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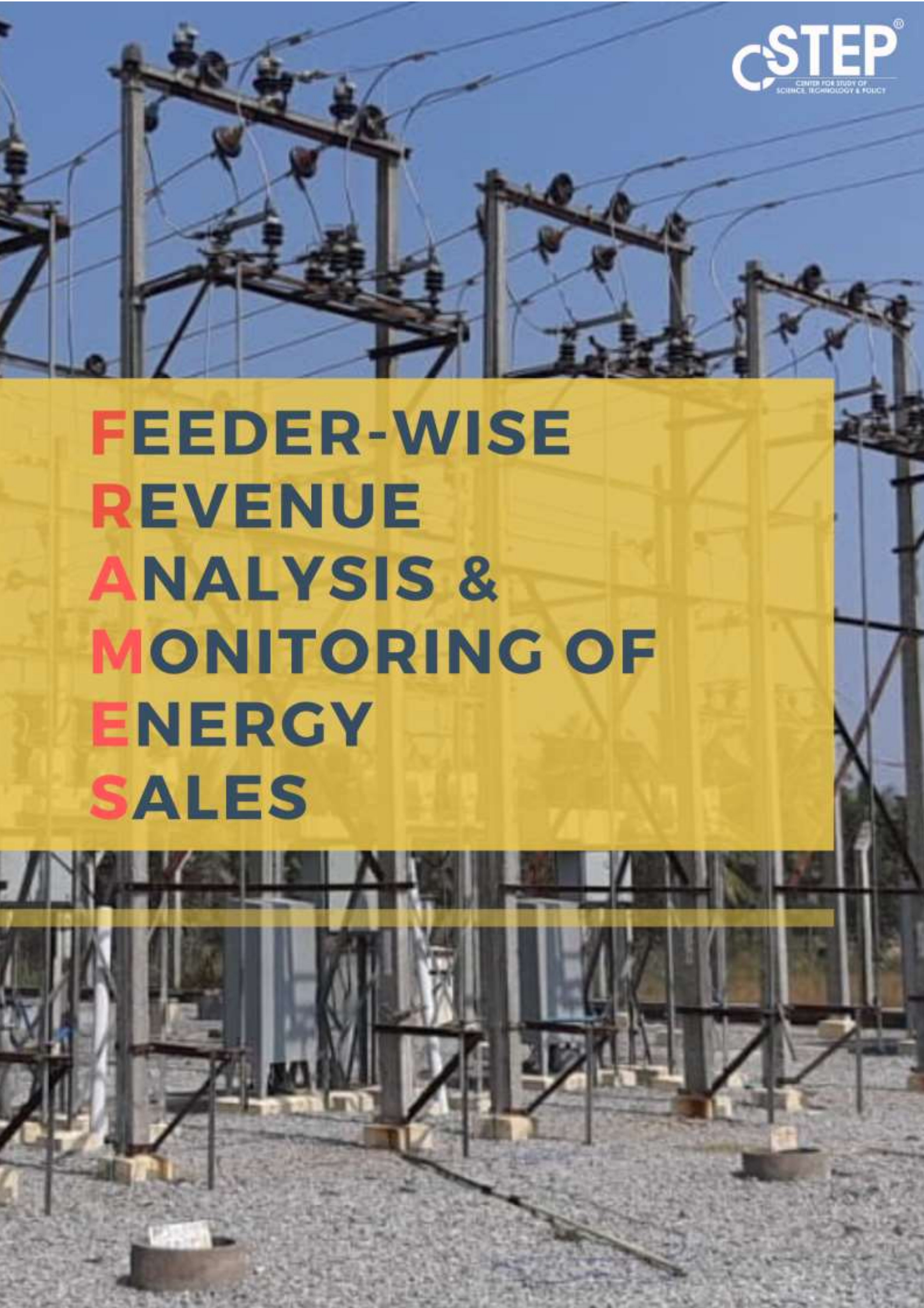

FEEDER-WISE REVENUE ANALYSIS & MONITORING OF ENERGY SALES

Feeder-wise Revenue Analysis and Monitoring of Energy Sales

(FRAMES)

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Center for Study of Science, Technology and Policy (CSTEP)

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Executive Summary

The Indian power-distribution sector has been plagued with inherent issues of high aggregate technical and commercial (AT&C) losses and a wide gap between the cost incurred and revenue realised. Most distribution companies (DISCOMs) continue to struggle with these issues even after the implementation of Ujwal DISCOM Assurance Yojana (UDAY), launched for the revival of the distribution sector.

A primary reason for the poor financial condition of DISCOMs is their inability to recover revenue commensurate with the cost of supply, because of either technical losses or inefficiencies in the billing process. One of the reasons for the ineffective revenue realisation is that revenue accountability is confined to the corporate level and does not percolate to DISCOMs' operational levels. This calls for an urgent change of approach by the DISCOMs. The new approach should be focused on making field-level functionaries more accountable for revenue realisation vis-à-vis the input energy supplied at each feeder. The Center for Study of Science, Technology and Policy (CSTEP) developed a framework for instilling accountability at the operational level of DISCOMs.

This framework, named Feeder-wise Revenue Analysis and Monitoring of Energy Sales (FRAMES), tries to enforce revenue accountability at the feeder level. Each 11 kV feeder in the distribution network is treated as a profit centre, and each Feeder Manager, the head of this profit centre. The FRAMES will help each Feeder Manager be cognisant of the sales and revenue target on a monthly basis. Any deviation at the month end requires investigation by the Feeder Manager, and corresponding actions to minimise the deviation. Further, the feeder has to follow a loss-reduction trajectory to maximise earnings over the years.

FRAMES could be replicated for all feeders under a DISCOM's jurisdiction and developed as a FRAMES mobile application (app). Such an app will not only help monitor the performance of each feeder, but support decision-making at different hierarchical levels of the DISCOM.

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1. Introduction

The primary reasons attributed to the distressed financial condition of power distribution companies (DISCOMs) in India are high aggregate technical and commercial (AT&C) losses and the wide gap between the costs incurred and revenues realised by the DISCOMs. The Ministry of Power's (MoP) flagship scheme, Ujwal DISCOM Assurance Yojana (UDAY), had four initiatives at its core: improving operational efficiencies of DISCOMs, reducing the cost of power, reducing the interest cost of DISCOMs, and enforcing financial discipline on DISCOMs through alignment with state finances. The operational-efficiency improvement measures (smart metering, network upgradation, universal metering, energy-efficiency measures, etc.) were envisaged to reduce AT&C losses and eliminate the gap between the cost of supply and revenue. Even after UDAY implementation (and consequent unburdening of DISCOMs' liabilities), the factors contributing to the power-sector losses seem to continue for most DISCOMs. It is, therefore, necessary to address these underlying issues for improving the performance of DISCOMs.

A financially healthy distribution system is vital for the power sector as a whole, as it is the end-consumer-facing, revenue-generating entity. The revenue sustaining the power sector flows from consumers to DISCOMs, and eventually to generators and transmission utilities. Only if the revenue realised is adequate to cover all the costs of a DISCOM, the operations of DISCOMs remain financially viable. Therefore, it is imperative for DISCOMs to run their business on effective commercial principles and initiate measures to ensure their financial viability.

One of the ways to improve the financial viability of DISCOMs is by encouraging implementation of commercial accountability at the field level. At present, commercial accountability is centralised at the board level of each DISCOM or at the corporate-office level. Zones/Divisions and operational departments (subdivisions and section offices) of DISCOMs are held accountable for their progress in terms of implementation of projects, maintenance of operations, and control of expenditure, but not for earning profits or realising revenue commensurate with the service provided. Vertically-divided operational departments are typically responsible only for specific aspects of operations, such as construction of new distribution lines or substations, procurement of materials, personnel management, and maintenance of accounts. Because employees at the operational level (subdivision and section office) focus mainly on the maintenance of power supply rather than revenue realisation, DISCOMs are unable to effectively relate the input energy and the revenue realised from its sale at the field level.

Therefore, a need is felt to make employees at the field level accountable and responsible for revenue realisation. In this regard, the Center for Study of Science, Technology and Policy (CSTEP) has developed a framework for feeder-wise revenue analysis and monitoring of energy sales (FRAMES) at the 11 kV-feeder level. The framework is envisaged to incentivise field-level employees to be responsible for the commercial viability of operations involving power supply to consumers through each feeder under their jurisdiction.

1.1. Estimation of ACS and ARR

An important indicator of the financial viability of DISCOM operations is the gap between the average revenue realised (ARR) per unit of energy supplied and the average cost of supply (ACS). A DISCOM's operations will be profitable if its ARR exceeds the ACS in a given year of operation. *ACS is the sum of all costs associated in supplying power*—such as the cost of purchasing power from various generators (conventional, non-conventional, power exchanges, etc.), cost of operating and maintaining the distribution network (such as service lines and distribution transformers), employee cost, depreciation, and finance cost—*divided by the total sales to consumers*.

$$\text{Average Cost of Supply (ACS)} = \frac{\text{Power Purchase Cost} + \text{O\&M cost} + \text{Depreciation} + \text{Interest \& Finance Cost}}{\text{Total Sales}}$$

On the other hand, *ARR is the sum of the total revenue earned* — by charging consumers at specified tariffs for the energy supplied — *and subsidy received from the state government, divided by the total sales*.

$$\text{Average revenue realised (ARR)} = \frac{\text{Revenue from sale of power} + \text{Subsidy received}}{\text{Total Sales}}$$

A surplus of ARR over ACS would mean that the DISCOM is able to earn enough revenue to recover its costs for the annual year's operations and to invest in augmentation/upgradation of its network in the future years. It would also translate to a return on the equity invested by the DISCOM.

The State Electricity Regulatory Commissions (SERCs) are entrusted with the task of regulating tariffs for consumers, considering DISCOMs' financial viability and the consumers' ability to pay. DISCOMs are, therefore, required to estimate the expenses they are likely to incur based on all associated costs for the projected supply of power. The component of return on equity is added if a DISCOM has a positive net worth in its balance sheet. The sum of expenses and the return on equity allowed is known as the aggregate revenue requirement, which is submitted to the SERC for review and approval.

The provisions relating to the determination of consumer tariff require SERCs to take into account the sales projections (provided by the DISCOM) and fix different rates per unit (kWh) of power supplied to different categories of consumers, such that the overall revenue meets the overall cost of service and allows a positive margin for the DISCOM. To attain a positive margin, DISCOMs should ensure that the sales to each category of consumers earn the required revenue. This would require a realistic estimation of the sales projections, so that the projected revenue roughly corresponds to the actual revenue, with little or no deviation.

2. Feeder-wise Revenue Analysis and Monitoring of Energy Sales

2.1 Approach

Sound revenue management system of a DISCOM should be based on two main principles:

- All energy supplied to consumers should be billed as per the tariff applicable, and the corresponding revenue should be recovered fully.
- The difference between the energy drawn through the distribution system (input energy) and the energy actually supplied to consumers should be close to the inevitable technical losses in conveying electricity through the distribution system. In other words, the AT&C losses and technical losses should be nearly identical.

Based on the approach described above, a system of revenue accounting and monitoring must be designed to enable a DISCOM to determine the effectiveness of its operations in every part of its jurisdiction and detect technical inadequacies or other factors contributing to avoidable loss of revenue. When such a system is in place, the organisation will be able to ensure the efficient recovery of revenue by its executives and staff at different levels, thereby achieving overall viability of its operations.

2.2 ACS-ARR Gap in BESCOM and CESC

This paper analyses the operations of two DISCOMs in Karnataka using the framework outlined above. The analysis is based on the field data gathered by CSTEP and data furnished by DISCOMs. Tariff orders issued by Karnataka Electricity Regulatory Commission (KERC) are another source of data used for this study.

Karnataka's distribution sector has five DISCOMs. For this study, CSTEP selected 20 feeders in two DISCOMs—Bangalore Electricity Supply Company Limited (BESCOM) and Chamundeshwari Electricity Supply Corporation (CESC).

BESCOM

BESCOM is one of the five DISCOMs in Karnataka, serving eight districts in the state. It has a consumer base of 112 lakh as on March 2018. BESCOM's operations account for about a half of the total electricity supplied in the state by all DISCOMs. After incurring a total expenditure of INR 16,208 crore, BESCOM supplied 26,239 million units (MUs) in 2016-17. It earned a revenue of INR 15,861 crore in FY17 (KERC, 2018b). Table 1 summarises BESCOM'S turnover from FY14 through FY17, wherein the gap between the cost of supply and revenue realised is evident.

Table 1: ACS-ARR gap in BESCOM (FY14 to FY17)

Source: BESCOM tariff orders

Particulars	Measure	FY14	FY15	FY16	FY17
Actual sales (S)	*Million units*	23,065	24,083	24,126	26,239
Total expenditure (E), of which:	*INR crore*	12,311	13,563	14,785	16,208
a) Power-purchase cost, including transmission (P)	*INR crore*	10,703	11,685	12,601	*13,701*
b) Operation & maintenance cost (O)	*INR crore*	957	1,054	1,210	*1,298*
c) Depreciation (D)	*INR crore*	126	200	291	*375*
d) Interest and finance charges (I)	*INR crore*	524	624	683	*835*
Total revenue (R)	INR crore	11,617	13,255	14,050	15,861
Average cost of supply [ACS=(E*10)/S]	*INR/unit*	5.34	5.63	6.13	6.18
Average revenue realised [ARR=(R*10)/S]	*INR/unit*	5.04	5.50	5.82	6.04
Revenue gap [ACS–ARR]	*INR/unit*	0.30	0.13	0.30	0.13

CESC

CESC was established in 2005 for supplying electricity to five districts: Mysore, Mandya, Chamarajanagar, Hassan, and Kodagu. It has a consumer base of 31 lakh as on March 2018. In 2016-17, CESC supplied approximately 6,260 MUs of energy after incurring a total expenditure of INR 3,967 crore. It earned a revenue of INR 3,519 crore in FY17 (KERC, 2018b). Table 2 summarises CESC's turnover from FY14 through FY17. The ACS-ARR gap increased to 1.20 INR/unit in FY16 on account of a revenue loss of INR 620 crore on sales of 5,176 MUs. Although the gap declined in the subsequent year, CESC still suffered a revenue loss of INR 479 crore.

Table 2: ACS-ARR gap in CESC (FY14 to FY17)

Source: CESC tariff orders

Particulars	Measure	FY14	FY15	FY16	FY17
Actual sales (S)	*Million units*	5,112	5,240	5,176	6,260
Total expenditure (E), of which:	*INR crore*	2,526	2,685	3,376	3,997
a) Power purchase cost, including transmission (P)	*INR crore*	2,052	2,163	2,718	*3,267*
b) Operation & maintenance cost (O)	*INR crore*	347	367	414	*445*
c) Depreciation (D)	*INR crore*	37	46	92	*102*
d) Interest and finance charges (I)	*INR crore*	91	109	153	*183*
Total revenue (R)	INR crore	2,413	2,629	2,756	3,519
Average cost of supply [ACS=(E*10)/S]	*INR/unit*	4.94	5.12	6.52	6.39
Average revenue realised [ARR=(R*10)/S]	*INR/unit*	4.72	5.02	5.32	5.62
Revenue gap [ACS–ARR]	*INR/unit*	0.22	0.11	1.20	0.76

Figure 1 provides the ACS–ARR gap for BESCOM and CESC from FY13 to FY17. It indicates that both DISCOMs were unable to recover their costs through the revenue earned from the sale of power.

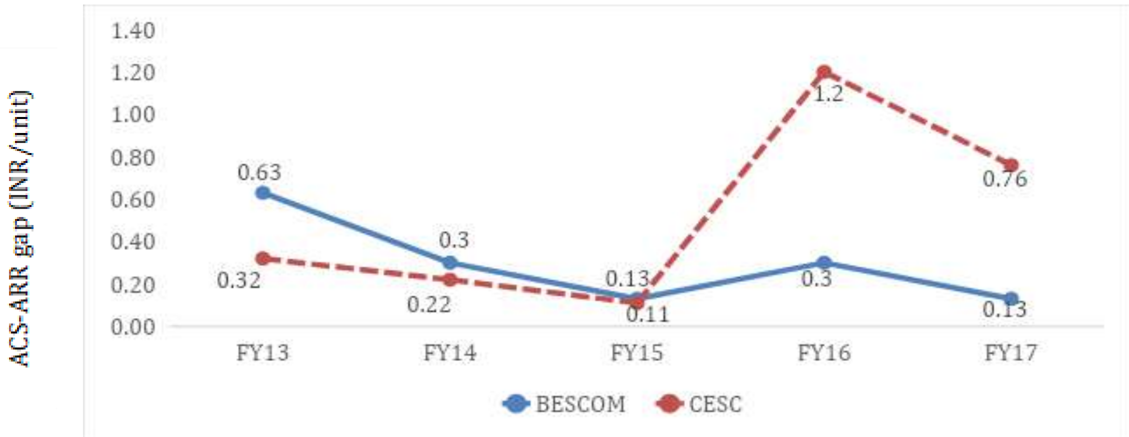

Figure 1: ACS-ARR gap trend in BESCOM and CESC

Source: BESCOM and CESC tariff orders

Generally, inadequate tariff revisions and low billing/collection are considered the two major factors leading to the ACS–ARR gap in most DISCOMs. However, tariff revision is not a major issue for DISCOMs in Karnataka. This is because KERC has been revising consumer tariffs every year to enable DISCOMs to cover the costs incurred in supplying power (KERC, 2018a). For instance, in FY15, the approved expenditure for CESC was INR 2,916 crore. The revenue to be realised was INR 2,581 crore. There was a revenue gap of INR 335 crore. Of this revenue gap, INR 132 crores was set aside as a regulatory asset to be recovered in the subsequent years. To cover the remaining gap, the Commission approved an average increase of 32 paise/unit. Similar increases have been seen in the past five years[1] (KERC, 2018). Also, during the period under review, the Government of Karnataka has been paying a subsidy (as fixed by KERC) towards the free supply of electricity for irrigation pump sets of farmers and household consumers of weaker sections[2]. Moreover, consumers in Karnataka generally show a willingness to pay their bills promptly. It is, therefore, evident that the DISCOMs are incurring huge losses mainly due to: (a) failure to accurately bill the total energy supplied and recover revenue corresponding to it, and/or (b) high technical losses. In such a situation, it is important for the DISCOMs to clearly identify the areas in which they are losing revenue. Also, it is necessary that a culture of revenue accountability be inculcated among field-level functionaries.

2.3 Revenue Accountability in DISCOMs

The organisational structure of DISCOMs in Karnataka involves a hierarchy, with offices at zonal, circle, division, subdivision, and section levels. Comparing the power supplied with revenue generated through sale of power at each level helps in assessing the financial viability of a DISCOM's operations in different parts of its operational area. Such a comparison could be performed either at the circle/division level or at the lower level of a subdivision/section/feeder. The lowest level in the DISCOM hierarchy where both energy supply and revenue collection functions are combined is the subdivision. It has control over both the operation and maintenance (O&M) staff and the billing and collection personnel.

A subdivision, which is typically headed by an Assistant Executive Engineer, includes officers and staff responsible for field-level operations—including maintaining distribution lines, providing supply connections to new consumers, and supervising the collection of supply bills. The monitoring of collected revenue (in accordance with tariff fixed and actual sales) is also carried out at the subdivision office. A subdivision oversees the functioning of two or three section offices headed by an Assistant Engineer or Junior Engineer (and assisted by field staff such as linemen and meter readers).

The jurisdiction of each section office typically covers several hundreds of consumers, including households and commercial establishments. Typically, power is supplied in each section through four/five 11kV feeders originating in a substation, with a number of distribution transformers and service lines. Although the actual sales are billed at the section office, the focus of the section office is mainly on maintaining uninterrupted power supply to its consumers.

One approach to implementing a system of commercial accountability in operating units at the lowest levels in the DISCOM hierarchy is by making the section office accountable for ensuring that revenue is collected as per the tariff fixed, while minimising any leakage of revenue due to incorrect billing or power theft.

[1]FY14 - 23 paise/unit, FY15 - 32 paise/unit, FY16 - 13 paise/unit, FY17 - 53 paise/unit, FY18 - 48 paise/unit, and FY19 - 33 paise/unit)
[2]Bhagir Jyoti / Kutir Jyoti (BJ/KJ) households

2.4 Methodology

From the perspective being discussed, CSTEP has evolved a framework for accounting and monitoring the revenue of DISCOMs at the lowest operational levels—that is, subdivisions and section offices and down to the level of each feeder in the distribution network. **In this method, the Section Officer (Assistant Engineer / Junior Engineer) will be made responsible to ensure that the energy supplied through each feeder in his/her area earns a revenue corresponding to the weighted average of consumer tariffs applicable to the consumers in the area.**

The underlying principle in this methodology is to focus on the relationship between the energy drawn into the system (input energy) for supply to the consumers, the energy actually sold to consumers (in terms of the quantum of energy billed), and the revenue collected from consumers for the energy sold to them. Because nearly 80% of the ACS is accounted for by the cost of energy procured as input to the system, it is important to maximise the revenue realised for any given quantum of input energy fed into the distribution system at the level of each feeder. Higher AT&C losses not only push up the ACS of the energy supplied, but also negatively impact the revenue realised per unit of input energy.

For example, if in a distribution system, 10 million units of energy are procured to effect sales of 9 million units to consumers, with a loss of energy (line losses + other losses) of one million units, there is a 10% loss in terms of energy. If the total cost incurred in the process is INR 50 million, the cost per unit sold, that is, the average cost of service (ACS) is INR 50 million / 9 million units, which is INR 5.56 per unit. If, in the given example, the tariff structure is fixed to result in an average revenue of INR 5.70 per unit of energy sold (the total revenue amounting to INR 51.3 million), the ARR is INR 5.70—which is 2.5% higher than the ACS of INR 5.56. If the losses in the system are 15% instead of 10% (as assumed), with the tariff remaining the same, realisation of revenue will be less than the costs at INR 48.45 million, or at an average of only INR 4.85 per unit of input energy. It is to be noted here that while the revenue per unit of energy sold remains at INR 5.70, the **revenue realised per unit of input energy** reduces from INR 5.13 to INR 4.85, well below the average cost per unit of input energy of INR 5.00. This illustrates the importance of monitoring the revenue realised with reference to the quantum of input energy. This is particularly important in view of the average billing rate (ABR) being different from place to place (feeder to feeder), depending on the rates applicable to different mix of consumers. Realising the desired ARR is possible only if, in addition to realising revenue as per the applicable tariff to the energy sold, the proportion of sales to input energy is maintained as assumed.

To operationalise the approach described above, it is necessary to calculate the revenue potential of each feeder in terms of the average billing rate (ABR). The ABR is the weighted average of the tariff applicable to consumers served by the feeder, including fixed charges like meter rent or line minimum charges payable in addition to the tariff for the energy consumed. ABR is comparable to the ARR at the DISCOM level and is easily calculated by dividing the revenue collected in a given year (excluding arrears) by the units of energy sold. ABR is to be revised after every tariff revision, so that it reflects the potential revenue to be realised for the energy sold during the ensuing tariff period.

To arrive at the revenue per unit of input energy, the ABR is multiplied by the factor of average input energy needed (including allowable AT&C losses) for a given quantum of energy sold in the area of the feeder. For example, if the ABR of a feeder is INR 6 per unit and the expected/allowable AT&C losses are 12%, the revenue to be realised from sales will be INR 6* 0.88 = 5.28 per unit of input energy. Depending on the revenue per unit of input realised in comparison with the potential as estimated above, the operational efficiency of the management of the feeder may be viewed positively or otherwise. This will enable the DISCOM management to trigger corrective action to plug technical losses or address billing or recovery issues to improve revenues to the desired level.

While implementing the system discussed above, it is necessary to consider that the loss levels differ from feeder to feeder—depending on the length of the feeder, number of consumers, rates applicable to the varying consumer mix, etc. Therefore, while working out the feeder-wise performance parameters, the framework should consider different levels of allowable losses among feeders in different areas. Additionally, the aggregate allowable losses at the corporate level or at the division level of a DISCOM need to be judiciously allocated to each subdivision and feeder, keeping in view the losses recorded in the past and the improvement expected in a given year. Where losses are more than the average for the DISCOM, a higher rate of improvement may be required every year, while subdivisions/feeders with lower losses may be supported[3] to further minimise losses to the extent possible. For example, feeders with up to 10% loss may be expected to marginally improve or maintain the status quo (Figure 2) ('HVDS Analysis for Technical Loss Reduction in Power Distribution System', 2014).

This analysis may, on the face of it, suggest the conclusion that AT&C losses at the operational level can be monitored by comparing the energy input recorded in a given area and the corresponding amount of energy billed to the consumers. While this is important on its own, it does not give very satisfactory results because of certain practical difficulties. In the absence of universal coverage of smart meters that can measure consumption on a real-time basis, sale of energy is recorded during the billing cycle spread over several days in a month or quarter. This makes it difficult to compare the energy sold with the input energy as recorded at any given point of time. Moreover, in cases where a significant proportion of energy supplied is unmetered (such as in irrigation pump sets or some categories of households), the supply to those categories may often be overstated to reduce reported AT&C losses. To avoid such issues, the FRAMES approach proposes adoption of a system of monitoring revenue per unit of input energy in the area served by each distribution feeder at the field level. In this system, the input energy as recorded for each feeder at the substation and the revenue realised from the sale of energy in the area fed by the feeder are compared on a monthly/quarterly basis. The revenue realised per unit of input energy truly reflects the commercial efficiency of a DISCOM at the field level. Monitoring of revenue with reference to input energy can also help in preventing misallocation of sales as well as inefficiency in billing or collection of revenue.

A number of conditions are to be met for the system to work effectively, and DISCOMs should ensure that the following issues are addressed before the system is put into operation:

- It is necessary to accurately measure the quantum of energy supplied through a feeder and the distribution network during each billing cycle. For this, not only should the input energy be metered at the origin of the feeder in the substation, but any energy supplied from other feeders into the distribution network (during supply failure, etc.) should also be measured through boundary meters at the points connecting the distribution networks of two or more feeders.
- Power consumption by all consumers served by a feeder should be metered. Any unmetered supply should be suitably segregated or measured at the distribution-transformer (DT) level, at the origin of the service line for such supply. In DISCOMs where free or subsidised supply for agriculture constitutes a significant part of the total supply, segregation of feeders providing free supply is an appropriate solution.

[3]Technological advancements for further reduction of losses

- Revenue accruing against free or concessional supply should be calculated at the rate of subsidy payable per unit, as determined by the SERC concerned.
- DT-level metering and DT-consumer tagging will help compare the energy supplied from each DT with the total energy consumption at the consumer level. This will enable the staff to precisely locate the stretches where technical and other losses are abnormally high and take corrective action.

3. Analysis

This section elaborates the framework using the actual data collected for a few feeders in CESC and BESCOM. To develop and test this framework, we chose 20 feeders, 10 in each DISCOM (BESCOM and CESC). For each feeder, the input energy over a period of 12 months as recorded at the origin of the feeder (i.e., at the substation) was obtained from the daily meter readings. The total input energy was compared with the total billed energy for the corresponding period on the basis of the aggregate of monthly-billed energy for all consumers. The total input energy for 20 feeders is 66.7 MU. Of this, 57.8 MU has been sold as per the bills issued to consumers, indicating a loss of over 13% of the energy in the feeder.

Table 3 and Table 4 provide data of two feeders (feeder-1 and feeder-2) in CESC for the financial year 2017-18 to illustrate the FRAMES methodology. The energy input to the feeder (EIF) is the energy received at the feeder on a monthly basis. The metered sales is the energy sold/billed to the consumers connected to this feeder. The feeder loss is the difference between the energy input and the billed sales. The demand is the amount of revenue that needs to be collected for the energy supplied to the consumers.

For the current year, the ABR of the feeder is calculated by dividing the total revenue billed during the previous year (adjusted for the revision of tariff for the current year) for all consumers by the energy sold/billed to all consumers.

$$Average\ billing\ rate = \frac{Total\ revenue\ billed\ for\ all\ consumers}{Energy\ sold\ to\ all\ consumers}$$

Table 3 shows that the revenue billed during the year was INR 64.95 lakh for 8.82 lakh units of electricity supplied to consumers. The demand includes fixed charges and consumption tariff but not arrears.

The ABR will change every year depending on changes in the applicable tariff for consumers, as approved by the SERC. ABR can be changed in the same proportion as the changes in tariff. Therefore, ABR for FY19 should be calculated as follows:

$$CESC\ ARR\ in\ FY18 = 6.18\ INR/unit$$

$$CESC\ ARR\ in\ FY19 = 6.37\ INR/unit$$

$$Ratio = 6.37/6.18 = 1.03$$

$$Feeder\ ABR\ in\ FY18 = 7.15\ INR/unit$$

$$Feeder\ ABR\ in\ FY19 = 7.15 * 1.03 = 7.37\ INR/unit$$

The average billing rate (ABR) is calculated to be INR 7.37/unit. The actual revenue for FY19 also matches the adjusted ABR. This means that the revenue has been billed in accordance with the tariff and is reflective of tariff changes in the current year.

Based on the adjusted ABR, the target revenue per unit of input energy (TRI) for feeder-1 should be calculated as:

$$TRI = Adjusted\ ABR * (1 - allowable\ losses)$$

$$TRI = 7.37 * (1 - 13\%) = 6.41\ INR/unit$$

However, the actual revenue per unit of input energy (ARI) is INR 6.38/unit.

$$ARI = 64{,}95{,}194/10{,}17{,}328 = 6.38\ INR/unit$$

Based on the analysis, feeder-1 seems to be performing well within the targets. This essentially means that all the energy sold is being billed for generating revenue. For subsequent years, the feeder can set a target for loss reduction from 13% to 10% (reduction of 0.5% each year).

Table 3: FRAMES analysis for feeder-1

Year	EIF (kWh)	Energy Sold (kWh)	Feeder Loss (%)	Revenue (R) (INR)	Adjusted ABR (INR/ kWh)	Actual ABR (INR/ kWh)	TRI (INR/ kWh)	ARI (INR/ kWh)
FY18-19	10,17,328	8,82,219	**13%**	64,95,194	**7.37**	**7.36**	**6.41**	**6.38**
FY17-18	**9,79,740**	**8,55,859**	**13%**	**61,21,769**	**7.15**	-	-	-

In feeder-2, the ABR for FY18 is INR 6.03/unit. ABR for FY19 should be calculated as follows:

$$CESC\ ARR\ in\ FY18 = 6.18\ INR/unit$$

$$CESC\ ARR\ in\ FY19 = 6.37\ INR/unit$$

$$Ratio = 6.37/6.18 = 1.03$$

$$Feeder\ ABR\ in\ FY19 = 6.03 * 1.03 = 6.21\ INR/unit$$

However, the actual ABR for FY19 is 5.26 INR/unit. Further, there is an 86 paise deviation in the TRI and ARI. This essentially means that revenue has not been generated for all the billed energy. Another plausible reason for such a deviation could be higher technical losses in the distribution network that are not reflected in the calculations. The Feeder Manager could use the calculated ABR as an indicator to accurately estimate the total revenue to be billed every month.

Table 4: FRAMES analysis for feeder-2

Year	EIF (kWh)	Energy Sold (kWh)	Feeder Loss (%)	Revenue (R) (INR)	Adjusted ABR (INR/ kWh)	Actual ABR (INR/ kWh)	TRI (INR/ kWh)	ARI (INR/ kWh)
FY18-19	18,62,580	16,85,713	**9.5%**	88,70,012	**6.21**	**5.26**	**5.62**	**4.76**
FY17-18	16,40,936	14,79,573	10%	89,28,388	**6.03**	-	-	-

To monitor the feeder-wise revenue to control losses, an important requirement is that the sales revenue considered should include only the current month's billing and not past arrears. Otherwise, this could skew both TRI and ABR figures. For example, the revenue in July 2017 for feeder-2 is higher than the June 2017 demand, even when the energy sales in July are much lower (by 44%) than the June sales. Similarly, the June demand is higher than that of April, although sales were lower. Because tariff does not change on a monthly basis, such deviations in revenue demand figures could be only because of past arrears included in both these months. Such deviations could be easily noticed using the FRAMES mechanism, as the ABR should be the same for all the months in a particular year.

Using our framework, DISCOM officials will be able to effectively monitor the areas in which AT&C losses exceed 15% or any other acceptable loss levels for the feeder, as decided by the management. In such situations, it would be beneficial to conduct technical and commercial audits. The technical audit will check the line condition and identify the possible points of power theft and losses due to defective network. It would involve comparing DTs' readings with consumer billing in each DT area, and would require the metering of all the DTs and consumers. A commercial or billing audit will compare the individual consumer bills with meter readings in about 10% of cases to detect incorrect billing. This audit will help ascertain the exact reasons for deviations between the actual revenue billed and revenue target for the feeder.

4. Conclusion

The FRAMES mechanism is an attempt to address the challenges faced by Indian DISCOMs:

a. Inability to earn the revenue commensurate with the cost of energy supplied (high ACS–ARR gap)

b. Non-paid supply due to incorrect billing, pilferage, and theft

c. High technical losses due to the poor quality of the distribution network.

The FRAMES would help each Feeder Manager / Section Officer to be cognisant of the sales and revenue target on a monthly basis. Deviation in any particular month would be identified at the end of the month. Consequently, the officials could act appropriately to minimise the deviations. The Feeder Managers would be able to reduce losses once they are aware of the areas/feeders that have deviations beyond acceptable levels.

CSTEP is developing a FRAMES mobile application (app) for 20 feeders, wherein the exact locations of the feeder and associated DTs are mapped. The app will showcase the monthly target sales and revenue from the feeders, based on the feeder ABR. At the end of every month, the Feeder Manager can enter the actual sales and revenue in the app. The app will then calculate and display the ARI, and compare it with the TRI. The Feeder Manager can record the causes of any deviations in the app and plan potential mitigation measures. The app would help the Feeder Manager to be accountable for his/her feeder revenue.

The proposed mechanism could be implemented in DISCOMs without any modification in their existing administrative setup. The framework/app could also be used by officials at the circle/zonal level for monitoring operations at the consolidated levels of subdivision and division offices. Corporate-level officials could utilise it as a decision-making tool to improve the commercial viability of the DISCOM.

While advanced metering at the DT and feeder levels will lead to easy implementation of FRAMES, the system can be implemented even with conventional metering equipment. It has to be ensured that meters at the feeder, DT, and consumer levels are read at specified intervals and the readings are accurately recorded and analysed. The recommended structure (FRAMES) can be incorporated as part of the distribution-strengthening programme of the UDAY initiative.

5. References

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