Annual Energy Audit Report

of

Kanpur Electricity Supply Company Ltd.

(For **FY 2021-22)**

KESCO, KESA House, Civil lines, Kanpur - 208001

Sept 2022

by

Lokesh Chourasia
(BEE Accredited Energy Auditor – AEA 0302)

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ACKNOWLEDGEMENT

Active Energy OPC Pvt Ltd would like to express sincere thanks to the management of Kanpur Electricity Supply Company Ltd. (KESCO) for giving us an opportunity to carry out Annual Energy Audit of FY 21-22.

We sincerely acknowledge the contribution of the following dignitaries and the entire team and support staff during this audit exercise. because of whom the Energy Audit could progress smoothly.

Shri. Anil Dhingra, IAS (Managing Director)

Shri. Sanjay Srivastava (Director – Technical & Commercial)

Shri. Sanjay Agarwal (Chief Engineer)

Shri. Arif Ahmed (SE Commercial)

Shri. Lalit Krishna (EE-Technical)

Smt. Rajbala (EE Commercial)

Shri. Sarvesh Pandey (EE-IT)

Shri. Prateek Bhalla (Accounts Officer)

Shri. Nitin Kumar (AE Commercial)

Shri. Anurag Sinha (REC PDCL- Energy Audit Consultant)

Shri. Pratyusha Khandelwal (Mercados-Policy & Regulatory Consultant)

We are also thankful to the other staff members who were actively involved while collecting the data and conducting the studies.

For Active Energy OPC Pvt Ltd

Lokesh Chourasia
BEE Accredited Energy Auditor (AEA 0302)

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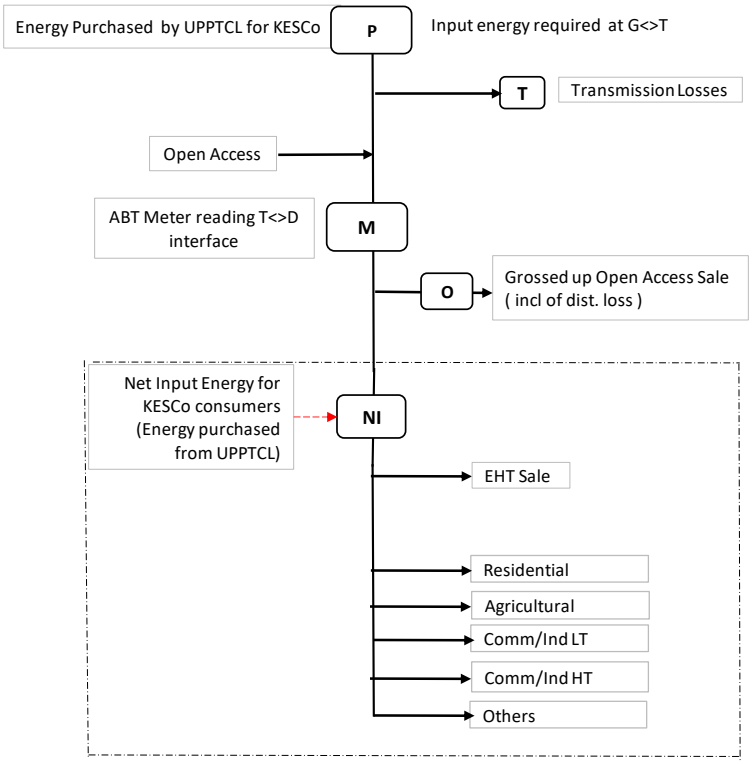
1. Executive Summary

Kanpur Electricity Supply Company Ltd. (KESCo) was formed on 14 January 2000 under U.P. Electricity reform act 1999. This company is registered for distribution of electricity in the area under Kanpur City (Urban). The total area supplied electricity by KESCo is around 500 Square K.M. The area of distribution is divided in 4 Circles & 20 divisions.

1) The bulk purchase of power is made available by the holding company (UP Power Transmission Corporation Limited) and the cost of power purchase is accounted for on accrual basis at the rates approved/ bills raised by UPPTCL.
2) KESCo network is also used by consumers who procure power through open access.
3) KESCo receives power from 9 transmission substation of 220 KV and 132 KV of U.P. Power Transmission Corporation Ltd. Meters are installed at these Receiving substations for recording of input energy. Joint meter readings are taken to measure the input energy at KESCo periphery.
4) KESCo is serving 672805 consumers of bulk, domestic and commercial power categories connected to grid through 87 no. 33 KV substations and 528 no. 11 KV feeders
5) KESCo has installed total 217 power transformers and 5659 distribution transformers in its distribution network.
6) The below diagram graphically indicated the various energy inputs and sales.

Energy Input & Output Diagram



Infrastructure detail:

Number of circles	4
Number of divisions	20
Number of sub-divisions	43
Number of feeders	528 (11 kV Feeder)
Number of DTs	5659
Number of consumers	672805

2.3 Energy billing

1) Energy meters are installed at each voltage level for energy consumption. The readings are taken manually and entered in Omni-net module which calculates the losses. Energy consumption and calculation of losses at each voltage level is available.
2) The energy reading of commercial and Industrial consumers, Distribution transformer readings are downloaded by CMRI into the appropriate software for billing and analysis.
3) There is 100% metering of consumers. Also, KESCO has claimed that there is 100% metering at 132,33,11 KV including the transformers.
4) The energy consumed by KESCO offices, receiving stations is also metered and accounted.

Metering & Energy Accounting system:

Injection point meters -→ JMR manual
DT Meters→ 100% AMR
HT consumer – Partially AMR → Server
remaining downloaded by CMRI
LT consumer→ Probe billing (downloaded in mobile app & transferred to server)

The consumption recorded by UPPTCL are taken as Input energy.

1.2 Distribution loss

Net Input Energy for KESCO is arrived as below:
Net Input Energy at T<>D periphery (For KESCO consumers) =
Gross Input Energy purchased
– (minus) Transmission Loss
+ (plus) Energy Input for Open Access consumers
- (minus) grossed up Open Access Sale

- The OA sales are grossed up (Wheeling loss as percentage of metered energy is added to metered energy.
- The grossed-up sales are then deducted with energy recorded at T<>D periphery (ABT meters) to arrive at Net input energy at T<>D to KESCO consumers.

The various parameters for FY 2021-22 mentioned above is tabulated below

Particulars	21-22
Own Sales (With Self consumption) (MU)	**3396.635**
Energy at T-D (MU)	3927.662
Total T-D energy attributable to OA consumption	151.227
Total T-D energy export to DVVNL (MU)	18.573
Net T-D energy attributable to KESCO-D sale (MU)	**3757.862**
Distribution Losses (MU)	361.227
Distribution Losses (%)	9.61%

The below table shows the distribution loss as calculated for KESCO consumers from FY 2017-18 to 2021-22

Sr no	Particulars	Unit	2017-18	2018-19	2019-20	2020-21	2021-22
1	Net T<>D energy attributable to KESCO-D sale	MU	3677.918	3468.973	3578.253	3382.737	3757.862
2	Own Sale	MU	3199.738	3173.839	3300.502	3029.253	3396.635
3	Distribution Losses	MU	478.18	295.13	277.751	353.484	361.227
4	Distribution Losses	%	13%	8.51%	7.76%	10.45%	9.61%
5	T&D Losses (MU)	MU				552.867	
6	T&D Losses (%)	%				15.43%	

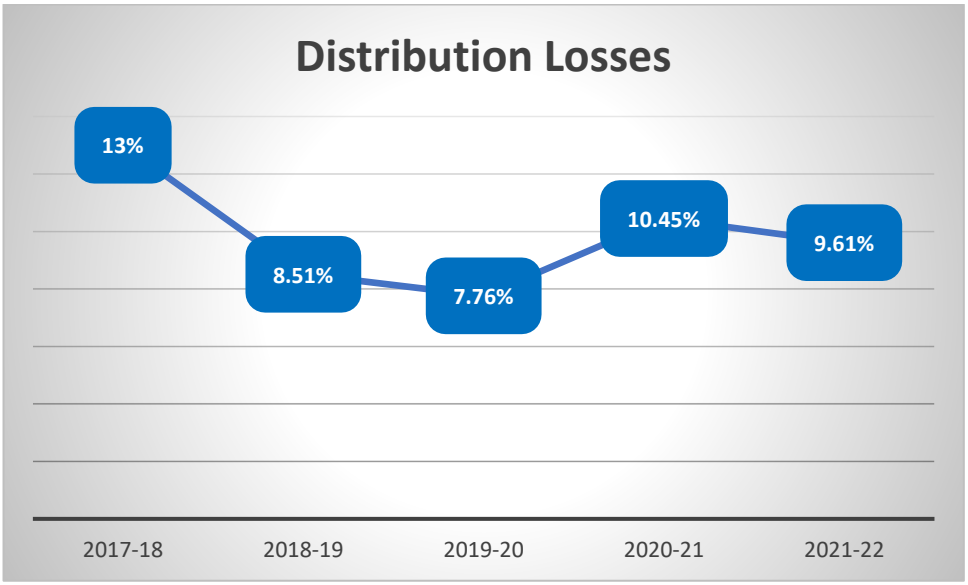


Figure 1: Year wise Distribution loss

1) The AT&C loss is mentioned below

Particulars	**2021-22**
Collection efficiency	97.05
AT & C loss	12.28%

In Proforma:
Net Input Energy at T<>D periphery =
Input Energy purchased (for KESCO consumers on their network)
–(minus) Transmission Loss

OR
Net Input Energy at T<>D periphery =
Input Energy received at KESCo periphery
–(minus) Energy received for Open Access Consumers
–(minus) Transmission Losses

Net Sold Energy at T<>D periphery = Energy Sale (for KESCO consumers on their network)

Power Purchase:

- The bulk purchase of power is made available by the holding company (UP Power Corporation Limited) and the cost of power purchase is accounted for on accrual basis at the rates approved/ bills raised by UPPCL.
- Transmission charges are accounted for on accrual basis on bills raised by the UP Power Transmission Corporation Limited at the rates approved by UPERC

2. Summary of Critical Analysis

2.1 Critical Analysis by Energy Auditor

1) Distribution losses have reduced from 13% in 2017-18 to 9.61% in 2021-22. The Distribution losses were continuously reducing from 17-18 to 19-20. However, it increased in FY 20-21 & FY 21-22 during COVID-19 pandemic.
   - The HT consumption is around 30% of the total consumption and HT consumers are approximately 0.4 %.
   - The residential consumers form a bulk of the consumers where losses are high.
   - The HT/LT ratio is approximately 0.75. The growth of LT is higher than HT network.
   - The numbers of 11/0.415 KV transformers very high as compared to 33/22/11 KV transformers due to high LT load and LT consumers. This is one of the reasons for high T&D loss.

2) Around 70% of KESCO load is LT with LT Residential consumers nearly 85%. To cater to the high LT load and consumer demand the number of LT and LT cables is high.
3) The Distribution losses were continuously reducing from 17-18 to 19-20 as, efforts are vigorously taken to reduce this loss the details given further in report.
   - The major loss sections are distribution Transformers.
   - The number of distribution transformers is high, hence the no load losses of X'mers are a major contributor. But given the wide area of distribution system and predominantly LT load, and to install transformers near load centres their numbers is inevitable.
   - Some of the transformers are very old. The old transformers have more losses compared to modern transformers.
   - The length of LT cables is 1.33 times that of HT cables. The HT load is around 30% with approx. 0.4% of HT consumers. These necessitates long lengths of LT cables to cater to demand which increase distribution loss.
   - The older PILC insulated cables have high losses compared to newer cables
4) As the cost of removing the cables is very much high, they need to be abandoned and new laid. Due to congested localities, space constraints of laying cables on footpaths, high reinstatement costs a feasibility study is needed. Similar for distribution transformers.

2.2 Status and progress in compliance to pre-requisites to energy accounting

- Proforma of Q2, Q3, Q4 FY 21-22 & Q1 of FY 22-23 has been submitted by KESCO.
- Annual Energy Report and Proforma of FY 20-21 has been submitted by KESCO.
- Annual Proforma of FY 21-22 is being submitted alongwith Annual Audit Reports.
- Energy meters are installed at each voltage level for energy consumption. The readings are taken manually and entered in Omni-net module which calculates the losses. Energy consumption and calculation of losses at each voltage level is available.

- The energy reading of commercial and Industrial consumers, Distribution transformer readings are downloaded by CMRI into the appropriate software for billing and analysis.
- There is 100% metering of consumers. Also, KESCO has claimed that there is 100% metering at 132,33,11 KV including the transformers.
- The energy consumed by KESCO offices, receiving stations is also metered and accounted.

Important notes:

1) The consumer data (no's & load and other details) mentioned in report are exclusive of OA consumers.
   Division wise, load and consumption for each category of consumers was not made available. Consumer number, load and consumption for each category includes all consumers at KESCO network (Excluding Open Access consumers).
2) Data given in proforma for Feeder I/O data is incorrect due to internal feeds.
3) Consumption of Open Access consumers in KESCO network is inclusive of distribution losses (In this report) hence losses calculated are for KESCO consumers in their network
4) Where Collection efficiency is more than 100%, it is considered 100% for calculation of AT&C losses.

2.3 Management Analysis (Responses of DISCOM management on Comments by Auditor)

KESCO has planned varied field actions and track the performance of the said actions to ensure sustainable loss reduction initiatives. Following key loss reductions initiatives undertaken in corresponding financial years.

- 11KV feeder bifurcation work has done.
- All 6.6KV feeders has converted to 11KV feeders.
- Smart meters has installed.
- Low consumption LED light distribution work has done.
- Undergroud cable has layed in theft prone areas.
- LT ABC cables has layed in theft prone areas.
- HT ABC cables has layed.
- Power transformer capacity enhancement work has done.
- Distribution transformer capacity enhancement work has done.
- Agency has been appointed for monitoring of feederwise loss on monthly basis.
- Combing abhiyaan is carried out at time to time.
- On ground distribution inventories (distribution transformers, 33kv, 11kv feeder panels, undergroud cables, overhead lines etc.) were checked and replacement for the same has been done from time to time.

KESCO has also planned major advanced initiatives for enhancing productivity and efficiency. Details of planned major advanced initiatives are given in annexure.

3. BACKGROUND

3.1 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 centre, 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:

- To suppose leadership and give policy system and guide to national energy efficiency and conservation programs and efforts
- To direct the stakeholders about the policies and programs on using energy efficiently
- 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
- 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
- To show the delivery mechanisms of energy efficiency, by a public and private partnership
- 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 dt 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 consumer.

3.2 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%. As long as AT&C losses continues to be in such a high range, it is difficult for the DISCOMs to be commercially viable. In order 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 losses 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.

3.3 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 (i.e. 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

- Bureau of Energy Efficiency
- State Designated Agency **(UPNEDA)**
- the periodic energy accounting report should be made available on the website of 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 also 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 taking into account 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.

4. INTRODUCTION OF KESCo

Introduction:

Kanpur Electricity Supply Company Ltd. (**KESCo**) is a company incorporated under Companies Act, 1956 and having its registered office at 14/71, Civil Lines, Kanpur-208001.

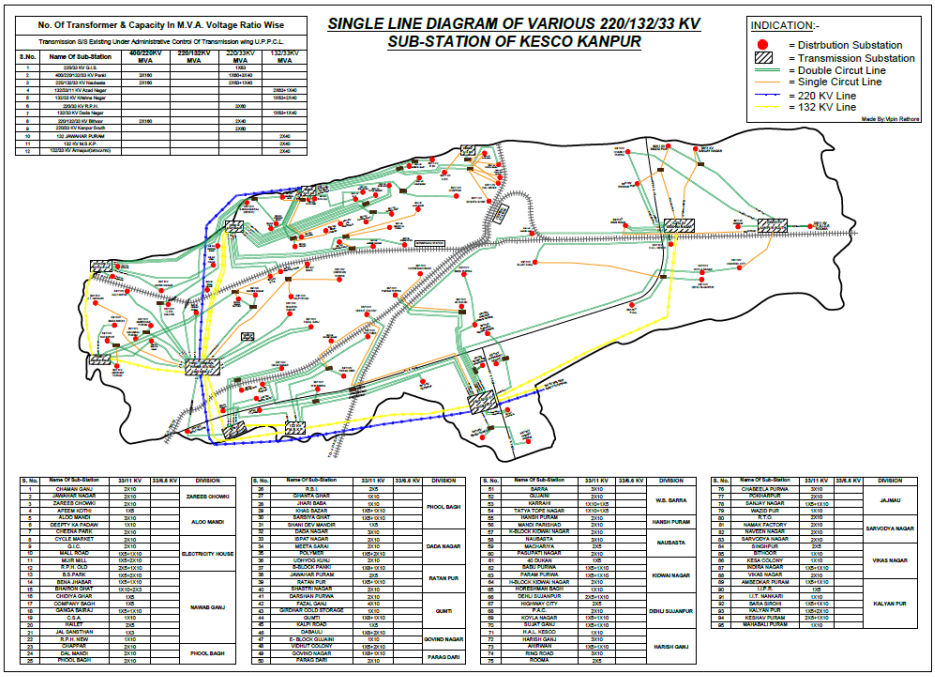
Kanpur Electricity Supply Company Ltd. was formed on 14 January 2000 under U.P. Electricity reform act 1999. This company is registered for distribution of electricity in the area under Kanpur City (Urban) by U.P. Government Gazette No. 118/P.-1/2000/24-152-P./98 published on 13/01/2000.

On 15th January'2000, assets, liabilities and personnel of Kanpur Electricity Supply Authority (KESA) under UPSEB were transferred to Kanpur Electricity Supply Company (KESCO).

According to geographic condition the complete region of Kanpur Nagar Nigam is decided as the work area of KESCo. Boundaries of above KESCo region are upto river Ganga in North, upto river Pandu in South, upto I.I.T. campus in West and upto villages of Chakari in East. The total area supplied electricity by KESCo is around 500 Square K.M., which comes in jurisdiction of Kanpur Nagar Nigam. Kanpur is the main hub of industries in North India. The big industries in the KESCo region are M/s Lohia Machines Ltd., M/s H.A.L., Ordinance Factory, Small Arms Factory, Field Gun Factory, Tanneries and Ganga pollution institute etc.

KESCo is serving 657692 consumers of bulk, domestic and commercial power categories connected to grid through 87 no. 33 KV substations and 528 no. 11 KV feeders after receiving electricity from 9 transmission substation of 220 KV and 132 KV of U.P. Power Transmission Corporation Ltd. . Presently KESCo has installed total 201 power transformers (capacity 1517 MVA) and 4754 distribution transformers in its distribution network.

Distribution area map:



4.1 Name and Address of Designated Consumer

Name : Kanpur Electricity Supply Company Ltd. (**KESCo**)

Address: KESCo, 14/71, Civil Lines, Kanpur-208001

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

Energy Manager Details

Name : Prabodh Kala

Email : prabodhkala@rediffmail.com

Contact No **:** 9004346637

Authorized Signatory of DC (Nodal Officer)

Name : Shri. Sanjay Agarwal

Designation : Chief Engineer KESCo

Contact No **:** 9838650749

4.3 Summary profile of DCs (Assets, Energy Flow, Consumer base, salient features etc.)

4.3.1 ASSETS

Data as in March 2021

Table1:Total Asset

Number of circles	4
Number of divisions	20
Number of sub-divisions	43
Number of feeders	528 (11 kV Feeder)
Number of DTs	5659
Number of consumers	688755

Consumers:

Parameters	**> 66kV**	**33kV**	**11/22kV**	**LT**
Number of conventional metered consumers	1	18	810	572163
Number of consumers with 'smart' meters				43641
Number of consumers with 'smart prepaid' meters				58356
Number of consumers with 'AMR' meters		22	395	78
Number of consumers with 'non-smart prepaid' meters				13271
Number of unmetered consumers				
Number of total consumers	**1**	**40**	**1205**	**687509**

Transformers:

Parameters	**> 66kV**	**33kV**	**11/22kV**	**LT**
Number of conventionally metered Distribution Transformers		219	6905	0
Number of DTs with communicable meters		219	6905	0
Number of unmetered DTs				
Number of total Transformers	**0**	**217**	**5659**	**0**

Feeders:

Parameters	**> 66kV**	**33kV**	**11/22kV**	**LT**
Number of total feeders	**2**	**106**	**528**	**0**

Line length:

Line length (ct km)		541	1378	2891
Length of Aerial Bunched Cables			1015	115
Length of Underground Cables		270.5	423	889

Line length (ckt. km) at 66kV voltage level	0
Line length (ckt. km) at 33kV voltage level	789
Line length (ckt. km) at 11kV voltage level	1378
Line length (km) at LT level	2891
HT/LT ratio	0.75

4.3.2 CONSUMER BASE

Parameters	> 66kV	33kV	11/22kV	LT
Number of conventional metered consumers	1	18	810	572163
Number of consumers with 'smart' meters				43641
Number of consumers with 'smart prepaid' meters				58356
Number of consumers with 'AMR' meters		22	395	78
Number of consumers with 'non-smart prepaid' meters				13271
Number of unmetered consumers				
Number of total consumers	**1**	**40**	**1205**	**687509**

1st Apr 2021 to 31 Mar 2022

Consumer category	Total Number of connections (Nos)	% of number of connections	Input energy (MU)	Metered energy	Unmetered energy	Total energy
Residential	569364	85%	3757.862	1645.31	0	1645.31
Agricultural	0	0%		0	0	0
Commercial/Industrial-LT	99491	15%		677.77	0	677.77
Commercial/Industrial-HT	2150	0.4%		975.86	35.05	1010.91
Others	1579	0%		62.65	0	62.65
Total	**672584**	**100%**	**3757.862**	**3361.59**	**35.05**	**3396.635**

4.3.3 ENERGY FLOW

Energy Input & Output Diagram

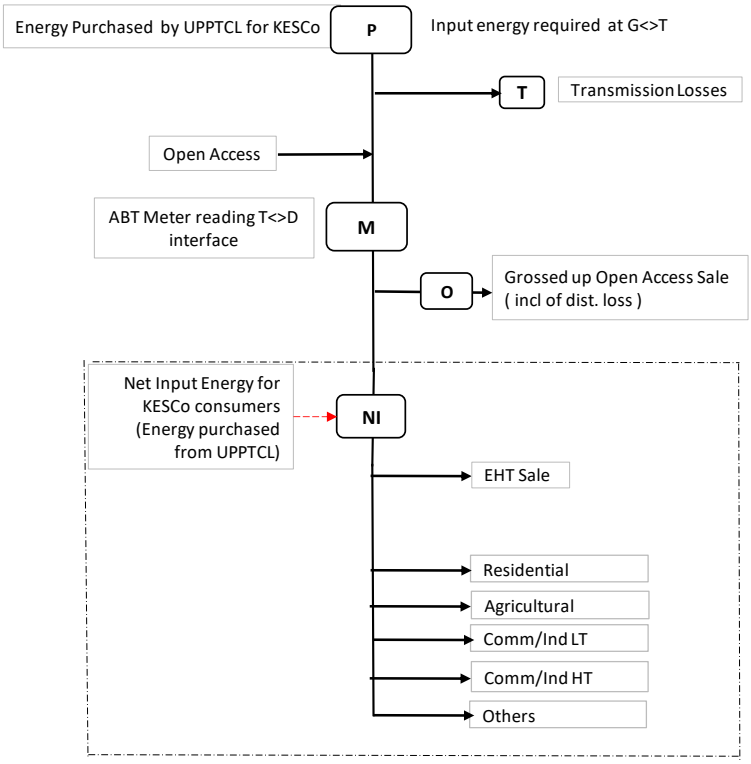


Figure 2: Single line Diagram

Meter	Description
P	Purchased Energy Input energy required at G<>T
T	Transmission losses
OA	OA Consumer (at KESCO Network)
M	ABT Meter reading T<>D interface
O	Grossed up OA and other sales
NI	Net input for KESCO consumers on its network

5. DISCUSSION & ANALYSIS

5.1. ENERGY ACCOUNTS OF PREVIOUS YEARS (17-18, 18-19, 19-20 & 20-21)

The Energy Accounts of 17-18, 18-19, 19-20 & 20-21 were verified from Trued up MYT order of UPERC.

The below table shows the distribution loss as calculated for KESCO consumers from FY 17-18 to 21-22

Sr no	Particulars	Unit	2017-18	2018-19	2019-20	2020-21	2021-22
1	Net T<>D energy attributable to KESCO-D sale	MU	3677.918	3468.973	3578.253	3382.737	3757.862
2	Own Sale	MU	3199.738	3173.839	3300.502	3029.253	3396.635
3	Distribution Losses	MU	478.18	295.13	277.751	353.484	361.227
4	Distribution Losses	%	13%	8.51%	7.76%	10.45%	20-21
5	T&D Losses (MU)	MU				552.867	
6	T&D Losses (%)	%				15.43%	

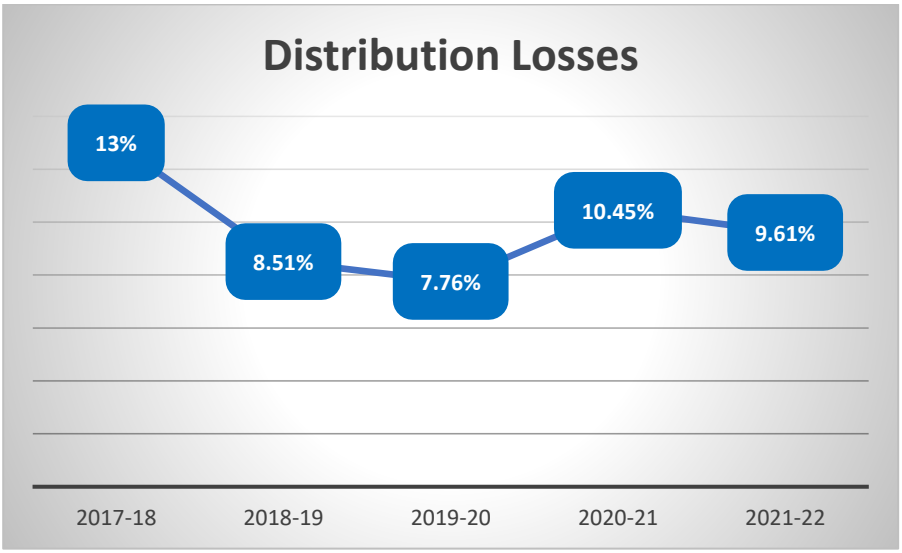


Figure 3: Year wise Distribution loss

The AT&C loss is mentioned below

Particulars	2021-22
Collection efficiency	97.05
AT & C loss	12.28%

From the above tables it can be observed that despite almost same input energy for KESCO consumers, the Distribution losses has consistently decreased from 13% to 7.76% during 17-18 to 19-20. However, it increased in 20-21 due to low HT power consumption during COVID-19 pandemic.

This implies that KESCO has taken measures to reduce the distribution losses.

5.2 ENERGY ACCOUNT OF FY 2020-21

5.2.1 Details of computation of Input energy

- Energy is purchased from UPPTCL. Purchased energy data was taken from monthly energy purchase report of UPPTCL.
- Transmission loss is not accounted as energy purchased from UPPTCL is the energy available at DISCOM periphery.
- Energy received at the periphery includes energy for Open Access consumers at KESCo network. Energy for Open Access consumers is deducted to arrive Input energy required at T<>D.
- Input energy at T<>D interface (including OA consumers) is computed by compilation of ABT meter readings. The energy drawn by KESCO at T<>D interface is based on ABT meters installed at their RSS and check meters.

Net Input Energy for KESCO is arrived as below:

Net Input Energy at T<>D periphery (For KESCO consumers) =

Gross Input Energy purchased
–(minus) Transmission Loss
+ (plus) Energy Input for Open Access consumers
- (minus) grossed up Open Access Sale

- The OA sales are grossed up (Wheeling loss as percentage of metered energy is added to metered energy.
- The grossed-up sales are then deducted with energy recorded at T<>D periphery (ABT meters) to arrive at Net input energy at T<>D to KESCO consumers.

The various parameters for FY 2021-22 is tabulated below

Particulars	Values
Own Sales (With Self consumption) (MU)	3396.635
Energy at T-D (MU) – including Open Access	3927.662

Particulars	Values
Total T-D energy attributable to OA consumption & DVVNL (MU)	169.800
Net T-D energy attributable to KESCO-D sale (MU)	3757.862
Distribution Losses (MU)	361.227
Distribution Losses (%)	9.61%

5.2.2 AGGREGATE TECHNICAL LOSSES

The aggregate technical loss is shown below

Sr no	Particulars	Unit	2020-21
1	Net T<>D energy attributable to KESCO-D sale	MU	3396.635
2	Own Sale	MU	3029.253
3	Distribution Losses	MU	361.227
4	Distribution Losses	%	9.61%

Note:

- The energy attributed to OA consumers is not included in KESCO network T&D loss calculations.
- The transmission losses are not made available. As Energy purchased through the UPPTCL is billed for energy received at DISCOM periphery, technical losses as exclusive of transmission losses.

Comparing the loss levels from 2017-18 onwards it is observed that after falling consistently the loss has increased in FY 2020-21 & FY 2021-22. The reason for increase is reduction in consumption (due to COVID-19) & decrease in vigilance.

5.2.3 AT&C LOSSES

Collection efficiency

Commercial Parameter		
Billed Amount in Rs. Crore	**Collected Amount in Rs. Crore**	**Collection Efficiency**
1029.32	1079.63	104.89%
0	0	0.00%
694.04	634.49	91.42%
908.25	852.05	93.81%
109.49	94.09	85.93%
2741.10	**2660.26**	**97.05%**

The AT&C losses is shown below

Particulars	**2021-22**
Collection efficiency	97.05
AT & C loss	12.28%

5.2.4 VOLTAGE-WISE LOSSES

Voltage-wise consumption data and losses are given below:

Sl. No.	Voltage Level	CIRCLE1	CIRCLE2	CIRCLE3	CIRCLE4	KESCO
		FY 21-22	FY 21-22	FY 21-22	FY 21-22	FY 21-22
A	**System Losses At 220 KV**					
1	Energy received into the system				0.74	0.74
2	Energy sold at this voltage level				0.74	0.74
3	Energy transmitted to the next (lower) voltage level				0	0.00
4	Energy Lost				0	0.00
5	**Total Loss in the system (4/1)*100%**				0	0.00
B	**System Losses At 132 KV**					
1	Energy received into the system		330.852		36.61	367.46
2	Energy sold at this voltage level		330.86		36.61	367.47
3	Energy transmitted to the next (lower) voltage level		0.00		0.00	0.00
4	Energy Lost		-0.01		0.00	-0.01
5	**Total Loss in the system (4/1)*100%**		0.00		0.00	0.00
C	**System Losses At 33 KV**					
1	Energy received into the system	815.28	1015.46	938.4785	620.4365	3389.66
2	Energy sold at this voltage level	16.66	24.42	96.295	53.83	191.20
3	Energy transmitted to the next (lower) voltage level	784.52	976.40	821.32	562.97	3145.21
4	Energy Lost	13.86	14.40	20.73	3.39	53.25
5	**Total Loss in the system (4/1)*100%**	0.02	0.01	0.02	0.01	1.57
D	**System Losses At 11 KV**					
1	Energy received into the system	784.52	976.40	821.32	562.97	3145.21
2	Energy sold at this voltage level	101.00	106.98	102.44	78.17	388.59
3	Energy transmitted to the next (lower) voltage level	673.46	857.39	709.803	475.28	2715.93
4	Energy Lost	10.06	12.03	9.077	9.52	40.69
5	**Total Loss in the system (4/1)*100%**	0.01	0.01	0.01	0.02	1.29
E	**LT System Losses**					
1	Energy received into the system	673.46	857.39	709.803	475.28	2715.93
2	Energy sold at this voltage level	570.80	821.79	623.677	432.368	2448.64
3	Energy Lost	106.23	39.17	89.69	46.478	267.30
4	**Total Loss in the system (3/1)*100%**	0.16	0.05	0.13	0.10	9.84
F	**Overall Losses**					
1	Energy In	815.28	1346.31	938.48	657.79	3757.862
2	Energy Out	688.46	1284.05	822.41	601.72	3396.635
3	**Total T&D Loss ((1-2)/1)*100%**	**15.56%**	**4.63%**	**12.37%**	**8.52%**	**9.61%**

5.2.5 DIVISION-WISE LOSSES

Division wise data was not made available. The circlewise energy input and sales data was collected. Circle wise and total distribution losses are given below:

ENERGY DETAILS	CIRCLE1	CIRCLE2	CIRCLE3	CIRCLE4	KESCO
Energy Inputs (MU)	815.28	1346.31	938.48	657.79	3757.862
Energy Sales (MU)	688.46	1284.05	822.41	601.72	3396.635
Distribution losses (MU)	126.82	62.26	116.07	56.07	361.227
Distribution losses (%)	**15.56%**	**4.62%**	**12.37%**	**8.52%**	**9.61%**

5.2.6 FEEDER-WISE LOSSES

Feeder-wise losses are not available due to the system being in Ring. The input and Output points are dynamic and are changed as per the load conditions and maintenance and repair requirements.

5.3 ENERGY CONSERVATION ADOPTED AND PROPOSED FOR FUTURE

KESCO also planned varied field actions and track the performance of the said actions to ensure sustainable loss reduction initiatives. Following key loss reductions initiatives undertaken in corresponding financial years.

- 11KV feeder bifurcation work has done.
- All 6.6KV feeders has converted to 11KV feeders.
- Smart meters has installed.
- Low consumption LED light distribution work has done.
- Undergroud cable has layed in theft prone areas.
- LT ABC cables has layed in theft prone areas.
- HT ABC cables has layed.
- Power transformer capacity enhancement work has done.
- Distribution transformer capacity enhancement work has done.
- Agency has been appointed for monitoring of feederwise loss on monthly basis.
- Combing abhiyaan is carried out at time to time.
- On ground distribution inventories (distribution transformers, 33kv, 11kv feeder panels, undergroud cables,overhead lines etc.) were checked and replacement for the same has been done from time to time.

KESCO has also planned major advanced initiatives for enhancing productivity and efficiency

5.4 UNITWISE PERFORMANCE (Circle wise)

The area of distribution is divided in 4 Circles & 20 Divisions. Division wise data was not made available. The circlewise energy input and sales data was collected. Circle wise and total distribution losses are given below:

ENERGY DETAILS	CIRCLE1	CIRCLE2	CIRCLE3	CIRCLE4	KESCO
Energy Inputs (MU)	815.28	1346.31	938.48	657.79	3757.862
Energy Sales (MU)	688.46	1284.05	822.41	601.72	3396.635
Distribution losses (MU)	126.82	62.26	116.07	56.07	361.227
Distribution losses (%)	**15.56%**	**4.62%**	**12.37%**	**8.52%**	**9.61%**

5.4.1 Power Purchase Details

- The bulk purchase of power is made available by the holding company (UP Power Corporation Limited) and the cost of power purchase is accounted for on accrual basis at the rates approved/ bills raised by UPPCL.
- Transmission charges are accounted for on accrual basis on bills raised by the UP Power Transmission Corporation Limited at the rates approved by UPERC

The transmission losses are charged and the energy received at the DISCOM periphery is considered as power purchased. Monthwise power purchased is given below:

MONTH	BILL NO.	DATE	ENERGY (in kWh)
Apr-21	01/2021-22	18.06.2021	284642000.000
May-21	02/2021-22	23.07.2021	314889000.000
Jun-21	03/2021-22	04.08.2021	365648000.000
Jul-21	04/2021-22	08.09.2021	402403000.000
Aug-21	05/2021-22	06.10.2021	374533000.000
Sep-21	06/2021-22	26.10.2021	364108000.000
Oct-21	07/2021-22	06.12.2021	344455000.000
Nov-21	08/2021-22	28.12.2021	235226000.000
Dec-21	09/2021-22	13.01.2022	309910000.000
Dec-21	09/2021-22 S0	10.02.2022	-47140000.000
Jan-22	10/2021-22	18.02.2022	303781000.000
Jan-22	10/2021-22-S0	22.03.2022	-10001000.000
Feb-22	11/2021-22	29.03.2022	240967000.000
Mar-21	12/2021-22	22.04.2022	623952000.000
Mar-22	12/2021-22/S0	28.04.2022	-18564300.000
Mar-22	12/2021-22/S1	04.05.2022	-330946700.000
		TOTAL	**3757862000.000**

5.4.2 Consumer Consumption Details

1st Apr 2021 to 31 Mar 2022 (Energy in MU)

Consumer category	Total Number of connections	% of number of connections	Input energy	Metered energy	Unmetered energy	Total energy
Residential	569364	85%	3757.862	1645.31	0	1645.31
Agricultural	0	0%		0	0	0
Commercial/Industrial-LT	99491	15%		677.77	0	677.77
Commercial/Industrial-HT	2150	0.4%		975.86	35.05	1010.91
Others	1579	0%		62.65	0	62.65
Total	**672584**	**100%**	**3757.862**	**3361.59**	**35.05**	**3396.635**

This detail excludes Open Access consumers at KESCO network.

5.5 CRITICAL ANALYSIS ENERGY AUDITOR

- The T&D losses given are Distribution losses only as the energy received at the DISCOM periphery is considered as power purchased
- The Distribution losses excludes Open Access consumers at KESCO network.
- The area of distribution is divided in 4 Circles & 20 Divisions. The Circle/Division wise data was not made available.
- Feeder-wise losses are not available due to the system being in Ring. The input and Output points are dynamic and are changed as per the load conditions and maintenance and repair requirements.

The below table shows the distribution loss as calculated for KESCO consumers from FY 17-18 to 21-22

Sr no	Particulars	Unit	2017-18	2018-19	2019-20	2020-21	2021-22
1	Net T<>D energy attributable to KESCO-D sale	MU	3677.918	3468.973	3578.253	3382.737	3757.862
2	Own Sale	MU	3199.738	3173.839	3300.502	3029.253	3396.635
3	Distribution Losses	MU	478.18	295.13	277.751	353.484	361.227
4	Distribution Losses	%	13%	8.51%	7.76%	10.45%	20-21
5	T&D Losses (MU)	MU				552.867	
6	T&D Losses (%)	%				15.43%	

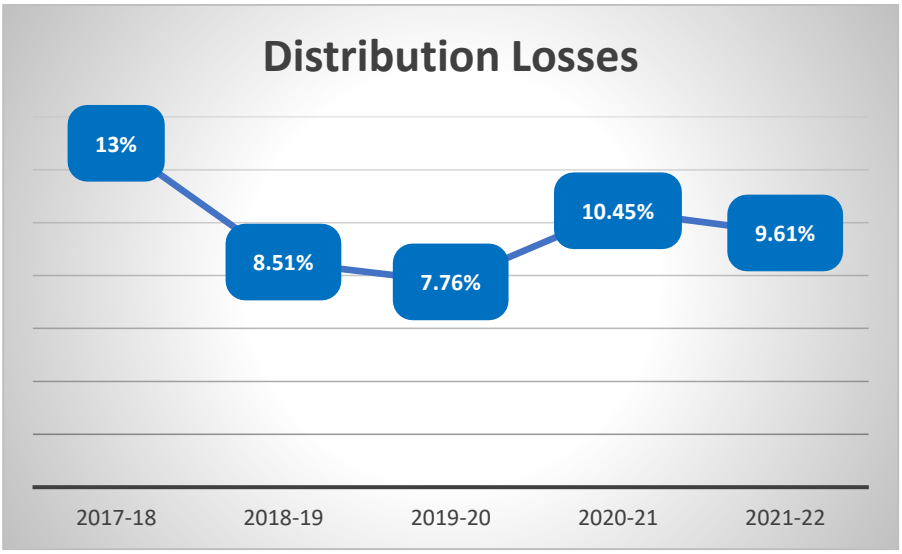


Figure 4: Year wise Distribution loss

The AT&C loss is mentioned below

Particulars	2021-22
Collection efficiency	97.05
AT & C loss	12.28%

5.6 INCLUSION AND EXCLUSIONS

The inclusion and exclusion are as below:

- Open Access Energy is excluded
- Transmission losses are excluded as energy purchased from UPPCL is energy received at KESCO periphery

6. NOTES OF THE EA/EM ALONG WITH QUERIES AND REPLIES TO DATA GAPS.

1) The consumer data (nos & load and other details) mentioned in report are consolidated (inclusive of OA consumers). Need KESCO specific details.
   Due to switching to Open Access, the number of own consumers (KESCO) and their load are variable.
2) The T&D losses given are Distribution losses only as the energy received at the DISCOM periphery is considered as power purchased
3) The area of distribution is divided in 4 Circles & 20 Divisions. The Circle/Division wise data was not made available.
4) Where Collection efficiency is more than 100%, it is considered 100% for calculation of AT&C losses.
5) Feeder-wise losses are not correct due to the system being in Ring. The input and Output points are dynamic and are changed as per the load conditions and maintenance and repair requirements.
6) Detailed write up measures adopted for loss reduction (not like consumer DSM measures) is needed along with quantified expenditure and savings.

Net Input Energy for KESCO is arrived as below:

Net Input Energy at T<>D periphery (For KESCO consumers) =

Gross Input Energy purchased

–(minus) Transmission Loss

+ (plus) Energy Input for Open Access consumers

- (minus) grossed up Open Access Sale

- The OA sales are grossed up (Wheeling loss as percentage of metered energy is added to metered energy—(% as per UPERC order, metered data provided by OA consumers.)
- The grossed-up sales are then deducted with energy recorded at T<>D periphery (ABT meters) to arrive at Net input energy at T<>D to KESCO consumers.

The various parameters for FY 2020-21 mentioned above is tabulated below

The below table shows the main parameters to arrive at distribution loss as calculated for KESCO consumers

Particulars	21-22
Own Sales (With Self consumption) (MU)	**3396.635**
Energy at T-D (MU)	3927.662
Total T-D energy attributable to OA consumption	151.227
Total T-D energy export to DVVNL (MU)	18.573
Net T-D energy attributable to KESCO-D sale (MU)	**3757.862**
Distribution Losses (MU)	361.227
Distribution Losses (%)	9.61%

Figure 5: FY 21-22 Distribution loss

The AT&C loss is mentioned below

Particulars	**2021-22**
Collection efficiency	97.05
AT & C loss	12.28%

In Proforma:

Net Input Energy at T<>D periphery = Input Energy purchased (for KESCO consumers on their network) –(minus) Transmission Loss + (plus) grossed up Open Access Sale - (plus) grossed up Open Access Sale

Net Sold Energy at T<>D periphery = Energy Sale for KESCO consumers on their network

(Open Access Sale is not included).

2. Summary of Critical Analysis

2.1 Critical Analysis by Energy Auditor

Distribution losses have reduced from 13% in 2017-18 to 9.61% in 2021-22. The Distribution losses were continuously reducing from 17-18 to 19-20. However, it increased in FY 20-21 & FY 21-22 during COVID-19 pandemic.

- The HT consumption is around 30% of the total consumption and HT consumers are approximately 0.4 %.
- The residential consumers form a bulk of the consumers where losses are high.
- The HT/LT ratio is approximately 0.75. The growth of LT is higher than HT network.
- The numbers of 11/0.415 KV transformers very high as compared to 33/22/11 KV transformers due to high LT load and LT consumers. This is one of the reasons for high T&D loss.

Around 70% of KESCO load is LT with LT Residential consumers nearly 85%. To cater to the high LT load and consumer demand the number of LT and LT cables is high.

The Distribution losses were continuously reducing from 17-18 to 19-20 as, efforts are vigorously taken to reduce this loss the details given further in report.

- The major loss sections are distribution Transformers.
- The number of distribution transformers is high, hence the no load losses of X'mers are a major contributor. But given the wide area of distribution system and predominantly LT load, and to install transformers near load centres their numbers is inevitable.
- Some of the transformers are very old. The old transformers have more losses compared to modern transformers.
- The length of LT cables is 1.33 times that of HT cables. The HT load is around 30% with approx. 0.4% of HT consumers. These necessitates long lengths of LT cables to cater to demand which increase distribution loss.
- The older PILC insulated cables have high losses compared to newer cables

As the cost of removing the cables is very much high, they need to be abandoned and new laid. Due to congested localities, space constraints of laying cables on footpaths, high reinstatement costs a feasibility study is needed. Similar for distribution transformers.

7. ANNEXURES

7.1 Minutes of Meeting with the DISCOM team

7.2 Check List prepared by auditing Firm

7.3 Sector Specific Proforma Signed

a. General Information
b. Summary Sheet (Form-1)
c. Infrastructure Details
d. Division-wise losses
e. Form Input Energy
f. Details of received sources
g. Details of consumers & consumption
h. Details of Feeder levels

7.4 Power Purchase Details

7.5 List of documents as Source of data

7.6 List of documents verified with each parameter

7.7 List of Parameters arrived through calculation or formulae with

7.8 Photographs

7.9 Meter Test & Calibration report