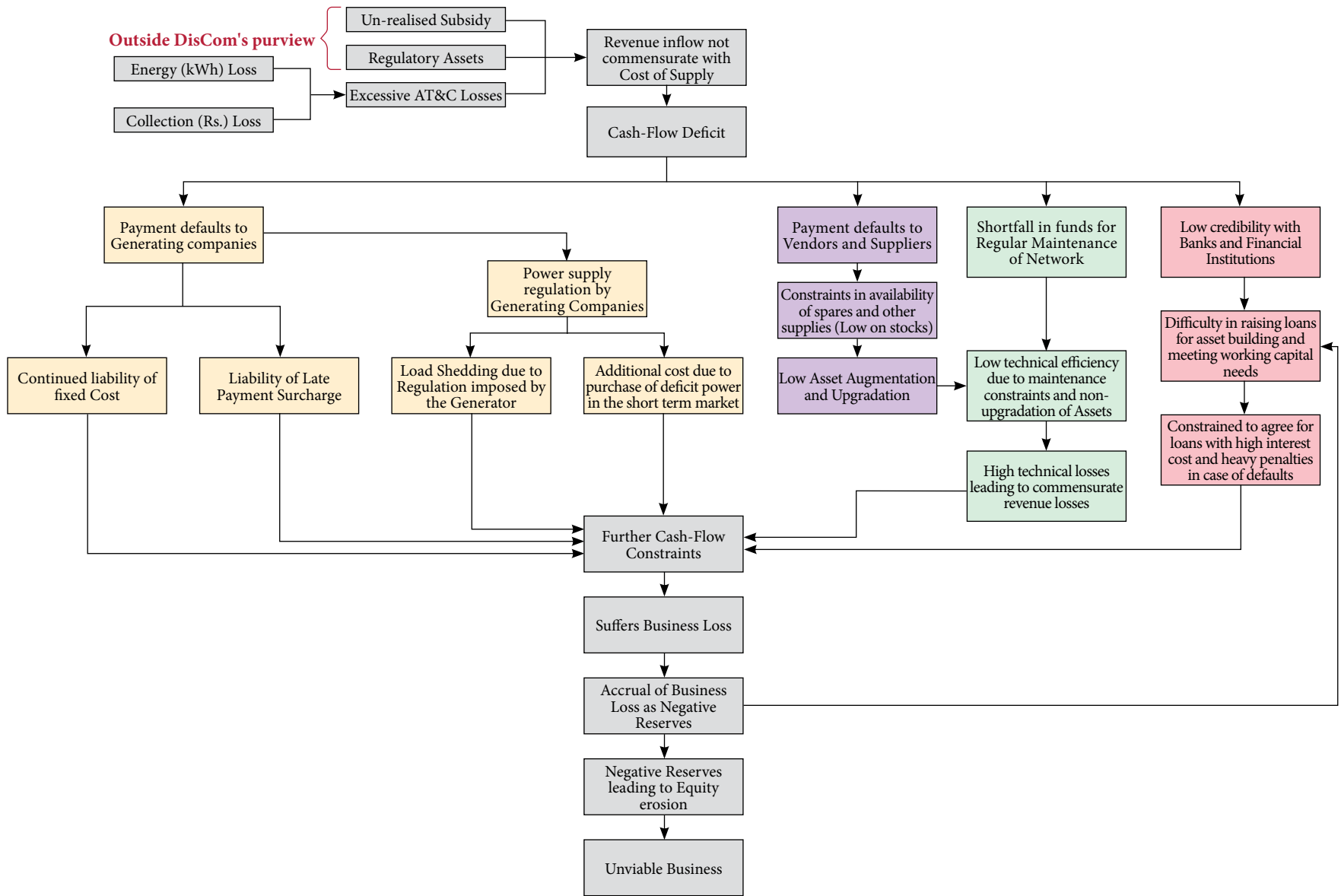
Being loss-making impacts everything from DisCom financials, costs-of-capital, ability to pay suppliers including generators, ability to invest in operations hurting quality of supply, and, ultimately, the health of the balance sheet.

We have seen the enormous cash flow losses DisComs face every year. The causes are split between DisComs' non-performance (of different types), failure to receive subsidies, creation of regulatory assets, and finally a residual gap. Regardless of cause, what does the gap mean for the business?

There are three main types of implications of the gap. First, annual losses show up in the balance sheets (discussed in subsequent sections), and they also show up in terms of weakened cash flows. This increases their delayed payments (payables), such as to generators. Second, the

accumulation of such deficits over a period erodes the credibility of the utility, and affects its ability to raise loans and working capital needs (as Devaguptapu and Tongia (2020) showed), at least in reasonable terms. Third, the lack of cash means an inability to invest in revenue-accretive and loss-preventative investments, resulting in more system failures, poorer quality of supply, etc. Ultimately, these risks turning the DisComs into sick units. DisComs also have muddled along at best, with a combination of intense support (such as bailouts and access to finance) and neglect (from oversight and consequences) (Figure 12).

Figure 12: Flow statement showing effects of operational and financial inefficiency on the viability of the distribution business



Source: Authors' analysis.

Notes: In some cases, higher costs can lead to higher revenue requirements, with subsequent tariff hikes instead of only further cash-flow losses.

7. Measure of the Actual Financial Deficit

There are 3 main measures of the health of a company – the operating performance (profit & loss statement, or P&L), cash accounting (which is distinct from the accrual basis accounting of a P&L), and the balance sheet. In this section, we examine the balance sheets in more detail, and link annual operations to the accumulated picture in the balance sheet.

- Many cash basis losses are ones of not getting paid for booked income or revenues, and accumulate on the balance sheet as assets, including Regulatory Assets (created by regulators) and Trade Receivables (non-payments by consumer).
- Un-paid subsidies are not shown as line items in the balance sheets, hence no reconciliation takes place.
- The residual gap we identified closely matches accumulated deficits in the balance sheet.
- On an annual basis, in the balance sheets the sum of the ‘Residual Gap’ and ‘Un-Paid Subsidy’ compared to the ‘Change in Accumulated Deficit’ closely match in most years (with periodic unexplained outliers once every 5 years).

We have seen the operating (profit and loss) issues of DisComs, compounded at the level of cash accounting. The third pillar of understanding an entity’s finances is the balance sheet, which gives a cumulative snapshot, and only all three put together paint a complete picture of the situation. The US Government’s Securities and Exchange Commission (US SEC, 2007) has a primer on understanding these three financial statements and their importance. For our purposes, we are interested in how and why operating (annual) gaps accumulate and show up on the balance sheet. This is where payables and receivables also show up (as liabilities and assets, respectively). A key measure of interest is the accumulated surplus (or deficit), explained in more detail in the box.

The detailed components of the DisCom balance sheets are complex, but many of the failures at an operational level end up as “assets” on the balance sheet, e.g., regulatory assets or trade receivables. Importantly, as discussed before, PFC’s compilation of the balance sheets does not include unpaid subsidies as a separate asset. We also couldn’t find them in the corporate filings with the Ministry of Corporate Affairs (MCA, 2014-2019), not even as “other receivables.”³⁸ These are also not part of trade receivables, which, for DisComs, as far as we have seen, are unpaid dues from consumers.

³⁸ There are many “other receivables” possible, especially for trades and transfers of power. For example, in the case of BESCOM, their FY2018–19 audited Annual Report shows most of the other receivables to be for inter-ESCOM sales and other similar transactions.

Highlights of Balance Sheets and DisCom Nuances

A general balance sheet looks like:

$$\text{Total Assets} = \text{Total Liabilities} + \text{Total Equity}$$

where

$$\text{Total Equity} = \text{Shareholder paid-up capital} + \text{Reserves}$$

Assets are typically tangibles and intangibles, the latter being things like goodwill. Most DisComs reflect zero value for intangibles. Tangibles are the operating assets, land, financial securities, cash, etc., plus the dues owed to the DisCom, including the regulatory assets. Assets seen here are book value assets, post-depreciation, even though the practical assets—which don't show up on the books—may be higher, both in case depreciation rates are high and because many assets are undervalued, e.g., the land and rights-of-way.

Debt is a typical form of liability, but there can be others, e.g., payables that DisComs have accrued over time.

Total equity has three components—the paid-up share capital (also simply called equity), general reserves, and capital or accumulated reserves (which can be accumulated surpluses or deficits). General reserves are small and meant to be for planned and unplanned needs, like an emergency fund. Government accounts also list equity grants, as these are meant for asset creation, but this is not a normal component of total equity. For illustration purposes, to show the trends, we do not delve into this component.

For any entity, the book value of equity can differ from the market value of the shares, but DisComs are not publicly traded entities (for the most part; even private DisComs in India don't have standalone listings, e.g., Tata Power, BSES, and Adani list their larger energy company). Thus, we are interested in the book values of equity, not the market-perceived value of the equity. This represents investments by their owners, state governments, into the business.

Normally, when a company makes a profit, its reserves rise. For most public DisComs, their book equity value remains the same unless they add more paid-up capital, but it is the capital reserves that change. Unfortunately, instead of rising total equity, i.e., “book equity + capital reserves,” we usually have declining total equity, given the annual losses that accumulate—also termed as “accumulated deficits” in the balance sheets. All such calculations, of course, are after accounting for any dividends paid out from profits, which for

most DisComs is zero (not just because DisComs usually have no profits, as no dividends are paid out even if profitable).³⁹ In contrast, many public-sector power companies, like NTPC and Power Grid Corporation (PGCIL), routinely pay out hefty dividends.

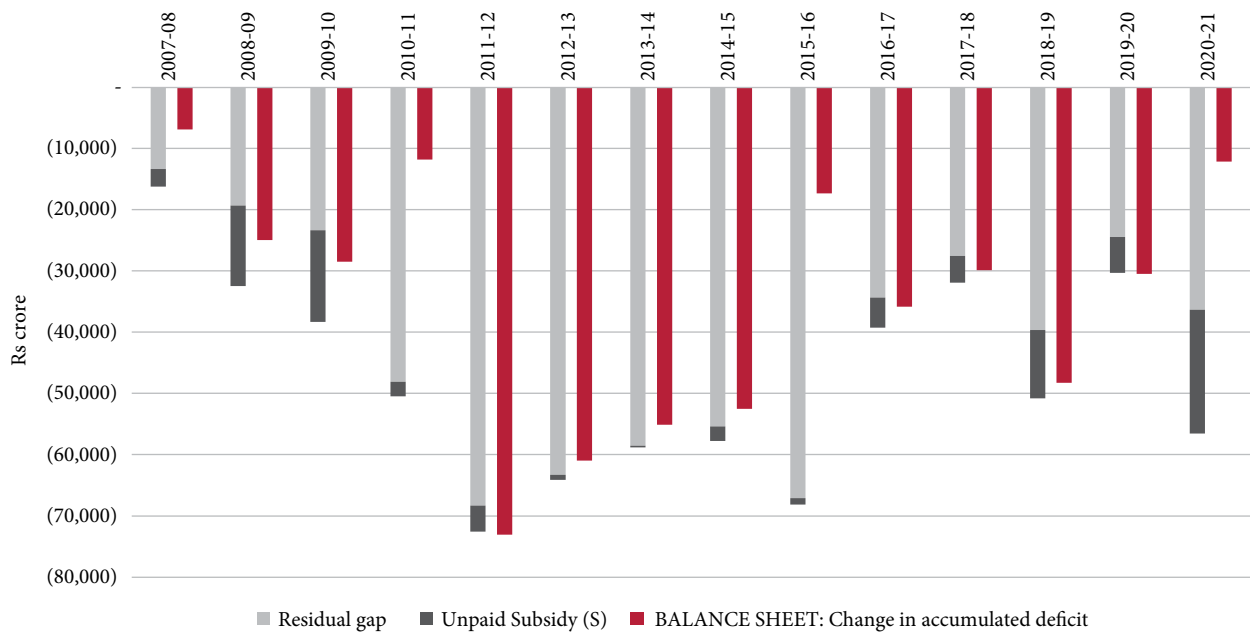
In theory, the annual residual cash level losses would be the change in accumulated deficit, with other components mostly showing up elsewhere in the balance sheet, but the numbers don't

³⁹ A profitable entity need not pay out profits as dividends. It can use such cash flows for reinvestment into the business, thus reducing the need for additional capital infusion, or it can simply accumulate assets (which raises the company value). Such positive reserves can also be used for acquisitions. Another option in publicly listed companies is to use such positive reserves for share buybacks.

match up entirely.⁴⁰ Given that unpaid subsidy doesn't directly get reflected as a line item in the balance sheet, but might be hidden elsewhere, for illustration purposes, we show the annual change in accumulated deficit versus the (negative) sum of the unpaid subsidy and residual gap. These track quite closely (Figure 13) except for a few

outlier years, which we cannot explain, which surprisingly seem to happen every five years. In 2015-16, this may have been due to the effect of UDAY, but we cannot be sure. Despite the outlier years, the aggregate sum of annual losses and accumulated deficit are similar.

Figure 13: Link between operations (residual loss + unpaid subsidy) and balance sheet (annual change in accumulated deficit)



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2007-2021).

For the public DisComs analysed, the sum of the annual residual gap is higher than the balance sheet accumulated deficit, but accounting issues likely explain much of the consistent error, while outlier years need another explanation. As we've seen, the annual operating losses (on a cash basis) are far higher, but most of those (but not all!) are accounted

for on the balance sheet, e.g., as trade receivables. In theory, only D should never show up on the balance sheet, while S, C, and RI should show up. S isn't showing up, at least not directly, which is why we added it for illustration. If S is embedded within our components of the balance sheet, then it could be removed from the comparison.

⁴⁰ Instead of book-level losses, we take cash flow losses, and partition them into how they might show up in the balance sheet; some factors for the cash flow gap are already covered as receivables or an asset. As the Sankey diagram in Figure 3 shows, the book value gap with RI correction as we have done (unlike PFC) and the cash-basis residual gap are the same.

8. Equity and Reserves within the Balance Sheet as a Marker of Accumulated Financials

The aggregate net worth of DisComs has fallen from negative Rs 22,147 crore to negative Rs 1,70,447 crore over 15 years. Debt and Equity are two major components of the balance sheet, and rising losses over the years have meant an increase in both debt and state-government owned equity.

- DisComs adopt different coping mechanisms to manage the accumulated deficit, which include a combination of heavy borrowing from banks and FIs, infusion of money through higher equity by the State Governments, and delaying payments to suppliers (a hidden loan).
- Booked equity has more than quadrupled in just five years FY2013-14 to FY2018-19. However, much of such equity infusion does not garner any return and is a hidden bailout.
- Reasons for non-receipt of return on equity (RoE) include the regulator's refusal to allow RoE in full (partly due to non-creation of commensurate assets), complete denial RoE by the regulator citing a tariff shock, lack of interest by the DisComs to claim returns etc., or a combination of these reasons.
- As a bounding exercise, if RoE is allowed in full (on all paid up equity at a normative 15%), an additional Rs 27,409 crore would be required, which in turn would impose an average tariff burden 0.30 Rs/kWh (FY2019-20) on consumers.

One of the key measures of an entity's health is its net worth, also termed "total equity." PFC formal accounts⁴¹ add in government grants and subsidies for capital assets as part of the net worth.⁴² We examine the adjusted total equity (calculated using the expression given following this) as a better measure of financial health, removing capital grants since they lead to assets and not cash:

Total Equity* = (book) Equity + General Reserves + Accumulated Surplus / (Deficit)

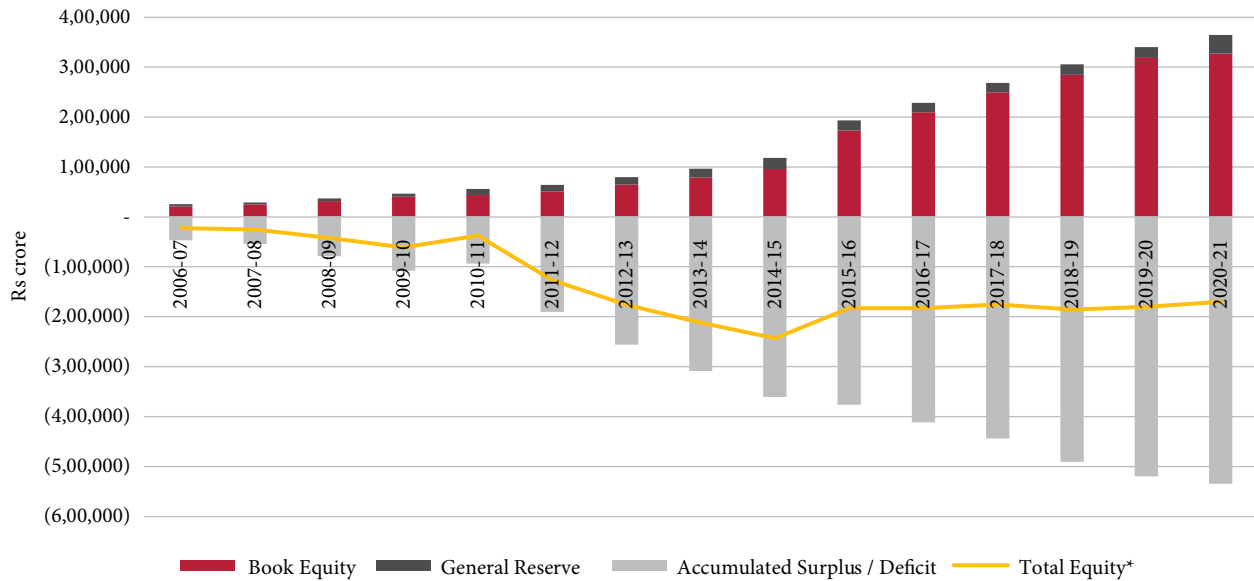
Book equity is the paid-up shareholder equity, and general reserves are a small amount kept aside for special needs (only Rs 37,469 crore for all state

sector DisComs at the end of FY2020-21). Per PFC accounting, net worth includes government grants and subsidies for capital assets (e.g., to buy computer hardware or any other long-lived asset) besides book equity, general reserves, and accumulated surplus/(deficit). However, these assets become tangible and do not reflect the financial position under equity as clearly. Hence, for illustration, unlike in PFC accounting, we defined total equity* as equity not including government grants and subsidies for capital assets. Accumulated surplus/(deficit) is also termed as accumulated or capital reserves/(deficits) and is theoretically the source of dividends, but it is negative for almost all DisComs.

⁴¹ Annexure 1.6 of PFC report on performance of power utilities (2020-21).

⁴² The formal accounts of assets will balance factoring in such grants, but our focus isn't on balancing the balance sheet but to show trends and the operating health of DisComs, and hence we do not highlight equity grants.

Figure 14: Total equity* and components as of March 31, 2021 (public utilities and power departments)



Source: Compiled using PFC underlying data.

Notes: Total equity* is defined as book equity plus general reserves plus accumulated surplus/(deficit). Unlike the PFC definition, we remove the grants given for capital assets.

In Figure 14, We can clearly see that equity has been pumped in, but it has been eroded, and this is the total equity*. This is the aggregate picture, and at an individual DisCom level (shown in Figure A7: DisCom-wise Total Equity* (Book Equity + General Reserves + Accumulated Surplus / (Deficit)) for FY2020-21), the majority have negative total equity, which is not surprising for long-time loss-making entities. This is true even if we add in capital grants for capital assets.

8.1. Implications of Growing Negative Reserves – Coping Strategies

We have seen growing accumulated losses from annual operations, and these manifest as negative reserves in the balance sheet. In terms of the formal balance sheet (Assets = Total equity + Liabilities), the growing negative total equity must be offset by rising liabilities, which could

be formal debt or delayed payments to suppliers. A time series examination of paid-up equity subsequently also shows one of the other coping mechanisms: infusing more equity. However, it is very difficult to determine how much of any equity (or debt) was due to the running annual losses versus “normal” growth of debt or equity for a growing company.

Regardless of the cause of more debt (whether to cover annual operating losses or as investments towards more assets), total debt has been rising steadily over the past 15 years under study. Because we don’t have full data on where and why debt or equity was raised, we can consider a few examples to show the trends and trade-offs. It is difficult to rigidly categorise all the DisComs due to multiple interrelated factors; for example, rising losses can be offset via a combination of rising equity, debt, payables, and so on.

Example 1: Madhya Pradesh DisComs: Show diversity within a state and falling RoE with rising book equity

Table 10 shows the equity position for Madhya Pradesh-based DisComs. While tariff orders do not show a percentage RoE that is booked, we back-calculate the booked RoE. We found this to be less than 10% for most of the periods indicated, which is far less than the 16% rate indicated in their multi-year tariff (MYT) regulations.

Because there are so many variables and

interconnected components in the balance sheet, it is difficult to generalise and posit a single explanatory trend, but we find that most generally accepted hypotheses of coping with losses via debt or equity are supported in the subsequent examples. Annual operating P&Ls track accumulated surplus/deficit, and any rising accumulated deficit then tracks rising equity infused or higher debt. The examples cover a range of DisComs, one with high deficits, one with positive surplus, and one with more debt or with more equity.

Table 10: Book equity vs tariff order return on equity (RoE) of Madhya Pradesh-based DisComs from FY2013-14 to FY2018-19

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
MPMaKVVCL						
Book Equity (Rs crore)	1,842	1,918	1,945	3,601	5,544	5,949
RoE (Rs crore)	174	212	237	255	302	377
RoE (%)	(9.5%)	(11.1%)	(12.2%)	(7.1%)	(5.4%)	(6.3%)
MPPaKVVCL						
Book Equity (Rs crore)	1945	2065	2105	3049	5129	5674
RoE (Rs crore)	168	167	182	181	178	177
RoE (%)	(8.6%)	(8.1%)	(8.6%)	(5.9%)	(3.5%)	(3.1%)
MPPoKVVCL						
Book Equity (Rs crore)	1742	1817	1858	3322	5446	6092
RoE (Rs crore)	168	195	259	306	219	281
RoE (%)	(9.7%)	(10.7%)	(13.9%)	(9.2%)	(4.0%)	(4.6%)

Source: Tariff orders of MPERC (2014-2019) and the PFC reports on performance of power utilities (Power Finance Corporation, 2014-2019).

Abbreviations: MPMaKVVCL, Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited; MPPaKVVCL, Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited; MPPoKVVCL, Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited.

Example 2: Dakshin Gujarat Vij Company Limited (DGVCL): Accumulation of surplus throughout the period under study, liquidating debts

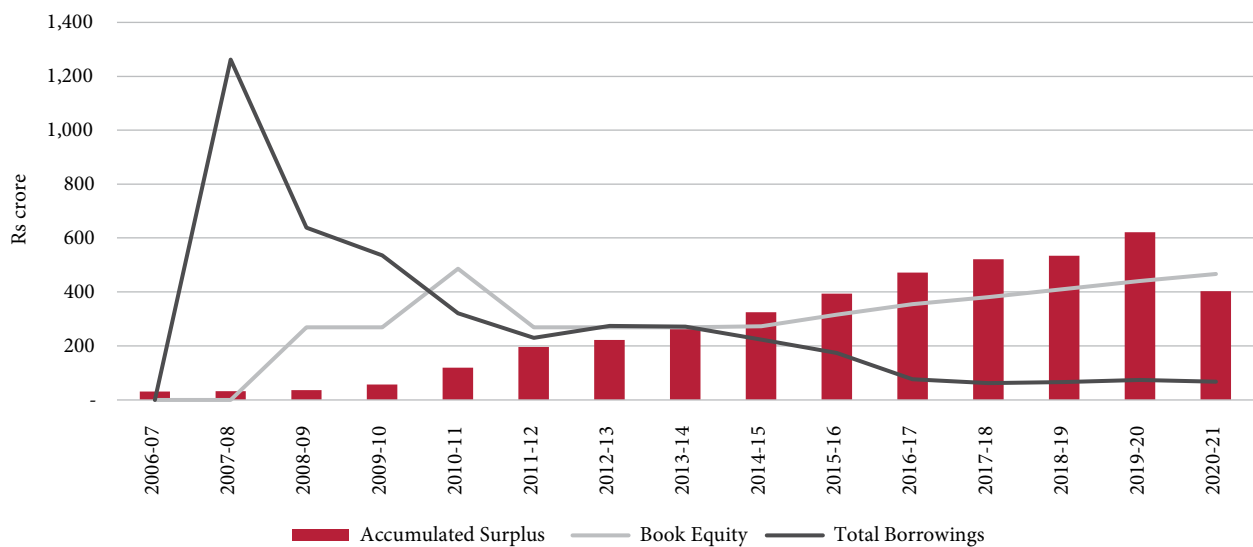
Figure 15 shows that DGVCL has had positive performance and thus an accumulated surplus throughout the period. There does not seem to be any financial stress. Such accumulation has not only brought down the need for external borrowings (from Rs 1,263 crore to Rs 66 crore), but it has also facilitated the growth of book equity from Rs 268 crore to Rs 466 crore, meaning minimal equity infusion. It's unclear what the purpose of the early high borrowing was, but the utility did take steps to improve operations, including building up its assets. Note that borrowings shown here are formal borrowings—that is, short- and long-term debt—but exclude other liabilities.

Example 3: Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL): Accumulation of deficit, met

through borrowings initially and later through equity infusion

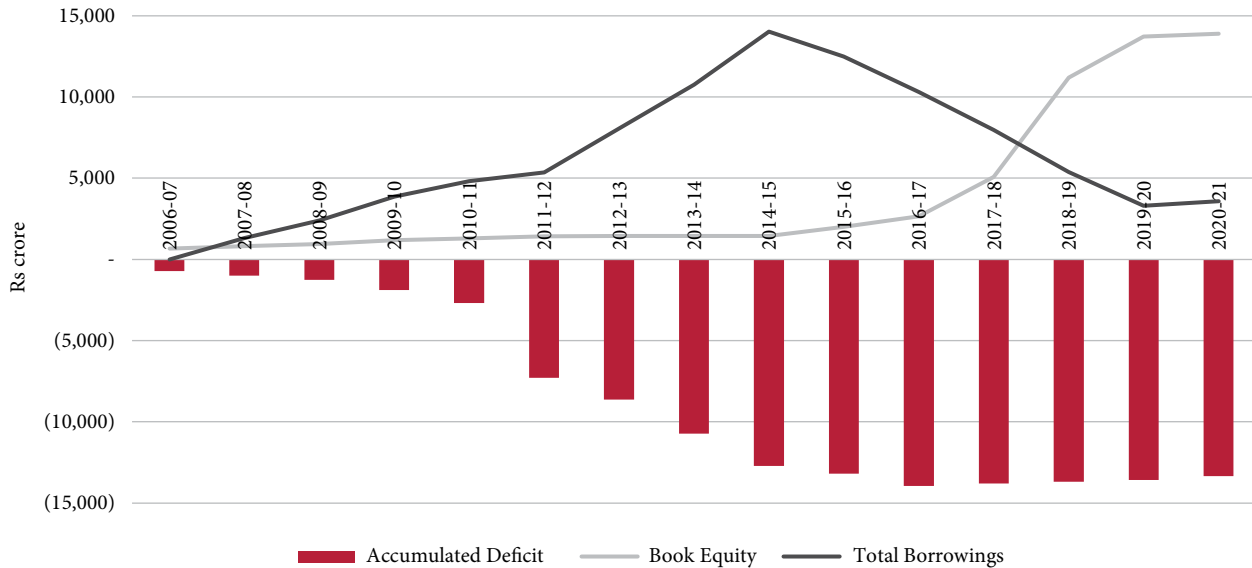
Figure 16 shows that over 15 years, DHBVNL significantly grew its accumulated deficit from Rs 714 crore to Rs 13,342 crore of losses. It seems initially that the deficit is met through borrowings, but from FY2014-15 onwards, it can be seen that the deficit (along with borrowings) is met through significant equity infusion. The accumulated deficit has stabilised, largely matching improved operations, and hence book equity is disproportionately paying off debt. On the other hand, approved RoE during FY2017-18 and FY2018-19 remained less than Rs 200 crore, which clearly indicates that the entire equity has not earned RoE as cash flow difficulties (debts and deficit) seem to have been met through book equity. In other words, equity has been used as a liquidity (or pseudo-bailout) package, instead of being used for building assets.

Figure 15: Performance of DGVCL (accumulated surplus vs book equity vs total borrowings) from FY2006-07 to FY2020-21



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2007-2021).

Figure 16: Performance of DHBVNL (accumulated surplus vs book equity vs total borrowings) from FY2006-07 to FY2020-21



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2007-2021).

Example 4: Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO): Accumulation of deficit throughout the period under study, met through both borrowings (majority) and equity infusion

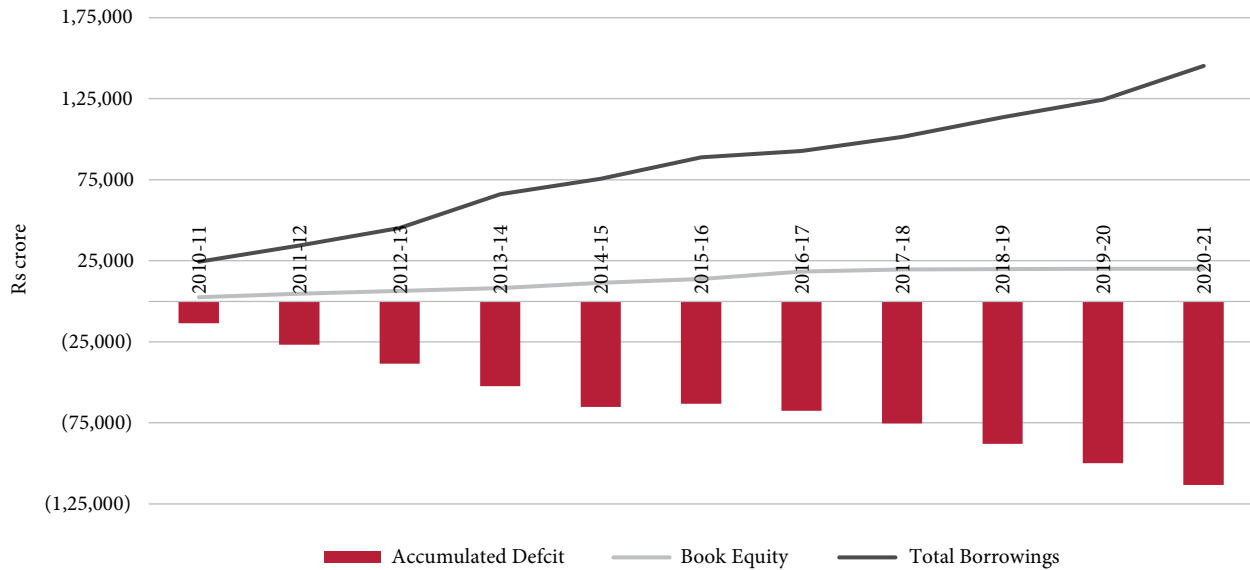
Figure 17 shows the components for TANGEDCO over the 11 years under consideration. TANGEDCO is a utility providing both power generation and distribution services and was only established in 2010 (from the erstwhile Tamil Nadu Electricity Board (TNEB)). We have tried to segregate DisCom components from generation (GenCo equivalent), but this isn't always straightforward. There are also some data limitations for TANGEDCO, in part (surprisingly), as it went many years without notifying new tariff orders.

TANGEDCO's accumulated deficits grew significantly from Rs 13,480 crore to Rs 1,13,268

crore. We can see that since FY2010–11, the accumulated deficit has been met through equity infusion but more so through increased borrowings. The book equity increased from Rs 2,588 crore to Rs 20,058 crore, while the borrowings have gone sky high, from Rs 24,466 crore to Rs 1,45,322 crore. The RoE figures of TANGEDCO are not available, so we cannot assess the impact of equity infusion on RoE.

These examples show how DisComs managed surging accumulated deficits through equity or debt or both, but this does not seem to be sustainable because interest costs reach unmanageable proportions as debt grows. While some of the annual operating gap can *directly* be blamed on the DisCom for worse-than-targeted distribution and collection losses, as we have shown, this constitutes only about 28% of the gap on a cumulative basis (Figure 11).

Figure 17: Performance of TANGEDCO (accumulated surplus vs book equity vs total borrowings) from FY2010-11 to FY2020-21



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2007–2021).

Although we can examine formal debt or equity infusion as a coping mechanism for operating losses, this doesn't tell the complete story, since there are other factors at play as well. For example, there are other coping mechanisms such as the DisCom delaying payments to GenCos or suppliers, which is a different liability (a payable).

The amount of coping required isn't just a function of book value losses (negative reserves). If we only looked at the book values, which are on an accrual basis, this would not show the cash flow hit by rising trade receivables, which are an asset based on consumer receivables to be recovered in the future. Similarly, we cannot find any explicit account in formal balance sheets for

historical unpaid subsidy.⁴³ Note its absence in Table 1.

So how do balance sheets then add up if “unpaid subsidies” aren't a line item? In some cases, these may be embedded in other components, but the situation could also arise wherein there is an understatement of assets (cumulative receivables), which then lowers the total assets. Because formal total equity and total liabilities are on book basis regardless this gap (S, or cumulative S) doesn't impact those components of the balance sheet. There are several ways this is likely absorbed, including the way in which assets are defined and allocated. There is no uncertainty on definitions at an operational

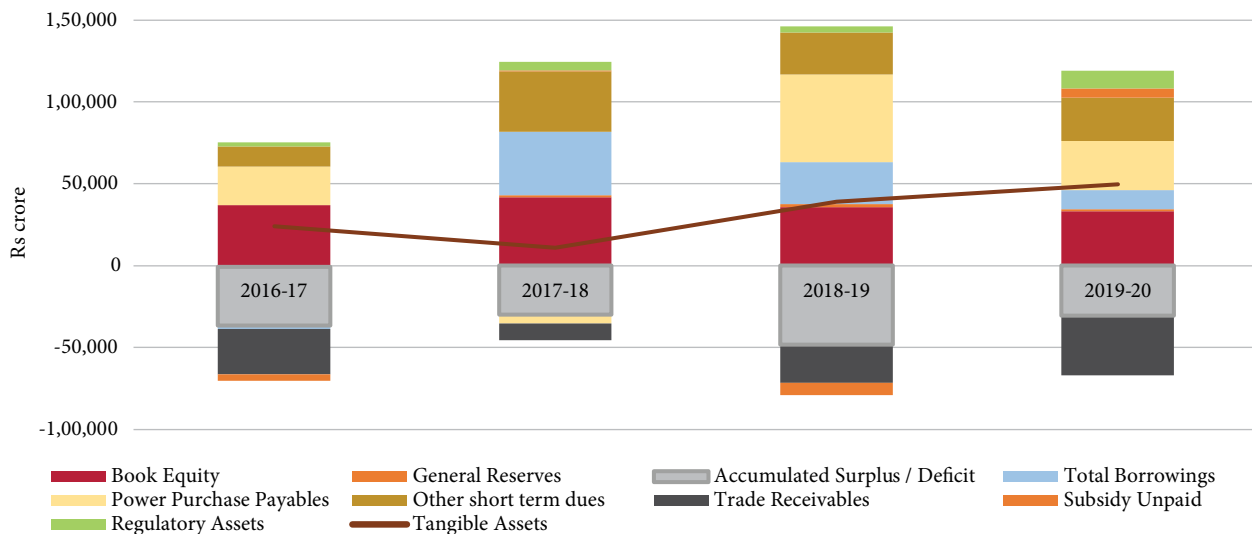
⁴³ Discussions with regulators indicate that this is an inconsistency, and the Ministry of Power (MoP, 2022b) recently notified new rules to try and harmonise the accounting, including for subsidies. Formal definitions (JVVNL, 2017) indicate that trade receivables are for sale of power, but are due from the consumer and not from the state. State regulators have clarified to us that trade receivables as they have been traditionally recorded exclude unpaid subsidies.

level—official AT&C targets combine collection losses from consumers and subsidies—but at an accumulated (balance sheet) level, there is uncertainty. However, even if this were not the case, and we cannot segregate the accumulation of unpaid subsidies as a separate component, *this only strengthens our arguments by increasing the residual gap we identified.*

On the coping side, one other hidden debt (but, nonetheless, a formal liability) is dues not just to GenCos, but also to other suppliers (for hardware, parts, services, etc.). However, unlike GenCo dues, the latter rarely attract LPSC or similar charges.⁴⁴

While consistent time series data on these aren't available throughout the 15 years, we can examine the last few years, more specifically comparing the cash flow level of ups versus downs in annual change (Figure 18). This is explicitly different from a balance sheet change analysis. Here, our objective is to see overall change in accumulated surplus/(deficit) and corresponding changes in debt, book equity, unpaid dues to suppliers, and so on. Hence, changes in incoming cash flow are a negative, such as regulatory income, unpaid subsidies, or dues unpaid by consumers, which need coping, even if on formal balance sheets they are an accumulation of assets.

Figure 18: Annual change (Year-on-Year difference) in book equity, tangible assets, liabilities, and so on from FY2016-17 to FY2019-20 (all governmental utilities and power departments)



Source: Compiled from PFC reports on Performance of Power Utilities (2017-2020).

⁴⁴ Informal discussions with vendors indicate that one issue is “final closure” of projects and bill clearing, which is often delayed due to technicalities or other factors, thus absolving the DisCom of contractual non-compliance or delays; however, they still owe the money in the contract. In some cases, there are complaints that such delays citing lapses are also used as a means of negotiation (or worse).

While there are many other factors at play that prevent a complete balancing, we see that in these four years, unlike in the previous year, there was a lot more debt and hidden debt (liabilities such as payables) than just the sum of the annual incremental accumulated surplus plus incremental cash losses from unpaid subsidy, consumer non-payments, and regulatory assets that grew. Some of this additional cash flow (rather, reduction in outflow) showed up in net creation of assets, to which if we added depreciation, we would have seen an even closer match (to give us gross asset formation).

Stated another way, even if the details don't balance in full, there has been a rise in book equity, debt, dues to suppliers, and so on, which clearly weren't intended for creating more assets.

8.2. What Does Book Equity Tell Us?

We have seen that equity infusions have increased dramatically over time, and some of this appears to be a coping mechanism to offset ongoing losses. In this section, we examine book equity to see how it performs and discuss whether it is a prudent use of state funds.

While our analysis has been on the “total equity*” (defined as Book Equity + Reserves + Accumulated Surplus/(Deficit)⁴⁵), when it comes to “fixing” the financial health of the DisComs, it is especially illustrative and important to examine what happens to (book) equity—that is, shareholder equity or shareholder paid-up capital.

DisComs being a regulated entity, regulators allow a statutory or normative RoE, typically in the range of 14% to 16%. This return is the source of income for the business owner (assuming, of course, that it performs as expected, such as in terms of AT&C losses).

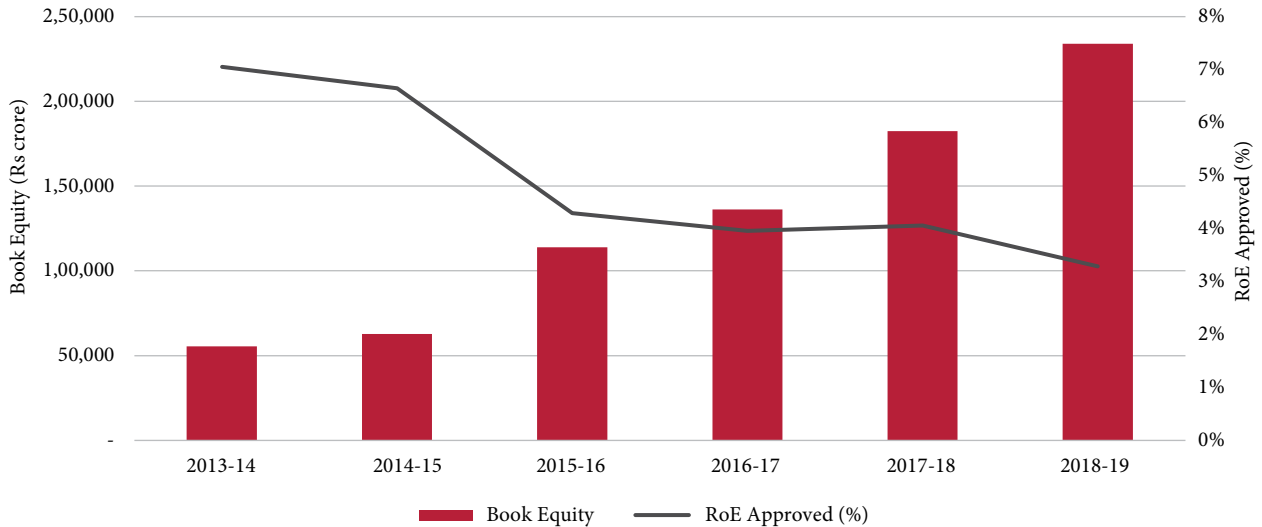
Examination of corporate filings,⁴⁶ balance sheets, and tariff orders of various public DisComs indicates that during the six-year period from FY2013-14 to FY2018-19, the total book equity via paid-up capital of these DisComs put together increased from Rs 55,522 crore to Rs 2,33,947 crore.⁴⁷ This equity infusion translated to an equity growth of more than 400% (Figure 19).

⁴⁵ Some regulators segregate book equity and capital reserves, but others lump them together and also use the total for the rate base on which they allow a RoE. In some cases, they allow a return on capital employed, a measure that then disallows some portion of book equity.

⁴⁶ Corporate filings are with the Ministry of Corporate Affairs and hence don't exactly match the PFC's data.

⁴⁷ The PFC's methodology includes issued shares that haven't been taken into the books yet as part of equity, and hence their figures are higher than as filed with the Ministry of Corporate Affairs as shown for these DisComs.

Figure 19: Growth of book equity vs book-basis return on equity (RoE) from FY2013-14 to FY2018-19 (Rs crore) (39 utilities)



Notes: Book equity is the paid-up and allotted share capital per Ministry of Corporate Affairs filings and is thus lower than per PFC accounts, which includes shares not yet allotted. Information in this figure relates to 39 DisComs as detailed in Appendix 1. The RoE is as per the tariff orders—their free cash flow and thus real returns are often lower.

Although there was a rise in equity, the important questions are what this was for, what happened to it, and whether the infused equity could also garner RoE? Based on our understanding from informal discussions with DisCom officials and regulators, if the equity is infused as a stopgap measure—to meet cash shortfalls instead of meeting the need for capital works—such book equity isn't allowed to garner any RoE; however, determining the allocation of equity is rarely straightforward or irrefutable.⁴⁸

The central government, from time to time, notifies the hurdle rate to cross-check the viability of projects and their financing. The Ministry of Finance considered an appropriate hurdle rate as 10% for financial internal rates of return with

respect to projects which have identifiable stream of financial returns (MoF, 2017).

Compared to the growth of more than 400% of paid-up book equity between FY2013-14 and FY2018-19, the RoE increased from Rs 3,913 crore to Rs 7,683 only, not even doubling. The RoE reduced from 7.05% in FY2013-14 to just 3.28% in FY2018-19 (Figure 19 right-hand side), using the full book value as the basis.

There's a nuanced but important background to DisCom RoE. In many companies, generally, RoE comes from residual earnings (free cash flow) that the company owners can claim after paying off all expenses, including debt servicing, taxes, and so on. For DisComs, the ARR includes the statutory

⁴⁸ In some cases, regulators use a 70:30 debt to equity ratio as a capping mechanism for equity that enjoys returns, but this is nuanced since much of the non-formal debt could be other liabilities, such as dues to GenCos, or, alternatively, there could be additional debt taken on to manage cash flow problems.

RoE as approved by the regulator. This explains why, despite being loss-making at a P&L level, a number of DisComs do find some RoE because some level of it is included in the cost structure.

The actual RoE achieved on a full book equity basis falls squarely short of the normative level for a range of reasons. In some cases, as for example, in UP-based DisComs, the regulator disallows the RoE citing the significant under-recovery in cash flows. In some cases—for example, Rajasthan—it is the DisComs that choose not to ask for RoE. This is ostensibly to keep consumer prices low, but it is an unsustainable means of doing so. In other cases, the regulator may only allow a fraction of the paper (book) equity into calculations for the rate base, based on both a normative debt-to-equity ratio and also capital works and asset creation (or lack thereof commensurate with incoming equity infusions).

Discussions with industry professionals indicate a complex, or at least not universally standardised calculus, used for “allowed equity,” but the tariff orders don’t cite detailed reasons for the same. In some cases, even the rate base isn’t clear in the tariff order (but may be known to the DisCom)—one cannot back-calculate from public data if the formal rate is also not specified. If equity is infused over time simply for cash flow support (or to pay down debt), it is not clear whether regulators can or cannot allow such book equity into the rate base for RoE.

Although some equity infusions may be questionable, the total book equity is quite low for some DisComs. Compare West Bengal and three DisComs of Rajasthan (put together)? Even after normalising for their size of operations, the book equity (paid-up capital) differs by a large margin. During FY2007-08 and FY2020-21, the book equity of West Bengal State Electricity

Distribution Company Limited (WBSEDCL) increased by just Rs 143 crore (from Rs 2,223 crore to Rs 2,366 crore), whereas, for the same period, all Rajasthan-based DisComs together saw a surge in equity by a whopping Rs 31,224 crore (from Rs 1,432 crore to Rs 32,656 crore).

Should book equity be higher? In some cases, perhaps, but there has already been significant equity pumped in, and if we compare the formal debt-to-equity ratio, it has changed over these 15 years from 83:17 to 63:37 (again, on a full paid-up equity basis and not based on what the regulator may have allowed, which is not easily visible). Part of this is because there has been a jump in equity, but debt growth has also slowed in recent years, relatively speaking. Firstly, there has been an explosion of hidden debt in the form of liabilities as payables. Secondly, DisComs may be facing difficulties in raising debt. To fully examine this, we would need a breakdown of the sources of debt and their terms, such as the interest rate. Such data are not compiled across the country, and even individual annual reports don’t always specify the debt rates per lender.

Anecdotally, much of the debt raised in recent years appears not just from government entities but also specifically from the REC and PFC, which are Ministry of Power-held non-banking financial companies. Discussions with experts indicate that much of such debt is because post-14th Finance Commission rules, the share of grants to come from the states increased—for example, under flagship schemes such as the IPDS. Given that states have limited ability to issue matching grants to the tune of 40% (under the 60:40 rule for Centre:State), this forced more debt by DisComs from these entities, who were keen to let such debt be given to allow the flagship schemes to continue.

More book equity, *if allowed into the rate base*, increases the tariff burden equal to the RoE component, and its rate of return is higher than for almost all debt, more so after generator late payment surcharges (LPSC) reduced from 18% to 12% for a brief period during COVID-19.⁴⁹

As a bounding exercise, we can calculate the RoE required if the whole equity base were to be allowed. For the existing equity base, in case RoE is required at the normative level, say at an average of 15%, an additional Rs 27,409 crore would need to be recovered through the tariff in FY2019-20, averaging 0.30 Rs/kWh.

Regardless of the cause of the shortfalls in RoE, this doesn't make for a viable business. No private DisCom will voluntarily waive RoE for the sake of charity—it would violate fiduciary duty if it did so. The 15% norm should in theory be considered very attractive for any private investor.⁵⁰ In case a private entity aims to take over a DisCom, it would not just ask for a reasonable RoE, but it would likely invest suitably into the business, raising the equity base (and thus RoE impact within the tariff setting). For example, Delhi's BRPL doubled book equity in five years from Rs 460 crore in FY2006-07 to Rs 1,040 crore in FY2011-12.

Pumping in more equity doesn't seem to be a winning formula for DisCom finances. At best, it is an expensive stopgap measure using state taxpayer money. While the long-term solution requires fixing operations such that “excessive” equity (beyond what is prudent for asset creation) is not required, in the short term, equity needs to be properly categorised and classified. In addition to its use for stopgap purposes, anecdotally, there are instances of state government equity coming from converting state debt into equity. This is a further example of the lack of transparency, and emphasises the need for setting consistent and prudent norms.

No DisCom is publicly listed, and hence, its reporting requirements are less than those for public companies. However because of this, we also lose a marker of value based on external shareholder valuation. However, as this section showed, we have significant (and rising) state government equity in increasingly loss-making entities. This use of funds doesn't seem prudent—given that the returns are very low—but until we fix the operational gap, it is unclear if the book equity trend will improve.

⁴⁹ Informal discussions with domain experts indicate that not all the LPSC is paid out—some generators partially waive these in return for quicker payments. The government is also keen to pay off generators and has notified new support mechanisms in mid-2022 to encourage DisComs to pay off GenCo dues, including a relaxation of new LPSC charges if DisComs adhere to a trajectory of pay downs, typically over 48 months.

⁵⁰ Most statutory or regulated returns in the power sector have been close to 15% or more, even for generators. This is likely a legacy issue, as these started at 16% with the 1991 reforms and invitations to private generators (including foreign ones). Since then, prime lending rates have fallen, post-COVID-19 increases notwithstanding, but the formal RoE hasn't trended downwards similarly. Gokarn, Tyagi, and Tongia (2022) show international RoE comparisons, and India is strikingly high on paper.

9. Fixing DisCom Finances

Fixing DisCom finances needs a two-pronged strategy: at the operating level as well as at the balance sheet level (both are strongly inter-linked with each other). We categorize DisComs on the basis of both, and such differentiation highlights the need for relevant measures. We focus on fixing operating (annual) gaps, if any, without which no amount of bailout, even if given, would last.

- Based on FY2019-20 data, seven DisComs carry no operating gap, of which three have no accumulated losses.
- 40 DisComs carry either an operational gap or accumulated gap or both.
- Out of 36 DisComs which have operating gap, 18 DisComs can turn positive if their attributable gap components, i.e., unpaid subsidy, regulatory assets, billing loss and consumer collection loss, are resolved.
- Even if the attributable causes of the gap are closed, which is not easy, this still leaves 18 DisComs with a loss, caused by the residual gap.
- Mitigation of regulatory assets as well as the residual gap would lead to a tariff hike. While in theory this is in the hands of the regulator, in practice this also needs political support.
- Even more challenging than fixing the operating gap is cleaning up the balance sheets, where losses have accumulated across at least 15 years.

What does it mean to fix the DisComs' finances? There are two distinct measures of financials—operating and balance sheet—and we have shown a link between the two.

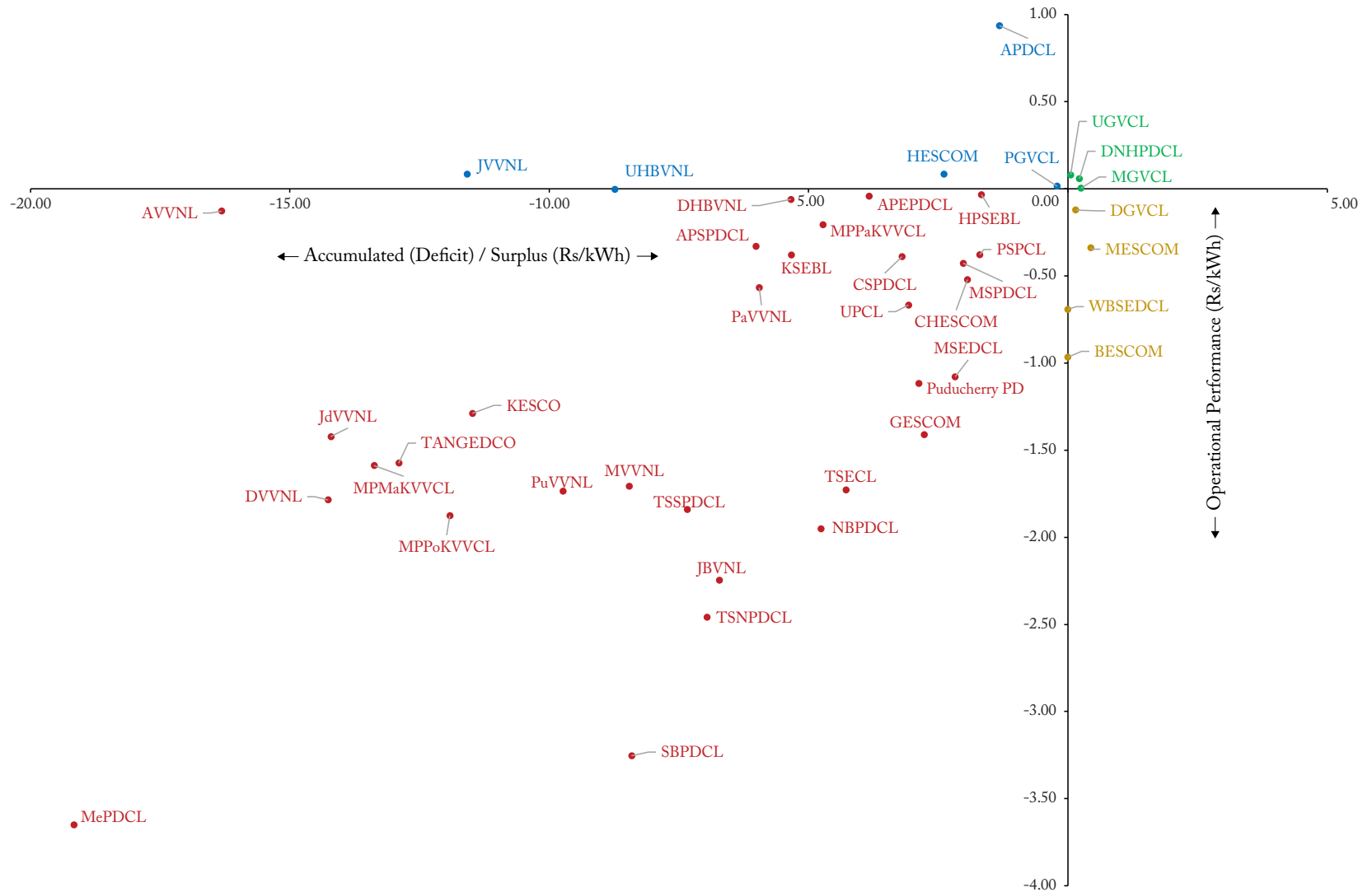
To understand the quanta of fixing required, we need a reference point. We often use FY2019-20 as a base year for many calculations since operational performance for that year is likely to be more representative of the usual trend than performance in FY2020-21. Naturally, all DisComs vary in their performance on an annual basis; our intent is to show examples and a trend, instead of singling out a particular DisCom based on one year's performance.

Figure 20 shows the performance of DisComs across two different aspects of financial performance—annual operations (as-received basis) and accumulated surplus/(deficit), that is, book basis. These are normalised to per kWh sold in FY20. The x -axis does not represent the formal balance sheet position such as net worth but is

a simpler reflection of historical performance. However, the two aspects aren't directly linked since the book-basis accumulated surplus/(deficit) understates any losses in case there are other receivables created, such as regulatory assets or trade receivables.

The first quadrant in green is doing well on both counts: annual operations and accumulated position. The second quadrant in blue is currently doing reasonably well, but it would take them a long time to overcome their past deficits just through present operational surpluses, assuming that these continue. The fourth quadrant in gold has ongoing losses, but their past performance has been reasonable, so assuming this is a one-off problem or something transient, they can recover. They could also dip into their reserves to overcome any short-term obligations. The real challenge involves those that have both accumulated and ongoing losses, which constitute the majority (31) of DisComs.

Figure 20: Operational performance (as-realised) FY2019–20 and accumulated surplus/(deficit) as of March 31, 2020



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2020-21).

Notes: These are only for the sample of 43 public DisComs as per this portion of our study.

9.1 National Aggregates are Misleading – Profit of one DisCom does not Offset Loss of Another

Figure 20 shows how there are a few DisComs that are profitable or have positive accumulated surpluses, but most publications and government figures—including for action plans—typically show the national totals as a simple sum of all DisComs. This is not helpful since, if we’re looking to fix the problem, we have to overcome each of the negatives.

DisComs are independent business entities, and depending on their operational and financial performance, they earn a profit or loss in adherence to regulatory norms. But a national aggregate would incorrectly smoothen out some of the profits versus losses. This is why we showed separate positive and negative financials in Table 2. No DisCom would share its surplus with another DisCom that has a deficit. Therefore, it becomes essential to consider the heterogeneity of positives and negatives across DisComs. This also emphasises the fact that one size does not fit all when it comes to solutions.

One exception to how we view the negatives that we have chosen arises when we consider the residual gap, as shown in multiple tables and figures. While there are per-DisCom breakdowns possible, these vary and become complex, and the aggregate all-India scenario is illuminating. What does a negative “residual gap” even mean? It means that if the DisCom performed as targeted, and if there was no further S or RI, then they’d have a profit, ostensibly one even above and beyond the statutory return as allowed and embedded in their cost structure. It’s unlikely that this would be a consistent feature, and it would likely smoothen out over time for these DisComs.

Is a negative residual a regulatory failure in the other direction? Not really, since the actual as-

realised picture may be based on changes from plans—for example, if the DisCom happened to sell more units to high-end (like commercial) consumers and fewer to poorer households. Other possible explanations for such a negative residual gap (i.e., positive operations at a book level) include simply controlling costs compared to plans (tariff orders). Such a surplus (negative residual gap) may, over time, be taken care of in the true-up processes.

Lastly, consider the scenario of what happens if one has a negative residual gap but positive as-realised gap due to, say, high C. Without the high C, the DisCom would have had a surplus, but it might just break even or make an as-realised loss thanks to a high C loss. There is no cash-basis negative residual gap (i.e., a surplus) left over, and hence, no changes to the balance sheet. Therefore, we choose not to zero out any negative residual gaps in the aggregation analysis.

9.2 Two levels of Fixing DisCom Finances – Operational and Balance Sheet

The first step towards fixing the problem is to stop the ongoing bleeding of cash—the operational problem (vertical axis of Figure 20). Even profitable DisComs are mostly barely so. This can be viewed as a *financial turnaround*. Only then can we aim to fix the historical problems accumulated on the balance sheet, unless, of course, one has external fill-ups. This would be a balance sheet *clean-up*. A turnaround is key to keeping DisComs as going concerns, but a clean-up may be required if one wants to privatise the entity. When the Government of India sold the loss-making Air India, they first absorbed about three-quarters of the debt and short-term liabilities such as pending fuel payments (Banerjea, 2022). In the case of Odisha’s DisComs that were recently privatised, they reportedly gave the new buyers (also Tatas) a relatively clean balance sheet.

What does a clean-up mean? There are multiple levels of balance sheet clean-up one could aspire for.

At the highest level, this can mean overcoming all the accumulated negative reserves, which are more than Rs 5,36,672 crore.⁵¹ This is *too high a bar since much of the impact of accumulated deficit has already happened through eroded book equity*. In aggregate, the total paid-up equity of Rs 3,20,136 crore⁵² has been eroded for these DisComs with negative accumulations. The DisComs with a positive accumulated surplus have a book equity of Rs 6,942 crore.

Another clean-up method could be making the true net worth positive (excluding the in-works capital equity, since that will turn into tangible assets). That would require Rs 1,85,236⁵³ crore of infusion. There has also been some amount of “extra” debt taken on, but we don’t know how much, and so, it is harder to apportion and ask for it in a clean-up.

Yet another possible benchmark for clean-up is to ensure that all DisComs can pay off current liabilities (GenCos and other suppliers). That is also close to Rs 5,05,776 crore for FY2020–21 across all the 59 public DisComs and power departments. In reality, the short-term liquidity stress isn’t so severe as DisComs have current assets as well, but it is unclear if those are entirely liquid or available in full. As a bounding exercise, assuming that all such short-term assets including trade (consumer) receivables and regulatory assets are received, the FY2020–21 liquidity gap would still be Rs 62,999 crore for all public DisComs studied (as shown in Table 1).

This simplified calculation exemplifies how a bailout is different from and smaller than a

clean-up. Part of a clean-up would be recovery of accumulated RI (in the form of regulatory assets) and unpaid subsidies, not to mention trade receivables. These don’t (technically) need a bailout, but some of these (such as unpaid subsidies) would still require state government funds—these would just not be “new” funds as they would be finances already promised in the past.

If accumulated unpaid subsidies are not formally in the books, then how would they be realised? Most likely they would show up as over-achievements of annual booked subsidies in the P&L. Of course, we have no timeline for when (or even if) these will be recovered. The same is true for trade receivables. Regulators are now asking for more details on unpaid consumer dues, ultimately to determine how many such dues are likely unrecoverable (e.g., from disconnected consumers or those more than, say, three years old).

One last reference point is the accumulation of the residual gap based on as-realised (cash-basis) annual operations of Rs 5,92,518 crore through FY2020–21. Not all of this is the fault of the DisCom, at least not directly. Even some of the other gaps (such as S and RI) are not the fault of the DisCom, but these could be recovered, as could C (technically the fault of the DisCom). This accumulated residual gap thus becomes yet another benchmark for what a clean-up can look like, but more like the upper bound of scenarios. It is not only similar in scale to the accumulated deficit, but it also has already been dealt with through additional equity and liabilities.

It is worth emphasising that fixing DisCom finances isn’t the same as fixing their operational targets or financial *system* design. AT&C losses

⁵¹ This sum excludes eight DisComs which have positive accumulated surplus at the end of FY2020–21. A simple summation of the negative and positive accumulated surpluses would be Rs 5,34,994 crore, not much better than the total negative accumulation.

⁵² Sum of book equity of the DisComs which have accumulated a deficit by the end of FY2020–21.

⁵³ For the DisComs which have accumulated a deficit by the end of FY2020–21.

should be targeted lower, which would lower consumer tariffs. But, we have a host of other issues, that includes over-reliance on subsidies, not just tariff subsidies outside regulatory purview, but also subsidies and grants that buttress cash flows such as from UDAY, high cross-subsidies distorting the system. A well-functioning power system should also address such issues, but premature focus on these (e.g., unrealistically tightened AT&C targets or overnight removal of other grants) would simply raise DisCom losses.

9.3. Fixing the Operational Problem

Figure 21 shows the operational gap (as-realised) for FY2019-20 in our sample across the DisComs, along with the explanatory factors (D, S, C, RI) and the residual. If our starting aim is to have no ACS-ARR gap going forward, then this figure shows how much of the total gap can be bridged via which factor across the various DisComs. This is just one year's picture, and things can and do vary, but a similar exercise for each year would still show what the relatively more important components or factors are.

As discussed earlier, we have some DisComs with negative residual gaps, meaning that they had a higher revenue base than costs assuming no D, S, C, and RI, but we do not consider that a problem. It's unlikely that this happens consistently, and many single-year tariff calculations include one-offs of special items or entities that have only been factored in with a lag. One cannot make claims based on this single data point, but, if this continues, then it may indicate scope for a lower tariff. It's important to point out that we don't want operating revenues to be exactly equal to costs—there should be *some* positive cash flow if we aim to liquidate past problems.

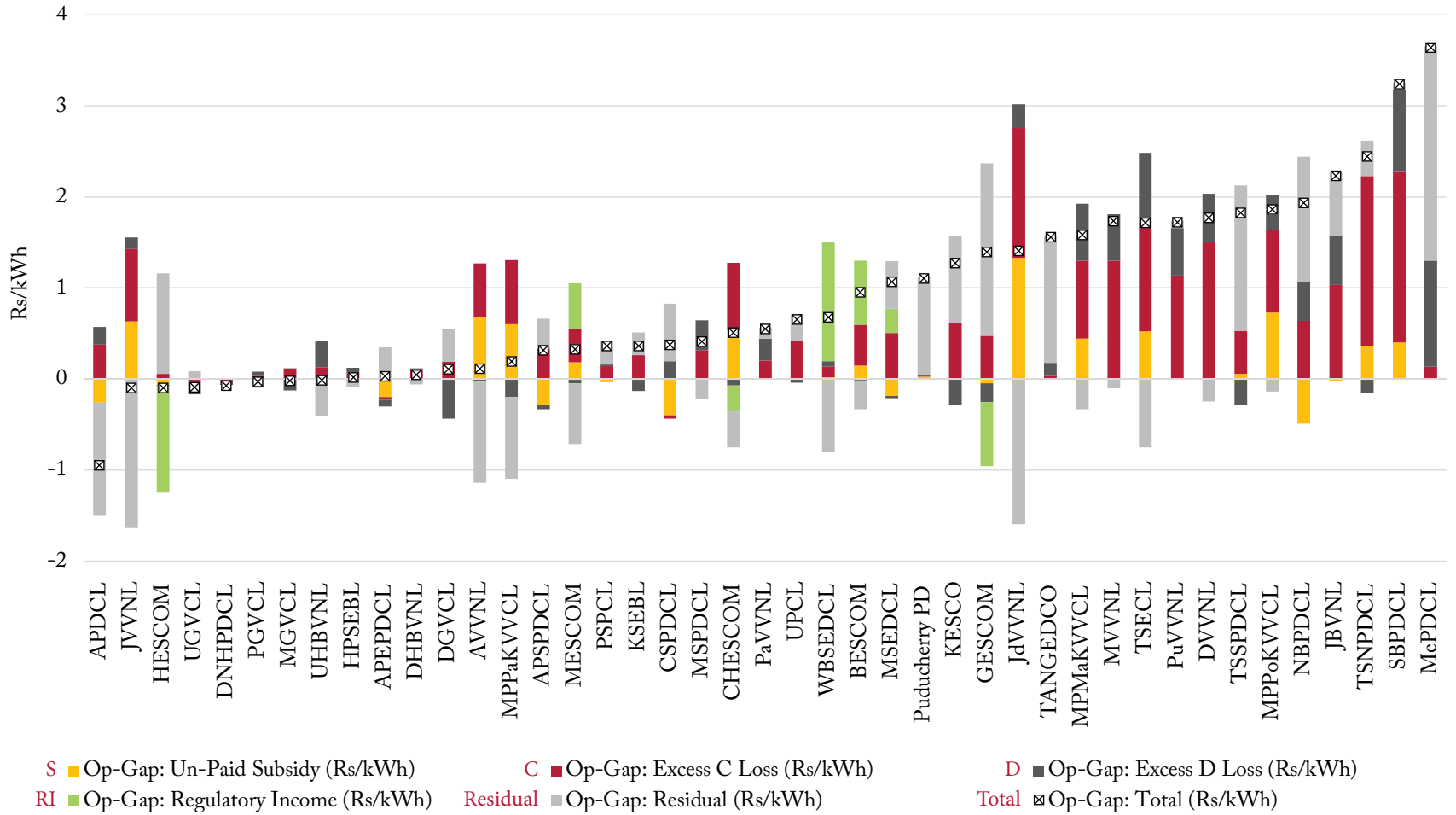
There are a range of DisComs where the pathway to profitability is relatively straightforward, but,

unfortunately, there are also a number of DisComs where the biggest component is the residual gap, meaning that even if they fix D, C, S, and RI, there will still be a gap. As the figure shows, the DisComs with the highest operating gaps tend to have a high residual gap as well. In fact, DisComs with lower overall gaps disproportionately have negative residual gaps.

A summary of the FY2019-20 snapshot of the number of DisComs and their level of losses is shown in Table 11 based on fixing a growing number of operational components (S, RI, D, and C in rough order of difficulty based on a combination of expenses, effort, and tariff impact). Of course, this order is arbitrary and only meant to be illustrative, and other combinations may suffice to move towards ending an operational gap. S only requires state government intervention. RI is with the regulator, but requires a tariff rise (the other components “only” need compliance). Fixing D requires support from multiple entities (technical, vigilance, and political support). C requires tens if not hundreds of millions of consumers to improve (other than bulk government consumers). For argument's sake, as a bounding exercise, we allow all overachievement of billing efficiency to accrue to the DisCom.

From Table 11, we can see that adding a single fix at a time helps a few DisComs achieve zero gap, but all the fixes are likely to operate in parallel. The mildly good news is that for 18 DisComs, fixing D, C, S, and RI is sufficient (or, in some cases, even fixing fewer than all the components is enough). The bad news is that this won't be easy. The even worse news is that there are 18 DisComs where we still would have a gap. Fixing these would necessarily require addressing the residual gap. In the policy section of this study, we elaborate on what these steps may entail.

Figure 21: Operating gap and components for FY2019-20



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2019-20).

Notes: Some components (in coloured stacks) are negative, indicating overachievement of targets or booked values. A negative residual suggests a tariff that more than covers costs, assuming no D, C, S, and RI.

Table 11: Impact of various gap component fixes on the operating gap (FY2019-20 data)

Fix	No. of DisComs (total: 43)
Already no gap	7
S is enough	+3
S and RI are enough	+2
D, S, and RI are enough	+3
D, C, S, and RI are enough	+10
Gap remains even after D, C, S, and RI are fixed	Still leaves 18

Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2019-20).

9.4. Fixing the Balance Sheet Problem

Raising tariffs for fixing ongoing operational gaps is already contentious, and it would be difficult to raise them sufficiently to clean up past (balance sheet) problems.

We must also recognise two more issues when relying on tariff increases to fix past problems. Firstly, these issues have accumulated over many years. Just like with dieting, years of weight build-up are difficult to fix in a crash course, and likely unsustainable. Secondly, there is an issue of fairness. Say we even recognise that there was a failure to set proper tariffs in the past (leaving aside issues of D, C, S, and RI), the “beneficiaries” of lower tariffs in the past will not be the same as those who face the burden of higher tariffs going forward. In fact, more of the growth in demand going forward is likely to come from residential users and newer users, more so because premium consumers (commercial and industrial) are likely to move towards renewable energy (RE) and/or third-party procurement, including via rooftop solar, open access, and captive or group captive power.

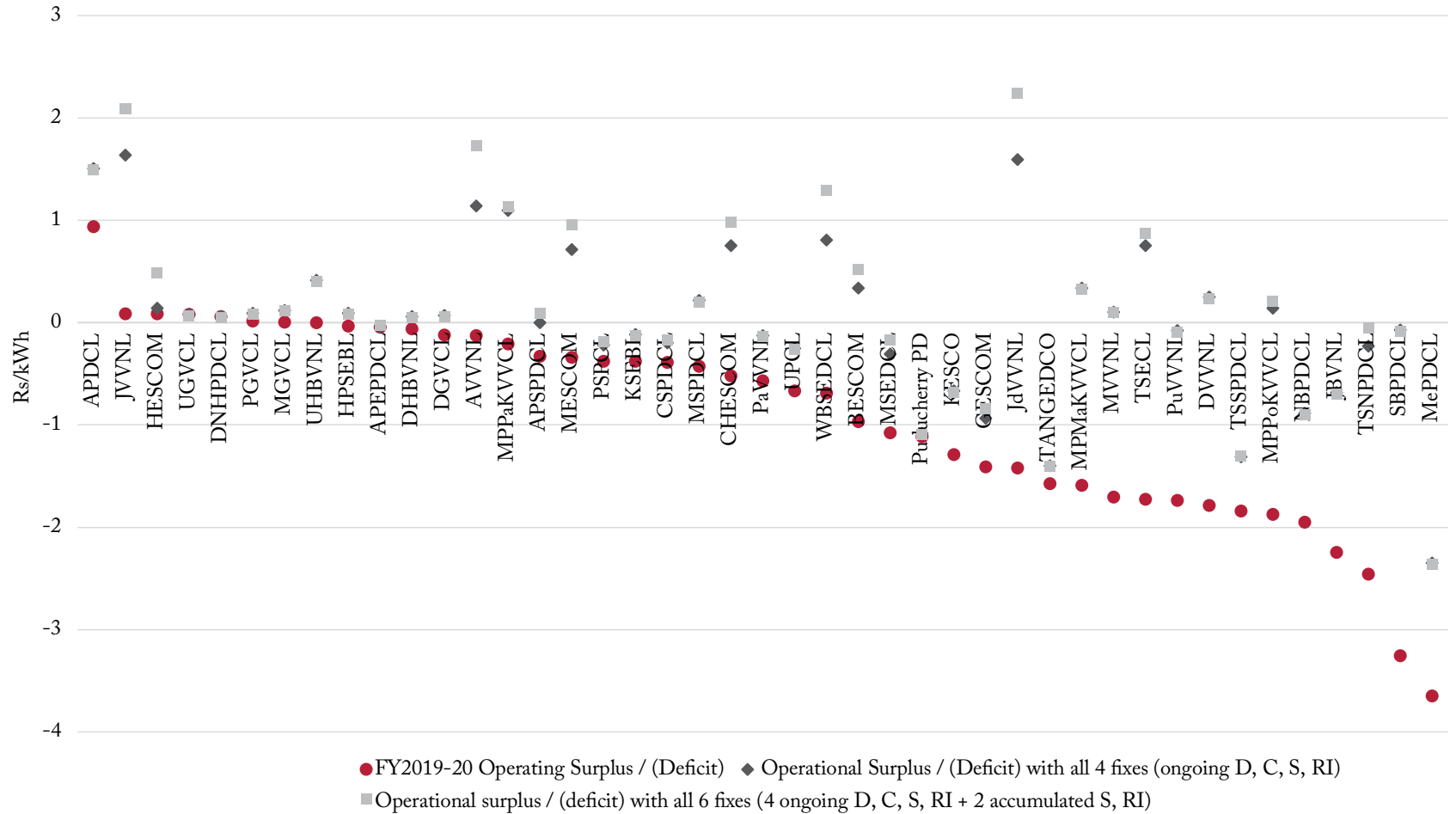
One piece of good news for any financial instrument meant to cover historical gaps is that the volume of sales is increasing over time,

so the impact per unit (per kWh) will diminish over time. This, of course, assumes that we fix operating gaps going forward, so that only a finite quantum of historical gaps needs to be covered in the future. We also assume that continued general trend of higher billing efficiency, further makes financial improvements easier.

As a simple thought exercise, Figure 22 shows the impact of further addressing cumulative S and RI compared to the baseline gap and also fixing the four identified ongoing gap components, namely, D, S, C, and RI. This exercise exemplifies the *operational* (annual P&L) value of these balance-sheet fixes since the extra cash can be used to pay down liabilities, which we assume saves 10% per annum carrying cost.

These balance sheet lapses are significant cash gaps concentrated in a handful of DisComs, and S and RI are potentially fixable with actions or choices beyond the DisCom—that is, the state government (for S) and regulators (for RI). We limit ourselves to these two components as D is lost forever and doesn't show up on any balance sheet (it is secondary if/where S is recognised on the balance sheet). We also choose to not include cumulative C (trade receivables) as those aren't about policy fixes.

Figure 22: Impact of interventions (all four ongoing components) versus adding two of the accumulated components (S, RI) on operating surplus/(deficit)



Source: Authors' calculation based on PFC Reports on Performance of Power Utilities (2019-20).

Note: This uses FY2019-20 as the reference year.

The clean-up amounts for these would need to be given to DisComs, but these would not be a bailout or “extra” infusion. From our sample up through FY2019-20, accumulated unpaid subsidies for the 14 years are Rs 69,281 crore, whereas cumulative regulatory income came to Rs 33,709 crore. These are “extra” revenues distinct from “organic” growing revenues for DisComs arising from volume increases and also regular (inflation-linked) tariff rises that regulators already carry out. However, fixing regulatory assets (the net accumulation of RI) does require a tariff rise.⁵⁴

As Figure 22 shows, there is far greater profitability achieved from fixing the ongoing operational gaps (annual D, C, S, and RI) than the annualised benefit from cleaning up the balance sheet problem of accumulated S and RI. Although there is a benefit from the extra cash, it mostly improves DisComs that have already become profitable. Only 2 more DisComs cross over to profitability, leaving 18 DisComs for which we would still need an additional tariff rise (or also a separate cash infusion) to achieve profitability. The bad news is that for the highly loss-making DisComs (the right side of the graph), paying down accumulated S and RI barely moves the gap. The graph does show one positive trend—even for very highly loss-making DisComs (which are on the right), we can significantly improve the gap (in a few cases even into profitability) with these fixes, especially if we fix the operational D,

C, S, and RI gap. Stated another way, for a number of these DisComs, the problem isn’t the residual gap, and hence there isn’t a major tariff increase required, except to address regulatory income.

The remaining operating gap gives us a sense of the amount by which tariffs would need to be hiked after these fixes (either the annual D, S, C, and RI or also adding in improvements from fixing the accumulated S and accumulated RI). We can compare the remaining gaps with existing consumer tariffs to get a sense of how hard the remaining problem is. As we discuss in the policy section, it’s not easy raising tariffs—more so for the other reasons we discuss than just political support.

Of course, this is just an exercise, and say we did liquidate accumulated S and RI, there would be competing uses for such funds. We simply showed the tariff-level comparison for gauging the impact. Which liability is paid down first is a specific policy decision that needs to be made. As we later discuss, paying off GenCos is a prime candidate, more so since LPSCs may not be allowed by regulators into the rate base, and so these would be cash savings (instead of risking pressure to lower tariffs).

A subsequent study is envisaged which focuses on cleaning up the balance sheet in more detail, and in it, we also focus on heterogeneity and varied instruments.

⁵⁴ In some cases, we lack regulatory asset data since some may have been wound down, so we use summation of regulatory income—the difference at a national level would be trivial, but in some states, this may be important given that RI only occurs in a fraction of DisComs.

10. Discussion and Recommendations

The overall gross shortfall in tariff has stabilised at around 14% during the last few years, and this is reduced only through grants and other income. Before addressing the operational gap problem, inefficiencies embedded within the tariff determination process (including the true-up mechanism) need to be resolved so that gap between ex-ante and ex-post scenarios is resolved.

- Efficiency improvements like reducing the AT&C gap are important but insufficient to closing the operating gap. An inevitable solution for the residual gap and also fixing regulatory assets is raising the tariff.
- There are a range of actions outside raising tariffs that include regulatory process related and operational improvements. The former includes speeding up the reconciliation timeframe for true-ups, charging a carrying cost on unpaid subsidies (and listing them as a receivable in the balance sheet), and avoiding creation of new regulatory assets. The latter includes improved billing, installation of smart meters, and increasing the security deposit of consumers.
- Additional enabling steps include better planning to reduce *ex-post* deviations from tariff orders, utility and regulator capacity building, improvements in data and accounting norms to bring in greater transparency and dissemination, and improved granularity with standardisation in billing and payment data.
- Ultimately, “fixing” the problem runs even deeper than just accounting. Given many of the issues facing the power sector are political, these would need support of the political leadership and cross-stakeholder buy-in.

The concluding section of the paper focuses on a few key issues related not only to the residual gap identified, but also the ongoing total gap:

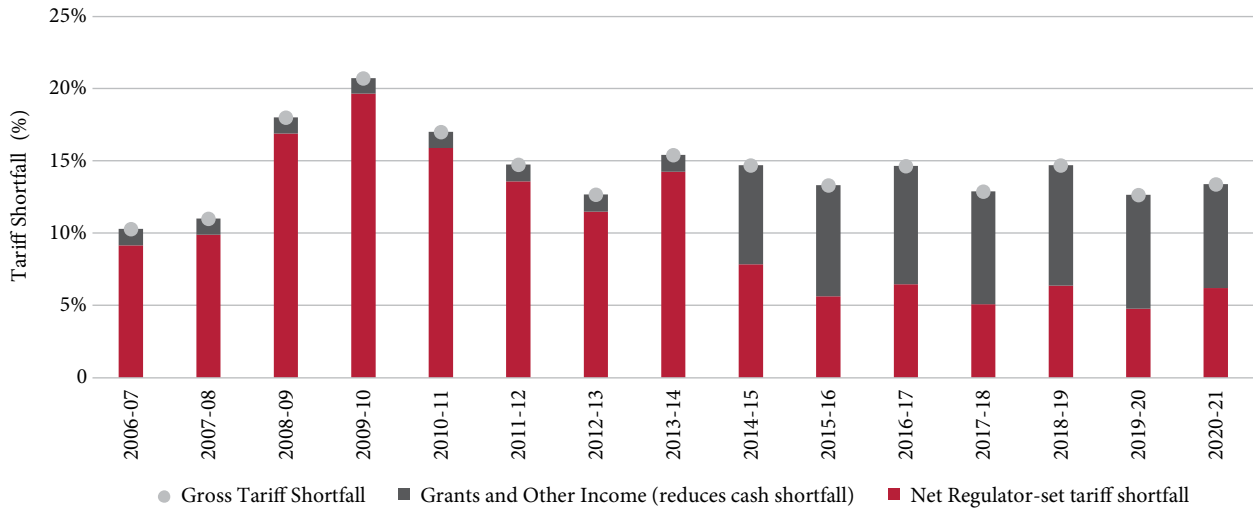
1. Why is there a residual gap?
2. Who (or what process) is responsible?
3. What do we do to fix DisComs financially?

10.1. What Causes the Gap?

At a simplified level, as this paper shows, the cash gap DisComs face is due to a combination of operational lapses (D, C, S, RI) and a residual gap, which mathematically means that regulators didn't set a tariff that would cover the costs.

It's also worth emphasising that the net gap we have focused on in this paper is *after* including additional income and grants that were outside regulator purview when setting tariffs. Figure 23 shows how the gross gap (before other income and grants) has been relatively stable, but the net gap has come down disproportionately in recent years due to government support or unplanned other income. The support here is from revenue grants, including UDAY grants, and excludes capital grants under schemes such as the Restructured-Accelerated Power Development and Reforms Programme (R-APDRP), Integrated Power Development Scheme (IPDS), and so on.

Figure 23: Regulator tariffs and their shortfall—with vs without grants and other income



Source: Author calculations from PFC, tariff order, and other data.

Notes: These are the shortfalls based on the tariff and exclude the cash-basis loss due to operational lapses such as higher AT&C losses than targeted.

While it may be mathematically true, it is incomplete to state that regulators are not setting a high enough tariff to cover costs even after accounting for factors such as high billing loss, consumer non-collection, subsidy non-payment, and creation of regulatory assets (D, C, S, and RI, respectively). Firstly, there may be other causes for the gap where they are right to not raise tariffs, such as a request by the DisCom in a true-up that is expressly disallowed, beyond failing to meet AT&C targets. But, are DisComs asking for all they should in true-ups? Are all of their requests being allowed, even reasonable ones?

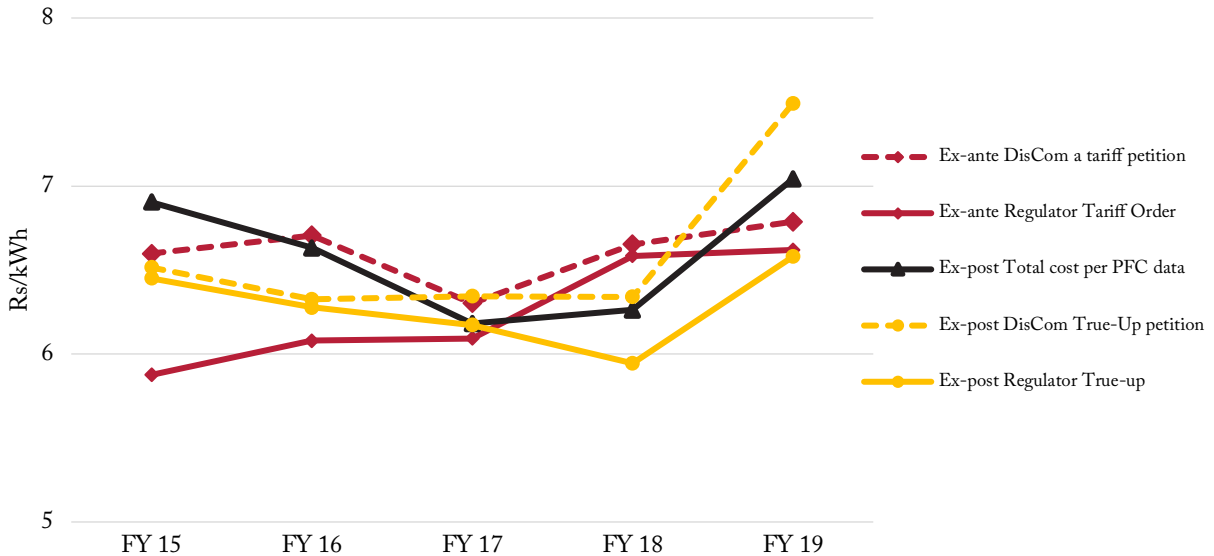
Figure 24 shows the aggregation of different processes for a sample DisCom. Note that these

are shown for the year of relevance and not the year these transpire (power sold). For example, the true-up for FY2016-17 occurs some two years later but is shown for FY2016-17. The typical process is given below:

1. Tariff petition (year $N - 1$)⁵⁵
2. Tariff order (year $N - 0.5$ up through the period up to financial year end in March)
3. Year in force
4. True-up petition (year $N + 1$), which is after audited reports come out
5. True-up order (year $N + 1.5$), which embeds into future tariffs
6. True-up comes into force (year $N + 2$)

⁵⁵ This timeline here doesn't show the advance MYT issued in groups of years well in advance, for planning purposes, since those are superseded by the annual tariff-setting process. The timelines are only indicative—some steps may take longer. Tyagi and Tongia (2023) (in press) show the process in more detail.

Figure 24: True-up life cycle for Paschimanchal Vidyut Vitran Nigam Limited (PVVNL) of Uttar Pradesh (ACoS from FY2014-15 to FY2018-19 in Rs/kWh)



Source: Tyagi and Tongia (2023) (in press), based on various UPERC regulatory orders.

Notes: In some years, PVVNL beat the billing efficiency targets—in part due to lax targets—and in such years, we assume that they keep half the extra savings as incentive.⁵⁶

In this example, we split the process around the middle (year in force)—the blue lines are the *ex-ante* tariff order, and the black lines are the true-ups. The dotted lines are the petitions made by the DisCom, whereas the solid lines are the approved values (or the actuals in green).

We note that the ask is never allowed in full every time. Was the DisCom asking for inappropriate cost coverage or were its assumptions unreasonable?

Typically, regulators accept volumes as petitioned, so that is not the key problem. Is this a general negotiation stance (over-ask assuming you would be cut down)? If we then consider the actual costs that should be allowed (removing failures to meet AT&C targets), we see that there is no consistent trend, but there are cases where the ask in the true-up appears to be lower than the costs that should be allowed.⁵⁷ Alternatively, they also ask

⁵⁶ In most of our calculations, we do not adjust for a negative D (exceeding the billing efficiency target) with an incentive since we don't know the threshold at which this kicks in. Similarly, even for missing the target, some regulators allow a buffer. Given the lack of data, we don't factor in this level of detail, except in the PVVNL example for illustration purposes. This issue also flags another issue for which we don't have proper norms compiled. Say a DisCom overachieves on D but underachieves on C. Ideally, it should get half the savings of D (since C is separate and a cash flow issue only, remaining alive on the balance sheet as a trade receivable), but our limited understanding is that most regulators only look at the total under AT&C losses.

⁵⁷ This case also reflects how dramatic volume (kWh) swings (not shown in the graph) can be between *a priori* petition/tariff order and true-up—by some 25%! We can speculate on the types of reasons there would be for claiming such a jump in planned volume in a year, only to find in the true-up that the volume increase was only a few percent. Is it sales optimism or a game played to keep tariffs low (more cost recovery through volume instead of tariff increases)?

for more in the true-up than true costs appear to be. This may be due to how some costs carry over across years, and it's an issue of how or when they are taken in the books.

Tyagi and Tongia (2023) (in press) have delved into the tariff process and the differences between *ex-ante* tariff orders and *ex-post* actuals. We summarise a few of their findings, which appear to be key for understanding the source of the residual gap.

When tariff orders are notified, they ostensibly do not have any cost–revenue gap, but by the time we have booked values (thus removing many operational lapses), there is a significant gap. The gap is worsened on a cash basis. It arises disproportionately due to higher costs than notified in the tariff order and, to a lesser extent, lower revenues than anticipated.

Given that tariff orders are assumption laced, *ex-post* actuals will inevitably differ. However, Tyagi and Tongia (2023) (in press) found a one-sided skew that indicates it is not a random error. Even having a skewed gap shouldn't be a long-term problem given that there is a true-up (reconciliation) process meant to cover *ex-ante* to *ex-post* shifts through future tariffs (theoretically, covering all allowed shifts—that is, disallowing performance failures such as AT&C losses). However, not only is there a multi-year time lag between when true-up recoveries can be earned, which adds thousands of crores of carrying costs, but true-ups also seem to only cover a small fraction of the gap, even the gap that should be allowed (i.e., excluding AT&C lapses).

Tyagi and Tongia (2023) (in press) investigated a number of cost components and found that,

on average, power procurement costs showed the largest shift from *ex-ante* to *ex-post*. It's worth highlighting that a fraction of the higher power costs is already recovered through a quarterly Fuel Adjustment Charge (FAC), raising the average billing rate compared to what was planned in the tariff order. Thus, the gap is more complex and deeper than it appears.

We do not have the data to fully identify the cause(s) of the residual gap, but it doesn't exist *ex-ante*, and the reasons for its non-resolution through the true-up process are systemic. However, it is widely acknowledged that there is political pressure to keep consumer tariffs low, and this seems to be a hidden factor in all stages of the process: the DisCom asks, the tariffs as allowed, and the reconciliation process. Unfortunately, lowering tariffs by making losses results in poor equilibrium. Rather, lower tariffs should be driven by efficiency.

10.2. Who Bears Responsibility for the Gap?

Responsibility should be viewed more as a marker for who can fix things as opposed to a means of assigning blame.

Table 9 shows the implications and financial remedies for the components of the gap (as-realised basis). It also shows how gaps that are directly under DisCom purview constitute only a little over a quarter of the cumulative financial gap over 15 years. Table 12 shows the primary and additional stakeholders for gap components, along with remedies for future avoidance.

Table 12: Stakeholder roles in gap components and their options for avoidance

Gap Component	Primary Responsibility	Other Stakeholder Roles	Remedy for Future Avoidance
D Distribution network loss (beyond allowed target)	DisCom	Being cash-strapped makes investments harder, one reason for Central Government schemes and support for lowering AT&C losses	<ul style="list-style-type: none"> • Technical losses: Investments in technology, hardware, analytics; better planning • Theft: Vigilance and political support
C Consumer non-collection	DisCom	A large fraction of consumer dues is from government users (state and local)	<ul style="list-style-type: none"> • Make it easier to pay • Disconnect the consumer if they don't pay (takes political support) • Use of (smart) pre-paid metering
S Subsidy non-payment	State Government	Regulators setting cross-subsidies also strongly influence subsidy burdens Tyagi and Tongia (2023) (in press)	<ul style="list-style-type: none"> • Transparency and visibility for timely payments • Create feedback loops to pressure them to pay (incl. penalties)
RI Regulatory Income (tariff not raised as required)	Regulator	States need to lower undue pressure for artificially low tariffs	<ul style="list-style-type: none"> • Follow existing norms to <i>NOT</i> have Regulatory Income (that needs to be carried forward)
Residual	The outcome is a direct interplay of DisComs and Regulators (the latter ultimately setting the tariffs)		<ul style="list-style-type: none"> • Structural Change? • <i>Ex-ante</i> tariff closer to <i>ex-post</i> realities • Improved tariffs

Even without considering the residual gap, it's worth mentioning that many remedies are easier said than done. If it's difficult for DisComs to enforce payment collection on average, it's even harder to disconnect users in “problematic

neighbourhoods,” which would likely be disproportionately causal. A large fraction of the substantial consumer dues owed by governmental users includes outstanding dues from urban and rural local bodies for vital civic services such as

lighting, water supply, and so on, and therefore, disconnecting them would not be feasible. There is also a risk that one remedy (disconnection) could just cause another failure (increased theft).

While DisComs are ostensibly at fault for D and C (but as Table 12 shows, even C is linked to other stakeholders), it is difficult to state whether they are at fault for the residual gap. The previous section listed numerous possible causes of the residual gap, and DisComs have a role in some of them even if they don't have the final responsibility for setting tariffs, which ultimately is the key factor in creating the residual gap. DisComs, however, are responsible for timely, prudent, and realistic petitions.

It is worth emphasising that even if all stakeholders perform as planned, it would only avoid future losses and not clean up past problems. It is only when one overachieves targets for components festering in the balance sheet, such as by achieving more than 100% collection, or by getting one-time special receipts, would one clean up past problems.

10.3. Fixing the Issues

The precursor to fixing the issues is proper identification of the problem. This paper is an attempt at that.

If we revisit the myriad possible causes of the residual gap, we find that these are heavily structural. Fixing them will thus involve several changes, many of them also structural, including who bears risk, even going beyond the DisCom to encompassing generation and transmission.

Ending operational losses should come before fixing the balance sheet, but these are not mutually exclusive. On the other hand, the former appears easier than the latter, not just due to the volumes involved, but also because the latter involves a range of choices to be made—as discussed earlier, what level of clean-up are we aiming for? Too much may risk moral hazard,⁵⁸ whereas too little may not be enough and may also be unfair to the DisComs (at least to the level of aspects provably not their fault).

The range of options and instruments for fixing DisCom finances can have several dimensions, as detailed below:

1. Scope:

Operational fix ↔ Balance Sheet Clean-up

2. Mechanism:

Tariff Rise ↔ Non-Tariff Rise

3. Instrument:

Direct ↔ Indirect (aka enabling)

Point (1) has already been discussed; point (2) is straightforward, even if some actions are difficult in practice (e.g., recovering past dues from consumers); point (3) is split between directly tackling the gap versus steps that make it easier to tackle the gap, such as administrative changes. Of course, as we've seen, for example, how some balance sheet clean-ups improve annual operations by freeing up cash, there can be an overlap between dimensions.

A list of recommendations is given below, while acknowledging some are easier said than done.

⁵⁸ Not all debt write-off is a moral hazard. Anthropologist David Graeber (2011) in his book *Debt: The First 5,000 Years*, makes the case for debt jubilees to create a useful reset.

1. Fix the operational gap: No more *D*, *C*, *S*, or *RI* (excess distribution or billing losses, consumer non-collection, subsidy non-payment, or creation of regulatory assets (listed as regulatory income on an annual basis), respectively).

As discussed before, addressing *RI* and the residual gap both require a tariff rise.

a. Distribution losses (*D*)

- i. Technical loss reduction requires planning and engineering upgrades, which require investments. Recent central government schemes starting with PDRP attempted this, but instead of an aggregated scheme DisCom wide, starting bottom up at a feeder level is likely to give the greatest returns .
- ii. Theft reduction requires determined action, but smart meters can help pinpoint problem areas.
- iii. Proper targets are key for a plausible trajectory of improvement. Loosened targets might help improve compliance but are bad for consumers and not recommended. On the flip side, we also do not want overly aggressive targets that are implausibly tough. During UDAY, some DisComs such as Uttar Haryana Bijli Vitran Nigam signed up for sharp reduction trajectories of more than 8% in one year (Government of Haryana, 2017). If they fail to achieve this, the financial hit would be enormous.⁵⁹ Another reason why the targets need to be in the right range (balancing improvement with practicality) is that proper data are

needed for baselining. Acquiring data is still problematic in rural areas (or where there aren't regular meter readings taken), especially because of the large number of agricultural or unmetered consumers.

- iv. There are incentives to beat the targets in many DisComs, such as 50:50 sharing with consumers, but the norms should be updated. Instead of a blanket AT&C target, there should be a separate target applying only to *D*, and if the DisComs beat this, there is a case for them to enjoy all the benefits since they also have to invest to achieve the improvement. More importantly, getting the target right is key—one can justify all the benefits of going to the DisCom if the target is stringent.

b. Consumer non-collection (*C*):

- i. Given that a substantial fraction of dues is from governmental users, and disconnecting them is problematic, there need to be new financial mechanisms to encourage, if not force, them to pay. If an entity is cash-strapped, the entire budgeting and financial outlay process may need to be revamped. For local bodies, the state may need to step in, and for states, the centre may need to step in.
- ii. Smart meters are a key tool for reducing *C* losses as well. These can help at two levels:
 1. First, they can operate as prepaid meters (a strong component of which to be provided to the government

⁵⁹ During UDAY discussions across stakeholders, while there was no single mandatory loss target, and states had leeway to choose, there was nonetheless pressure to be aggressive. Even more material is the fact that UDAY targets as signed by DisComs superseded the regulator-set tariff, typically with much greater tightening.

- consumers), a strong component of government roll-out plans for smart meters under the Revamped Distribution Sector Scheme (RDSS). Non-smart prepaid meters aren't ideal for a range of reasons, including (manual) interface issues, inability to update tariffs easily, and lack of DisCom interface and visibility amongst others (Tongia, 2020).
2. Second, smart meters can also help with collection since they come with remote connect and disconnect capabilities. Of course, nothing stops DisComs from disconnecting consumers who don't pay even today, but this requires far more political support. Manual disconnection is also much more cumbersome in terms of resources, and occasionally, it also involves safety risks for the linesman.
 - iii. Proper use of consumer deposits can also help improve collection. These are meant to be equivalent to two months of billing. A major problem is that these are often not updated, and someone who signed up 10 years ago may have a trivial deposit on file. Some DisComs, such as BESCOM in Bengaluru, are diligent, with annual increases separately charged as an additional security deposit, proving that it can be done. Even with a proper deposit, DisComs would still need to disconnect consumers if they don't pay.
 - iv. Staff need to have oversight and incentives to improve collection.
1. One technique is to have bottom-up accounting—for example, at a feeder level—so that problem areas can be identified and isolated. Different feeders can then be given different (and realistic) trajectories for collection efficiency. Dedicated staff can be assigned for different feeders (or other geographies), helping provide a sense of ownership (and responsibility) for operations.
 2. Staff alignment is a key factor, especially for field staff. Haryana reduced its AT&C losses dramatically in just a few years, and it offered a *10% bonus of extra recovered/settlement amount* as part of its UDAY alignment.⁶⁰
 - v. Improved service is something that consumers deserve, but it can also be an incentive for better consumer behaviour (especially paying on time). In several states, such as Maharashtra and Bihar, DisComs have trialled offering proportionally better service to areas with lowered AT&C losses. Better service begins with improved power supply but extends to customer service as well—including, for example, more call centres, complaint tracking, and timely resolution. Simply making it easier to pay via more outlets and mechanisms can help a lot. Some states are even offering incentives for automated electronic payment.
- c. Subsidy non-payment (S):**
- The first step in ending this gap is simply enforcing payment of what was promised.

⁶⁰ As per the reward scheme in Haryana (Govt of Haryana, 2017), “Under the scheme it has been decided to give incentive of 10% of the amount realised on account of final settlement will be paid to the authorised officer/ official concerned/ Nigam employee/ private person (including informer if any) to personnel carrying out vigilance work.”

Given that states own the DisComs, it is very difficult to expect DisComs to be vocal in asking for timely subsidy payments, forget historical unpaid dues. Maybe regulators need to have authority to penalise states for S; Punjab ERC does so. A plausible rate would be equal to GenCo LPSC rates, and this could be put into the National Tariff Policy.

How do we enforce subsidy payment or cut down such a risk? It is unlikely that states would be willing to put promised or booked subsidy amounts in escrow up front. There have been attempts to use mechanisms such as interventions on centre–state funding flows as offsets for non-payment (e.g., to NTPC, a central power generator). Can something similar be planned for non-payment of subsidies?

How, when, and in what manner subsidies are paid out varies enormously across DisComs and is extremely complex. The norms can range from flat per unit to percentage to lump-sum subsidy (though the latter is declining), which means that it can be tricky to get subsidies right because we know that *ex-ante* to *ex-post*, the consumer mix and sales volumes can vary significantly. What we often don't have is a “subsidy true-up” process.

Very often, there are transfer adjustments made for subsidy instead of cash, sometimes against electricity duty collected from consumers by the DisCom. It would be a separate exercise to compare subsidies and duties on a per-DisCom basis. Given that electricity duty rates are outside regulator purview, they are not studied much. CEA data indicate wide heterogeneity in rates,

sometimes in a manner that becomes a major hidden cross-subsidy. For example, in Maharashtra in FY2020–21, commercial users could pay electricity duty as high as 18.8%, whereas residential users could pay a lower duty of 13.8% (in both segments, there were minor variations by slab).

d. Regulatory income (RI):

This fix requires a tariff rise, which may be substantial for a few DisComs. In theory, regulatory income should not even be allowed any more. Although regulators may claim that they are doing this to protect consumers from a tariff shock, they are not only kicking the can down the road, but they are also aggravating the problem since the DisComs are still owed interest until these are resolved, and the regulatory assets keep piling up.

2. Fix the operational gap: No more residual gap

Although we don't know the underlying mechanisms of the residual gap exactly (and it likely varies by DisCom), resolving the residual gap ultimately requires raising the tariff. The quantum of residual gap in per unit (per kWh) terms averaged only about 3% of costs in FY2019-20, but this average varies measurably, and for a number of DisComs, it exceeds a 5% annual additional rise even when spread out over four years.

Raising consumer tariffs is a very complex issue. As Tyagi and Tongia (2023) (in press) opine, even varying tariffs (with no average rise) to change cross-subsidies is challenging because the relative increase from low-paying consumers would be higher. Outright raises prompt the question of which consumer sector should pay and how much. Does a 10% rise mean everybody's prices rise 10%? Or, should lower payers pay disproportionately

more of the rise, which would bring prices more into alignment? Such a shift would be rational and even part of compliance with the National Tariff Policy (which limits cross-subsidies). However, *any* tariff rise is politically very challenging, and current electoral trends appear to be moving towards even greater promises of cheap (or even free) power in some states. Such issues are outside the scope of this study.

Specific improvements to end the residual gap include the following:

- a. *Fix the true-up process.* This is the key need since the *ex-ante* tariff orders have virtually no gap.
- b. *Have realistic assumptions of costs and revenues in tariff orders.* Getting this right reduces the pressure on true-up mechanisms.
- c. *Shorten the time until true-ups.* This could be done perhaps using quarterly pro forma adjustment, to be settled after audited accounts are finalised. This will reduce carrying costs for DisComs. Already, fuel adjustment costs are handled quarterly without waiting for audited accounts to be passed through to consumers. In December 2022, the central government amended the electricity rules that prescribed for automatic adjustment of variations in cost of procurement on a monthly basis and true-up on an annual basis (MoP, 2022b). In order to effect this change, regulators need to amend their tariff determination principles under their respective MYT regulations and reflect the implementation through subsequent tariff orders. In any case, this will take not less than six months of time.
- d. *Improve accounting norms for increased transparency that will reduce the residual gap* (a subset of broader improvements in data listed subsequently).
- i. Separate true-up or other historical amounts in the accounts to provide clarity on current cost structures. This will be especially important as we move towards more competition.
- ii. Standardise what is versus isn't allowed to be claimed in true-ups, and make these explicit in regulatory orders. Based on discussions with regulators, including on aspects not part of public rulings, a fraction of the gap even after true-ups appears to consist of disallowed costs, especially those that are not related to power-procurement. However, a principle for (dis)allowance should be based on whose fault it is. Often, the DisCom is squeezed by generators and is left with no alternatives.
- iii. Link true-ups to additional (trued-up) subsidy requirements if any. Discussions with experts indicate that one subtle problem isn't just a failure to collect the booked subsidy, but also not even asking for the right amount of subsidy, more so after the true-up.
- e. *Create a new mechanism to examine what residual gaps remain after true-ups that cannot be pinned on DisCom lapses and also allow for their recovery.* Based on a few cases we examined in more detail, the residual gap doesn't appear to be entirely due to DisComs asking for a certain cost structure and being disallowed the same by the regulator; there is even a gap in what is asked for at times. Part of this may be because the present systems inherently have limitations in regard to what can be asked for, and thus the entire template might need to be updated.

3. Improve planning (especially to reduce deviations from tariff orders).

DisComs have a large role to play here, more so because—as Tyagi and Tongia (2023) (in press) found—deviations in power purchase costs dominate changes from the tariff orders to actual volumes and costs/revenues in absolute terms. Beyond getting it wrong less often, we need better mechanisms to catch such errors along the way.

Planning will become even more critical as we move to a high-RE future, but the legacy system of costs-plus tariffs with pass-throughs, especially of fuel charges, reduces incentives to save costs in procurement. Planning starts with demand planning and will need to expand to planning at the level of time-of-day. The good news is that proper planning is increasing in DisComs, and we believe that it may be a factor in the decline seen in the residual gap in the past few years.

One of the weak links in better planning is capacity building, especially for utility staff (and regulatory commission staff) to learn new market designs, software, data handling, and so on. Staff are stretched simply keeping the lights on, and medium- to long-term planning often takes a back seat. This also happens due to the short tenure of staff at leadership levels. Although improving human capacity will take time and money, lack of money does not seem to be the problem. Among the central government schemes for the power sector, the component for capacity building is often under-utilised. For example, under R-APDRP, announced in 2008, Part C was for capacity building and personnel enhancement. Out of an outlay of Rs 1,177 crore, only Rs 236.65 crore was taken up through March 2015 (CAG, 2016).

4. Improve data and accounting norms, with greater transparency and dissemination.

This broad topic spans what is captured all the

way to how it is made available. This is important not just for reasons of forensic accounting, but because data and accounts are part of the tariff-setting process and useful for policy targets.

- a. *Align official data sets.* This study relied on manual compilation across many sources, which don't always align. "Regulatory accounts" such as those listed by PFCs don't fully match generally accepted accounting principles (GAAP) accounting. They need to match.⁶¹
- b. *Improve data transparency.* This begins with transparency on data sources and assumptions and extends to underlying granularity of data.
 - i. *Split up AT&C losses into its components.* "Collection losses" should be broken down transparently into consumer non-payment and subsidy non-payment, as we have done in this paper. Losses from billing efficiency failures should also be broken down into the best possible estimate of technical losses and theft, though this would, naturally, need to be assumption driven. Even data such as fraction of billing done through estimated reads or assumptions should be broken down, since it inherently has room for error (or manipulation).
 - ii. *Improve the granularity and components of all relevant data.* For example, the PFC heading "grants and other income" should be redone to separate grants (paid by taxpayers) from other income. Even the latter should be broken down—for example, into that paid by consumers for regular usage and that paid for penalties. A much harder challenge

⁶¹ A small fraction of issues relates to how amounts under dispute are accounted for—for example, anything sub-judice wouldn't show up as a *past* due, perhaps showing up as a current due. Such things should be segregated and shown separately.

is tracing whether funding was used for the intended purpose or whether there were any possible diversions — for example, capital grants being used as a stopgap measure to address urgent cashflow issues. This was identified by the Comptroller and Auditor General of India in their examination of earlier governmental schemes (CAG, 2016). This is more than an academic issue since regulators have to take a call on what the “allowable” costs are that should be borne by consumers in the tariff.

iii. *Improve the granularity of billing (revenue) data and payment data.*

1. *Billing revenue in books of account should have granularity.* For example, fixed and variable costs and volumes of sales should be separated by type of consumer at least, if not by slab level. These will become more important as we increase more competition and RE (which may be consumer owned at the edge). Today’s equilibrium undercharges fixed costs compared to variable costs in consumer tariffs, creating a greater likelihood of premium consumers reducing or even exiting DisCom supply through options such as rooftop solar.
2. *Break down trade receivables into type, likelihood of getting paid, and so on.* Trade receivables constitute an enormous due to the DisComs, but it is unclear how many of these are likely to turn into bad debts. DisComs should declare the ownership (governmental user vs private individual, residential vs industrial, etc.), age, and status of unpaid dues—for example, whether

it is for a disconnected consumer and hence unlikely to be recovered. Regulators should correspondingly notify norms for how to handle or write off such dues.

- iv. *Make data available publicly, including underlying data.* Although many data are public, these are often not made available in Excel-type formats or downloadable data formats. Ali and Tongia (2018) lay out some suggestions for better data dissemination.

While data are sourced bottom-up from the DisComs, the central government has several publications that attempt to compile these. The data sets should be enhanced to add new (and sometimes simple) metrics such as timelines of tariff petitions, like the REC is now compiling, but there are many more aspects that need to be standardised and captured.

- v. *Raise consumer awareness of pricing in consumer bills.* DisComs should add line items to split up cost components—for example, if a regulatory asset is being liquidated, it should be specified what part of the tariff pays for that. Similarly, consumers should be made aware of how much over- or underpayment they have in relation to the tariff. Railway tickets already contain information on how much passengers are underpaying. Consumer bills should also be made easier to interpret, highlighting both the average cost paid and the marginal (slab) rate being paid. As we increase the use of smart meters and expand options for third-party power sales, improved consumer interfaces to billing data

(including time-of-day data) will become increasingly important.

Ultimately, the data obtained will need to have the characteristics of greater clarity, consistency, and wider coverage (including granularity).

Although DisComs do have auditors, perhaps they need external auditors who are *not paid by them or the state government* to reconcile their books. However, it is even more important (but difficult), since so many parts are interconnected, that they reconcile against counter-party books.⁶²

5. Fix the balance sheet problem through a range of options and instruments.

This paper doesn't focus on the balance sheet, which is a deeply entrenched problem and one built up over more than 15 years; an ongoing parallel study will elaborate on balance sheet and clean-up challenges in more detail.

Regardless of the level of clean-up desired, there are a few steps that could apply across the board.

- a. *Segregate and focus on key receivables.* Consumer dues (trade receivables) are often diffuse, so lump-sum revenues could come from accumulated S and RI (i.e., regulatory assets). These are not a bailout and are anyway due to the DisCom (although the latter does require a tariff rise, by design).

While these two clean-ups would only cover about half the GenCo dues for our sample (but more if the private sector, which has a disproportional amount of regulatory

assets, is included), for some states, the impact would be far higher than the average. Policymakers should determine and then enforce a viable trajectory for resolving accumulated S and RI.

- b. *Include line-item unpaid subsidies as a receivable in the balance sheet.* Assuming that the accumulation of unpaid subsidies really isn't on the balance sheets (to the best of our knowledge), it needs to be separated, instead of such lost cash flow being embedded elsewhere in the balance sheet.
- c. *Have a priority list or order for where incoming money is to be utilised.* While liquidity needs to take priority, assuming we have sufficient funds, there will be many possible uses for such funds. If DisComs do get money one-off as a historical recovery, they may be tempted (or nudged) to pump that towards lower tariffs. That would be wrong on two levels. First, such money is given to remedy past deficits, and should thus be used for cleaning those up. Second, such money, even if it is used to clean up the balance sheet, can directly help lower tariffs. This happens for those components that attract ongoing costs such as interest on debt, interest on regulatory assets, working capital, and so on. Although LPSCs may or may not be allowed into the rate base by regulators (it is ostensibly a fault of the DisCom), paying off GenCos would still help the cash flow problem. Paying them off is important given their primary role in the supply chain and also because of the ongoing energy transition, where new RE suppliers worry most about counterparty (i.e., DisCom) risk (CEFF, 2016).

⁶² State accounts are an important example as they link to subsidies. When this issue was flagged in the audited annual report for a Karnataka DisCom, the management reply was, "we take subsidies as booked as being received since the Govt. of Karnataka has accrual basis accounting, and we have to match that." This further strengthens our argument for segregating subsidies not received in the balance sheet.

d. *Seek to lower bank interest rates* without necessarily relying on an UDAY-type scheme. This can be done through risk-pooling mechanisms, for which coordinated or central government help may be required. The Central Government introduced new liquidity schemes with loans through PFC/ REC during COVID-19. In addition, they have undertaken a range of other steps to address the financial woes of DisComs such as the Revamped Distribution Sector Scheme (RDSS), Late Payment Surcharge (LPS) Rules etc. (Appendix 9 has more details on these).

Ultimately, we need a retail pricing system with more simplicity, consistency, ease of reconciliation, and timeliness.

Raising tariffs is inevitably political, but the first step can and must be simplification, not just of the myriad slabs and price points in tariffs (or even consumer sub-categories—such as carve-outs for silkworm cultivation in some cases), but also of *methodologies*. Unfortunately, given the political economy of electricity pricing and regulations, complexity and opacity may be a feature, not a bug.

Regular tariff increases should be periodic, so that no single rise is extreme—and is thus palatable. Another benefit of periodic, even if incremental rises is that it reinforces the idea in the public mindset that increases are normal and to be expected. There should never be a gap between tariff adjustments due to technicalities such as

absence of a quorum of regulators or failure by the DisCom to petition a tariff rise. The proposed Amendments to the Electricity Act, 2003, include the obligation for regulators to set revised tariffs *suo motu* in case the DisCom doesn't step forward, which is a welcome step.⁶³

The issue of failing to have annual tariff orders highlights the fact that not only do we need new rules and norms, but we also need to enforce existing norms, such as not creating new regulatory assets and liquidating existing ones within a reasonable time period.

10.4. Other Reasons Fixing the Gap is not Easy

All change is difficult, not just for obvious reasons of political economy but as a result of specific trade-offs between winners and losers. It is well known that raising tariffs is politically unpopular. What may be less widely appreciated is that in states where there are high subsidies, raising tariffs would mean that even higher subsidies are required, which is another reason why states may not like tariff rises.

Not only is there pressure to keep tariffs low, but there is also insufficient pressure on stakeholders in the value chain to seek efficiency because many aspects operate on a costs-plus basis, from fuel supply agreements (coal) to power purchase agreements (generation, especially fuel), to DisCom rate base and cost structure. Too much “pass through” reduces innovation or incentive to lower costs, and it also reduces flexibility, which

⁶³ SERCs should be issuing *suo moto* tariff orders even if DisComs fail to petition for them, based on an Appellate Tribunal for Electricity (APTEL, 2011) judgement for the need for doing so. This judgement was in response to a letter from the Ministry of Power about some DisComs not filing timely tariff petitions. APTEL ruled, specifically, “In the event of delay in filing of the ARR, truing up and Annual Performance Review, one month beyond the scheduled date of submission of the petition, the State Commission must initiate *suo-moto* proceedings for tariff determination in accordance Page 86 of 92 Judgment in OP No.1 of 2011 with Section 64 of the Act read with clause 8.1 (7) of the Tariff Policy.”

will be more important over time as we increase RE from new entrants (who will “compete” with regulated legacy providers).

There will be a need for higher tariffs, not just to fill the residual operating gap, but also to comply with limits on cross-subsidies. The National Tariff Policy limits over- and underpayment by consumers to $\pm 20\%$ of costs, but many consumers dramatically underpay, and their tariffs would need to go up. Tyagi and Tongia (2023) (in press) quantify this issue. In addition to these drivers, there are several other pressures that may raise prices in the short term, above and beyond any organic increases due to normal inflation. These will make tariff increases for fixing the root financial problems even harder.

First, there is an ongoing shift in the consumer mix. More revenue will come from underpaying consumers, including households, more so as we now have $\sim 100\%$ household electrification (and the recently added households under the SAUBHAGYA scheme were all metered). This consumer shift is also because industrial and, especially, commercial demand took a dive due to COVID-19. Some of the impacts on demand persist beyond the lockdown because work-from-home options increased manifold, with some of them being irreversible.

The second cause of short-term price rises is the hit on supply chains (first due to COVID-19 and then the Ukraine crisis), which has led to a massive spike in fossil fuel prices. While imported coal makes up about a quarter of India’s total consumption of coal (and this number is lower for utility power), the burden on coal rose as natural gas prices spiked even higher. Even the price of imported coal to the extent used (such as blended into the mix at a power plant—forget 100% import-designed plants) rose so high that the government’s temporary target of

blending in 10% imported coal (PIB, 2022a) at, say, Rs 8/kWh premium for such fuel would mean an 80 paise/kWh jump in coal generation costs.

Third, there is exceptional pressure on DisComs to pay off GenCos, whether it is through liquidity loans (called a COVID-19 “stimulus”) or, more recently, the proclamation under the LPSC Rule 2022 (PFC, 2022) which says that states can be denied power-trading access if they have unpaid dues to GenCos. While paying off dues is a balance sheet shift, operationally, it boils down to cash, which may come from other finances, including more working capital or debt, and it may ultimately show up in tariffs to the extent that regulators allow such costs to pass through. As we observed before, allocating causes or utilisation of debt or even equity is complex.

Lastly, at some point, there will be a renewed push for installing pollution control equipment on coal power plants to comply with the updated norms that were meant to come into force in 2017. Power plants have repeatedly obtained extensions for compliance, but more serious planning is finally underway. Retrofitting such equipment would raise coal generation costs at least by ~ 30 paise/kWh, if not more, depending on the duty cycle for the plant (Tongia & Sehgal, 2020).

The regulatory process is *quasi-judicial*, but remedies are ultimately judicial, which take time. Delay in implementation of higher-authority orders or in accepting recognised costs into tariffs can morph into avenues for artificially keeping tariffs low for some time. For redressal, the DisCom needs to appeal higher up, first to the Appellate Tribunal for Electricity (APTEL), or, in the cases where ERCs fail to implement APTEL orders, to the Supreme Court. These issues hurt some DisComs more than others, and such sub-judice

matters can even accumulate to multiple times higher than their annual gross revenues. Appendix 10 expands on these issues with an example.

When looking for solutions, we must recognise the interconnectedness of many issues, which makes partial solutions harder. A single intervention or instrument also suffers from a portfolio problem, even if it could be deployed to its full potential alone, because it wouldn't necessarily solve the problem of the ACS-ARR gap in its entirety. This reduces pressure on any single intervention to be harnessed, and although this helps, it's not enough, so this lowers its value and urgency.

At the end of the day, while for, say, 18 DisComs, the operating financial gap can be closed through improved operations and simply following the norms (including by states and regulators), there is often a need to raise tariffs. Ultimately, it will boil down to how much they can be raised and how soon is acceptable.

10.5. Early Actions and Credible Pathways – But External Support May Still be Needed

The road ahead will likely be long if not painful, unless one happens to find budgetary support to bridge the gap and clean up historical lapses that have accumulated. Even with external funding, fixing the operating gap won't be easy. There are several steps to help build confidence in the plans chosen.

Plans should focus on low-hanging fruits for early wins (such as, in a couple of years). For this, some requirements need to be met. First, we aren't trying to do everything equally or at once, unlike UDAY or many other schemes. As discussed previously in the section on segmentation, across DisComs,

there need to be different targets to fix their operating losses and their balance sheets. Second, in addition to different targets, the instruments themselves will need to be explicitly different. Third, we need reinforcement mechanisms for those who improve aggressively.

Targets are tricky. Too aggressive, and you set yourself up for failure. Too easy, and things don't change much. Those who perform well both in absolute and relative terms should be rewarded through matching funds or lowered interest rates (perhaps feasible through risk-pooling mechanisms or counter-guarantee mechanisms).

Why are some DisComs doing better than others? A time-series analysis suggests that usually there are multiple factors—not just low AT&C losses, cheap power, or good consumer mix and demographics individually. This means that we should have normalised benchmarks for targets that factor in such issues.

Many government efforts, including the COVID-19 “stimulus,” focused on liquidity (in this case, to pay off GenCos), which is naturally important. But it is insufficient unless the fundamentals (a solvency issue) also get fixed. The REC offers funding *at standard interest rates* up to 10 years for half the regulatory assets assuming that there is a trajectory for recovery in the tariff orders. This doesn't really change the fundamentals, even though the interest rate is probably lower than the LPSC charge of 12%. It does mean that generators get paid off quickly, but the balance sheet doesn't change until the tariff increases for liquidating regulatory assets take effect over time. The only things that shift are the headings on the balance sheet: a payable to a GenCo is replaced with a loan.

A focus on credible pathways is also key—wishful thinking over target improvements may end up as a recipe for failure. “Credible” here means that (a) the pathway is ambitious but not overly ambitious, (b) there is support from and alignment of all stakeholders involved, and (c) feedback loops exist that reward performance, with repercussions for failure. The last point is the focus of our subsequent paper, but one issue common to most other schemes in the past is that there has been no structural change or meaningful repercussion integrated into the process for those who don’t achieve even the most basic of targets or fulfil basic obligations (e.g., simply have timely tariff orders issued). This is a recognised problem, and the central government is highlighting compliance towards such simple steps through periodic reviews and publications.

Ongoing analysis on fixing the problem indicates that many targets will need to be graded or phased in over a few years. We cannot expect tariff rises equal to the residual gap to be covered through a one-off jump for a number of DisComs (though, for some, a one-time fix would be sufficient). In those cases where credible trajectories for operating improvements and tariff increases are laid out, there would still be an interim financial gap for the period until all the targets are met, which could be of the order of Rs 1 lakh crore. This assumes that a graded plan limits tariff rises beyond inflation to just a few additional percent every year. Such a gap may require central government support or some other special form of support.

A good trajectory will always have a buffer in targets. This means that instead of just adding up all the loss components and assuming full compliance, there should be a mechanism to create a buffer cash flow. In the long run, even all

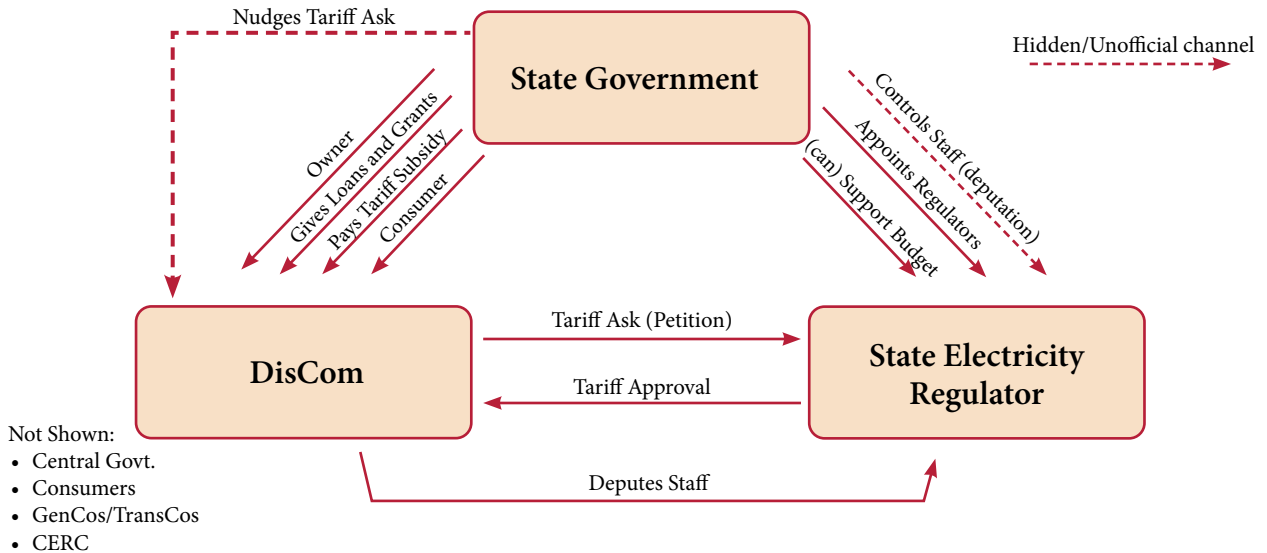
our financial accounting should aim for a buffer. We know today that there is a skew in actuals versus tariff-order plans, requiring one-sided true-ups. Instead, if there were a regulatory norm to create a small buffer (instead of being priced to perfection), this would avoid the pipeline of pendency when there are changes in plans; otherwise, one would need aggressive true-ups when DisComs face cash flow issues. A buffer also provides a lot of system-level cushion and resilience. Of course, the only way to achieve this without external support would be via higher tariffs, but this might only be a small additional rise beyond what better accounting and planning could accomplish.

10.6. This is not just a Financial Problem

This paper focuses on the financial fundamentals and regulation of DisComs, but “fixing” the problem runs even deeper. Given that many of the issues facing the power sector are political, political solutions and political will are needed to address them, including issues of subsidies (or even cross-subsidies). Fixing would also include structural (e.g., how do we foster competition?), technological (use of not just smart meters but even just better data management and analytics), and capacity-building components. The limited tenure of political appointees who lead DisComs hampers the implementation of any profound changes, and the general management default appears to be “don’t rock the boat.”

India has struggled with answering the question of whether electricity is a commodity (and hence best handled via markets) or a public good (where the state matters the most). This is a false dichotomy as it does include both of the aspects. Even well-functioning market systems need good regulation. Electricity should be viewed as a well-regulated public utility.

Figure 25: Ownership and control linkages of DisComs



Source: Authors' analysis.

This brings us to the issue of DisCom ownership, and as we've shown, this is embedded in the financials (subsidies, book equity, grants, etc.). Why do states need to own DisComs? Is there something they offer that cannot be accommodated in private ownership? Figure 25 shows the ownership linkages for DisComs and the primacy of the state governments. Today, staff at SERCs is often on deputation from the very entities they regulate! Improved staffing spans both independence as well as specialised skills for regulatory oversight. One possible solution for this is the creation of a dedicated Regulatory Cadre.

While there are a range of techno-economic improvements possible for DisCom finances, the underlying issues can only be solved when states are willing to face up to the ramifications and options, which include raising tariffs, allowing true independence, and even perhaps privatising DisComs. One of the key issues in managing DisComs is the pressure

to keep prices (consumer tariffs) low. Lower prices are always welcome, but not at the cost of system viability.

The ownership of DisComs by the state has other ramifications for national accounting. As of now, state balance sheets do not include any debt owned by DisComs since, technically, DisComs are standalone companies with 100% state government ownership. (This is distinct from distribution utilities that are government departments for selected regions, especially some union territories or north-eastern states with special status.) However, most lenders seem to treat them as if they are backstopped by the state government as no prudent lender would lend to certain DisComs at the present rates if they weren't viewed as arms of the state, implicitly backed up by them. While suppliers like generators have accepted delayed payments, they appear to believe that the payables are at low risk of being unrecoverable.

There are well-known limits on state borrowing under their respective FRBM Acts. A second limit is under Article 293 of the Constitution, according to which, for States in debt to the Centre (which is all of them), the Centre's approval is needed for incurring new debt. While the Centre typically grants its consent subject to a borrowing ceiling, in March 2022, it decided to include off-budget borrowing by States as part of State debt for this purpose (MoF, 2022). Effectively, this means that there will be a significantly lower scope for States to make fresh borrowings, as a direct consequence of their prior off-budget borrowings. This may dramatically change the picture, and there has been resistance; for example, the Government of Kerala has formally pushed back (Govt of Kerala, 2022).

While privatisation would solve some of the book equity and state debt issues, it is a policy choice that's also unlikely in the near term in many states. Not only do unions and staff oppose privatisation, but state governments also need significant funds to hand over cleaned-up balance sheets to the new owners, as was done when Odisha privatised their DisCom in FY2020–21. Even in the current ownership structure, for DisCom clean-up, this flags larger issues of debt, book equity, etc., many of which boil down to state relationships with the DisComs. We suggest that there should be no further “in-kind” equity or conversions allowed. If a state wishes to increase the equity, it should pay in cash and no longer convert its debt into equity (which, as we've seen, isn't earning much returns).

A more nuanced question is whether states should be issuing debt to DisComs at all. Why would cash-strapped states ever do so? Because no one else will? Or because they are giving it on special terms? While the 14th Finance Commission increased the tax devolution afforded to the states substantially, many Centrally sponsored schemes

end up having state components. While this isn't formally part of the Centre-State formal framework per the Finance Commission recommendations, it is not unusual, and states typically sign on (with matching state debt) simply to gain access to the central government scheme.

While the political economy is important, one cannot escape issues of system-level fundamentals and economics. Lowering targets, such as AT&C targets, is important to lower tariffs, but per PFC data, 77% of FY20 all-India costs were for power procurement (though about 1.5% of that was due to over-procurement necessitated by billing efficiency failing to meet stipulated targets). Part of the fix for the “DisCom problem” will thus lie outside DisComs.

Lowering procurement costs is a vast and separate issue. Most procurement is under costs-plus PPAs, where fuel costs are not just separated from fixed costs but passed through to the DisComs. Thus, it's not innovation and management skills that lower generation costs, but access to favourable supply contracts and location. Kamboj and Tongia (2018) expounded on coal's cost structures and how transport costs raise power generation costs disproportionately due to cross-subsidies from coal freight to cover under-recovery from passengers.

More complex issues of procurement relate to issues of time of day, an issue that will become critical as India is set to invest significantly in RE. Not all generation is fungible, a fact that average pricing norms such as levelised cost of energy (LCOE) miss. Such norms also miss system costs, including transmission costs or impact on other generators. Yet another challenge is related to contracting and market design. DisCom (counter-party) risk is already the greatest challenge for generation companies, especially

RE companies, which are disproportionately from the private sector.

Ultimately, the biggest hurdle will remain one of mindset. DisComs have much to improve upon, but not all the financial mess is their fault. Regulators need to help them become viable in a manner that doesn't just rely on raised tariffs (or waiting for bailouts). Historically, they have focused on annual and operating issues, especially through tariff orders (annual, multi-year, and true-up). It might be time for them to also adjust trajectories based on examining DisCom balance sheets, especially by looking for festering or accumulating problems, more so ones stemming from a residual gap. Normally, a company would be told "your loss, your fault, your problem." But as we've shown, it is not purely their fault.

Several attempts at improving DisComs have focused on improving their operations through augmentation of infrastructure (e.g., R-APDRP) or improving their finances. The latter have either been "bailouts" or focused on liquidity, while asking for closing the ACS-ARR gap. (Appendix 2 gives more details on prior schemes—both financial and operational.)

When setting the tariffs, however, Tyagi and Tongia (2023) (in press) show that there is already no ACS-ARR gap *ex-ante*. Even improving AT&C losses (ending D and C) and financial flows (ending S and RI) isn't enough to avoid a residual ACS-ARR gap per FY20 figures. We need to revisit all the regulatory processes, especially true-ups, and how we do accounting, and then align operations to a zero gap. That is the fundamental fix required. While the steps will be difficult, the silver lining is that with such a fix, a bailout may only be required in some cases.

Failure to comply with existing rules and norms, leading to "known" gaps, is a challenge, but these only represent about 40% of accumulated financial losses. High DisCom losses such as AT&C losses are an issue, but they constitute only a minor fraction of the shortfall. As this paper identifies, the real issue is the residual gap arising from current processes. The sector needs and deserves a policy and process revamp to end the gap once and for all.

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Appendices

Appendix 1: List of distribution utilities, integrated utilities, and power departments

We apply three sets of utilities to our analysis, which are all a subset of the total number of 68 utilities or power departments shown in Table 2. We use data from the following:

- Up to 59 public utilities and power departments (i.e., excluding private utilities) for most of the financial-flow time series, varying in number by year (some new DisComs have been carved out over time, which include those formed after bifurcations of states). These cover 94.4% of units sold in FY2020–21 per PFC data.
- Forty-three utilities (shown below) for the financial analysis of balance sheets (primarily because power departments don't have or don't list equity, except Puducherry). These cover 89.9% of units sold in FY2019–20 per PFC data.
- Thirty-nine DisComs (shown subsequently) for RoE calculations as these are basis MCA corporate filings. A few DisComs hadn't filed with MCA for all the years studied, at least not at the time of writing. These cover 87.1% of units sold in FY2019–20 per PFC data.

The 43 public DisComs, integrated utilities, and power departments

APDCL	Assam Power Distribution Company Limited
APEPDCL	Eastern Power Distribution Company of Andhra Pradesh Limited
APSPDCL	Southern Power Distribution Company of Andhra Pradesh Limited
AVVNL	Ajmer Vidyut Vitran Nigam Limited
BESCOM	Bangalore Electricity Supply Company Limited
CHESCOM	Chamundeshwari Electricity Supply Corporation Limited
CSPDCL	Chhattisgarh State Power Distribution Company Limited
DGVCL	Dakshin Gujarat Vij Company Limited
DHBVNL	Dakshin Haryana Bijli Vitran Nigam
DNHPDCL	DNH Power Distribution Corporation Limited
DVVNL	Dakshinanchal Vidyut Vitran Nigam Limited
GESCOM	Gulbarga Electricity Supply Company Limited
HESCOM	Hubli Electricity Supply Company Limited
HPSEBL	Himachal Pradesh State Electricity Board Limited
JBVNL	Jharkhand Bijli Vitran Nigam Limited
JdVVNL	Jodhpur Vidyut Vitran Nigam Limited
JVVNL	Jaipur Vidyut Vitran Nigam Limited
KESCO	Kanpur Electricity Supply Company Limited
KSEBL	Kerala State Electricity Board Limited

MePDCL	Meghalaya Power Distribution Corporation Limited
MESCOM	Mangalore Electricity Supply Company Limited
MGVCL	Madhya Gujarat Vij Company Limited
MPMaKVVCL	Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited
MPPoKVVCL	Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited
MPPaKVVCL	Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MSPDCL	Manipur State Power Distribution Company Limited
MVVNL	Madhyanchal Vidyut Vitran Nigam Limited
NBPDCL	North Bihar Power Distribution Company Limited
PGVCL	Paschim Gujarat Vij Company Limited
PSPCL	Punjab State Power Corporation Limited
Pondicherry PD	Electricity Department Pondicherry
PuVVNL	Purvanchal Vidyut Vitaran Nigam Limited
PaVVNL	Pashchimanchal Vidyut Vitran Nigam Limited
SBPDCL	South Bihar Power Distribution Company Limited
TANGEDCO	Tamil Nadu Generation and Distribution Corporation
TSECL	Tripura State Electricity Corporation Limited
TSNPDCL	Telangana State Northern Power Distribution Company Limited
TSSPDCL	Telangana State Southern Power Distribution Company Limited
UGVCL	Uttar Gujarat Vij Company Limited
UHBVNL	Uttar Haryana Bijli Vitran Nigam
UPCL	Uttarakhand Power Corporation Limited
WBSEDCL	West Bengal State Electricity Distribution Company Limited

List of 39 distribution utilities for analysis of return on equity

APDCL	Assam Power Distribution Company Limited
APEPDCL	Eastern Power Distribution Company of Andhra Pradesh Limited
APSPDCL	Southern Power Distribution Company of Andhra Pradesh Limited
AVVNL	Ajmer Vidyut Vitran Nigam Limited
BESCOM	Bangalore Electricity Supply Company Limited
BRPL	BSES Rajdhani Power Limited
BYPL	BSES Yamuna Power Limited
CHESCOM	Chamundeshwari Electricity Supply Corporation Limited
DGVCL	Dakshin Gujarat Vij Company Limited

DHBVN	Dakshin Haryana Bijli Vitran Nigam
DVVNL	Dakshinanchal Vidyut Vitran Nigam Limited
GESCOM	Gulbarga Electricity Supply Company Limited
HESCOM	Hubli Electricity Supply Company Limited
JdVVNL	Jodhpur Vidyut Vitran Nigam Limited
JKPDD	Power Development Department, Jammu and Kashmir
JVVNL	Jaipur Vidyut Vitran Nigam Limited
KSEBL	Kerala State Electricity Board Limited
MePDCL	Meghalaya Power Distribution Corporation Limited
MESCOM	Mangalore Electricity Supply Company Limited
MGVCL	Madhya Gujarat Vij Company Limited
MPMaKVVCL	Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited
MPPoKVVCL	Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited
MPPaKVVCL	Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MVVNL	Madhyanchal Vidyut Vitran Nigam Limited
NESCO	North Eastern Electricity Supply Company of Odisha Limited
PGVCL	Paschim Gujarat Vij Company Limited
PSPCL	Punjab State Power Corporation Limited
PuVVNL	Purvanchal Vidyut Vitaran Nigam Limited
PVVNL	Pashchimanchal Vidyut Vitran Nigam Limited
SOUTHCO	SOUTHCO Utility, Odisha
TANGEDCO	Tamil Nadu Generation and Distribution Corporation Limited
TPDDL	Tata Power Delhi Distribution Limited
TSNPDCL	Telangana State Northern Power Distribution Company Limited
TSSPDCL	Telangana State Southern Power Distribution Company Limited
UGVCL	Uttar Gujarat Vij Company Limited
UHBVN	Uttar Haryana Bijli Vitran Nigam
UPCL	Uttarakhand Power Corporation Limited
WBSEDCL	West Bengal State Electricity Distribution Company Limited
WESCO	Western Electricity Supply Company of Odisha

Appendix 2: Central government schemes for infrastructure development and financial restructuring

The Government of India formulated multiple schemes to facilitate power sector infrastructure development as well as financial restructuring through a combination of Gross Budgetary Support (GBS) and Extra Budgetary Resources (EBR).

Under the segment of infrastructure development, the first national initiative was the Accelerated Power Development Programme (APDP) in FY2000-01. Two years from its inception, its objectives were expanded, and it was rechristened as Accelerated Power Development and Reforms Programme (APDRP) with a focus on reduction of AT&C losses to the level of 15%. This scheme started in FY2002-03 and was in operation for six years.

In FY2008-09, APDRP was further modified as Restructured – Accelerated Power Development Reforms Programme (R-APDRP) to include modernisation, upgradation, and strengthening of the distribution network and establishment of IT-enabled systems as parts of the objective, along with an explicit component for human capacity building. It focused on urban areas. Around Rs 8,175 crore were spent under this scheme during six years of its operation, that is, up to FY2014-15, which was a small fraction of the originally planned amount of roughly Rs 44,000 crore. Some projects were likely delayed or ultimately financed through successor schemes.

After six years, R-APDRP was subsumed into a different scheme, Integrated Power Development Scheme (IPDS), which was aimed at extending financial assistance to meet gaps in sub-transmission, the distribution network, and metering in urban areas, with FY2021-22 as the sunset year. Up to the end of December 2021,

approximately Rs 22,311 crore were spent under this scheme, which also included the spill-over expenditure of R-APDRP beyond its sunset year.

In FY2021-22, the government brought in the Revamped Distribution Sector Scheme (RDSS), subsuming the IPDS. This scheme aims to bring in operational efficiency and financial sustainability to the distribution sector broadly through “metering and distribution infrastructure works,” “training, capacity building,” and a few other focus areas. It is projected to be in operation for five years, that is, till FY2025-26, with an announced total outlay of Rs 3 lakh crore, and it also provided for the absorption of pending liabilities of the Deendayal Upadhyay Gram Jyoti Yojana (DDUGJY) and IPDS schemes beyond FY2021-22.

There were also more focused schemes, especially for improving electricity connectivity of rural areas. The Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) was launched in FY2005-06 with the objective of developing rural electrification. Under this scheme, a total of Rs 29,387 crore was spent till FY2013-14.

The RGGVY scheme operated for nine years. In FY2014-15, it was subsumed into a new scheme, DDUGJY, with a larger set of objectives to include targets for better development of power networks in rural areas (in some ways a scheme analogous to R-APDRP/IPDS, which had an urban focus). The scheme is primarily aimed at the separation of agricultural and non-agricultural feeders (a system that Gujarat pioneered to help cut down losses and improve rural power supply), strengthening of transmission and distribution networks in rural areas, and metering at distribution transformers, feeders, and consumers. Under this scheme, approximately

Rs 55,332 crore (including budgetary support and extra-budgetary resources) has been released from FY2014-15 till FY2021-22 (through the end of January 2022).

Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHGYA) was another scheme that focused solely on household electrification. This scheme achieved electrification of almost all remaining 2.82 crore un-electrified households, with a budget outlay of Rs 14,270 crore, between FY2017-18 and FY2020-21.

Such operational schemes are not bailouts, rather providing enormous financial support for operational and performance objectives that DisComs would not be able to fund themselves. State governments have also lacked the free cash to fund such high-level projects.

Apart from operational schemes, there were programmes to address issues related to the financial ill-health of distribution utilities. The Montek Singh Ahluwalia Expert Group (MSA, 2001) recommended a waiver of 50% of the surcharge/interest on delayed payments by DisComs. It also suggested for securitisation of the rest of the dues (full principal and the remaining 50% of the interest/surcharge) aggregating to Rs 33,600 crore through bonds issued by the respective state governments.

Subsequently, based on the recommendation of an expert committee chaired by B.K.

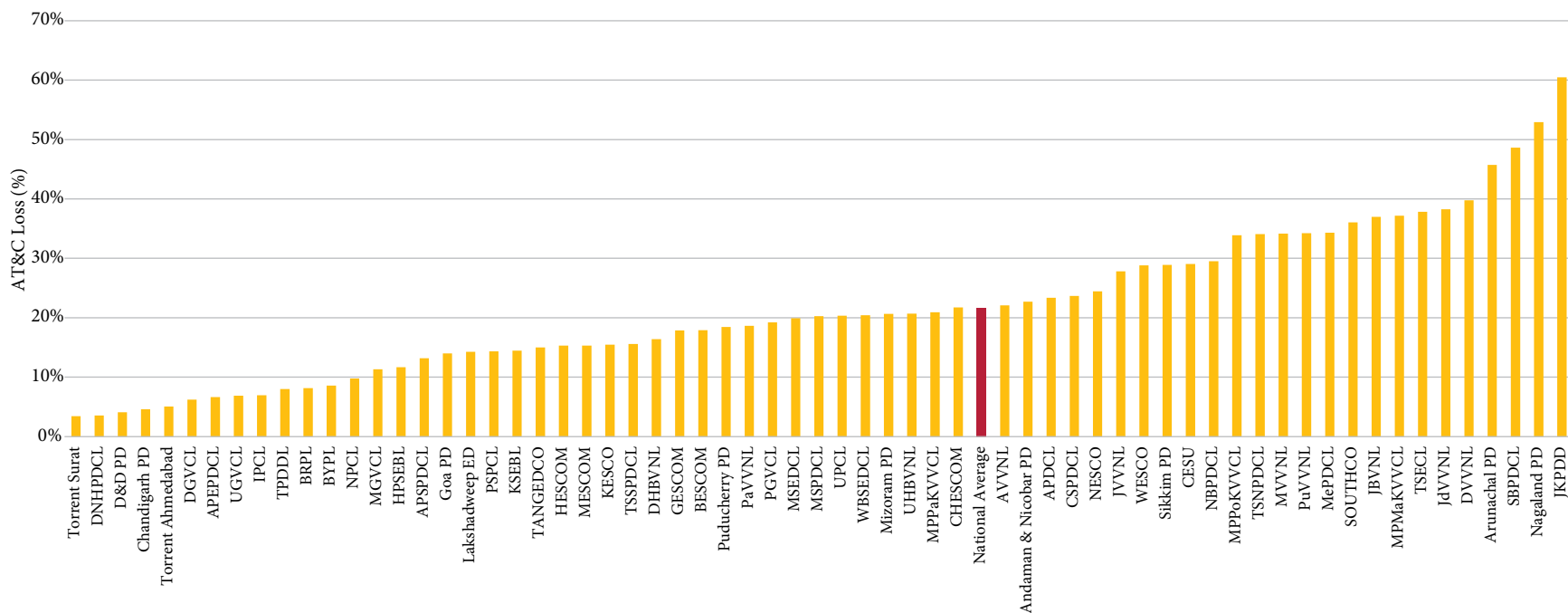
Chaturvedi (PIB, 2012), the central government approved for 50% of the outstanding short-term liabilities up to March 31, 2012, to be taken over by state governments. It also recommended restructuring the balance 50% of the short-term loans by rescheduling loans and providing a payment moratorium as well as “restructuring/rescheduling” the debt in the best possible terms.

A more recent scheme was Ujjwal DisCom Assurance Yojana (UDAY), which was launched with the aim of bringing down the accumulated debt of DisComs and reducing their interest burden. It involved states taking over 75% of DisCom debt onto state books and also recasting debts at lower rates. In practice, this happened mainly through public sector lending. For a few states, there were also grant components provided to the tune of Rs 72,223 crore. UDAY was in operation from FY2015-16 till FY2019-20.

During FY2020-21, in response to COVID-19, the government announced a new facilitative financial “stimulus” (in reality, a facility to borrow on easy terms) to meet financial constraints suffered by DisComs. The budget outlay for this scheme is around Rs 1,25,000 crore, as special debt to be issued through the PSUs Power Finance Corporation (PFC) and Rural Electrification Corporation (REC), which are specialised non-banking financial companies under the aegis of the Ministry of Power.

Appendix 3: Aggregate technical and commercial (AT&C) losses

Figure A1: DisCom-wise aggregate technical and commercial (AT&C) losses FY2019-20



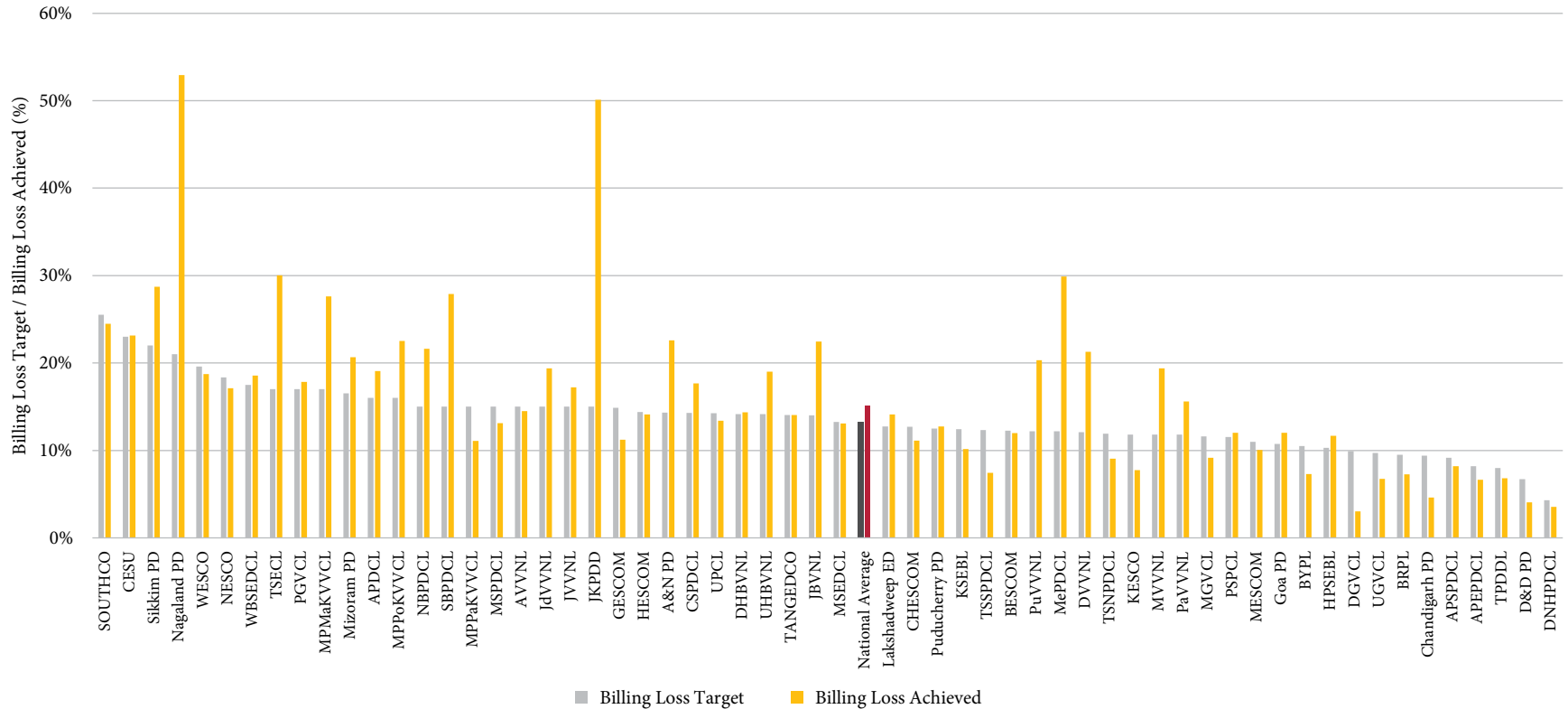
Source: Authors' calculation based on PFC reports on the performance of power utilities (2020-21) and REC report on the key regulatory parameters of power utilities (multiple editions).

Notes: AT&C Loss is calculated as equivalent to $1 - [(1 - \text{Billing loss} (\%)) \times (1 - \text{Collection loss} (\%))] = 1 - [(\text{Billing efficiency}) \times (\text{Collection efficiency})]$.

This formal definition of AT&C loss combines consumer collection and subsidy payment into collection efficiency.

Appendix 4: Billing loss targets vs achievement

Figure A2: DisCom-wise billing loss target vs billing loss achieved FY2019-20

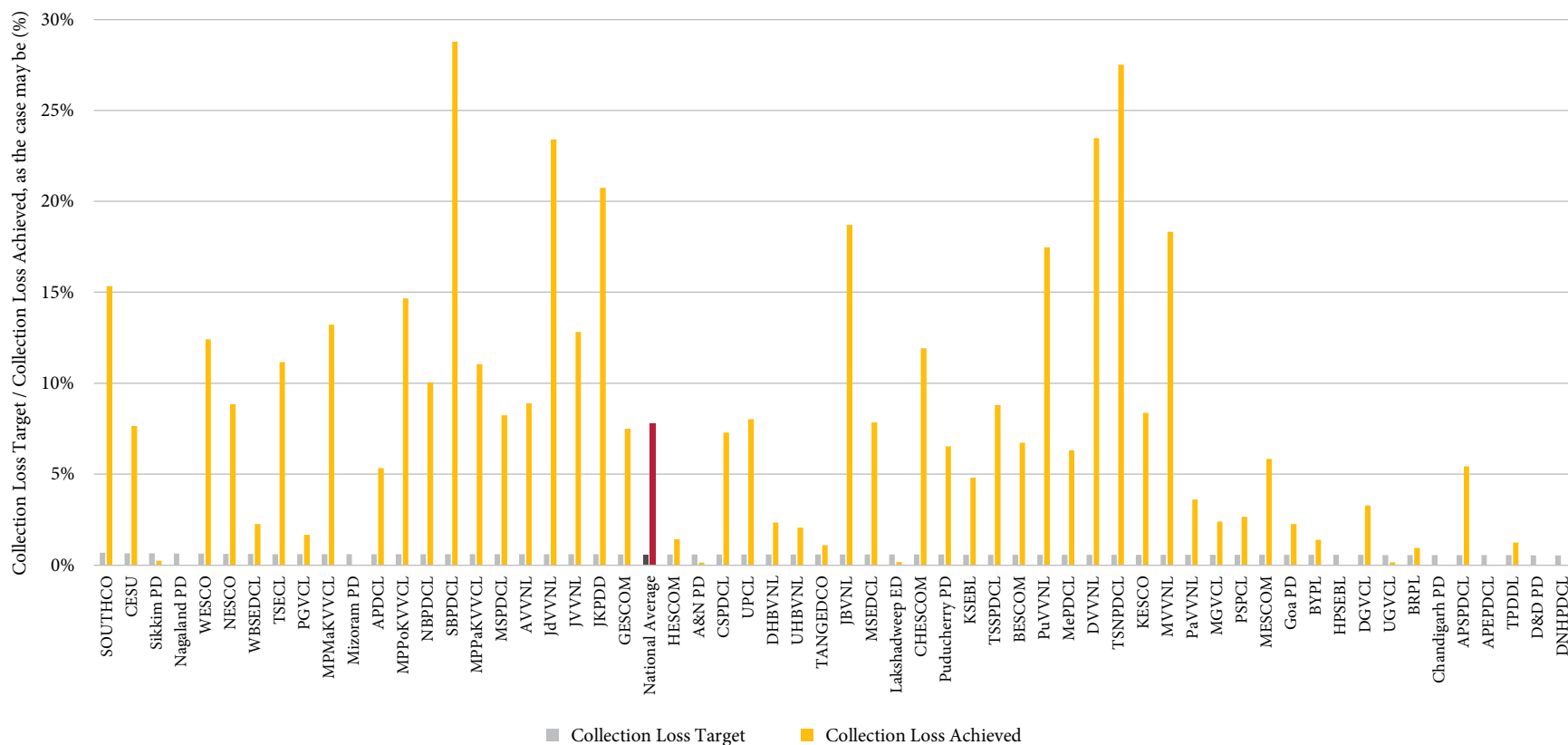


Source: Authors' calculation based on PFC reports on the performance of power utilities (2020-21) and REC report on the key regulatory parameters of power utilities (multiple editions).

Notes: Billing loss targets are based on the above-mentioned REC report, which covers recent years' AT&C targets, whereas the post-UDAY period data are available on the UDAY portal. We manually compile the previous years' AT&C and billing efficiency targets from the respective tariff orders. For a few states with either missing or unavailable data, we interpolate or extrapolate as appropriate.

Appendix 5: Collection loss targets vs achievement

Figure A3: DisCom-wise total collection loss target vs collection loss achieved FY2019-20

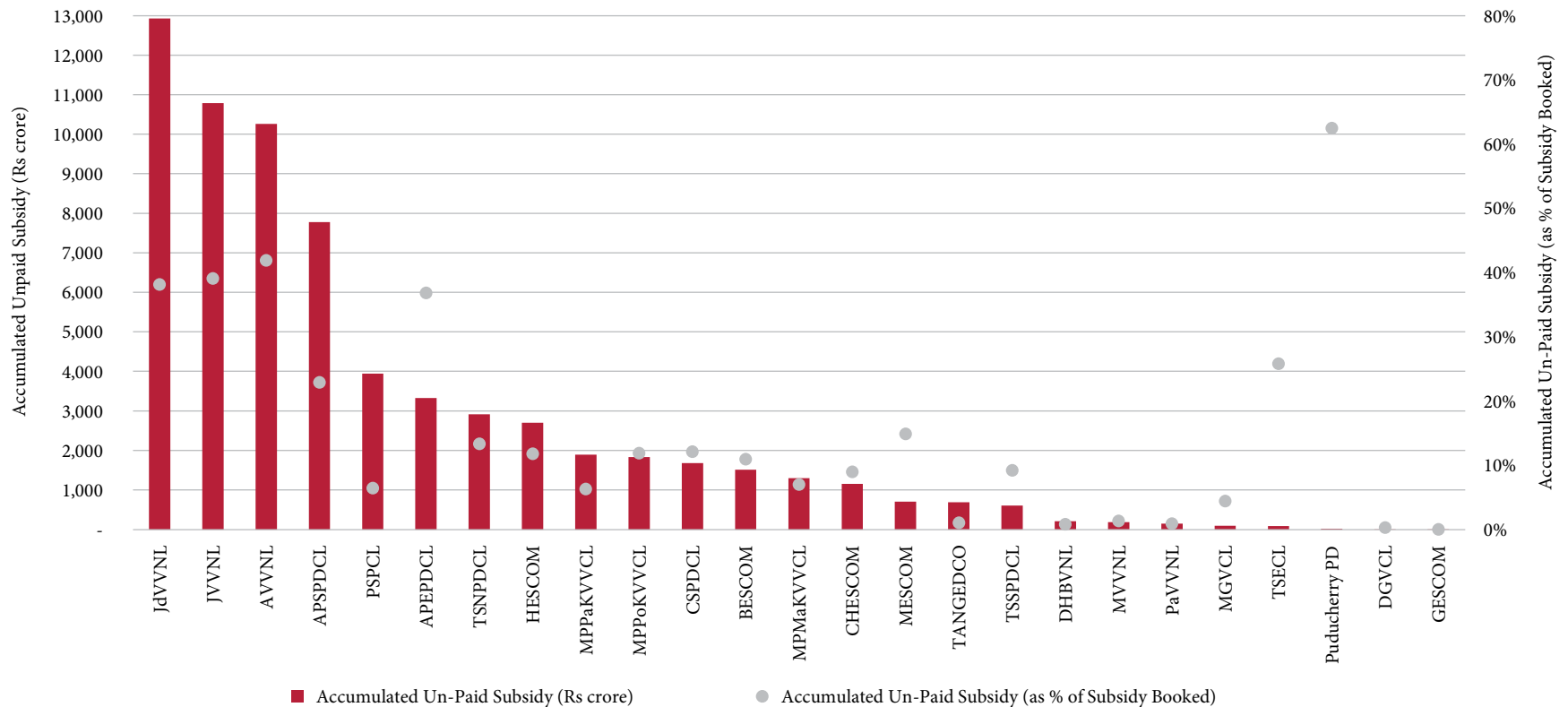


Source: Authors' calculation based on the PFC reports on the performance of power utilities (Power Finance Corporation, 2020-21). In our studies, we further segregate consumer collection losses from the total collection losses that are per government methodologies, which includes subsidy non-payment as a collection loss.

Notes: Collection loss targets are considered at 0.5%, per official accounting norms would include consumer plus subsidy non-collection. The majority of tariff orders do not segregate these. We apportion this allowed loss to consumer collection loss targets in our analysis. Historically, tariff orders never listed any collection loss allowances, but in recent years, these have been formally listed.

Appendix 6: Accumulated unpaid subsidies

Figure A4: Accumulated unpaid Subsidy (Rs crore and as share of subsidy booked) through FY2019-20

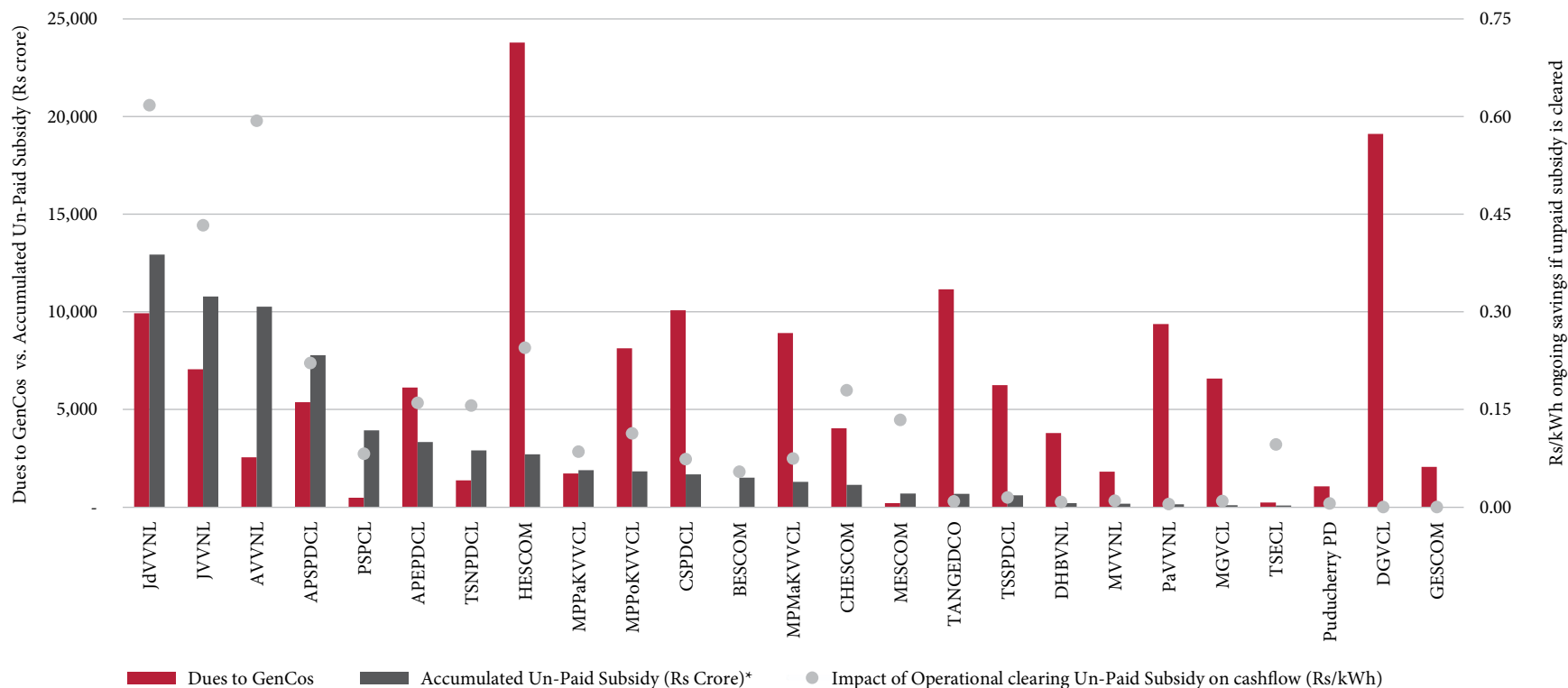


Source: Authors' calculation based on the PFC reports on performance of power utilities (2007-2021).

Notes: The figure depicts the 25 DisComs (out of the sample space of 43 DisComs) which have accumulated unpaid subsidy owed to them by the respective state governments.

(b) Comparison of accumulated unpaid subsidy with dues pending to GenCos with impact on perpetual cash flows upon clearing accumulated subsidy dues

Figure A5: Accumulated unpaid subsidy vs. dues to GenCos (Rs crore) and the impact of operational clearing the unpaid subsidy on cash flow (Rs/kWh) through FY2019-20

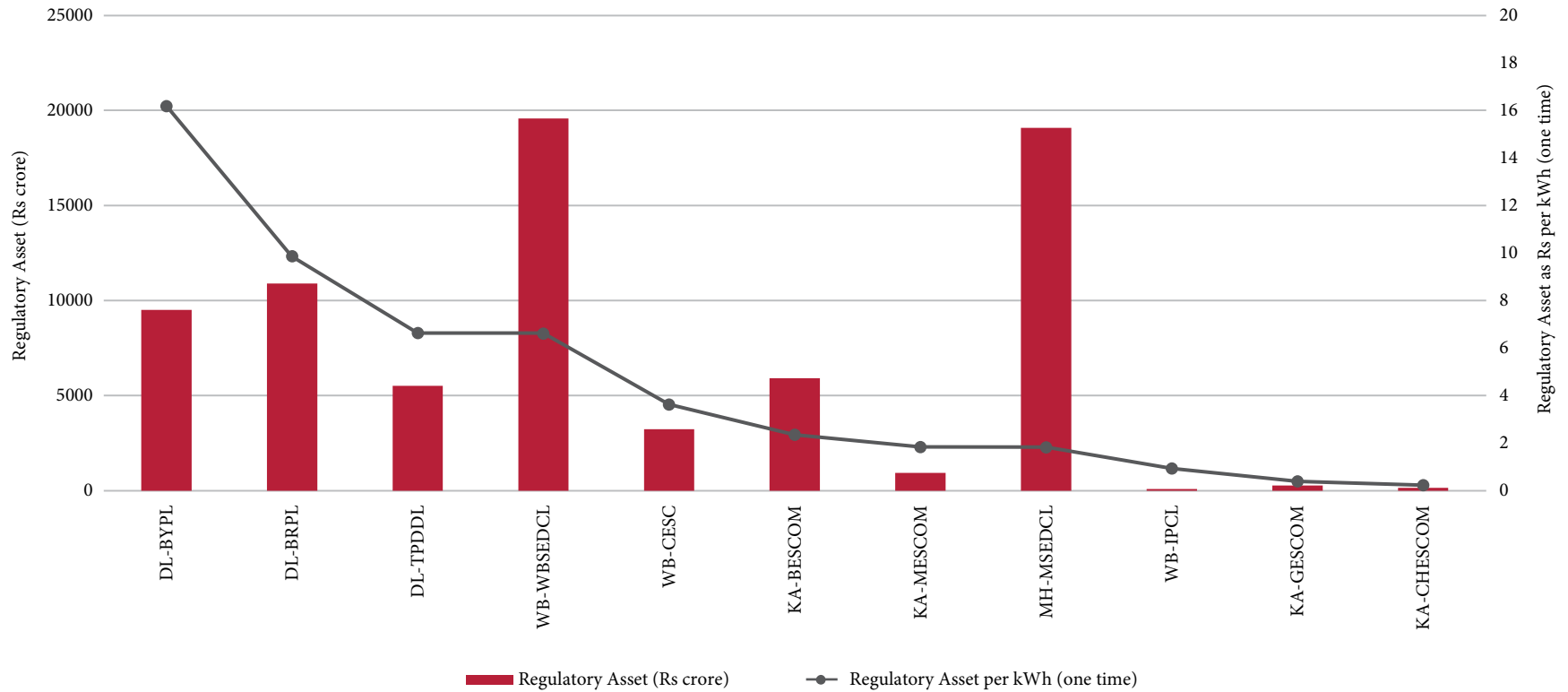


Source: Authors' calculation based on the PFC reports on Performance of Power Utilities (2007-2021).

Notes: The figure depicts the 25 DisComs (out of the sample space of 43 DisComs) which have accumulated unpaid subsidy owed to them by the respective state governments. The impact on the tariff, a reduction, is based on a 10% annual carrying cost (which can be covered or uncovered in the rate base, i.e., managed via additional loans or delayed payments to GenCos). Per-unit savings are based on the FY2019-20 volume of sales.

Appendix 7: Regulatory assets

Figure A6: Regulatory assets (Rs crore) and impact of its liquidation on tariff (Rs per kWh, FY2019-20 basis)

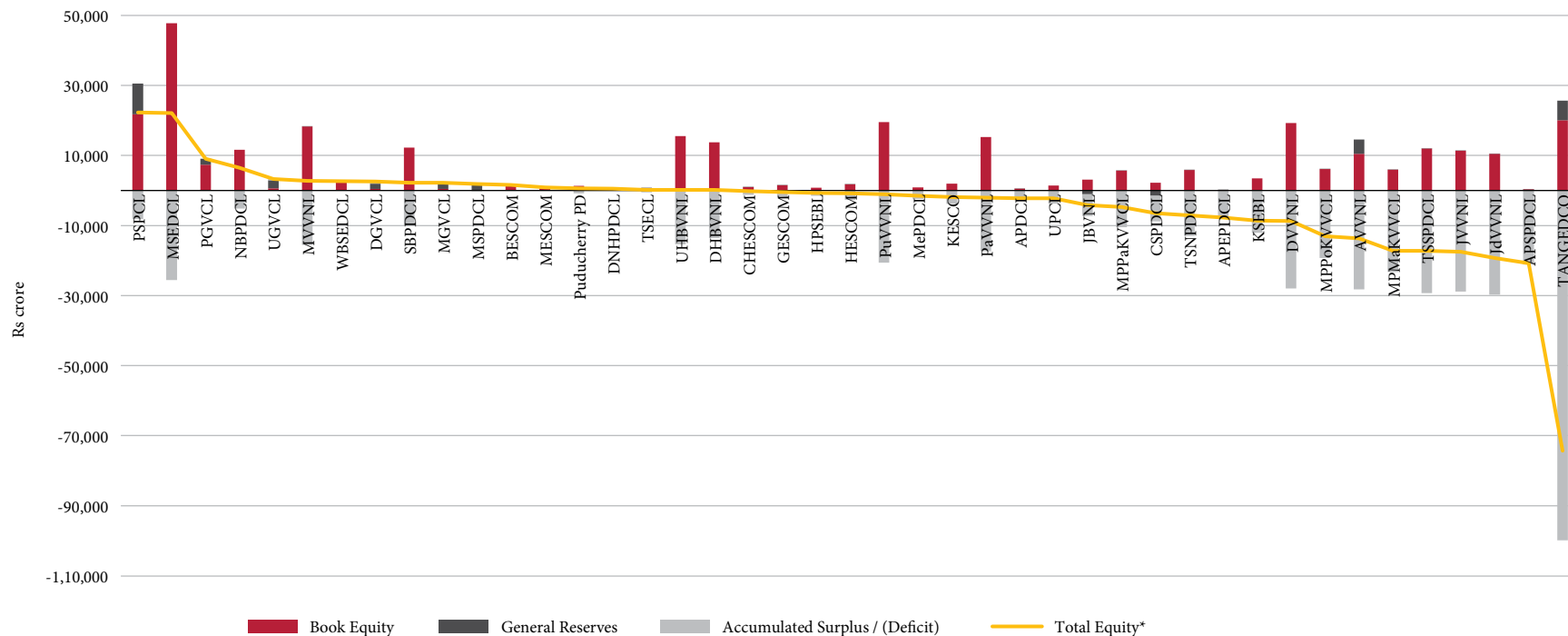


Source: Authors' calculation based on the PFC reports on Performance of Power Utilities (2007-2021).

Notes: This calculation is for the one-time increase in tariff to liquidate the regulatory assets, but it is expected that the winding down of RA would be over 5 years. However, once removed, there would be a permanent reduction in consumer tariffs because of the removal of the interest component of RA allowed into the tariff rate base. This would save 10% to 12% of the amount shown perpetually (using the FY2019-20 volumes as a base).

Appendix 8: Trends in Net Worth

Figure A7: DisCom-wise Total Equity* (Book Equity + General Reserves + Accumulated Surplus / (Deficit)) for FY2020-21



Source: Authors calculation from PFC report on performance of power utilities (2020-21).

Note: Total Equity* is calculated as Book Equity + General reserves + Accumulated surplus/(Deficit). This differs from the net worth as presented by the PFC in their reports on performance of power utilities (Power Finance Corporation, 2007-2021), wherein net worth also includes "Govt. grants and subsidies for capital assets," which we do not include in Total Equity*.

Appendix 9: Recent Central Government initiatives to contain DisCom losses

During the COVID-19 pandemic period the distribution sector took the biggest hit out of the entire electricity supply chain. This further added to the financial woes this segment has already been struggling with. The damage included plummeting demand from commercial and industrial consumers, who are not only high value consumers, but also cross subsidize domestic and agriculture consumes. In addition, there were higher billing and collection losses, severe cashflow constraints, steep increases in debt etc. which further hit DisComs.

Under these circumstances, the Central Government took several initiatives, initially to provide interim relief, thereafter with an aim to provide larger measures for fixing the sector. A few highlights are below, beyond which the Central Government is also keenly tracking the timeliness of DisCom and regulator statutory actions, such as petitioning and issuing tariff orders:

1. In FY21, the Central Government announced Rs 90,000 crore (which was later revised to Rs 1,25,000 crore) to infuse liquidity in the sector. This package, termed a “stimulus” under Atmanirbhar Bharat, offered loans to distribution utilities through public sector financial institutions.

This measure was a prompt response to COVID-19 aimed to provide instant relief to meet cashflow constraints. However, the relief was in the form of debt, therefore required to be paid back along with finance costs. Also, the quantum of relief offered was sufficient to ease only a part of the cashflow crunch. Hence, while the relief under COVID-19 “stimulus” was considered essential at that juncture, it

was not sufficient for DisComs to overcome the full depth of cash flow constraints during COVID-19.

2. In FY21, DisComs could not fully honour their power purchase dues to GenCos, a perpetual problem exacerbated by COVID-19 constraints in receiving payments from consumers. CERC, considering the magnitude of the problem, brought down the late payment surcharge (LPS) penalty from 18% p.a. to 12% p.a., on the payables of DisComs to GenCos.

This move is expected to facilitate immediate relief as DisComs were struggling to bridge operational cashflow gaps. However, the reduction in penalty rates didn’t cover prior pre-COVID period charges. This provided partial relief, but not enough to close the gap in payments to GenCos.

3. In FY22, MoP launched the Revamped Distribution Sector Scheme (RDSS), which is expected to be in operation till FY2025-26, aimed at helping DisComs improve their operational efficiency and financial sustainability. This is expected to be achieved through result-linked financial assistance to DisComs to strengthen supply infrastructure based on meeting pre-qualifying criteria and achieving basic minimum benchmarks.

RDSS has an outlay of Rs 3,03,758 crore over 5 years, i.e. FY 2021-22 to FY 2025-26, under two parts, viz., Part A (Financial support for Prepaid Smart Metering & System Metering and up-gradation of the Distribution Infrastructure) and Part B (Training & Capacity Building and other

Enabling & Supporting Activities). Major objectives of the scheme include reduction of pan-India AT&C losses to the levels of 12-15% by 2024-25, reduction of ACS-ARR gap to zero by 2024-25, improvement in the quality, reliability and affordability of power supply to consumers through a financially sustainable and operationally efficient distribution sector etc.

Part of the scheme is designed to lower losses through improved metering systems and upgradation of infrastructure. Through better distribution infrastructure, DisComs would have lower technical losses and correspondingly lower their costs of power purchase by requiring less units to be procured from generators to serve a given consumer load. Similarly, better metering infrastructure (especially pre-paid smart meters) would improve accurate billing and improved collections. As this paper shows, AT&C losses beyond the normative level constitute less than 30% of total operational losses (cumulatively over last fifteen years from FY07) and hence any improvement in AT&C losses would be welcome but not be sufficient to financially turnaround the DisComs.

4. The LPS Rules MoP notified in June, 2022, are aimed at strengthening the regulatory

provisions for recovery of outstanding dues by DisComs. Payment delays by DisComs affect the rest of the supply chain and thus the LPS Rules assume greater importance. These Rules focus on the timely payment of GenCo dues through a systematic payment plan to reduce outstanding and delayed payments.

These rules provide 100% relief in new late payment surcharges linked to an agreed GenCo dues' payoff trajectory by DisComs. However, such a trajectory forces DisComs to clear the dues in a specific number of instalments irrespective of their revenue inflow. Hence, it would be premature to comment on the impact of such committed payments to GenCos on the financial health of DisComs.

The above steps are important and welcome for reducing DisCom financial losses, but it is premature to make any assessment of their efficacy. More importantly, while these can be helpful in avoiding many of the losses of the system, especially billing and consumer collection losses, these do not address many other causes of DisCom losses, especially not the residual loss identified in this paper.

Appendix 10: Disputed Costs and Issues Sub-Judice

There are a range of issues related to regulated tariffs that are sub-judice, which create an asterisk upon the balance sheets. The issue isn't just the enormity of financials that go into limbo during this period, often tens of thousands of crores for some discoms, but also the fact that these processes can linger for years or even longer than a decade. Some disputes aren't over the magnitude of a cost or its allowance, but implementation of orders by APTEL (super-regulator above the ERC). In other cases, the DisCom has to appeal all the way to the Supreme Court. Even if a successful DisCom claims interest on the amounts that were disputed, such costs would ultimately pass on to the consumer. Any delay thus causes an even bigger tariff impact to consumers compared to if such orders were implemented into tariff recovery immediately.

The regulatory system allows DisComs to appeal the orders of state regulators through the Appellate Tribunal for Electricity (APTEL) and, subsequently, the Supreme Court. Hence, a DisCom can approach APTEL or the Supreme Court, seeking their intervention for any relevant issue including financial (tariff) issues such as for costs not allowed for recovery through the regulator's tariff order.

Details available publicly show some cases from 2004-05 are pending implementation, and resolving cases can take significant time. In general, cases take multiple years for closure under the appropriate judicial fora. The issue isn't just the enormity of the money under dispute – adding interest charges as claimed by DisComs can make the money more than 2.5x in some cases.

Not only can there be disputes over the amounts to be allowed by regulators, sometimes there is a delay or non-implementation of allowed costs

into the tariff recovery process. In such cases, the DisCom is forced to appeal to higher bodies over the non-implementation. Utility regulatory staff tell us that ERCs routinely delay implementation of APTEL orders into the tariff through two mechanisms. First, regulators posit that adding such huge costs for recovery would subject the consumers to a tariff shock and hence those costs are often converted into Regulatory Assets, that too without giving any time frame for recovery through future tariffs. Alternatively, some findings are not included in any regulatory orders, forcing the DisCom to approach the Supreme Court.

The case of a BRPL, a Delhi-based private DisCom, with respect to disputed costs and their accumulated impact with interest as claimed, is given in Table A8. Similar data for most DisComs isn't available – and state-owned DisComs are less likely to aggressively appeal inordinate delays by ERCs in implementing APTEL orders.

Table A1: Accumulation of disputed costs (including matters sub judice before APTEL and review by the regulator) as claimed by BRPL in its FY2020-21 Tariff Petition

BRPL (as claimed in their Tariff Petition for FY2021-22)			
	Principal (original dispute) (Rs crore)	Interest as claimed by DisCom (Rs crore)	Total (Rs crore)
Decisions of APTEL in favour of BRPL till FY2020-21 but not yet implemented into tariff recovery	5,776	7,652	13,428
Pending before DERC through Review Petitions	208	405	613
Pending before APTEL	3,884	6,136	10,020
Total	9,868	14,193	24,061

Notes: BRPL's FY2020-21 gross revenues as booked were 8,879 crores (per PFC data).

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