Annual Energy Audit Report

Of

Electricity Department Goa

For **FY 2022-23**

Electricity Department, Vidyut Bhavan, Panaji (Goa), 403001

by

Prabodh Kala
(BEE Accredited Energy Auditor – AEA 0122)

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ACKNOWLEDGEMENT

Active Energy OPC Pvt Ltd extends its heartfelt gratitude to the management of the Goa Electricity Department (now known as DISCOM) for affording us the privilege to conduct the Annual Energy Audit for the fiscal year 2022-23.

We wholeheartedly appreciate the valuable contributions made by Shri. Shailesh K. Nayak Burye, the Superintending Engineer, Commercial, as well as the entire regulatory team and support staff throughout the audit process.

For Active Energy OPC Pvt Ltd

Prabodh Kala

BEE Accredited Energy Auditor (AEA 0122)

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ABT	Availability Based Tariff
ACS	Average Cost of Supply
AEA	Accredited Energy Auditor
ARR	Average Realizable Revenue
AT&C	Aggregate Technical & Commercial Loss
BEE	Bureau of Energy Efficiency
CE	Collection Efficiency
COC	Change Over Consumer
DC	Designated Consumer
DISCOM	Distribution Company
DSM	Deviation Settlement Mechanism
DSPPL	Dhursar Solar Power Pvt. Ltd
EA	Energy Auditor
EM	Energy Manager
HT	High Tension
KVA	Kilo Volt Ampere
KW	Kilo Watt
LT	Low tension
MSLDC	Maharashtra State Load Despatch Centre
MU	Million Units
MVA	Mega Volt Ampere
MW	Mega Watt
OA	Open Access
RE	Renewable Energy
SLDC	State Load Despatch Centre
STU	State Transmission Unit
T&D/T<>D	Transmission & Distribution
UI	Unscheduled Interchange

1. Executive Summary

The Electricity Department of Goa was established as a government department in 1963, and it holds the exclusive license for the transmission and distribution of electrical energy within the state of Goa.

Currently, the Electricity Department serves the electricity needs of more than 7,02,812 customers across an expansive area of 3702 square kilometers, encompassing two revenue districts, namely North Goa and South Goa. The boundaries of the state of Goa are defined by the Terekhol river in the north, which separates it from Maharashtra, and in the east and south, it is bordered by the state of Karnataka, while the western boundary meets the Arabian Sea. The distribution area is further divided into two circles and 18 divisions for efficient management.

The Electricity Department of Goa does not possess its own power generation infrastructure; instead, it procures electricity from Central Sector Power Stations operated by the National Thermal Power Corporation as per the allocation determined by the Central Government. Additionally, the department engages in bilateral agreements and purchases energy from private traders to supplement its renewable energy sources.

Within the DISCOM framework, the distribution division of the Electricity Department Goa receives power at 220 kV at their Receiving substations, which is subsequently stepped down to 110 kV, 33 kV, 11 kV, and 0.440 kV for consumer distribution. The installation of Availability-Based Tariff (ABT) meters at these Receiving substations allows for the accurate recording of input energy.

1. In addition to this, the Goa distribution division also receives power within DISCOM boundary at 33 kV, 11 kV, and low voltage (LV) levels at their Receiving substations from sources including co-generation, renewable energy, and net metering.

2. The Electricity Department of Goa is responsible for the maintenance and operation of street lighting poles throughout the region. The costs associated with these services are reimbursed by the respective area Municipal corporations or the Goa Government.

3. The diagram below provides a graphical representation of the various energy inputs and sales, offering a visual overview of the energy flow within the department's operations.

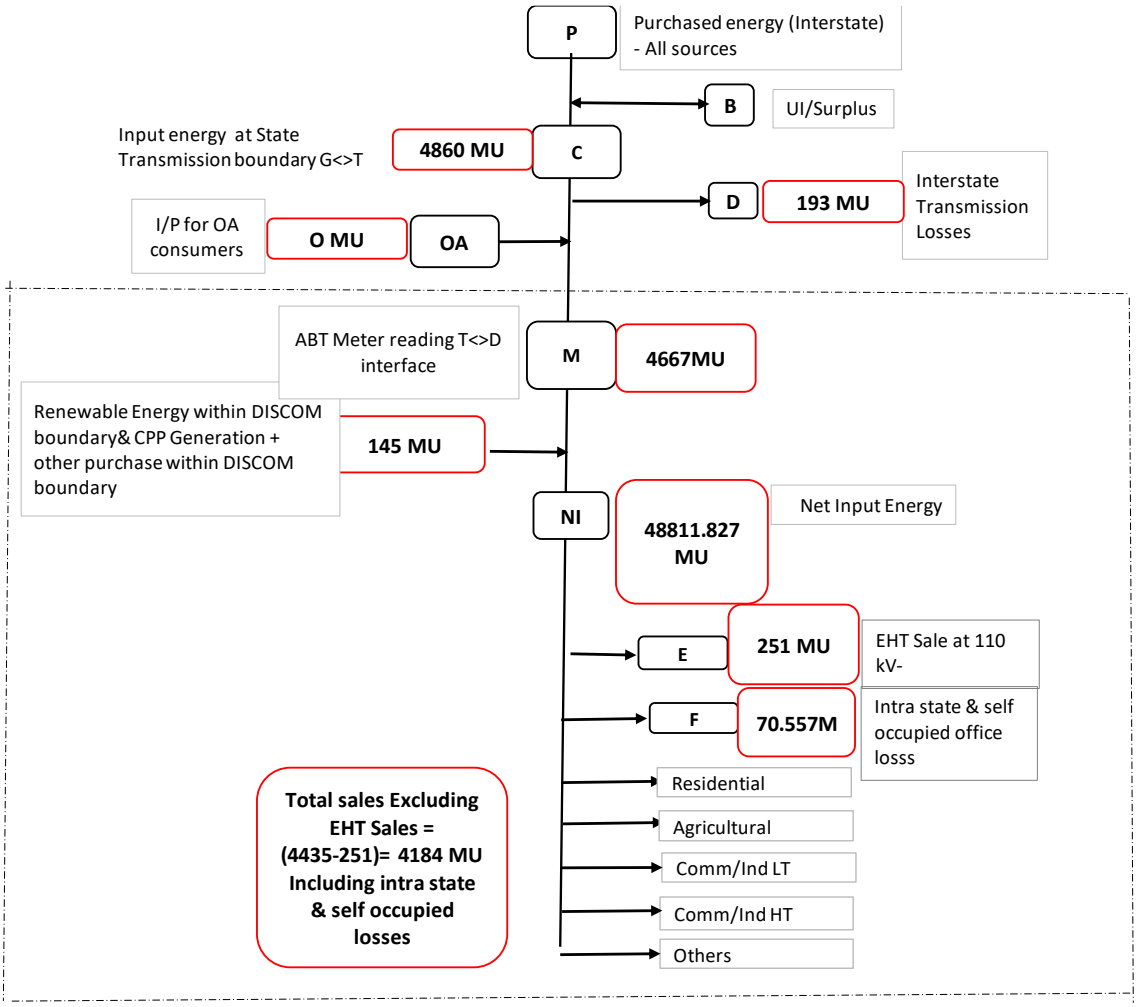


figure 1: Energy Input & Output Diagram

1. Infrastructure Details

Number of circles	02
Number of divisions	18 (including 7 self occupied premises)
Number of subdivisions	34 (O&M) excluding MRT/Civil, Store, EHV.
Number of feeders	337 (11 kV) (feeders for X'mer I/C are not considered as feeders by DISCOM)
Number of DTs	8636

	(DTC & HTC excluding Station & power Transformers)
Number of consumers	714431 (Including EHT consumers)

2. Table 1: Infrastruucture Details

2.Energy metering and billing

- Energy meters are installed at each voltage level for energy consumption at every division. Onsite sample verification and Feeder meter reading verification was done. However feeder wise losses could not be established due to non availability of back-feeding details.
- "R5-DTC & Comm sheets" and "R4-Infrastructure sheet" metering details corrected.
- Quantity of communicable Feeder meters and status of their communication were also corrected.
- DTC & Comm sheets X'mer metering data was corrected. The meters are communicable but only approx. 30% of the communicable meter readings of DTs are communicated. The readings are taken manually and entered in SAP module to calculate the losses. Further action is taken based on the loss determined.
- Feeders metering data was also corrected. In very few cases the communicable meter readings of Feeders are not communicated due to network issue.
- The voltage level wise losses are calculated as metering is done at every voltage level. For 11KV Feeders RT-DAS (Real Time Data Acquisition System) Panels are installed. These panels give the readings of 11KV Feeders to NPP (National Power Portal) and to DC Goa site, too.
- The readings are taken manually and entered in SAP module to calculate the losses. However, Further action can't be taken as feeder wise losses could not be established due to non availability of backfeeding details.
- As Input energy received at various divisions are less than the total input energy received (due to Intra state losses and energy consumed by 7 self occupied divisions). This difference (1.45%) is added in Input energy (in Division wise losses sheet) as Division # 12 & 13.
  This was done to match total input energy (4812 MU), as summary sheet calculations are linked with total input energy of Division wise losses.
- Due to adjustment of Intrastate etc. losses as Input Energy across 11 Divisions, the Proformas submitted to BEE is reflecting slightly more T&D losses of 11 Divisions.

3. ED Goa has claimed that there is 100% metering of consumers. The energy reading of commercial and Industrial consumers, Distribution transformer readings are downloaded through AMR.

4. The energy consumed by ED Goa offices, receiving stations is also metered and accounted. In some DSS Solar Panels are installed for station lighting. This power is also recorded. However, metering records of 7 self occupied Divisions was not made available.

5. The various parameters for FY 2022-23 are tabulated below.

Particulars	**Values (MU)**
EHT Sale	250.75
Total Sales	4434.91
Distribution Loss (MU)	376.97
Distribution Loss (%)	7.83%
Energy at T-D (including EHT)	4811.88

Table 2: Energy Balance

The below table shows the main parameters and distribution loss as calculated for all consumers **(There are no OA consumers)** on E D Goa network.

Sr. No.	Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
1	Input Energy at T& D periphery	4082.36	4212.1	3,919.50	4,192.88	4666.86
2	Total Power Purchased within Goa State	198.56	169.50	163.20	198.14	145.03
3	Energy sales at T&D periphery	4,280.92	4,381.60	4,082.70	4391.02	4434.91
4	T&D loss MU	576.24	658.63	315.54	371.61	376.97
5	T&D %	13.46%	15.03%	7.73%	8.46%	7.83%

Table 3: Main Parameter and Distribution Loss

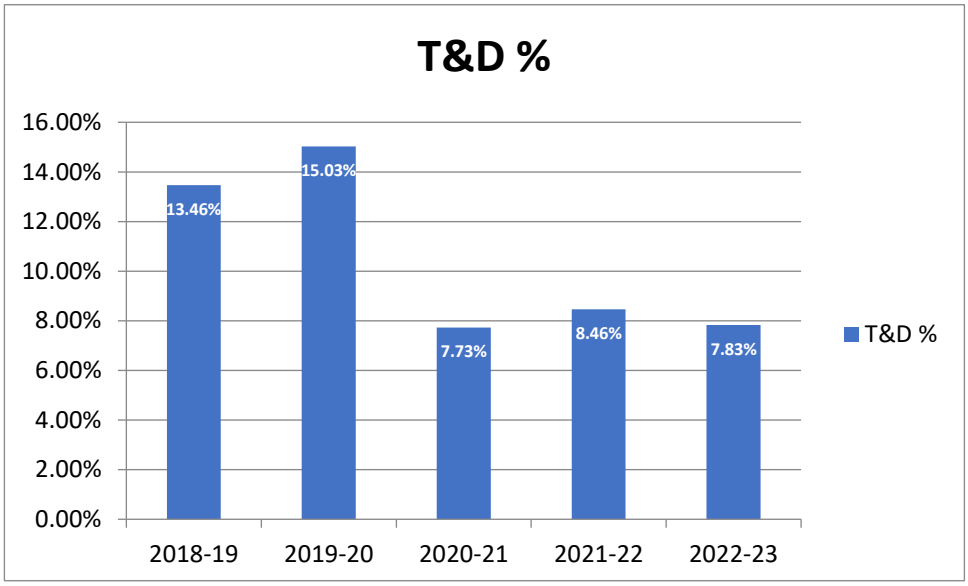
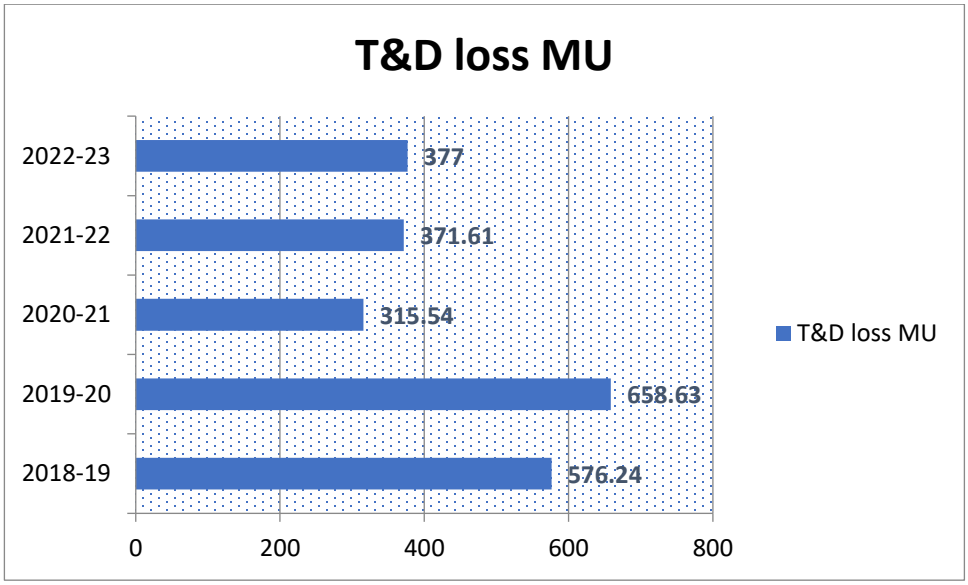


Figure 2: T&D Losses

Total T&D losses were more than 13% till 2019 but efforts are visible in controlling that, for FY 22-23 it was 7.83%, it has been reduced from 576 MU to 377 MU which is at 65% of base year 2018-19



• The HT consumption share increased from 50% of the total consumption in FY 20-21 to 54% in FY 21-22. Now it is 50.05% in 2022-23.

	20-21	21-22	22-23
Total Input Energy,	3919.50	4192.88	4811.83

MU			
HT/EHT Energy sale, MU	1959.75	2264.16	2408.35 (from Infrastructure detail)
HT/EHT Energy sale, %	50%	54%	50%

• The residential consumers form a bulk of the consumers (5,71,301 residential consumers; 79.97 % of the total 7,14,431 consumers).

• The growth of LT & HT network is same. The HT/LT line ratio is approximately 0.89. In quarterly reports 220 & 110 kV ckt length is not given. Hence HT/LT ratio is not correct in quarterly reports.

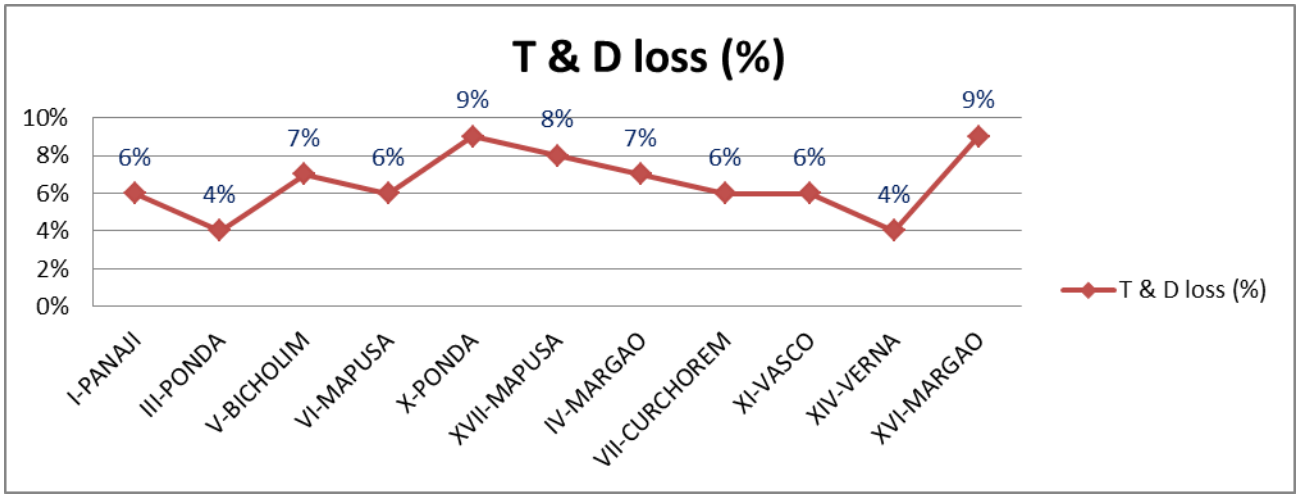
• The numbers of 11/0.415KV transformers are very high as compared to 220/110/33/11 KV transformers due to high LT consumers. This is one of the reasons for high T&D loss.

6. The division-wise loss is given below.to be changed

Name of Division	**Circle**	**Circle Code**	**T & D loss (%)**
I-PANAJI	II	II-N	6%
III-PONDA	II	II-N	4%
V-BICHOLIM	II	II-N	7%
VI-MAPUSA	II	II-N	6%
X-PONDA	II	II-N	9%
XVII-MAPUSA	II	II-N	8%
IV-MARGAO	I	I-S	7%
VII-CURCHOREM	I	I-S	6%
XI-VASCO	I	I-S	6%
XIV-VERNA	I	I-S	4%
XVI-MARGAO	I	I-S	9%

Table 5: Division-wise loss

Input energy needs to be corrected.



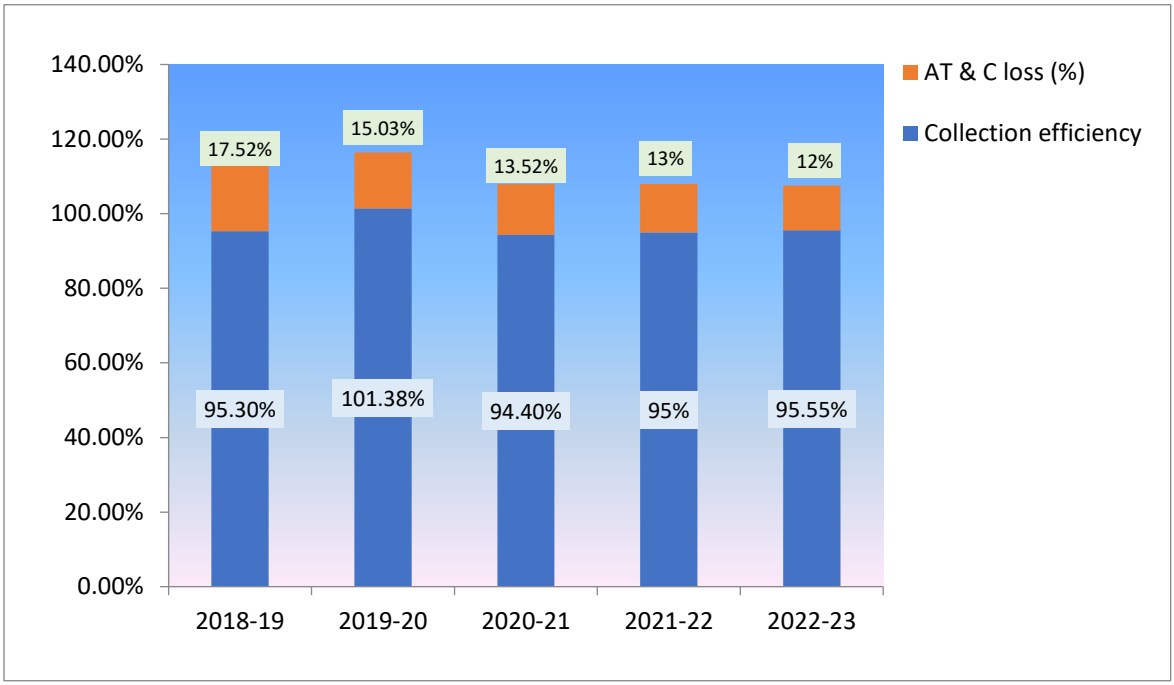
From the above graph, we can see that major T&D losses are in XVI-Margao division, Circle 1, Circle Code I-S and X-Ponda, Circle II, Circle Code II-N (9% each), followed by XVII-Mapusa, Circle II, Circle Code II-N (8%).

7. The AT&C loss is mentioned below.

Particulars	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**
Collection efficiency	95.3	101.38	94.40	95.00	95.55
AT & C loss (%)	17.52	15.03	13.52	13	12

Table 6: AT&C Loss

in case of >100% collection efficiency, AT&C Losses are calculated @ 100% collection efficiency



Other corrections in Proforma:

- 251* MU In Input Energy Sheet it is shown “0” however in Infrastructure Sheet it is shown 251 MU.
- Total input energy received at DISCOM boundary and at Divisions is slightly different due to Intra-state transmission losses and consumption by self occupied premises not considered in 11 divisions.

2 Background

➢ Extant Regulations and role of BEE

In the provision of the Energy Conservation Act, 2001 the Bureau of Energy Efficiency has been set up with effect from day one of March 2002 by joining the earlier energy management center, which was the society under the ministry of powers. The initial aim of the Bureau of Energy Efficiency (BEE) is to decrease the energy intensity in the Indian economy through the taking up of a result-oriented approach. The broad aims of the Bureau of Energy Efficiency (BEE) are:

1. To suppose leadership and give policy system and guide to national energy efficiency and conservation programs and efforts.
2. To direct the stakeholders about the policies and programs on using energy efficiently
3. To set up a framework and procedures to monitor, verify and measure the efficient use of electricity in individual sectors as well as at the national stage.
4. To use multi-horizontal, bi-sidelong, and private segment support in the execution of the Energy Conservation Act and projects for effective utilization of energy and its preservation
5. To show the delivery mechanisms of energy efficiency, by a public and private partnership
6. To manage, implement, and plan energy conservation policies as given in the Energy Conservation Act.

In exercise of the powers conferred by clause (g) of sub-section (2) of section 58, read with clause (q) of sub-section (2) of section 13 of the Energy Conservation Act, 2001 (52 of 2001), the Bureau of Energy Efficiency, with the previous approval of the Central Government, has made a regulation regulations, (Manner and Intervals for Conduct of Energy Audit (Accounting) in Electricity Distribution Companies) vide No. 18/1/BEE/DISCOM/2021 dtd. 6th October 2021 and published it in the Gazette of India Part III section 4 on 7th October 2021. These regulations apply to all electricity distribution companies specified as designated consumers.
An amendment ------

➢ Purpose of audit and accounting Report

A healthy distribution sector is considered as the key to a financially viable power sector. One of the major challenges affecting the health of Indian distribution sector is the high aggregate technical and commercial (AT&C) losses. AT&C loss is the sum of technical loss and

commercial loss. The technical loss occurs due to flow of energy into transmission and distribution network. Technological advancements could help in reduction of technical loss to an optimum level. As per international norms, the technical loss in a distribution system should be in the range of 4-5%. On the other hand, the commercial loss is mostly man-made and occurs due to inefficient billing and collection of the energy supplied, illegal connections, theft, meter tampering, and pilferage, etc. The commercial loss is occurring mostly due to managerial issues and could be brought down to zero with efficient administrative practices. National aggregate technical and commercial losses stood at 22%. If AT&C losses continue to be in such a high range, it is difficult for the DISCOMs to be commercially viable. To improve the energy efficiencies in the power system, the Ministry of Power, Government of India issued notification S.O. 3445 (E) dated 28th September 2020 to cover all the Electricity Distribution Companies (DISCOMs) under the preview of the EC Act. As per the notification, which was formulated in consultation with Bureau of Energy Efficiency (BEE) "**All entities having issued distribution license by State/Joint Electricity Regulatory Commission under the Electricity Act, 2003 (36 of 2003)" are notified as Designated Consumers (DCs)**."

T&D loss is considered as performance matrix of electricity distribution companies under PAT. Now, each DISCOM will be governed under the various provisions of EC Act, such as Appointment of Energy Manager, Energy Accounting & Auditing, identification of Energy Losses Category wise, Implementation of energy conservation & efficiency measures etc.

➢ Period of Energy Auditing and accounting

Periodic Energy Accounting:

After the commencement of BEE regulations dated 6th October 2021, every electricity distribution company should conduct its first periodic energy accounting, for the last quarter of the financial year immediately preceding the date of such commencement (ie from 2nd quarter of the FY 21-22);

And

Conduct its subsequent periodic energy accounting for each quarter of the financial year for a period of two financial years from the date of such commencement and submit the periodic energy accounting report within sixty days from the date of periodic energy accounting.

An electricity distribution company should submit the periodic energy accounting report to

i. Bureau of Energy Efficiency
ii. State Designated Agency (**Chief Electrical Engineer, Electricity Department, Goa)**
iii. The periodic energy accounting report should be made available on the website of the electricity distribution company within forty-five days from the date of the periodic energy accounting.

Annual energy audit: Every electricity distribution company should conduct an annual energy audit for every financial year and submit the annual energy audit report to the Bureau and respective State Designated Agency and made available on the website of the electricity distribution company within a period of four months from the expiry of the relevant financial year. ***The first annual energy audit of should be conducted within six months from the date of such commencement, by considering the energy accounting of electricity distribution company for the financial year immediately preceding the date of the commencement of these regulations (i.e., for FY 20-21).***
A new electricity distribution company is established after the commencement of these regulations; such electricity distribution company shall conduct its first annual energy audit on completion of the first financial year from the date of being notified as designated consumer.

Record of DISCOM:

Annual energy audit Report submitted for FY 20-21.

Report submitted for FY 21-22.

Periodic energy accounting reports from the Q2 of FY 21-22 to Q1 of FY 22-23 are submitted.

Trajectory of T&D losses:

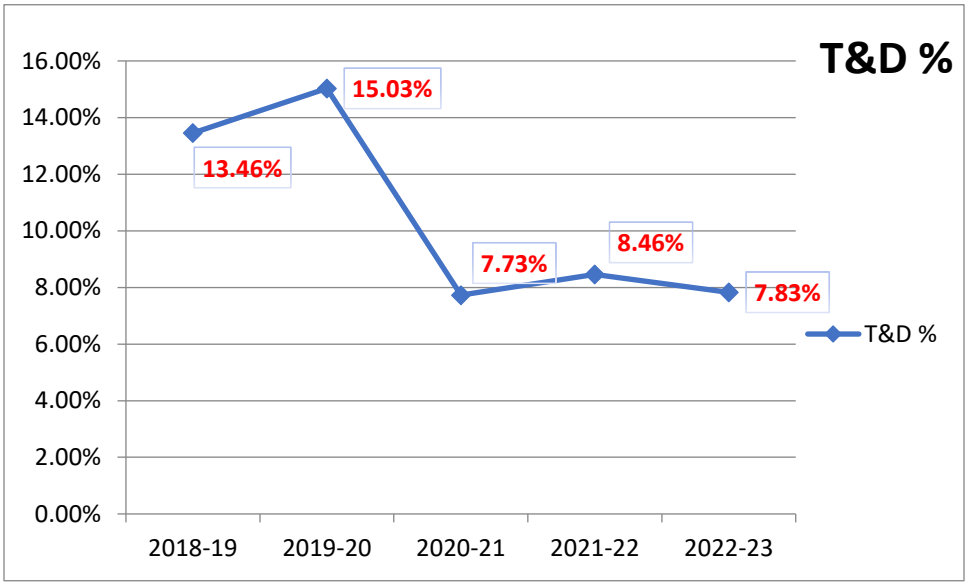


Figure 4: Trajectory of T&D Losses

T&D losses have remained more than 10% from 2018-19 to 2019-20. The T&D losses reduced to 7.73% in 20-21, during the pandemic of the CORONA; but again increased to 8.46%. Now again it reduced to 7.83%.

3. DISCOM introduction and overview

i. Introduction:

The **Electricity Department Goa** was created as a Govt. Department in the year 1963. The Electricity Department is the only licensee in the state of Goa for transmission and distribution of Electrical Energy.

Electricity Department, Goa is catering to the electricity needs of over 714431 customers in an area of **3702 square kilometers. State of Goa** comprises two Revenue district viz North Goa and South Goa. Boundaries of Goa State are defined in the North Terekhol river which separates it from Maharashtra, in the East and South by Karnataka State and West by Arabian Sea. (https://www.goa.gov.in). The area of distribution is divided in 2 Circles and 18 divisions.

The Electricity Department, Goa, does not have its own generation and purchases power from the Central Sector Power Stations of the National Thermal Power Corporation as per the allocation made by the Central Government. Other major sources are bilateral arrangements. ED Goa, also procures energy from private traders for renewable energy.

Distribution area map:

ii. Name and Address of DISCOM

Name : Electricity Department Goa.

Address : Vidyut Bhavan, Panaji, Goa, 403001

ii Name and Contact Details of Energy Manager and Authorized Signatory of DC (Nodal Officer)

Energy Manager Details

Name : Mr. Mayur Hede

Email : mayur.hede@gmail.com

Contact No : 8975594811

Authorized Signatory:

Name : Mr. Stephen Fernandes

Designation : Chief Electrical Engineer

Email : XXXXXX

Contact No : 7350644000

Energy Manager

Name : Mr. Mayur Hede

Designation : Superintending Engineer (Plg.) & Energy Manager

Email : mayur.hede@gmail.com

Contact No : 7796633114

IT Manager

Name : Smt. Anita Pai Raikar

Designation : Assistant Engineer & IT Manager

Email : anita.raikar@goaelectricity.gov.in

Contact No : 7796633111

Financial Manager

Name : Mr. Subhash Mandrekar

Designation : Jt. Dircetor of Accounts & Financial Manager

Email : jtdaccounts@yahoo.in

Contact No : 9420596522

iii. Summary profile of DISCOM (Jurisdiction, Electrical circles/ divisions/ sub-divisions etc., Consumer base, Electrical infrastructure, and assets voltage wise, Energy Flow, pattern of energy distribution, other salient features etc.)

E D Goa is a 100% subsidiary of Government of Goa. The Electricity Department was established as a Govt. Department in the year 1963. The Electricity Department is the only licensee in the state of Goa for transmission and distribution of Electrical Energy.

Electricity Department, Goa is catering to the electricity needs of over 7,14,431 customers, an area of 3702 square kilometers. State of Goa comprises two Revenue district viz North Goa and South Goa. Boundaries of Goa State are defined in the North Terekhol river which separates it from Maharashtra, in the East and South by Karnataka State and West by Arabian Sea.(https://www.goa.gov.in). The area of distribution is divided in 2 circles and 18 divisions

The Electricity Department Goa does not have its own generation and purchases power from the Central Sector Power Stations of the National Thermal Power Corporation as per the allocation made by the Central Government. Other major sources are bilateral arrangements. ED Goa, also procures energy from private traders for renewable energy.

At DISCOM periphery, ED Goa distribution division receives power at 220 KV at their Receiving substations. It is further stepped down to 110 kV, 33 kV, 11 kV and 0.433 kV for consumers. ABT meters are installed at these Receiving substations for recording of input energy. In addition to this Goa distribution division receives power at 33 KV, 11 KV & LV at their Receiving substations from Co-Gen, renewable and Net metering. ED Goa also maintains and energizes the street light poles. The charges are reimbursed by the Goa Government.

The below diagram graphically indicated the various energy inputs and sales.

Figure 5: Distribution Area of ED Goa

Number of circles	02
Number of divisions	18 (including 7 self occupied premises)
Number of subdivisions	34 (O&M) excluding MRT/Civil, Store, EHV.
Number of feeders	337 (11 kV) (feeders for X'mer I/C are not considered feeder by DISCOM)
Number of DTs	8636 (DTC & HTC excluding Station & power Transformers)
Number of consumers	714431 (Including EHT consumers)

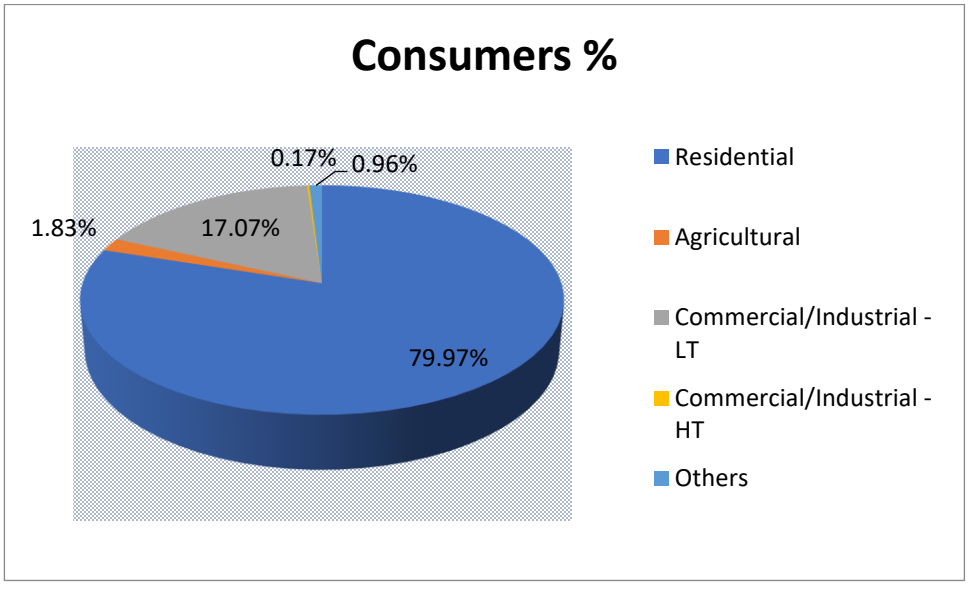
Table 7: Details of ED Goa

Consumer Base

The below table gives the consumer breakup category wise. It is observed that the residential consumers form the largest base of 79.97 %

Category	Nos	% of consumers
Residential	571301	79.97%
Agricultural	13083	1.83%
Commercial/Industrial - LT	121984	17.07%
Commercial/Industrial - HT	1195	0.17%
Others	6868	0.96%
Total	**714431**	**100%**

Table 8: Consumer numbers Category-wise.



Electrical Infrastructure and Assets Voltage-wise

Line length	Ckt Kms
Line length (ckt. km) above 33kV voltage level	587
Line length (ckt. km) at 33kV voltage level	1622.94*
Line length (ckt. km) at 11kV voltage level	5091.35*
Line length (km) at LT level	8231.94*
Length of Aerial Bunched Cables (Only 11kV)	679.12
Length of Underground Cables (33kV)	547.57
Length of Underground Cables (11kV)	1401.72
Line length (km) underground at LT level	966.94
HT/LT ratio	0.88*

Table 9: Electrical Infrastructure Line length-wise

* Corrected in Proforma FY 22-23.xlsx Data submitted by the DISCOM

The HT/LT ratio is approximately 0.88. In quarterly reports 220 & 110 kV ckt length is not given. Hence HT/LT ratio is not correct in quarterly reports.

Transformers & their metering	66kV and above	33kV	11/22kV	LT
Number of conventionally metered Distribution Transformers	NIL	NIL	NIL	NIL
Number of DTs with communicable meters	NIL	213	8423	NIL
Number of unmetered DTs	NIL	NIL	NIL	NIL
Number of total Transformers	NIL	213	8423	NIL

Table 10: Transformer and their metering parameter

Basic DISCOM Details (Electrcity Department Goa, Goa)

B. DTs (Distributions Transformers)

Feeder-wise numbers	No. of Rural DTs (1 ph+3ph)			No. of Urban DTs			No. of Industrial DTs			No. of Agriculture DTs		
	As on 1st April 2022 (A)	As on 31st March 2023 (B)	Average (A+B)/2	As on 1st April 2022 (A)	As on 31st March 2023 (B)	Average (A+B)/2	As on 1st April 2022 (A)	As on 31st March 2023 (B)	Average (A+B)/2	As on 1st April 2022 (A)	As on 31st March 2023 (B)	Average (A+B)/2
Division I: Panaji	405	424	414.5	478	482	480	35	35	35	0	0	0
Division II (S&W): Madgaon	0	0	0	0	0	0	0	0	0	0	0	0
Division III (EHV): Ponda	0	0	0	0	0	0	0	0	0	0	0	0
Division IV: Madgaon	385	409	397	379	406	392.5	0	0	0	0	0	0
Division V: Bicholim	586	605	595.5	196	199	197.5	18	18	18	0	0	0
Division VI: Mapusa	1126	1189	1157.5	324	342	333	83	88	85.5	0	0	0
Division VII: Curchorem	489	507	498	153	156	154.5	22	22	22	0	0	0
Division VIII (MRT) : Madgaon	0	0	0	0	0	0	0	0	0	0	0	0
Division IX (EHV) : Tivim	0	0	0	0	0	0	0	0	0	0	0	0
Division X: Ponda	469	495	482	182	186	184	142	148	145	0	0	0
Division XI: Vasco	339	353	346	329	345	337	35	35	35	0	0	0
Division XII (EHV): Xeldem	0	0	0	0	0	0	0	0	0	0	0	0
Division XIII: Kadamba	0	0	0	0	0	0	0	0	0	0	0	0
Division XIV: Verna	204	176	190	36	23	29.5	147	197	172	0	0	0
Division XV (Civil): Panaji	0	0	0	0	0	0	0	0	0	0	0	0
Division XVI: Madgaon	640	650	645	154	154	154	62	63	62.5	0	0	0
Division XVII: Mapusa	771	847	809	17	19	18	60	63	61.5	0	0	0
Division XVIII (Civil): Ponda			0			0			0			0
0			0			0			0			0
0			0			0			0			0
Total	5414	5655	5534.5	2248	2312	2280	604	669	636.5	0	0	0

	5655	2312	669	8636
				Total

Feeders and their metering	**66kV and above**	**33kV**	**11/22kV**	**LT**
Number of metered feeders	22	168	337	NIL
Number of feeders with communicable meters	22	168	337	NIL
Number of unmetered feeders	NIL	NIL	NIL	NIL
Number of total feeders	22	168	337	NIL

Table 11: Feeders and their metering

Parameters	**66kV and above**	**33kV**	**11/22kV**	**LT**
Number of conventional metered consumers	Nil			5338 (electro-mech) + 690384 (digital meters)
Number of consumers with 'smart' meters	Nil	Nil	Nil	Nil
Number of consumers with 'smart prepaid' meters	Nil	Nil	Nil	Nil
Number of consumers with 'AMR' meters	**1215**			Nil
Number of consumers with 'non-smart prepaid' meters	Nil	Nil	Nil	NA

Number of unmetered consumers	Nil	Nil	Nil	Nil
Number of total consumers	**1215**			**695722**

Electrical distribution and energy flow:

Energy input and Output

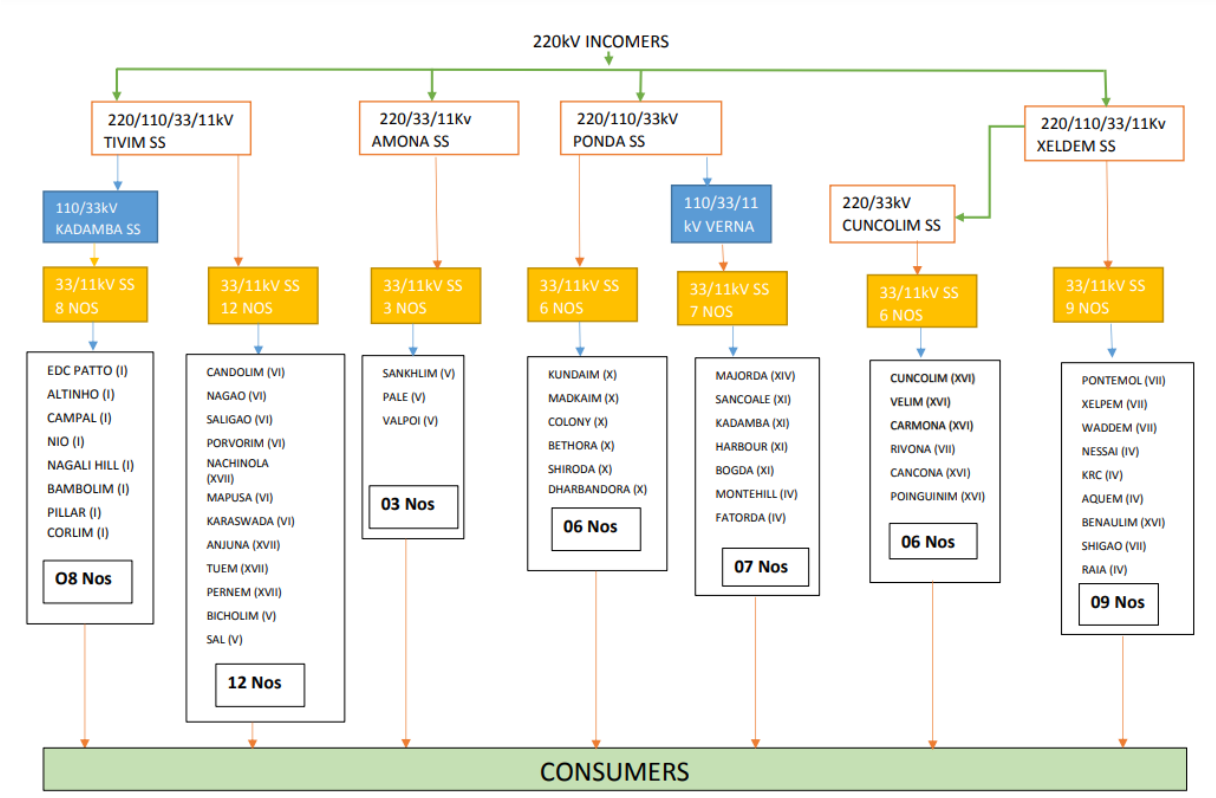


Figure 6: Energy Input and Output

Voltage wise energy flow:

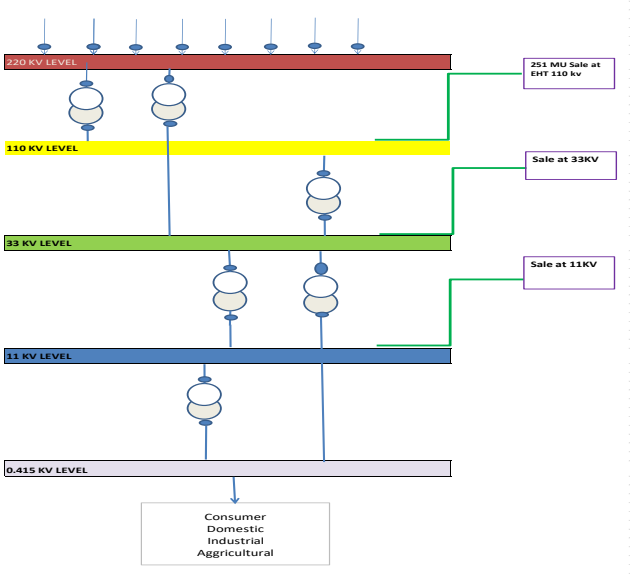


Figure 7: Energy Flow Diagram

GOA distribution division receives power at 220KV at their Receiving substations. It is further stepped down to 110 KV, 33kV, 11kV and 0.440 KV for consumers. ABT meters are installed at these Receiving substations for recording of input energy.

Other salient features:

iv. Energy Conservation measures already taken and proposed for future.

Energy Conservation measures already taken.

Action Plan reporting format for PAT Cycle-VII (2022-25)

A. Implemented :

Sl. No.	Description of energy efficiency improvement measure	Investment (Lakh Rupees)	Verified savings (Lakh Rupees)	Verified energy savings	Units
1	Replacement of old conductor by underground cable for HT network	5,650	525	9,331,145	kWh/Annum
2	Replacement of old conductor by new conductor for HT network	49	8	138,045	kWh/Annum
3	Replacement of old conductor by underground cable for LT network	54.66	9	166,130	kWh/Annum
4	Replacement of old inefficient DTC by new energy efficient DTC	143.92	8	133,678	kWh/Annum
5	Installation of new DTC as replacement for faulty DTC	559.88	78	1,380,839	kWh/Annum
6	Savings by replacing Fluorescent Tube lights (FTL) & High Pressure Sodium Vapour Lamps (HPSV) with LED lamps	6820.13	296	5,261,140	kWh/Annum
Total		**7,140**	**924**	**16,410,977**	**kWh/Annum**

B. Under Implementation:					
Sl. No.	**Description of energy efficiency improvement measure**	**Investment (Lakh Rupees) estimated**	**Verified savings (Lakh Rupees) estimated**	**Verified energy savings estimated**	**Units**
1	Replacement of old conductor by underground cable for HT network	17,237	1,524	27,065,593	kWh/Annum
2	Replacement of old conductor by new conductor for HT network	410	183	3,246,436	kWh/Annum
3	Replacement of old conductor by underground cable for LT network	3119.38	23	415,634	kWh/Annum
Total		**20,766**	**1,730**	**30,727,663**	**kWh/Annum**

Table 12: Conservation measures taken and under implementation.

Other actions taken for Theft Identification etc.

- The DISCOM has claimed that it has skill teams comprising technical experts, legal professionals and field personnel to take actions on Theft cases.
- Inspections taken up by Centralized Vigilance Cell under office of the Chief Electrical Engineer
- Inspections taken up by Div. VIII MRT (Meter Realy Testing Team) as centralized team for both Circles I (S) & II (N).
- The 34 nos. Of O&M (Operation & Maintenance) sub divisional offices carry out inspections at sub divisional levels.
- The appx. count of raids and inspection for the FY 2021-22 is 400 nos. and for FY 2022-23, the cases are 1200 nos.

4. Energy flow analysis

i. Energy flow across 5 Service Levels

Voltage wise energy flow:

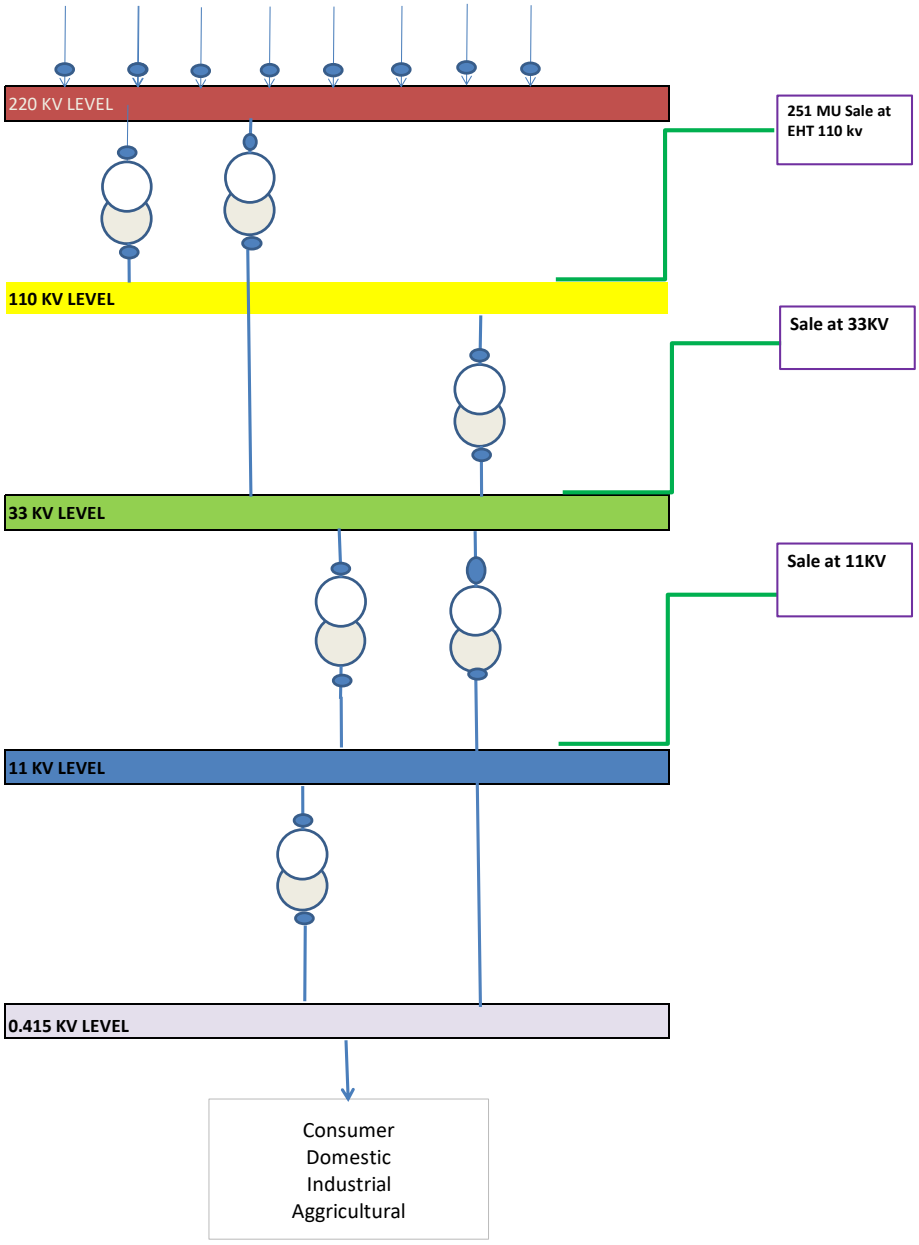


Figure 8: Voltage-wise Energy Flow

Voltage wise consumption:

DISCOM	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
LT		2026.56	included with 11KV	included with 11KV
11 Kv	2906	555	324	11.15%
33 kv	1652	1602	50	3.01%
> 33 kv	254	251	3	1.34%
Total	**4812**	**4435**	**377**	**7.838%**

Table 16: Voltage-wise Consumption

Type of Consumers	Category of Consumers (EHT/HT/LT/Others)	Voltage Level (In Voltage)	No of Consumers	Total Consumption (In MU)
Domestic	LT/HT	0.220/0.400/11.00	571301	1370.65
Commercial	LT/HT	0.2/0.4/11/33	116549	665.98
Public Lighting	LT	0.2/0.4	6777	45.42
HT Industrial	HT/EHT	11/33/110	867	2188.82
Industrial (Small)	LT	0.2/0.4	5763	89.80
Others-1 (if any , specify in remarks)agriculture & allied	LT/HT	0.2/0.4/11/33	13083	37.13
Others-2 (if any , specify in remarks) misc & other	LT/HT	0.2/0.4/11/33	91	37.08
Total			**714431**	**4434.88**

ii. Validation of metered data

Metered Data was validated by

- Manual Inspection (Meter No, CT & PT ratio, MF and MWh)
- Verifying Inspected parameters from DISCOM documents/log books.
    i. Instantaneous Energy and Energy Flow Verified from SCADA
    ii. Meter No, CT & PT ratio, MF and MWh verified from Monthly recorded statements of DISCOM.
- Sample verification of consumers meter was done through Inspection (Meter No, CT & PT ratio, MF and MWh) and verifying Inspected parameters from DISCOM documents.
- Manual Inspection (Meter No, CT & PT ratio, MF and MWh)

DISCOM has 11 Divisions (other 7 Divisions are self occupied offices only), out of these, 4 High loss divisions were visited to verify their meters. Summary of Validation of metered Data is tabulated below:

	As per BEE Guideline	**Status of DISCOM**			Min	to be checked	
A	**Validation of feeder data**		Total Nos installed				

	Based on data available in 11 kV Feeder meter at substation for a sample size of 10% for which documentary evidence to be captured in the audit report	- There are 11 kV Feeders. - All these feeders are metered.	337	10%	34	39	- 39 Nos. of 11kV Feeders at various substations were verified and checked for documentary evidence. The details are given in the Annexure.
B	**Validation of energy flow data and losses**						
	Input energy metering points between Transmission and 66kV/33kV/11kV distribution feeders	- 220 kV feeders were verified only at periphery. - 110 kV feeders were verified	22	1%	10	11	All main incomer meters (SLDC) verified
C	**All Divisions with AT&C losses greater than 25% or at-least 1/3 of the total Divisions**		Total nos from high loss divisions				
	checking functional and communication status of meters	between 220-132-110- 66 /33 kV outgoing and 22kV incoming feeders/ direct end-consumer		1%	10	39	- All the input energy goes to the consumer - - 39 Nos. of 11kV Feeders at various substations were verified and checked for documentary evidence. The details are given
		between 220-132-110- 66 /33 kV outgoing and 11kV incoming feeders/ direct end-consumer					
		between 220-132-110- 66 /33 kV outgoing and 6.6kV incoming feeders/ direct end-consumer					

		between 220-132-110- 66 /33 kV outgoing and 3kV incoming feeders/ direct end-consumer					in the Annexure.
	Communicable meters installed under R-APDRP and IPDS	Urban High Loss Division (DT meters)		1%	5	0	- No meter installed underR-APDRP and IPDS Scheme.
	checking functional and communication status of meters	between 11kV/6.6kV feeders and DTs		1%	10	1	
	foot survey of feeder to check for thefts/ hooking etc.						Foot servey done
	at-least 1/3 of the total Divisions of high loss (only verification of meter & its connection)	Agriculture (Metered and Un-metered)	1701 (XVII Mapusa)	2%	10	34	Agricultural consumer
		Govt. category connection (ULB, RLB etc.)		2%	10		
		LT Industrial		2%	10	5	

Validation of Feeders Meter

11KV feeder meters:

Nos of DTS are 8636 , however only 337 feeders are considered by DISCOM

- 11KV feeder meters = Total 337
- 10% of 11kv feeder meter = 34
- Verified 11kv feeder meter = 37

Validation of Energy flow data & losses

Meters at injection point:

Injection point meters and details are given in Proforma

a) Min. 10 or 1% (whichever is higher) of DISCOM's input energy metering points between Transmission and distribution feeders were to be checked for functional and communication status .

Verified for 3 Divisions out of 11 Divisions i.e. 30%.

b)

b.1 Min. 10 or 1% (whichever is higher) of DISCOM's input energy metering points between Transmission and distribution feeders were to be checked for functional and communication status .

Verified for 3 Divisions out of 11 Divisions i.e. 30%.

b.2 For all Divisions with AT&C losses greater than 25% or at-least 1/3 of the total Divisions of DISCOM,

No Division has AT&C losses of more than25%, hence 4 Division out of 11 divisions of high losses were verified

- Between 220-132-110- 66 /33 kV outgoing and 22kV-11kV-6.6kV-3kV incoming feeders/ direct end-consumer by checking functional and communication status of meters.
  Verified for 4 Divisions out of 11 Divisions i.e. 35%.

- Metering points between 11kV/6.6kV feeders and DTs for foot survey of feeder to check for thefts / hooking etc.) = 4500 DTs (approx.- actual data not available)

a)

Transformer I/C feeder meters checked = 23 Nos (33/11KV Transformers 16 Nos. 33/0.440KV Transformers 6 Nos. and 11/0.440KV Transformer 1 No. are checked.)

Verify metering and connection status of min. of 10 or 2% consumers of the Division (whichever is higher) of the following category of consumers – Agriculture (Metered and Un-metered), Govt. category connection (ULB,RLB etc.), and LT Industrial

220/110, 33, 11 kV Kurti RSS. 220 kV side : 220 kV side meter details were verified as below.

220KV CURTI RSS

Substation Name	Division Name or DSS Name	Incomer Details	Installed	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
CURTI	II	Inter-State (Western Grid)	220/110/33kV	31/08/2023	YES	YES	
CURTI	II	CURTI	220/110KV	31/08/2023	YES	YES	
CURTI	II	CURTI	110/33 KV	31/08/2023	YES	YES	
CURTI	II	CURTI	33/11KV	31/08/2023	YES	YES	
PONDA-X	COLONY	PANJI-I	33/11KV	31/08/2023	YES	YES	
PONDA-X	KUNDAIM	PONDA	33/11KV	31/08/2023	YES	YES	
MADGAO-IV	RAIA	PONDA	33/11KV	01/09/2023	YES	YES	
MADGAO-IV	AQUEM	MADGAO EXP. 1	33/11KV	01/09/2023	YES	YES	

MADGAO-IV	UDUPI	AQUEM	11/440 V	01/09/2023	YES	YES	
MADGAO-IV	AQUEM	MADGAO EXP. 1	33/11KV	01/09/2023	YES	YES	
MADGAO-IV	UDUPI	AQUEM	11/440 V	01/09/2023	YES	YES	
MADGAO-IV	NESSI	MADGAO	33/11KV	01/09/2023	YES	YES	
MADGAO-XVI	CARMONA	VELIM-II	33/11KV	01/09/2023	YES	YES	
MADGAO-XVI	VELIM	VELIM-II & VILIM-I	33/11KV	01/09/2023	YES	YES	

Table 17: Details of Meter at Injection Point at 220kV/110kV/33kV at 220kV Sid

220KV INCOMER AT 220KV CURTI RSS

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
CURTI 220Kv RSS	220KV	Ambewadi – Ponda (APII)	01986616	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	220KV	Amona-Ponda(III)	X1346663		Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
	220KV	Amona-	12047318		Meter	Verified	Instantaneous

		Ponda(II)			No, CT & PT ratio, MF and MWh	from SCADA	Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	220KV	220KV Bus-to Tr. No. 1, 100MVA, (220/110KV) Primary	12047318		Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	220KV	220KV Bus-Tr. No. 2, 100MVA, (220/110KV) Primary	12047319		Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	220KV	220KV Bus-Tr. No. 3, 100MVA, (220/110KV) Primary	12047316		Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Table 17: Meters at ED Goa Periphery

Feeder meters between Transmission and Distribution Substation switchgears (220/110KV) at 110kV level .

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
CURTI 220Kv RSS	110KV	Tr. No. 1, 220/110KV Secondary		31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh

			09142489				Verification Pending
CURTI 220Kv RSS	110KV	Tr. No. 2, 220/110KV Secondary	10273621	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	Tr. No. 3, 220/110KV Secondary	No Meter	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	110KV Feeder To MRF	Y0063005	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	110KV Feeder To XELDEM	Y0063006	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	110KV Feeder To Ponda-Verna	12047300	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	110KV Feeder To Thivim-II	12047315	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification

							Pending
CURTI 220Kv RSS	110KV	110KV Feeder To Thivim-I	20009080	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

110/33KV FEEDERS

CURTI 220Kv RSS	110KV	110/33KV Tr. No. 2, 40MVA, Primary	12047317	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	110/33KV Tr. No. 1, 40MVA, Primary	No Meter	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	110KV	110/33KV Tr. No. 1, 30MVA, Primary	No Meter	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Table 18: Feeder meters between Transmission and Distribution Substation switchgears at 110kV .

Feeder meters of Distribution Substation at 33KV level of 110KV/33KV. Feeder Meter readings are verified and recorded as follows. Photographs are attached in Annexure.

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
CURTI 220Kv RSS	33KV	110/33KV Tr. No. 1, 40MVA, Secondary	01986633	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	110/33KV Tr. No. 2, 40MVA, Seconary	17104244	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	110/33KV Tr. No. 1, 30MVA, Secondary	X0174244	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33/11KV Tr. No. 2, 30MVA, Primary	XB417540	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33/11KV Tr. No. 1, 6.3MVA, Primary	No PT	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
CURTI 220Kv RSS	33KV	33KV Feeder Verna-I	12041540	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Panjim-II	12041530	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Pale-II	12041215	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Pale-I	12041409	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Verna-II	12041543	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder K.I.E. Sancole	12041507	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh

							Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder OPA	12041544	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Bethora-I	12041276	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Bethora-II	12041421	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Savordem	12041458	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV	33KV Feeder Ring FDR UGC	12041517	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Table 19: Feeder meters at Distribution Substation at 110KV/33kV, 33KV/11KV & 11KV/0.415KV.

CURTI 33/11KV DSS. (11KV feeders).

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
CURTI 220Kv RSS	11KV	11KV Feeder Farrmagudi	13012786	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder US Goa	120141497	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder Ponda-II	12041296	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder Shanti Nagar	13012779	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11/0.415KV Tr. No. 2, 6.3MVA Primary	01986632	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11/0.415KV Tr. No.1, 30MVA	01986663	31/8/23	Meter No, CT & PT ratio,	Verified from SCADA	Instantaneous Energy and Energy Flow

		Primary			MF and MWh		Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder Curti	WBB02900	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder Savordem	12041427	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder OPA	12041339	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	11KV	11KV Feeder Durbhat	12041331	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Table 20: 11KV Feeder meters at Distribution Substation at Curti 33KV/11KV DSS.

High Loss Area "Ponda-X"

(a) Colony DSS (33/11kV)

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
PANJI-I RSS	33KV	33KV Feeder Incomer at 33KV (Out Feeder)	X0174197	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
CURTI 220Kv RSS	33KV Ring Feeder	33KV Feeder Incomer	X0174199	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	33KV	33/11KV Tr. No. 2, 10MVA, Primary	X0174245	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	33KV	33/0.415KV Station Transformer Primary	No Meter at Primary LT Meter 16085391	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	11KV	11KV Tr. NO. 1, 6.3MVA, Secondary	07346645 (meter Off)	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Colony 33/11KV DSS	11KV	11KV Feeder Khadpabandh	12041523	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	11KV	11KV Feeder Ponda-I	12041374	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	11KV	11KV Tr. NO. 2, 10MVA, Secondary	XB417542	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	11KV	11KV Feeder Rajiv Gandhi Kala Mandir	X0271055	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	11KV	11KV Feeder Bazar	X0271056	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Colony 33/11KV DSS	11KV	11KV Feeder Farmagudi	X0271057	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

(b). Kundaim DSS (33/11KV)

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Kundaim 33/11KV DSS	33KV From Panjim-I	33KV Incomer-I, Tr. No. 1	12041449	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	33KV From Ponda	11KV Incomer-II, Tr. No. 2	12041349	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	33KV Feeders (HT Consumers)	33KV Feeder Himcast	13064835	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	33KV Feeders (HT Consumers)	33KV Feeder Cadila	GOA30414	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	33KV Feeders (HT Consumers)	33KV Feeder P&G	GOA30417	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	33KV Feeders (HT Consumers)	33KV Feeder HUL	GOA30416 Meter Display Defective	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Kundaim 33/11KV DSS	11KV	11KV Feeder Kundaim	15070069	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	11KV	11KV Feeder Mardol	15070056	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	11KV	11KV Feeder Marcela	15070070	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	11KV	11KV Feeder IND-III	15070045	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	11KV	11KV Tr. No. 1, Secondary	15098314	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	11KV	11KV Tr. No. 2, Secondary	01986461	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Kundaim 33/11KV DSS	11KV	11KV Feeder IND-II	12041384	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending
Kundaim 33/11KV DSS	11KV	11KV Feeder IND-I	12041250	31/8/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA. kWh Verification Pending

Madgon-IV High Loss Area : The sites were visited on 01st Sept. 2023. The detailed report is as follows

(a). Raia 33/11KV DSS

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Raia 33/11KV DSS	33KV	33/11KV, Tr. No. 1, 6.3MVA, Primary	1986451	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	33KV	33KV Feeder, Ponda-Madgon-II	12041315	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Raia 33/11KV DSS	33KV	33KV Feeder, Ponda-Madgon-I	12041447	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	33KV	33/11KV, Tr. No. 3, 10MVA, Primary	11095753	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	33KV	33/0.415KV Station Transformer, Tr. No. 1, 6.3MVA, Primary	33KV side No Meter LT Side Meter No. GOA11984	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	11KV	33/11KV, Tr. No. 2, 6.3MVA, Secondary	01986455	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	11KV	11KV Feeder, Raia	12041320	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	11KV	11KV Feeder, Santemol	12041431	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	11KV	33/11KV, Rachol	12041216	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	11KV	33/11KV, Tr. No. 3, 10MVA, Secondary	01986453	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Raia 33/11KV DSS	11KV	11KV Feeder, Tr. No. 1, Loutolim	12041511	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Raia 33/11KV DSS	11KV	11KV Feeder, Curtorim	12041502	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

(b). Aquem 33/11KV DSS

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Aquem 33/11KV DSS	33KV	33KV Incomer From Margao Exp-1	12041488	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	33KV	33/11KV Tr. No. 1, 10MVA, Primary	12041520	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	33KV	33KV Tr. No. 2, 10MVA, Primary	12019712	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	33KV	33/0.415KV Station Transformer connected parallel to Tr. No. 2, Primary	12019712	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Aquem 33/11KV DSS	11KV	33/11KV Tr. No. 1, 10MVA, Secondary	15070068	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	11KV Feeder Malbhat	15070078	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	11KV Feeder Margao-III	15070064	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	33/11KV Tr. No. 2, 10MVA, Secondary	X1602185	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	33/11KV Tr. No. 1, 10MVA, Secondary	15070068	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	11KV Feeder Khareband	12041433	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	11KV Feeder Margon-I	12042162	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	11KV Feeder Rumdamol (HSB)	12041404	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Aquem 33/11KV DSS	11KV	11KV Feeder Gogal (HSB)	12041262	01/9/23	Meter No, CT & PT ratio, MF and	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
					MWh		SCADA.
Aquem 33/11KV DSS	0.415KV	0.415KV Station Lighting (LT Meter)	GOA39953	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

(c). **Udupi 11/0.415KV DSS**

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Udupi 11/0.415KV DSS	11KV	11KV RMU	No Meter	01/9/23			
Udupi 11/0.415KV DSS	0.415KV	0.415KV	A1011201	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

(d). Nessai 33/11KV DSS

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Nessai 33/11KV DSS	33KV	33KV Incomer having no Breaker	No Meter	01/9/23			
Nessai 33/11KV DSS	33KV	33KV Incomer having no Breaker	No Meter	01/9/23			
Nessai 33/11KV	33KV	33KV Incomer having no	No Meter	01/9/23			

DSS		Breaker					
Nessai 33/11KV DSS	33KV	33KV Incomer having no Breaker	No Meter	01/9/23			
Nessai 33/11KV DSS	33KV	33/11KV Tr. No. 1, 6.3MVA, Primary	12041510	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Nessai 33/11KV DSS	33KV	33/11KV Tr. No. 2, 6.3MVA, Primary	12041322	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Nessai 33/11KV DSS	33KV	33 KV Feeder Borkar	12041448	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Nessai 33/11KV DSS	33KV	33 KV Feeder Macbrout	GOA41415	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Nessai 33/11KV DSS	0.415KV	LV Station Supply by Solar Meter	Solar Meter No. X0708968	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Madgao – XVI

(a). Carmona 33/11KV DSS

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Carmona 33/11KV DSS	33KV	33KV Incomer From Velim-II	07036259	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	33KV	33KV Incomer From Benaulim-II	12041310	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	33KV	33KV Feeder Leela	12041302	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	33KV	33/11KV Transformer, 6.3MVA, Primary	X1232358	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	11KV	33/11KV Transformer, 6.3MVA, Secondary	07036233	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	11KV	11KV Feeder Cavellosim	12041416	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	11KV	11KV Feeder XIRD	X1232355	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Carmona 33/11KV DSS	11KV	11KV Feeder Janoth Bazar	X1232356	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Carmona 33/11KV DSS	11KV	11KV Feeder Zalor	1232354	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

(b). Velim 33/11KV DSS

Substation Name:	Voltage	Incomer Details	Meter No.	Verified during Site Visit	Checked Parameters of Meters	Document for Verification	Remarks
Velim 33/11KV DSS	33KV	33KV Incomer From Velim-II	X0174235	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	33KV	33KV Incomer From Velim-I	X0174237	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	33KV	33KV Out Going To Mobor-II	X0174225	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Velim 33/11KV DSS	33KV	33KV Tr. No. 1, 6.3MVA, Primary	01986551	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	33KV	33KV Tr. No. 2, 6.3MVA, Primary	GOA24981	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	11KV	33/11KV Tr. No. 1, 6.3MVA, Secondary	11095632	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	11KV	11KV Feeder Assolna	11098008	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	11KV	11KV Feeder Kumbia Bhat	12041391	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	11KV	33/11KV Tr. No. 2, 6.3MVA, Secondary	19231176	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	11KV	11KV Feeder Dharmapur	19231196	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.
Velim 33/11KV DSS	11KV	11KV Feeder Chinchinim	19231179	01/9/23	Meter No, CT & PT ratio, MF and MWh	Verified from SCADA	Instantaneous Energy and Energy Flow Verified from SCADA.

Consumer Meter Verification :

LT Industrial Meter Readings Verified and Recorded are given below:

Sr. No.	Consumer Name	Category	Meter No.	Meter Reading 27/7/23	Monthly Consumption	Meter Reading 01/9/23	Consumption	Remark
1	Konkan Retreads	LT-Ind.	GOA00582	16064	199	16722	205	Consumption is almost same
2	Pooja Industries	LT-Ind.	GOA05841	53502	114	53621	119	Consumption is almost same
3	Trident Tool Industries	LT-Ind.	13055683	61482	648	62132	650	Consumption is almost same
4	Sandhya Enterprises	LT-Ind.	18051907	18042	474	18523	481	Consumption is almost same
5	Tana Engineering	LT-Ind.	GOA00517	38605	176	38793	188	Consumption is almost same

Table xx industrial Consumer's Meter Verification.

The meter readings/consumption are verified with the subsequent past two electric bills of the respective consumer.

Consumer Meter Verification : (LT Agriculture Meter Readings are Recorded as Follows.)

Sr. No.	Consumer Name	Catogery	Meter No.	Meter Reading	Remark
1	Shaikh Saif	LT- Agri.	18040099	087834	Consumption is almost same
2	Jo Rai Fernandis	LT- Agri.	H62269	000912	Consumption is almost same
3	Oscar S. Silverira	LT- Agri.	A5445529	000758	Consumption is almost same

Table xx : LT Agricultural Meter Verification.

The meter readings/consumption are verified with the subsequent past two electric bills of the respective consumer.

Month-wise Input Energy, Purchased Energy and Billed Energy details were provided. Each parameter was verified through various documents during the site visit.

b. Instantaneous Energy and Energy Flow was checked during site visit and verified from SCADA.

c. Site visits were carried out for data validation. The meter readings recorded are tallied with the actual meter reading recorded by DISCOM. The details are placed in an annexure.

d. Month-wise Energy Summary and Verified documents are given in Annexure along with the calculation of Energy losses

Summary of various Annual Energy Parameters and Validated documents for FY 2022-23 are given below:

Sr. No.	**Parameters**	**Energy Consumed (MU)**	**Energy Obtained From**	**Details in Proforma at**	**Documents Checked**	**Site Visit (Total / Verified)**
1	Purchased Energy (Inter-state)		SLDC Bill & WR/SR Power grid	Input Energy Sheet & Infrastructure Sheet	WR/SR Power grid Drawl report + Monthly bill summary (Within state I/P energy)	
2	Energy Embedded within DISCOM wires network	145.03	Other Energy purchased	Input Energy sheet and Infrastructure Sheet	Monthly bill summary (Within state I/P energy)	
3	Transmission Losses	4%		Input Energy sheet	SLDC Statement	
4	EHT Sales	251	SAP data	Input Energy/ Infra detail sheet	SAP data	
5	Pooled					

	Energy					
6	Bilateral Purchase	145.03	Renewable Energy Procurement	Infrastructure Sheet		
7	Input Energy	4666 (220 kV)	ABT meters at DISCOM Periphery + Monthly bill summary (Within state I/P energy)	Input Energy sheet	WR/SR Power grid Drawl report + Monthly bill summary (Within state I/P energy)	
8	Power Purchase within periphery	Meters for Energy received within Periphery	Input Energy sheet	Input Energy sheet/ Infrastructure sheet	Monthly Bill details	
9	Open Access Input Energy	NIL	Infrastructure Sheet			
10	Billed Energy		MIS & SAP details	Division wise losses	MIS & SAP details	

Table 22: Summary of various Annual Energy Parameters

Validation of losses:

e. EHT Sales at 110 kV are considered in the T&D Loss Calculation.

f. Total Input Energy (Metered at Injection point) is considered for Loss Calculation

g. Total Input energy was also calculated and verified through various purchase, drawl and transmission loss details.

h. Overall T&D losses are calculated considering the metered energy of all Consumers at their network (including EHT Sales).

In addition to above, losses are also calculated and verified for

i. Feeder meters were checked during the site visit and Feeder-wise meter readings were verified through recorded details and monthly reading of DISCOM. However, feeder-wise losses calculated were found inappropriate due to no metering for back feeding.

j. Transformer meters were checked during site visit and Transformer-wise meter readings were verified through record and monthly readings of DISCOM. However, Transformer-wise calculated losses were found inappropriate due to lack of Consumer Tagging.

5. Loss and Subsidy Computation

i. Energy Accounts Analysis for Previous Years

The below table shows the main parameters and distribution loss as calculated for all consumers (there are no CO and OA consumers) on GOA network.

Sr no	Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
1	Input Energy at T& D periphery	4082.36	4212.10	3919.50	4192.88	4811.884
2	Energy sales at T& D periphery Including EHT sale	4,280.92	4,381.60	4,082.70	4391.02	4434.909
3	T& D loss MU	576.24	658.63	315.54	371.61	376.9745
4	T&D %	13.46%	15.03%	7.73%	8.46%	7.83%
5	Billed Amount in Rs. Crore				2004.23	2600.40
6	Collected Amount in Rs. Crore				1903.64	2484.71
7	Collection Efficiency	95.30%	101.38%	94.40%	94.98%	95.55%
8	AT&C Losses	17.53%	15.03%	12.90%	13.06%	12%

Table 23: Input energy, Sales and Losses of consolidated Consumers

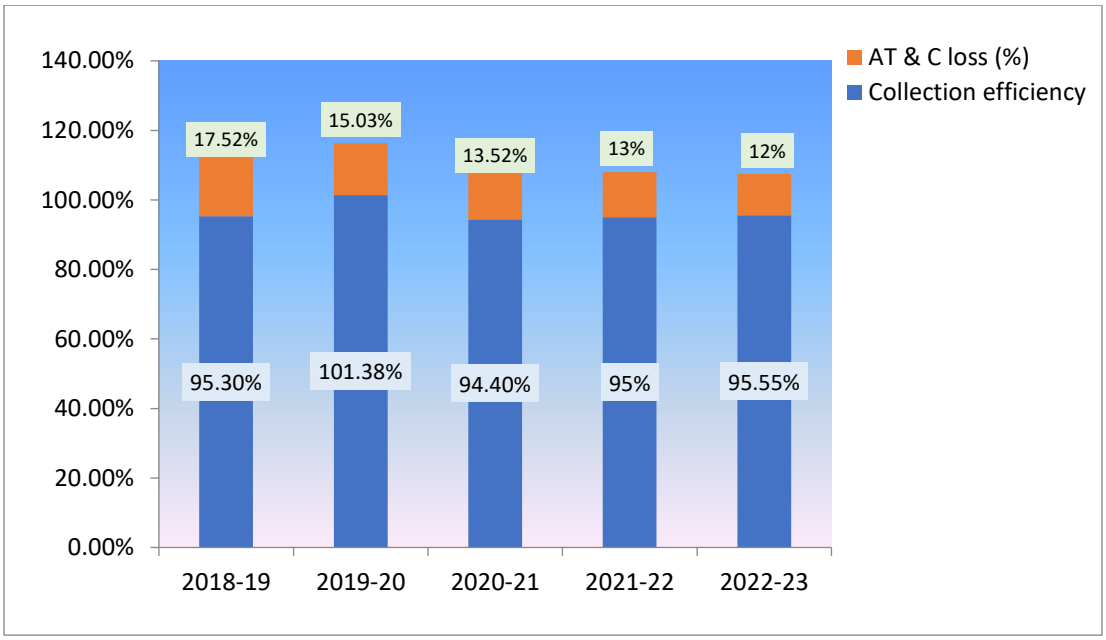
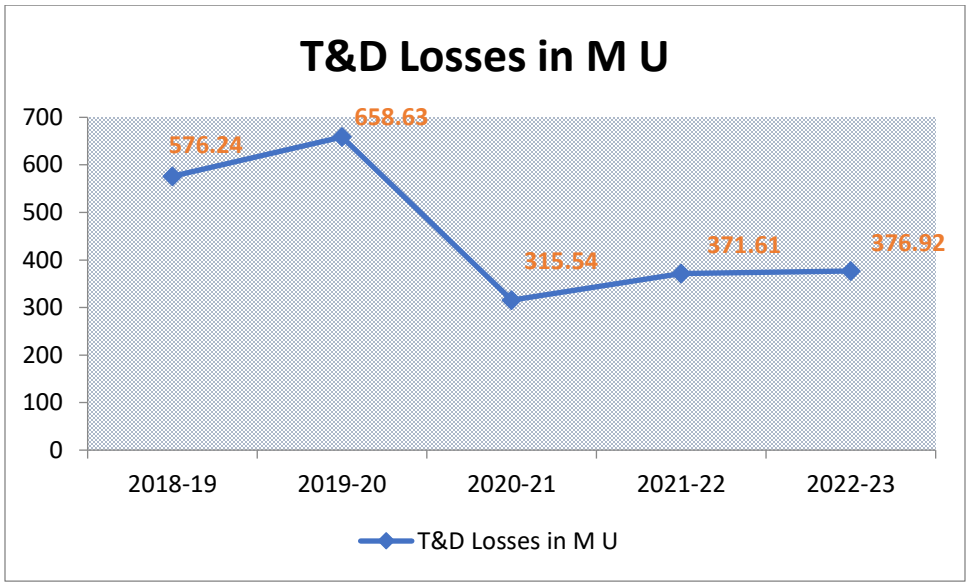


Figure 9: AT&D Losses of all GOA Consumers

The below table shows the main parameters and distribution loss as calculated for GOA consumers from FY 2018-19 to FY 2022-23

Sr no	Particulars	Unit	2018-19	2019-20	2020-21	2021-22	2022-23
1	Net input energy at T<>D interface to ED GOA consumers	MU	4082.36	4212.10	3919.50	4192.88	4811.884
2	Sale	MU	4,280.92	4,381.60	4,082.70	4391.02	4434.909
3	T&D Losses	MU	576.24	658.63	315.54	371.61	376.9745
4	T&D Losses	%	13.46%	15.03%	7.73%	8.46%	7.83%

Table 24: Input energy, Sales and loss of GOA Consumers



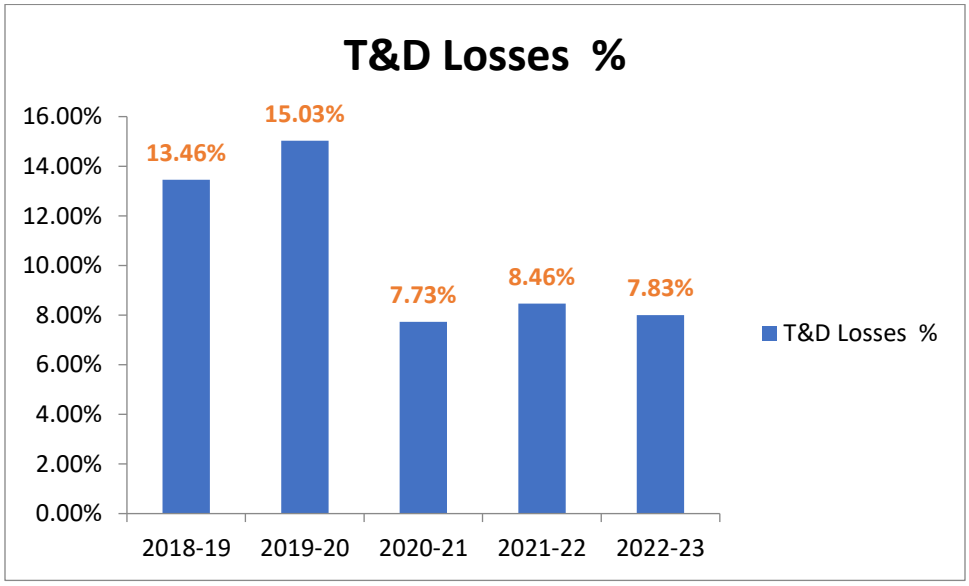


Figure 10: T&D LOSSES (excluding EHT)

From the above table it can be observed that the T&D loss are almost remained unchanged since 2020-21 to 2022-23.

ii. Energy accounts analysis and performance in current year (based on quarterly data)

a) Input energy, AT&C losses – aggregate, voltage-wise, Category-wise, division-wise, feeder wise etc.

Aggregate Technical & Commercial losses

Parameters	UNIT	Q1	Q2	Q3	Q4	Annual	Sum of all Quarters
Input Energy Purchase (From Generation Source)	MU	1233.76	1114.65	1150.57	1167.88	4666.85 (wrong data. This is metered I/P energy)	4666.86 (wrong data)
Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	1219.88	1090.28	1167.00	1133.83	4465.97 Corrected in final Proforma (4666.86)	4610.99
Total Energy billed (Including EHT sale)	MU	1193.52	1068.09	1076.88	1096.43	4434.91	4434.92
Transmission and Distribution (T&D) loss	MU	78.413	66.06	123.53	108.91	376.92	376.91
Transmission	%	6%	6%	10%	9%	8%	7.83%

and Distribution (T&D) loss							
Collection Efficiency	%	91.28%	90.00%	98.00%	103%	96%	95%
Aggregate Technical & Commercial Loss	%	14%	15%	12%	6%	12%	12%

Table 25: Input Energy, Sales and Losses

Voltage-wise losses

Voltage Level	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
LT	Not available	2026.56	INCLUDED IN 11KV	INCLUDED IN 11KV
11 Kv	2905.59	555.24	324.01	11.15%
33 Kv	1652.12	1602.36	49.76	3.01
>33 Kv	254.10	250.75	3.35	1.32%

Table 26: Voltage-wise Losses

Category-wise Losses

Category-wise consumption is available but Input Energy data is not available.

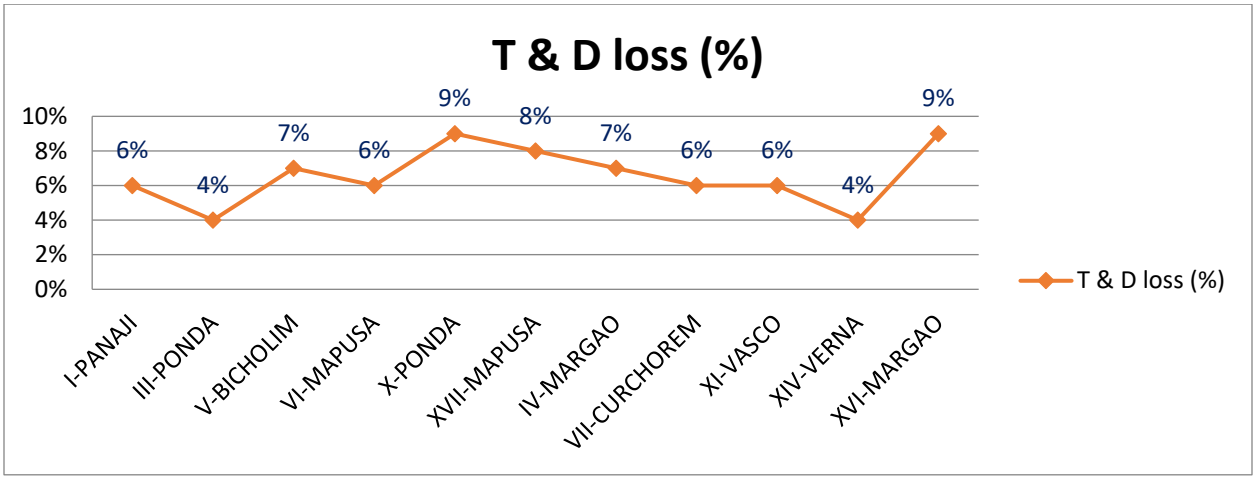
Division-wise losses

The Division-wise data is consolidated for all the consumers of the DISCOM. The division-wise distribution loss of all the consumers is as follows.

Division	Sales MU	Input Energy	TD loss MU	T&D loss (%)
I-PANJI	510.7068	550.3135	39.6067	6%
III-PONDA	515.8231	544.3839	28.56083	4%

V-BICHOLIM	415.0207	452.6052	37.58449	7%
VI-MAPUSA	626.5005	674.74	48.23946	6%
X-PONDA	266.7332	297.0455	30.31231	9%
XVII-MAPUSA	354.079	392.18	38.10105	8%
IV-MARGAO	295.5869	325.3346	29.74769	7%
VII-CURCHOREM	174.2808	191.8481	17.56733	6%
XI-VASCO	301.2282	326.3555	25.1273	6%
XIV-VERNA	501.1464	527.105	25.95863	4%
XVI-MARGAO	473.8039	529.9154	56.11143	9%
DISCOM TOTAL	**4434.909**	**4811.827**	**376.9172**	**8%**

Table 26: Division-wise Losses



Feeder-wise losses

Feeder-wise losses not correct due to no metering of back feeding of energy.

b. Identify high loss divisions.

The division-wise losses are given below.

Name of Division	Circle	Circle Code	Input Energy	T & D loss (%)
I-PANAJI	II	II-N	550.3135	6%
III-PONDA	II	II-N	544.3839	4%
V-BICHOLIM	II	II-N	452.6052	7%
VI-MAPUSA	II	II-N	674.74	6%
X-PONDA	II	II-N	297.0455	9%
XVII-MAPUSA	II	II-N	392.18	8%
IV-MARGAO	I	I-S	325.3346	7%
VII-CURCHOREM	I	I-S	191.8481	6%
XI-VASCO	I	I-S	326.3555	6%
XIV-VERNA	I	I-S	527.105	4%
XVI-MARGAO	I	I-S	529.9154	9%

Input Energy and T&D Losses of all the Divisions are graphically represented below:

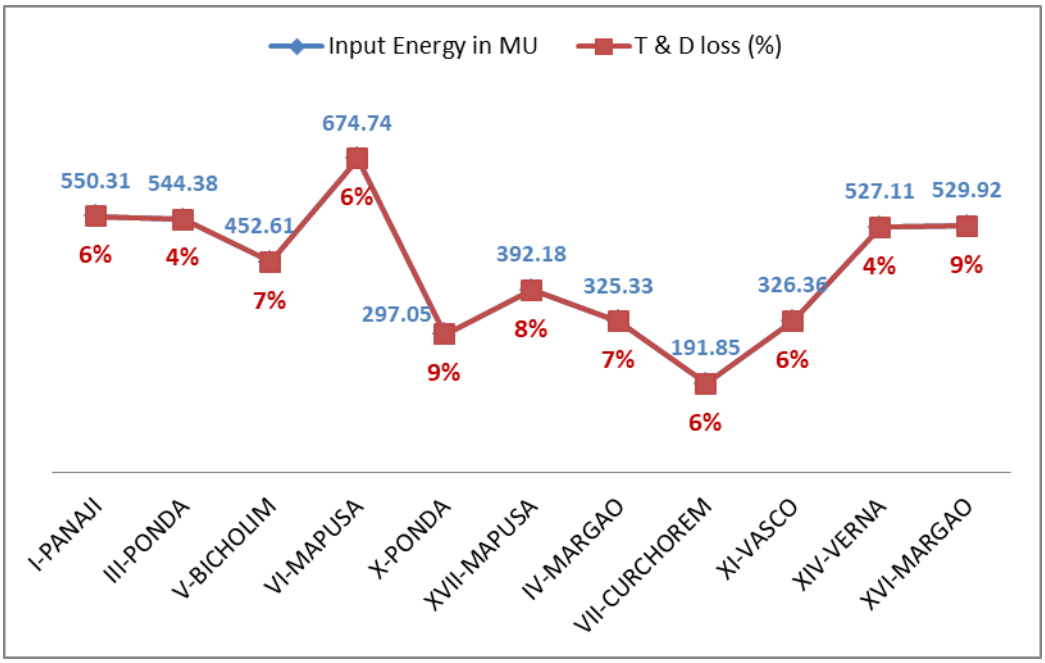


Figure 11:

From the above graph we can see that the major loss area is Margao and Ponda 9% each and Mapusa 8% respectively. Other divisions are having T&D Losses between 4% to 7%.

c. Identify high loss feeders.

Identification of High Loss Feeders was not possible. However, feeders from high loss Divisions were verified during site visit. Summary of verified Feeder meters are given in Annexure.

d. Identify overloaded segments / infrastructure.

Although losses of Transformer couldn't be evaluated, the output Energy of each DT is metered but data was not made available. Hence loading of transformers could not be evaluated.

b. Details of DT wise losses													
Sub-Station ID	Feeder ID	Feeder Name	DT Id no	DT capacity (KVA)	Predominent consumer Type of DT (Domestic/Industrial/Agriculture/Mixed)	Type of Metering (Unmetered/AMI/AMR/Other)	Status of meter (functional/non-functional)	%age of data received automatically (of AMI/AMR)	No of connected consumers	Input Energy (MU)	Billed Energy (MU)	Loss of Energy (MU)	%age Loss
		1	2						3	4	5	6=4-5	7=(6/4)*100

iii. Subsidy computation and analysis (based on quarterly data)

The DISCOM does not receive any subsidy for any category of consumers from the state. Also No direct subsidy given by E D Goa to consumer.

i. Trend analysis and identification of key exceptions

INPUT ENERGY AND T&D LOSSES GRAPH

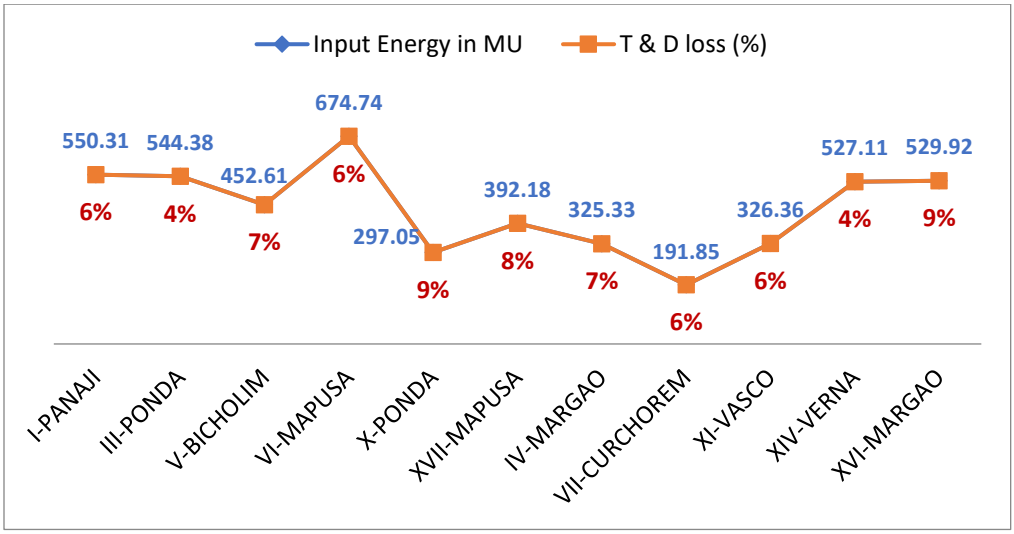
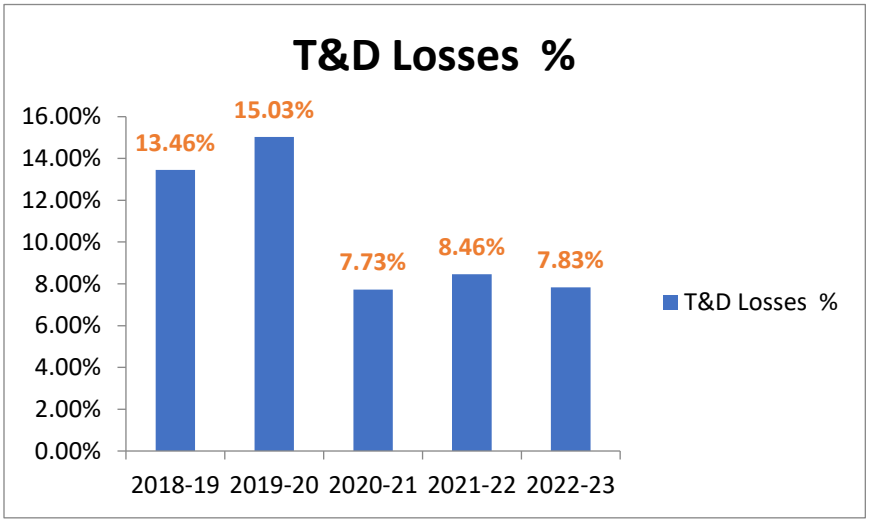


Figure 12: Input Energy and T&D Loss Trend

Overall T&D Losses of the DISCOM are in reducing trend. In 2020-21 (during COVID-19 Pandemic), it was minimum to 7.73%. in FY 21-22, the losses were 8.5% and in FY 22-23 loss are 7.83%



Key Expectations:

a. As DT-wise and Feeder-wise losses are not evaluated, it is difficult to pinpoint high loss-making location. It is recommended to improve Consumer Tagging for identifying actual high loss areas.

b. Out of 18 Divisions, 7 are Self occupied Divisions. Metering, Consumption & losses etc of these divisions are separately not available. For Overall loss calculations, Transmission losses and Consumption of 7 Self occupied Divisions were included separately as 2 divisions in the Proforma.

   As 7 Self occupied Division offices are mostly within physical boundary of other 11 divisions and they are billed by these 11 divisions. Hence total number of divisions needs to be revisited.

c. It is advisable to segregate details of Power Transformers above 11KV to quantify the losses.

d. Comply BEE guidelines for installation of communicable meters.

6. Energy Audit findings

i. Review of capacity of DISCOM's energy accounting and audit cell

DISCOM's Energy Accounting and Audit Cell

Sr No	Member of EAC	Name	Designation	Mobile No	Email	Address
1	Nodal officer	Shri Stephen Fernandes	Chief Electrical Engineer	7350644000	cee-elec.goa@nic.in	Electricity Department, 3rd floor, Vidyut Bhavan, Panaji Goa.
2	Energy Manager	Shri Mayur Hede	Superintending Engineer (Plg)	7796633114	mayur.hede@gmail.com	Electricity Department, 5rd floor, Vidyut Bhavan, Panaji Goa.
3	IT Manager	Smt Anita Pai Raikar	Assistant Engineer	7796633111	anita.raikar@goaelectricity.gov.in	Electricity Department, 5rd floor, Vidyut Bhavan, Panaji Goa.
4	Financial Manager	Shri Subhash Mandrekar	Jt Director of Accounts	9420596522	jtdaccounts@yahoo.in	Electricity Department, 4rd floor, Vidyut Bhavan, Panaji Goa.

DISCOM has appointed Nodal officer, Energy Manager, IT manager & Financial Manager as per BEE guidelines.

ii. Critical analysis - status and progress in compliance to prerequisites to energy accounting, data gaps and summary of key responses of DISCOM management on Comments by Energy Auditor

Status and progress in compliance to prerequisites to energy accounting, data gaps

Feeders:

- Although 8636 DTs are installed but 11 kV Feeders are 337.
- Data Gap in feeder-wise losses is due to non-metering of back feeding.

DTs:

- Although 8636 DTs are installed but only 3473 meters (40%) are communicable.
- Out of 3473 communicable meters , communication of only 1164 (13%) was available.

- Data Gap in DT-wise losses is due to Consumer Tagging problems.

Consumers:

- 100% consumers are metered.
- More than 99% consumers have communicable meters.
- All HT consumer have AMR. However recording & downloading of LT consumers is manual.
- Consumer billing data is available in SAP. However category wise summary is prepared manually by downloading SAP data from the system.

Key responses of DISCOM management on Comments by Energy Auditor

* The Action plan for monitoring, reporting & automated energy monitoring:

The DPR for smart prepaid metering work of Goa Electricity Department (GED) for the state of Goa under RDSS is already approved with total project cost Rs 467.42 Crore. Tenders are floated by GED and as per of component-I "Part-A" of RDSS scheme Prepaid smart metering solution at consumers, DT and feeder level including integration of existing infrastructure will be taken up.

In the smart prepaid metering approved DPR 741160 nos of consumers meter, 8369 nos of DT meters & 827 nos feeder metering has been approved. The prepaid smart metering with communicating features alongwith the associated Advanced Metering Infrastructure (AMI) will be implemented for GED to facilitate reduction of Distribution losses and enable automatic measurement of energy flows , energy accounting , Energy auditing without any human intervention & to reduce ACS-ARR gap . The smart metering & AMI for consumers, Feeders & Transformer level will facilitate proper energy accounting every month for identification of theft prone pockets , high loss areas, demand forecasting , asset management etc.

The Energy management cell, the ERP solution & AMISP (advanced metering infrastructure service provider) with HES/MDM application with customized generation of MIS reports will help GED to provide better quality, reliable and affordable power supply to consumers, material management, finance management, unified billing & collection system etc.

The Smart prepaid meters with communicating features will be integrated with NFMS (National Feeder Monitoring system) for monitoring hours of supply & power availability etc.

iii. Revised findings based on data validation and field verification.

- DTC & Comm sheets X'mer metering data was corrected. The meters are communicable but only approx. 30% of the communicable meter readings of DTs are communicated. The readings are taken manually and entered in SAP module.
- As Input energy received at various divisions are less than the total input energy received (due to Intra state losses and energy consumed by 7 self occupied divisions). This difference (1.45%) is added in Input energy (in Division wise losses sheet) as Division # 12 & 13.
  This was done to match total input energy (4812 MU), as summary sheet calculations are linked with total input energy of Division wise losses.
- The residential consumers form a bulk of the consumers (5,71,301 residential consumers; 79.97 % of the total 7,14,431 consumers).
- The growth of LT & HT network is same. The HT/LT line ratio is approximately 0.89. In quarterly reports 220 & 110 kV ckt length is not given. Hence HT/LT ratio is not correct in quarterly reports.
- The numbers of 11/0.415KV transformers are very high as compared to 220/110/33/11 KV transformers. This is one of the reasons for high T&D loss.
- EHT Sales at 110 kV are considered in the T&D Loss Calculation.
- Total Input Energy (Metered at Injection point) is considered for Loss Calculation
- Transformer meters were checked during site visit and Transformer-wise meter readings were verified through record and monthly readings of DISCOM. However, Transformer-wise calculated losses were found inappropriate due to lack of Consumer Tagging.
- Energy meters are installed at each voltage level for energy consumption at every division. Onsite sample verification and Feeder meter reading verification was done. However feeder wise losses could not be established due to non availability of back-feeding details.
- The DISCOM does not receive any subsidy for any category of consumers from the state. Also No direct subsidy given by E D Goa to consumer.

iv. Inclusions and Exclusions

Inclusion:

As Input energy received at various divisions are less than the total input energy received due to transmission losses (from discom boundary to division level distribution boundary) and some amount of energy consumed by self occupied offices of 7 divisions. This difference (1.45%) is added in Input energy (in Division wise losses sheet) as Division # 12 & 13.

This was done to match total input energy (4812 MU), as summary sheet calculations are linked with total input energy of Division wise losses.

There is no exclusion in this report.

7. Conclusion and Action Plan

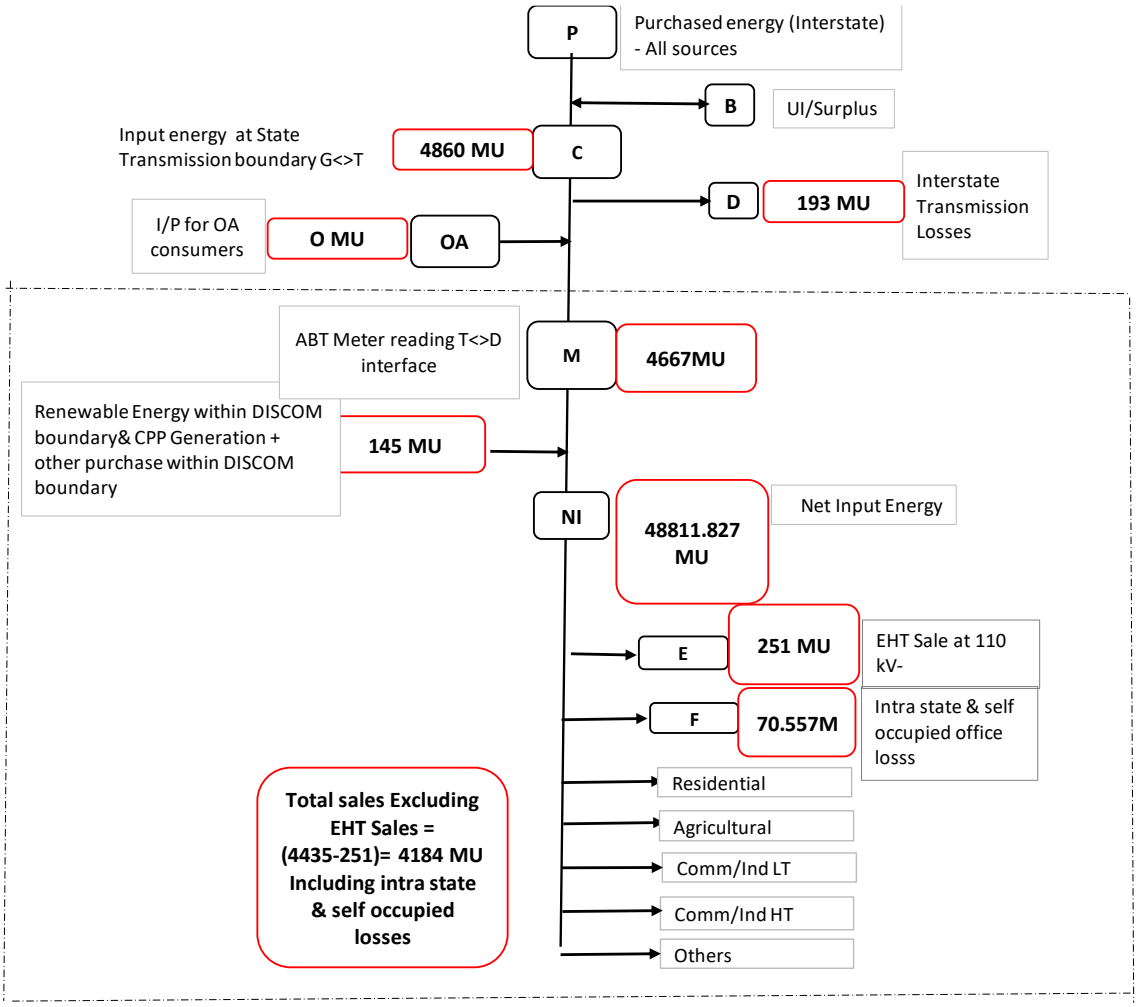
i. Summary of critical analysis by Energy Auditor

- The residential consumers form a bulk of the consumers (5,71,301 residential consumers; 79.97 % of the total 7,14,431 consumers).
- The growth of LT & HT network is same. The HT/LT line ratio is approximately 0.89. In quarterly reports 220 & 110 kV ckt length is not given. Hence HT/LT ratio is not correct in quarterly reports.
- The numbers of 11/0.415KV transformers are very high as compared to 220/110/33/11 KV transformers. This is one of the reasons for high T&D loss.
- EHT Sales at 110 kV are considered in the T&D Loss Calculation.
- Total Input Energy (Metered at Injection point) is considered for Loss Calculation
- Transformer meters were checked during site visit and Transformer-wise meter readings were verified through record and monthly readings of DISCOM. However, Transformer-wise calculated losses were found inappropriate due to lack of Consumer Tagging.
- The DISCOM does not receive any subsidy for any category of consumers from the state. Also No direct subsidy given by E D Goa to consumer.
- The DISCOM does not receive any subsidy for any category of consumers from the state. Also No direct subsidy given by E D Goa to consumer.

ii. Summary of key findings – energy balance and losses

Sr. No.	Particulars	2022-23
1	Input Energy at T& D periphery	4666.86
2	Total Power Purchased within Goa State	145.03

3	Energy sales at T&D periphery	4434.91
4	T&D loss MU	376.97
5	T&D %	7.83%



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This was done to match total input energy (4812 MU), as summary sheet calculations are linked with total input energy of Division wise losses.

iii. **Recommendations and best practices** – energy accounting, loss reduction, and energy conservation

- As DT-wise and Feeder-wise losses are not evaluated, it is difficult to pinpoint high loss-making location. It is recommended to improve Consumer Tagging for identifying actual high loss areas.
- Out of 18 Divisions, 7 are Self occupied Divisions. Metering, Consumption & losses etc of these divisions are separately not available. For Overall loss calculations, Transmission losses and Consumption of 7 Self occupied Divisions were included separately as 2 divisions in the Proforma.

  As 7 Self occupied Division offices are mostly within physical boundary of other 11 divisions and they are billed by these 11 divisions. Hence total number of divisions needs to be revisited.
- It is advisable to segregate details of Power Transformers above 11KV to quantify the losses.
- Comply BEE guidelines for installation of communicable meters.
- It is advisable to replace overloaded and very old DTs with new star rated transformers of adequate capacity.

i. Action plan for monitoring and reporting
ii. Action plan for automated energy accounting

The Action plan for monitoring , reporting & automated energy monitoring:-

The DPR for smart prepaid metering work of Goa Electricity Department (GED) for the state of Goa under RDSS is already approved with total project cost Rs 467.42 Crore. Tenders are floated by GED and as per of component-I "Part-A" of RDSS scheme Prepaid smart metering solution at consumers, DT and feeder level including integration of existing infrastructure will be taken up.

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be implemented for GED to facilitate reduction of Distribution losses and enable automatic measurement of energy flows , energy accounting , Energy auditing without any human intervention & to reduce ACS-ARR gap . The smart metering & AMI for consumers, Feeders & Transformer level will facilitate proper energy accounting every month for identification of theft prone pockets , high loss areas, demand forecasting , asset management etc.

The Energy management cell, the ERP solution & AMISP (advanced metering infrastructure service provider) with HES/MDM application with customized generation of MIS reports will help GED to provide better quality, reliable and affordable power supply to consumers, material management, finance management, unified billing & collection system etc.

The Smart prepaid meters with communicating features will be integrated with NFMS (National Feeder Monitoring system) for monitoring hours of supply & power availability etc.