

Annual Energy Audit Report of APSPDCL FY 22-23

Designated Consumer Registration No.: - **DIS0005AP**



Andhra Pradesh Southern Power Distribution Company Limited

APSPDCL, DoorR No 19-13,65/A, Tirchanoor Road,
Srinivasapuram, Tirupaiti,
Andhra Pradesh, India-517503

Conducted by



M/s Zenith Energy Services Private Limited

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Contents

Contents	2
List of Figures	5
List of Tables	5
I. ACKNOWLEDGEMENT	2
II. STUDY TEAM	3
1 EXECUTIVE SUMMARY	4
1.1 Introduction	4
1.2 Details of Energy Purchased, Net Input Energy % of Losses	4
1.3 Distribution Losses for the past 3 years	5
1.4 Critical comment	5
1.5 Comment on Metering of DTs	5
1.6 Empaneled accredited energy auditing firm [EMAEA] – an overview	6
1.7 Designated consumer – an overview	6
1.8 Brief Details of APSPDCL	7
2. SCOPE, APPROACH AND METHODOLOGY	9
2.1 Scope of energy audit	9
2.2 Approach adopted for annual energy audit	9
2.2.1. Data Review, interpretation and analysis	9
2.3 Methodology adopted for Annual Energy Audit	9
2.3.1. Team Composition	9
2.3.2. Minutes of Meeting/Verification	10
2.4 Purpose of the Annual Energy Audit report	10
3. INFRASTRUCTURAL DETAILS OF APSPDCL	12
3.1 Introduction	12

3.2	Statistical details of Metered Consumers	12
3.3	Statistical data of Meters on Power Transformers and DTs.....	13
3.4	Statistical data of feeders and meters provided on the feeders	13
3.5	The details of Feeders	14
4.	ENERGY SCENARIO OF APSPDCL FOR THE YEAR 2022-23	15
4.1	The Energy Scenario	15
4.2	The details of Power purchased from different sources.....	16
4.3	The Energy sales particulars and loss calculations at different voltage levels.....	17
4.4	Procedures for Loss Calculations.....	18
4.5	The voltage level-based hierarchy of the APSPDCL.....	19
4.6.	The methodology adopted by the DISCOM is as under	20
4.7.	Input Energy.....	21
4.7.1.	The energy purchase and net energy input details are as under.....	21
4.8	Summary of Losses:	21
5.	DETAILS OF VARIOUS CATEGORIES OF CONSUMERS AND THEIR CONSUMPTION.....	24
5.1	Consumer profile.....	24
5.2	APSPDCL Block Diagram.....	26
5.3	The details of Input metering points in various Divisions	27
5.4	The Energy Scenario of APSPDCL	27
5.5.	Billed Energy (Total Energy) = Metered Energy (MU) + Un-Metered energy (MU)	29
5.6.	The Divisionwise losses for the FY 2021-22 AND 22-23 are shown as under.	30
5.7.	Analysis of High Loss areas.....	30
5.8.	Agriculture Methodology.....	31
5.9.	Agriculture Billing	31

Annual Audit report of APSPDCL for the FY 2022-23

5.10. Energy Scenario of APSPDCLfor the Last 3 Years.....	34
5.11. Billed Energy (MU)	34
5.12 DISCOM wisePOC Loss statementissued by APSLDCfor the FY2022-23	35
5.13. A Note on Data Gaps	36
LIST OF ANNEXURES	37

List of Figures

Figure 1:Energy Accounting Pie Diagram	17
Figure 2: Hierarchy of Distribution loss by DISCOM	20
Figure 3: Billed energy of various category consumers.....	34

List of Tables

Table 1: Consumer Details.....	12
Table 2: Distribution Grid Details	13
Table 3: Details of meters on power transformers and DTs.....	13
Table 4: Details of Feeders and meters provided on the feeders.....	14
Table 5: Performance Summary	15
Table 6: Energy accounting Summary (voltage-wise).....	16
Table 7: Voltage-wise sales, open access demand and loss	17
Table 8: Calculation Procedures for Loss Calculations	18
Table 9: Energy Input Details	21
Table 10: Losses summary	22
Table 11: Consumer profile	24
Table 12: Energy and commercial losses	27
Table 13: Year wise T&D losses.....	30
Table 14: Divisions with high % Losses	30
Table 15: <i>Agriculture & related Billing</i>	32
Table 16: Consumer details - Year wise	34
Table 17: Billed energy details - Year wise	34
Table 18: Performance Summary tables for the Last 3 Years.....	35
Table 19: APSLDC Discom wise POC loss data for FY 2022-23	35

I. ACKNOWLEDGEMENT

Zenith Energy Services Private Limited (ZESPL), Hyderabad (an EmAEA by BEE) expresses its sincere gratitude to the management of “Andhra Pradesh Southern Power Distribution Company Limited (APSPDCL)” for giving them an opportunity for conducting the “Annual Energy Audit” 2022-23. Our special thanks go to the following APSPDCL officials for their whole-hearted support and the excellent cooperation extended to the Energy Audit team from ZESPL.

Shri V.Suresh Kumar	CGM(Energy Audit, Planning and Training)
Shri. P.Murali	General Manager (Energy Audit)
Shri. Md Ayub Khan	Executive Engineer (Energy Audit)
Shri. C. Balaji.	DEE (Energy Audit)
Smt D.Lakshmi	AEE (Energy Audit)

ZESPL also wishes to thank all other executives and staff of APSPDCL Tirupati for their active involvement, providing all the data connected to the audit, and sharing their experience on the implementation of energy conservation measures in APSPDCL.



ENERGY AUDIT TEAM
ZENITH ENERGY SERVICES (P) LIMITED

R. GOPALA KRISHNA
Accredited Energy Auditor
(B E E) EA-0432, AEA-0123

II. STUDY TEAM

S. No	Name	Qualification	EM/EA/AEA/EmAEA Registration No	Experience (In Years) EE/ Sector
Accredited Energy Auditor				
1	Shri. R.Gopala Krishna	B.E-Mechanical Engineering	AEA-123	40
Certified Energy Auditor/ Manager				
2	Shri.R. Sasidhar	B.E-Mechanical Engineering	CEA-7970	30
3	Shri.G Sreenivasulu	B.E-Electrical Engineering	EA-9755	28
DISCOM Sector Specialist				
4	Shri. S. VeeraSwamy	M. Tech- Power Systems	DISCOM Sector Expert	40
5	Shri. Ch. Shankar Satya Sai	M.Tech (Electrical Engineering)	Senior Electrical Engineer	6

1 EXECUTIVE SUMMARY

1.1 Introduction

As per BEE Notification No 18/BEE/DISCOM/2021 dated 6th October 2021 every energy Distributing Company shall conduct an annual energy audit for every financial year and submit the annual energy report to the BEE and SDA and also made available on the web site of the electrical distribution company within a period of four months from the date of expiry of the financial year.

In order to evaluate various critical parameters like T&D losses, Collection Efficiency, ATC Losses etc. BEE has developed a Sector Specific Proforma on 02-02-2022 and distributed the same to the eligible DISCOMs.

1.2 Details of Energy Purchased, Net Input Energy % of Losses

As per the Energy Accounting proforma submitted by APSPDCL for the FY 2022-23 the details are as under.

- a) The gross energy purchased by APSPDCL from all the generating sources put together is 34526.73MU which includes swapping import 277.46MU.
- b) The net input energy at DISCOM (After adjusting the transmission losses and energy traded) is 26778.42 MU.
- c) The transmission losses are 777.18 MU.
- d) The total Energy Billed is 24614.23 MU.
- e) The Distribution Loss for the AY 2022-23 is 2164.20 MU.
- f) The % of Distribution Losses is 8.08 %
- g) The Collection efficiency is 93.90%
- h) The billing efficiency is 91.92%
- i) The AT&C Losses are 13.69%
- j) % of Metered Sales is 68.08%

All the above data is also verified from the provisional 23rd Annual report published by APSPDCL in July 2023.

1.3 Distribution Losses for the past 3 years

The Percentage of Distribution Losses incurred by APSPDCL during the FY 2020-21,21-22 and 2022-23 are shown as under.

Financial Year	2020-21	2021-22	2022-23
D Losses (%)	8.21	8.10	8.08

From the above figures it is evident that the Distribution Losses have shown decreasing tendency in each financial year and the ECMs implemented by APSPDCL during 2022-23 are enumerated in the latter chapters. All the documents were signed by the head of the department of the respective circles.

1.4 Critical comment

Each parameter in the Proforma is verified from the certified documents provided by APSPDCL and also cross checked from the Data furnished by APPCC/Transco for FY 2022-23. The data furnished is also verified from the provisional 23rd Annual Report published by APSPDCL in July 2023. From the data provided by APSPDCL it was observed that APSPDCL purchased a total 10924.24 MU from renewable energy sources i.e solar and wind which was around 2989 MU less than previous year's purchase from the same sources respectively due to non-availability of wind.

1.5 Comment on Metering of DTs

As intimated by APSPDCL and as per the infrastructural details made available in the Energy Accounting Pro Forma, out of 6,23,890 DTRs 1,13,589 DTRs are provided with conventional meters and 5,10,301 DTRs are not provided with any meters. None of the DTRs is provided with communicable meters. APSPDCL is planning to install communicable meters in 1,02,246 DTs by March 2024 under RDSS Scheme. APSPDCL intimated that tenders for this work are finalized and execution will take place shortly.

Due to non-functioning of conventional meters in the DTs and non-functioning of Communicable meters provided on 1,13,589 Nos Transformers the losses in the LT Side could not be assessed and taken as zero and total sales were added to 11 Kv sales to evaluate the distribution losses.

1.6 Empaneled accredited energy auditing firm [EMAEA] – an overview

Name of the Firm : M/s Zenith Energy Services (P) Ltd, Hyderabad

Registration No of the Firm : EmAEA – 011

Registration No. of the Lead AEA : R Gopala Krishna (AEA –0123)

Other BEE empaneled AEA/ CEA/ DISCOM sector Expert

DSR Krishna- AEA

S.VeeraSwamy-Discom Expert

Y. Venkateswarlu- CEA EA 17704

R. Sasidhar- CEA EA 7970

Zenith Energy Services Private Limited (ZESPL) is a BEE empaneled energy auditing technical consultancy organization providing techno-commercial advisory services in the areas of Energy Efficiency, Renewable Energy, and Climate Change Management(CDM) for over three decades. The company also has rich experience in conducting baseline Audits, Energy Audits for DISCOMs, Cement sector and Power sector etc. The clients include DISCOMs like TSNPDCL, MSEDCL, DGVCL, cement majors like KCP, PENNA, and KESORAM group. besides Thermal Power Plants like NCTPS Stage II, KTPS (TS GENCO)

1.7 Designated consumer – an overview

Name and Address of Designated Consumer

Andhra Pradesh Southern Power Distribution Company Limited (**APSPDCL**)

Registration No.& Address DC No : **DIS0001AP**

APSPDCL, Door No 19-13,65/A,Tirchanoor Road,Srinivasapuram,Tirupati-517503

Name & details of Energy Auditor and Authorized signatory of DC

Details of Energy Manager	Details of Authorised Signatory
<p>Shri. S. Soma Sekhar (Energy Manager) Reg. No: EA- 7172 Mobile : +91- 9440817402 Mail : de_om@apspdcl.in</p>	<p>Smt V. Suresh Kumar Chief General Manager/Energy Conservation and Quality Control</p>

1.8 Brief Details of APSPDCL

The Southern Power Distribution Company of Andhra Pradesh Ltd (APSPDCL) was incorporated under the Companies Act, 1956 as a Public Limited Company on 01-04- 2000 with headquarters at Tirupati to carry out electricity distribution for the districts of Krishna, Guntur, Prakasam, Nellore, Chittoor and Kadapa.

On 2nd June 2014, due to bifurcation of the erstwhile Andhra Pradesh Anantapur and Kurnool districts were added to the Southern Power Distribution Company of AP Ltd.

AP Power Sector Reforms envisage creation of Distribution Companies as Government Undertakings. The Andhra Pradesh Gazette No.37 published by the Government of Andhra Pradesh on Friday 31 March 2000 declared formally formation of Distribution Companies. In this process, Andhra Pradesh Southern Power Distribution Company was formed for the following six districts of Andhra Pradesh. The corporate office and headquarters of APSPDCL is at Tirupati City.

Quality power at economic rates acts a catalyst in transforming the state by fostering growth in agricultural, industrial and commercial areas while meeting the increasing domestic demand. On Feb 1, 1999, Government of Andhra Pradesh initiated the first phase of reforms and restructuring in AP's power sector by unbundling APSEB into APGENCO and APTRANSCO to cater to Generation and Transmission & Distribution respectively. APTRANSCO was further reorganized into four distribution companies to cater to the needs to the different districts of AP.

APSPDCL was formed on April 1, 2000 to serve Krishna, Guntur, Prakasam, Nellore, Chittoor and Kadapa districts. After the bifurcation of the erstwhile Andhra Pradesh into the two new states of Andhra Pradesh and Telangana on 2 June-2014, two more districts Anantapur and Kurnool were added to the Southern Power Distribution Company of AP Ltd.

- a) To develop and maintain an efficient, co-ordinated and economical distribution system
- b) To supply electricity on an application of the consumer in accordance with the provisions specified in the Electricity Act 2003.

- c) provide non-discriminatory open access to the consumers.
- d) To establish a forum for redressal of grievances of the consumers

Since the State Government of Andhra Pradesh has vested the function of distributing power in the designated area to APSPDCL, APEPDCL, APCPDCL, the Business Scope of the Company falls within the legal framework as specified in the Act and can include:

- (i) To develop and maintain an efficient, co-ordinated and economical distribution system.
- (ii) To Operate the existing distribution infrastructure efficiently & effectively;
- (iii) Merchant Sale of Power in the event of availability of surplus power after meeting the requirement of own consumers with whom the capacity is contracted presently;
- (iv) Other associated businesses such as Training, Research and Development activities, Technical consultancy services, and O&M related services;
- (v) APSPDCL provides services to approx, 7130061 consumers of various categories of Consumers.
- (vi) The Consumer base of APSPDCL consists of Domestic, Non-Domestic , Agricultural and Industrial Consumers as major categories.
- (vii) While the energy billed by APSPDCL for the Customer is 24614.23 MU, the monthly consumption
- (viii) per customer stands at (288)KWH/Month. APSPDCL caters to area spread in 5 Circles, 31 Divisions.

2. SCOPE, APPROACH AND METHODOLOGY

2.1 Scope of energy audit

The Work order given by the DC to EmAEA is attached as an Annexure -1.

2.2 Approach adopted for annual energy audit

Based on the data collection and discussions as per BEE guidelines, EmAEA prepared the annual energy audit report for the FY 2022-23 and presented it to the DC.

2.2.1. Data Review, interpretation and analysis

All the documents submitted by APSPDCL is studied in detail and after detailed scrutiny APSPDCL is requested to make additional documents (Duly certified) ready to support the data entered in the Proforma and the final values like T&D Losses .AT&C Losses arrived at in the proforma. APSPDCL made all the documents available by the time Zenith team visited their office.

Activity	Period
Visit and Discussions with the DC	21-07-2023 to 22-07-2023
Post visit report preparation	24.07.2023 – 31-07-2023

2.3 Methodology adopted for Annual Energy Audit

- Discussion with the Audit team of APSPDCL regarding the plan of action for conducting Energy audit.
- Detailed study of various ENCON measures taken during 2022-23.
- Verification of energy input and sales data submitted by the DC.
- Examining mandatory Forms and source documents of the data presented during the audit.

Preparation of Annual Energy Audit report for the submission. The signed copy of Energy Accounting Pro Forma [is enclosed separately with a link. \(Annexure 3\)](#)

2.3.1. Team Composition

The following members from Zenith Energy and APSPDCL have participated in the Annual Energy study of the DC.

ZESPL Hyderabad	APSPDCL-Tirupati
Sri. R Gopala Krishna, AEA	Sri. S.Soma Sekhar Energy Manager(EA-7172)
Sri R VeeraSwamy DISCOM Expert	Shri N. Narendra Naidu, AO
Sri. G..Sreenivasulu (Energy Auditor) EA-9755	Kum J. Dhvani, AEE/IT
Sri. KothaVeeresh, EA-34649	
Sri Ch Sai Sankar (Sr Energy Engineer)	

2.3.2. Minutes of Meeting/Verification

The audit team verified the data filled in sector specific Proforma document by the DC with certified documents by the DC and other certified intra departmental documents and from the annual reports conducted by Independent Third-party Auditors.

2.4 Purpose of the Annual Energy Audit report

Energy Conservation Act 2001 (EC Act 2001) requires DCs to:

- a) Furnish report of energy consumption to the BEE and SDA(By External Agency)
- b) Designate or appoint an Energy Manager who will be in-charge for submission of annual energy consumption returns to BEE and SDA (Section 14 (l))
- c) Comply with the energy conservation norms and standards prescribed under Section 14 (g) of the Act

As per BEE Notification No 18/BEE/DISCOM/2021 dt. 6th October 2021 every energy distribution Company shall conduct an annual energy audit for every financial year and submit the annual energy report to the BEE and SDA and also made available on the web site of the electrical distribution company within a period of four months from the date of expiry of the financial year. The general structure of the report shall be as under.

- a) It shall be mandatory to record the energy supplied separately for each category of consumers which is being provided a separate of subsidy in the tariff by the State Government, so that the subsidy due for the electricity distribution company is

quarterly calculated by multiplying the energy supplied to each of such category of consumers by the applicable rate of subsidy notified by the State Government.

- b) Provide for monitoring of input energy and consumption pattern at various levels.
- c) Identify the areas of energy leakage, wastage or inefficient use
- d) Identify high loss making areas and networks for initiating target based corrective action and
- e) Identify overloaded segments of the network for necessary capacity addition.
- f) In addition, the report shall highlight the strength and weakness of the electricity distribution company in the management of energy and energy resources in the annual energy audit report and recommend necessary action to improve upon method of reporting data. energy management system in detail along with their underlying rationale.
- g) The audit report shall be signed by the AEA under the seal of its firm giving all the accreditation details along with details of manpower employed in conducting the annual energy audit.

3. INFRASTRUCTURAL DETAILS OF APSPDCL

3.1 Introduction

APSPDCL, Tirupati is responsible for Power Distribution for about 71.3 Lakh consumers in 5circles belonging to different categories as shown in the following table:

Table 1: Consumer Details

No.	Parameters	Total	Covered during in audit
i	Number of circles	5	5
ii	Number of divisions	31	31
iii	Number of sub-divisions	103	103
iv	Number of 33/11 Kv Sub Stations	1503	1503
v	Number of feeders	6630	6630
vi	Number of DTs	623890	0
vii	Number of consumers	7130061	7130061

3.2 Statistical details of Metered Consumers

APSPDCL, Tirupati is purchasing its entire energy requirement from various sources at 11 kV, 33kV and 66kV and above voltage levels.

Table 2: Distribution Grid Details

No.	Parameters	66kV & above	33 kV	11 / 22kV	LT
i	Number of conventional metered consumers	128	812	3080	5858689
ii	Number of consumers with 'smart' meters	0	0	0	0
iii	Number of consumers with 'smart prepaid' meters	0	0	0	0
iv	Number of consumers with 'AMR' meters	0	0	0	0
v	Number of consumers with 'non-smart prepaid' meters	0	0	0	0
vi	Number of unmetered consumers	0	0	0	1267352
vii	Number of total consumers	128	812	3080	7126041

3.3 Statistical data of Meters on Power Transformers and DTs

Power Transformers installed at 33/11kV substations are maintained by APSPDCL. Below is the detail of the meters provided on Power transformers.

Table 3: Details of meters on power transformers and DTs

No.	Parameters	66kV and above	33kV	11/22kV	LT
i	Number of conventionally metered Distribution Transformers	0	0	0	113589
ii	Number of DTs with communicable meters	0	0	0	0
iii	Number of unmetered DTs	0	0	0	510301
iv	Number of total Transformers	0	0	0	623890

3.4 Statistical data of feeders and meters provided on the feeders

APSPDCL, Tirupati maintains the network at 33kV and below. APSPDCL has 128 no. of 66kV&above feeders, 812 no of 33kV feeders and 3080 no feeders at 11kV level. Details of consumers with different type of meters are tabulated as under.

3.5 The details of Feeders

The details of Feeders at Different Voltage levels and type of meters provided on the feeders are tabulated as under.

Table 4: Details of Feeders and meters provided on the feeders

S.no	Parameters	66kV and above	33kV	11/22kV	LT
i	Number of metered feeders				0
ii	Number of feeders with communicable meters	0	727	5903	0
iii	Number of unmetered feeders	0	0	0	0
iv	Number of total feeders		727	5903	0
d.	Line length (ct km)	305967			
e.	Length of Aerial Bunched Cables in KM	19924			
f.	Length of Underground Cables in KM	88			

4. ENERGY SCENARIO OF APSPDCL FOR THE YEAR 2022-23

4.1 The Energy Scenario

The Energy Scenario of APSPDCL during the FY 22-23 is tabulated as below.

Table 5: Performance Summary

S. No	Description	Units	2022-23
1	Input Energy Purchase	MU	34249.27
2	Swapping Import	MU	277.46
2	Gross energy purchased	MU	34526.73
2	Exchange Sales	MU	718.36
3	Swapping Export(D)	MU	80.13
4	D<>D Sales	MU	6172.61
5	Transmission Losses	MU	777.18
6	Net Input	MU	26778.42
7	Sales	MU	24614.23
8	Distribution Losses	MU	2164.20
9	Distribution Losses	%	8.08
10	Collection Efficiency	%	93.90
11	Billing Efficiency	%	91.90
12	AT&C Losses	%	13.69
13	Revenue from Sale of Energy	INR Cr	16863.60
14	Collection	INR Cr	15834.16
15	No of Consumers	No	7130061

Note: The above data is verified from the provisional 23rd Annual report submitted by APSPDCL in July 2023.

4.2 The details of Power purchased from different sources

The details of Power purchased from different sources during the Financial 2022-23 is available in the Energy Accounting Proforma and the total tallies with the total referred in the provisional 23rd annual report and also statement of SLDC.

The following table shows the energy input, sales and losses at various voltage levels.

Table 6: Energy accounting Summary (voltage wise)

Energy Accounting Summary					
S.no	Voltage	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
i	LT	0	14687.88	0	
ii	11 Kv	17964.22	1942.88	1351.74	7.52
iii	33 kV	2816.67	2004.22	812.45	3.85
iv	> 33 kV	5997.53	5997.53	0	0
S.no	OA, Captive	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
i	LT	0	0	0	0
ii	11 KV	18.28	18.280	0	0
iii	33 kV	304.77	304.770	0	0
iv	> 33 kV	0	0	0	0

The Pie diagram showing the above data is shown as under

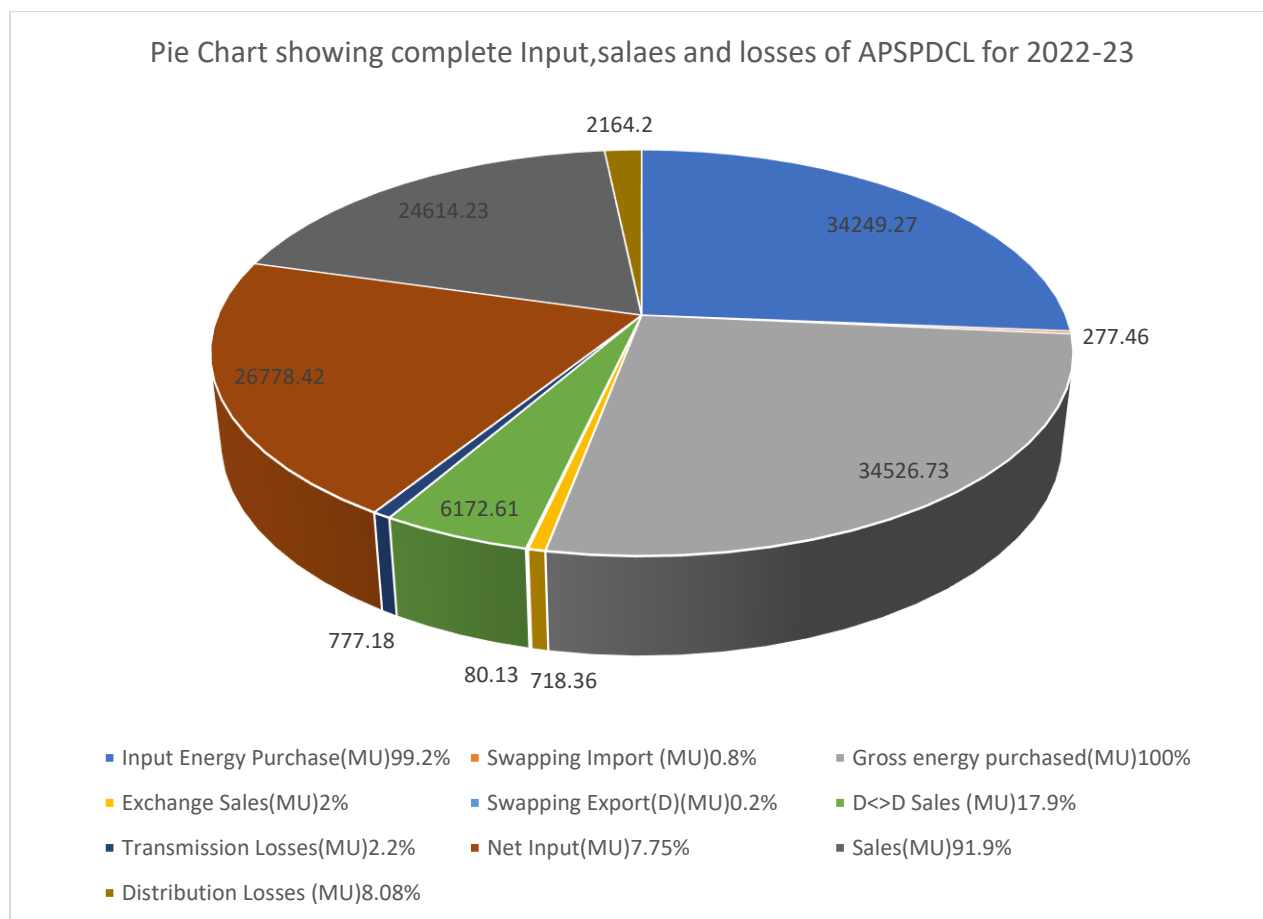


Figure 1:Energy Accounting Pie Diagram

4.3 The Energy sales particulars and loss calculations at different voltage levels

The Loss calculations for different voltage levels is shown as under

Table 7: Voltage-wise sales, open access demand and loss

S.no	Voltage	Energy Sales Particulars	MU
I	LT Level	DISCOM' consumers	14687.88
		Demand from open access, captive	0
		Embedded generation used at LT level	0
		Sale at LT level	14687.88
		Quantum of LT level losses (Notional)	0
		Energy Input at LT level	-
ii	11 kV Level	DISCOM' consumers	1924.60
		Demand from open access, captive	18.28
		Embedded generation at 11 kV level used	0
		Sales at 11 kV level	1924.60

S.no	Voltage	Energy Sales Particulars	MU
		Quantum of Losses at 11 Kv(Including LT Losses)	1,351.74
		Energy input at 11 kV+LT level	17,964.22
iii	33 kV Level	DISCOM' consumers	2004.22
		Demand from open access, captive	304.77
		Embedded generation at 33 kV or below level	0
		Sales at 33 kV level	2004.22
		Quantum of Losses at 33 kV	812.45
		Energy input at 33kV Level	2,816.67
iv	>66 kV	DISCOM' consumers	5997.93
		Demand from open access, captive	582.85
		Cross border sale of energy	0
		Sale to other DISCOMs	0
		Banking	0
		Input at 66kV and above (EHV)	5997.53
Total Energy Requirement(Excluding OA Sales+3 rd party sales)			27555.03
Total Energy Sales(Discom sales+ Open access sales)			25520.13

4.4 Procedures for Loss Calculations

The following table provides the loss calculations

Table 8: Calculation Procedures for Loss Calculations

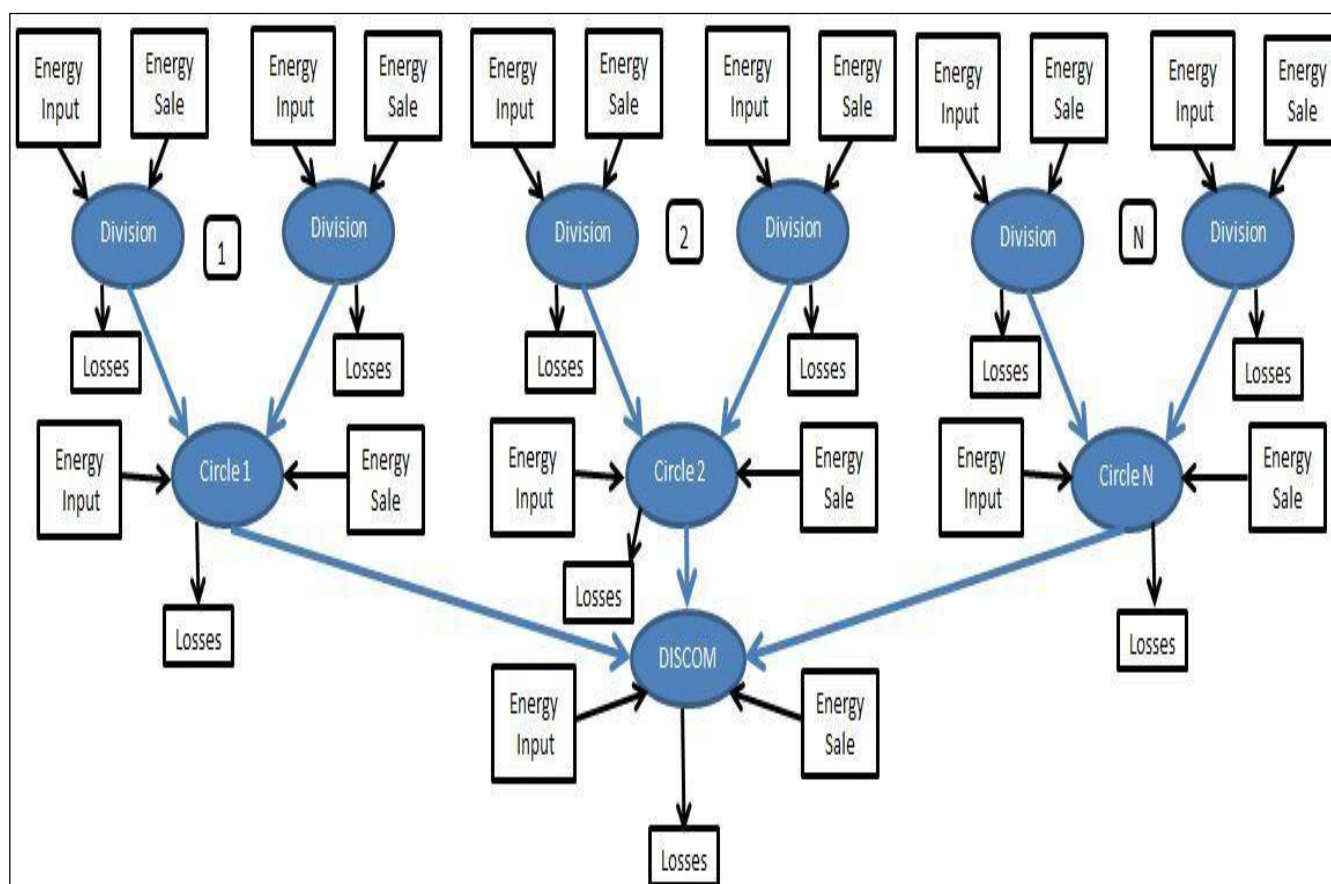
1	EHT Distribution network Input (Transco-Discom Boundary)		5997.53
2	EHT 3rd Party sales		93.29
3	EHT Open access sales which is being adjusted to respective HT consumer recorded energy		489.56
4	Net EHT Input Energy =1-2-3		5414.68
5	EHT Discom sales		5404.16
6	EHT Distribution N/w loss =4-5		10.52
7	% EHT N/w loss =6/4		0.19
(i)	Total Energy delivered into 33 KV Distribution System from EHT SSs	A	19950.23

(ii)	Energy delivered by all other Generating Stations at 33kV	B	1753.01
(iii)	Energy consumed by HT consumers at 33KV (Sales)	X	2536.24
(iv)	Energy Delivered into 11 KV and LT System from 33/11 KV SS	C	18039.35
(v)	33KV 3rd party+ OA sales	K	304.78
(vi)	EHT SS Auxiliary consumption	Z	12.21
	Losses (33 kV System)	$L=(A + B-K-Z) - (C + X)$	810.66
	% Losses (33 kV System)	$100 \times (L / (A+B-K))$	3.79
II. Losses in 11 KV System and Connected Equipment		II. Losses in 11 KV System and Connected Equipment	
(i)	Energy delivered into 11 KV system from 33/11kV SSs	C	18039.35
(ii)	Energy delivered into 11 KV Distribution System from EHT SSs	D	0.00
(iii)	Energy delivered at 11kV from all other Generating Stations	E	6.29
(iv)	Total Energy delivered into 11 KV and LT Distribution System	C+D+E	18045.64
(v)	Energy consumed by HT consumers at 11KV Sales	Y	1985.95
(vi)	LT sales	F	14687.88
(vii)	11KV 3rd party+OA sales	M	18.28
	Losses (11kV+LT System)	$N=(C + D + E-M) - (Y + F)$	1353.53
	% Losses (11kV System)	$N/(C+D+E-M) \times 100$	7.51

4.5 The voltage level-based hierarchy of the APSPDCL

The following figure shows the voltage level-based hierarchy of the APSPDCL

Figure 2: Hierarchy of Distribution loss by DISCOM



4.6. The methodology adopted by the DISCOM is as under

- i. Input energy is arrived with the joint Meter readings of Transco, DISCOM and other concerned officials at inter face points of Transco-Discom, Genco-Discom, Private developers –Discom, Discom- Discom.
- ii. The Input energy will be reconciled at Transco level every month with MRI dumps of all inter face points and will be considered as total input energy for APSPDCL.
- iii. The metered sales arrived through energy billing software using which bills are being issued.
- iv. The agricultural sales are being assessed as per the methodology proposed by Indian Statistical Institute.
- v. By knowing the input energy, metered sales and consumption, the Distribution losses and AT&C losses are computed at company level.
- vi. APSPDCL is also calculating the circle wise losses based on the inputs from boundary meters installed at circle level. Net energy input is finalised after

- Import/export of energy on the basis of boundary meters at circle level.
- vii. Energy billed is considered as per the Energy Billing System (EBS) reports of the DISCOM.
 - viii. T&D losses are calculated at circle level. Revenue billed and realized is taken from the financial records of APSPDCL finance department and accordingly AT&C losses are finalized.
 - ix. The energy input is taken from the sub- station meters of 11 kV/22kV, 33kV and 66 kVfeeders and 66 kV, 132 kV and 220 kV feeders. Sale of energy is taken as per Energy Billing System (EBS) software. Agricultural consumption will be arrived as per ISI methodology.
 - x. Since the DTs do not have meters the sale of Energy at LT Level is added to 11 kV level sales and then the losses at 11 kV level are evaluated.

4.7. Input Energy

4.7.1. The energy purchase and net energy input details are as under.

Table 9: Energy Input Details

S. No	Particular	FY (2022-23) MU
1	Net Input Energy Purchase (From Generation Source)	34526.73
2	Net Input Energy against Sale of Energy to Discom consumers	26778.42

The source of Data AP Transco EBC Wing. The input energy purchased from Generation sources for the FY 2022-23 is 34526.73.61 MU. The above Net Input energy value is verified from the provisional audit report submitted by third party for the financial year 2022-23 and from MIS data of APSPDCL for the year 2022-23. Since the report is provisional there may be slight changes in the energy figures after the final report is published. The details of energy exchanges between APTRANSCO and APSPDCL is enclosed in Annexure 4.

4.8 Summary of Losses: APSPDCL supplies Power to about 71.3 lakhs consumers belonging to different categories through a network consisting of 6630 feeders at different voltage levels and 6,23,890 no's distribution transformers of different

capacities. The procedure for verification of calculations by Zenith team to compute % of T&D Losses and % of Distribution Losses is as under.

- 1 Set the boundary of the operation as per gate-to-gate concept
2. Identify the sources of energy
3. Data collection from DISCOM
4. Account for Billed Energy, Net input Energy consumption and Meter reading of input energy injection points in different scenarios
5. Calculate Circle wise losses
6. Calculate DISCOM % T&D Loss

The % T&D Loss of the DISCOM is calculated excluding Open Access Energy on a monthly basis using the Transmission and Distribution losses in MU, the % T&D Loss of the DISCOM as per the following formula:

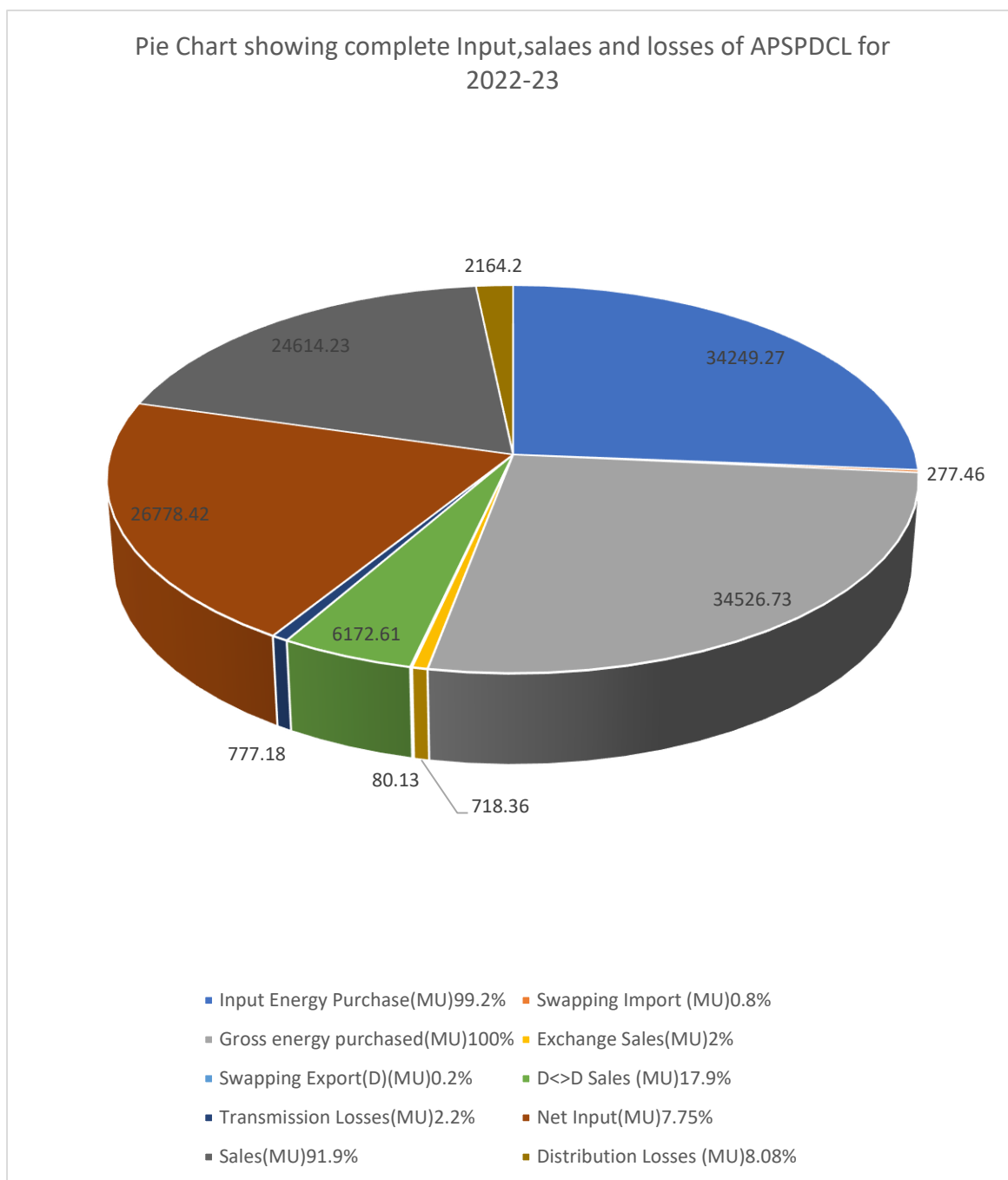
$$\% \text{ T\&D Loss} = (\text{Input Energy Purchase (MU)} - \text{Billed Energy (MU)}) / \text{Input Energy (MU)} * 100$$

$$\% \text{ Distribution Losses} = (\text{Net Input Energy Purchase (MU)} - \text{Billed Energy (MU)}) / \text{Input Energy (MU)} * 100$$

Table 10: Losses summary

No.	Particulars	Units	Quantity
1	Gross Input Energy Purchase	MU	34526.73
2	Net Input Energy(At DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	26778.42
3	Total Energy Billed (Is the net energy billed, adjusted for energy traded)	MU	24614.23
4	T&D Losses	MU	2941.37
5	% of T&D Losses	%	10.98
6	Distribution Losses	MU	2164.19
7	% of Distribution Losses	%	8.08

Pie Chart for the above details is shown as under



5. DETAILS OF VARIOUS CATEGORIES OF CONSUMERS AND THEIR CONSUMPTION

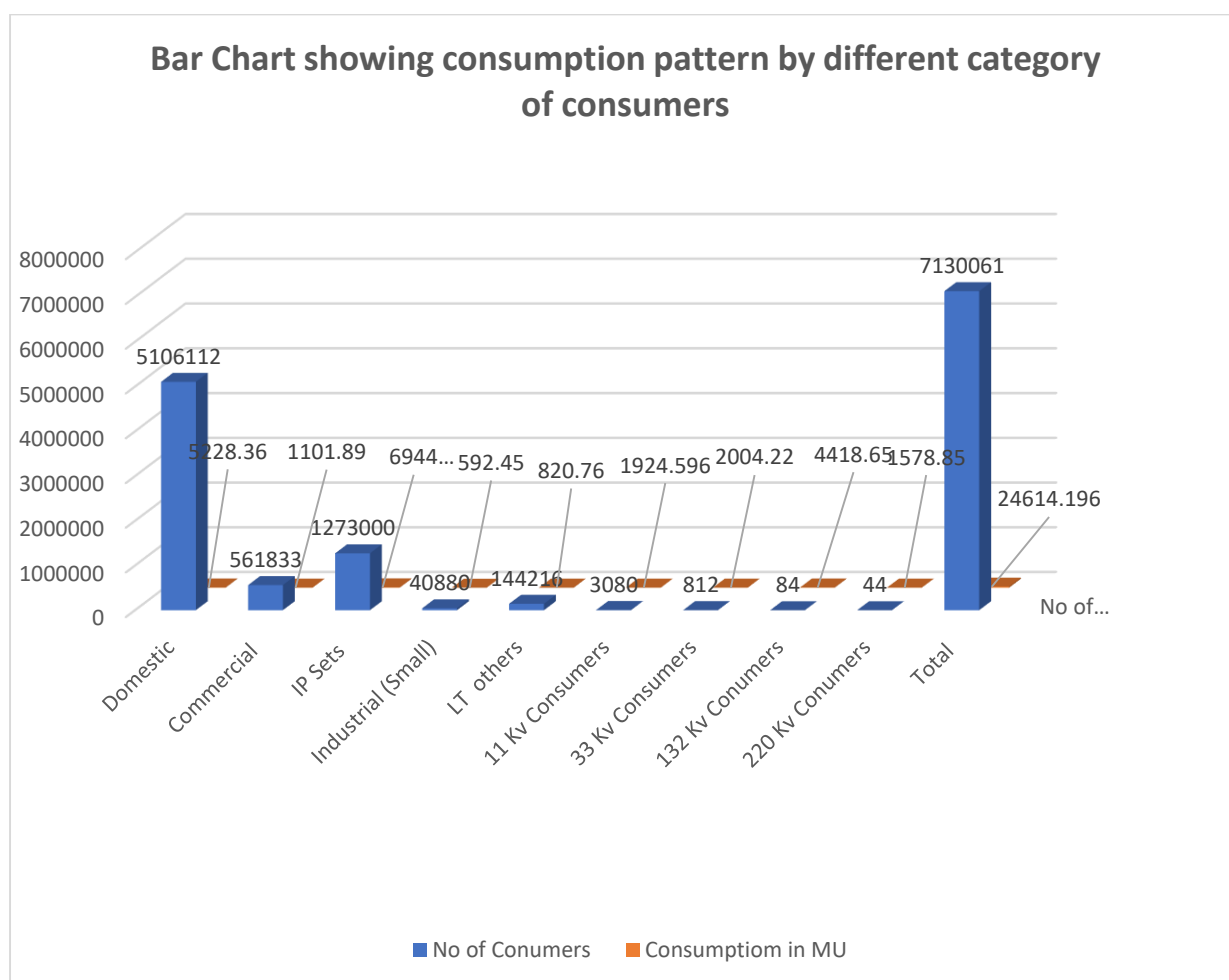
5.1 Consumer profile

APSPDCL, Tirupati supplies power to about 71.3 lakh numbers of consumers as per data up to FY-2022-23, detail of consumer for the FY-2022-23 is given in the table below.

Table 11: Consumer profile

Period From April ' 22 to March ' 23					
S. No	Type of Consumers	Category of Consumers (EHT/HT/LT/Others)	Voltage Level (In Voltage)	No of Consumers	Total Consumption (In MU)
1	Domestic	LT		5106112	5228.36
2	Commercial	LT		561833	1101.89
3	IP Sets	LT		1273000	6944.42
4	Industrial (Small)	LT		40880	592.45
5	LT others	LT		144216	820.76
6	Others-1 (if any , specify in remarks)	Cat:1	11kV	32	15.76
7	Others-2 (if any , specify in remarks)	Cat:2	11kV	1051	401.8555
8	Others-3 (if any , specify in remarks)	Cat:3	11kV	1582	937.67
9	Others-4 (if any , specify in remarks)	Cat:4	11kV	261	129.34
10	Others-5 (if any , specify in remarks)	Cat:5	11kV	154	4.04
11	Others-5 (if any , specify in remarks)	RESCO	11kV	1	435.93
12	Others-5 (if any , specify in remarks)	Cat:1	33kV	8	1.66
13	Others-5 (if any , specify in remarks)	Cat:2	33kV	277	59.27
14	Others-5 (if any , specify in remarks)	Cat:3	33kV	417	1877.97
15	Others-5 (if any , specify in remarks)	Cat:4	33kV	69	58.99
16	Others-5 (if any , specify in remarks)	Cat:5	33kV	40	6.33
18	Others-5 (if any , specify in remarks)	Cat:2	132kV	48	49.01
19	Others-5 (if any , specify in remarks)	Cat:3	132kV	25	3534.15
20	Others-5 (if any , specify in remarks)	Cat:4	132kV	4	766.05
21	Others-5 (if any , specify in remarks)	Cat:5	132kV	6	69.44

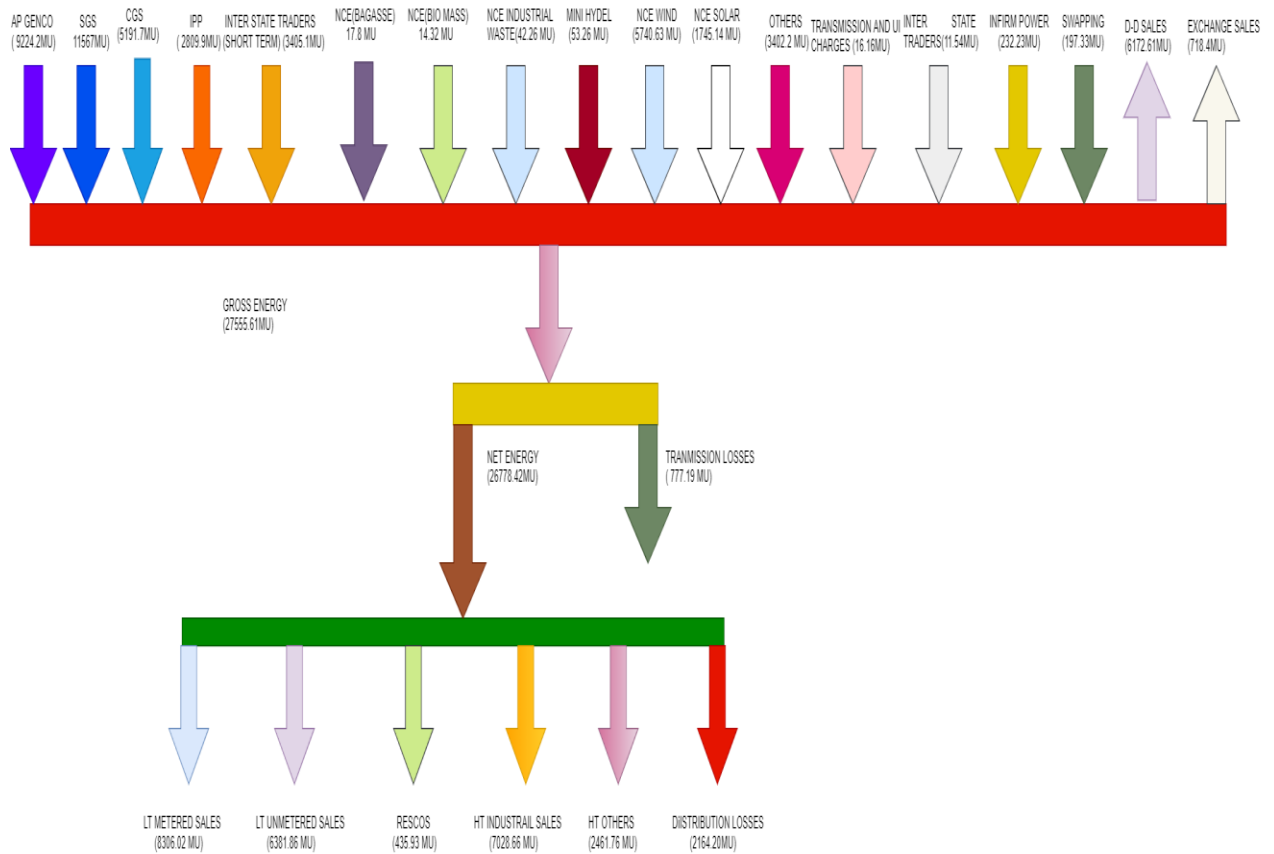
Period From April ' 22 to March ' 23					
S. No	Type of Consumers	Category of Consumers (EHT/HT/LT/Others)	Voltage Level (In Voltage)	No of Consumers	Total Consumption (In MU)
23	Others-5 (if any , specify in remarks)	Cat:2	220kV	10	1.32
24	Others-5 (if any , specify in remarks)	Cat:3	220kV	13	614.65
25	Others-5 (if any , specify in remarks)	Cat:4	220kV	12	148.18
26	Others-5 (if any , specify in remarks)	Cat:5	220kV	9	814.70
Total				7130061	24614.19



(Note: The above data is collected from Revenue Wing of Corporate Office.)

5.2 APSPDCL Block Diagram

The Block diagram indicating Energy flow from various sources and energy distribution to various category consumers is shown as under for reference.



5.3 The details of Input metering points in various Divisions

The details of Input metering points in various Divisions are verified from the previous data and import and export at sample locations are enclosed in Annexure 5

.The Energy Scenario of APSPDCL

The Energy Scenario of APSPDCL during the FY 2020-21,21-22 and 22-23 is tabulated as under.

Table 12: Energy and commercial losses

S. No	Description	Units	2020-21	2021-22	2022-23
1	Input Energy	MU	23379.67	25215.49	26778.42
2	Total Sales	MU	21460.20	23173.12	24614.23
3	Distribution Losses	MU	1919.47	2042.38	2164.20
4	Distribution Losses	%	8.21	8.10	8.08
5	Collection Efficiency	%	87.54	92.01	93.9
6	Billing Efficiency	%	91.8	91.9	91.9
7	AT&C Losses	%	37.48	15.45	13.69
8	Demand	INR Cr	11292.46	14058.78	16863.60
9	Collection	INR Cr	9885.61	12935.08	15834.16
10	% of metered Sales	%	83.22	82.55	82.2
11	No of Consumers	No	6664845	6796033	7130061
12	Profit after Tax	INR Cr	(4252.98)	(152.35)	Not yet Finalized

APSPDCL prepared demand collection division wise and category wise for all the quarters. and quarter wise. The consumption of HT Consumers in the energy accounting proforma and demand collection charts and verified and almost tallied. (Minor difference in the data is likely to occur because of manipulation of decimal digits upto zero/one/two etc decimals by various quarters. The data consists of quarterwise subsidy billed to the respective State Govt and Subsidy receive from the State Govt. APSPDCL also prepared voltage wise loss statement on monthly basis which provides all the details about gross energy input, losses, net energy input and sales on monthly basis. Copy of the details are enclosed in the Annexure 6.

Detailed study of previous energy accounting proformas indicates that the Collection Efficiency increased from 92.01% during 2021-22 to 93.90 during 2022-23. The AT&C losses reduced from 15.45% during 2021-22 to 13.69% during 2022-23. Other important particulars are enumerated as under.

- a) There is an increase in unmetered connection from 2021-22 to 2022-23.
- b) APSPDCL has prepared detailed analysis of Power Purchased from various sources, Fixed Cost and Variable cost of the particular source. The same data was verified from the audit report conducted by third party and the average cost of unit purchase works out to be INR 5.9 per Unit (Only Provisional).
- c) To reduce the Distribution losses and improve the quality of power APSPDCL has undertaken various measures a few of which are enumerated as under.
 - (i) APSPDCL identified a total of 10 No Towns and made an action plan to carry out various work to reduce energy losses which includes replacement of stuck up meters, replacement of Burn out meters, replacement of NIL Consumption meters.
 - (ii) APSPDCL replaced a total of 11439 conventional meters with IrDA port meters during 2022-23.
 - (iii) APSPDCL enhanced the capacity/erected new DTRs around 222 numbers during 2022-23.
 - (iv) APSPDCL carried out load balancing of 983 DTRs during 2022-23.
 - (v) Seling of 5447 meters was done and the same were reinstalled outside.
- d) Similar loss reduction works were undertaken in another 10 Mandal Head Quarters in various districts and the data is provided by APSPDCL.
- e) In order to have a comparison APSPDCL has provided the data for 2021-22 also for the above towns and Mandal Head Quarters.
- f) APSPDCL intimated their action plan to install communicable meters in DTRs and brief details are as under.
 - (i) It is planned to install 1,02,246 No communicable meters by March-2024 under RDSS. Tender finalized and agreement concluded. Work to be taken up and to be completed by March-2024 please.

- (ii) In addition APSPDCL is planning to install communicable meters to all agricultural services (around 11 lakh services) by the end of March-2024. Tenders finalized, agreement concluded and work to be taken .
- (iii) In order to reduce losses further APSPDCL is going to undertake the following works in nearby future.
- (iv) Over loaded feeder bi-furcation work, in which 32,798 Kms of 11KV line is proposed to erect. 14814kms of 6.3 KV line is going to be converted into 11KV line with 55 sq.mm conductor.
 - a. Around 200 nos sub-stations are going to be constructed
 - b. Around 35,000 nos additional dtrs to be erected to relief under over-load.
 - c. Erection of 2928 kms of AB cable under theft prone areas.
- (j) APSPDCL provided the data about various energy saving measures taken up by them to reduce energy consumption in their perview. The list of Measures undertaken under various schemes and the investment on these measures and energy savings achieved is eneclosed in Annexure 7.

The Billed Energy of the DISCOM is calculated Circle wise on a monthly basis using the Metered Energy and Unmetered Energy. The Billed Energy of the DISCOM measured in MU as per the following formula

5.5. Billed Energy (Total Energy) = Metered Energy (MU) + Un-Metered energy (MU)

Category wise sale for Assessment Year-2022-23 verified and matching to the total audited sale for Assessment Year-2022-23. The details are enclosed in Annexure 8.

Year wise T&D Losses

The Distribution losses for FY 2020-21,21-22 and 22-23 are shown below. tabulated below.

Table 13: Year wise T&D losses

S. No	Particulars	Unit	2020-21	2021-22	2022-23
1	% of Distribution Losses	%	8.21	8.10	8.08

From the above data it is evident that APSPDCL has initiated technical steps to reduce losses and legal steps to control the theft of electricity during 2022-23.

5.6. The Divisionwise losses for the FY 2021-22 AND 22-23 are shown as under.

- Various measures taken by all the circles of APSPDCL during the FY 2022-23 are enclosed in the Annexure 9.
- The ENCON measured taken resulted in reduction of Distribution losses by 0.02% from the previous year.
- APSPDCL is requested to concentrate more on theft cases in the circles where it exceeded 1000 in number.
- The year wise loss reduction statement with effect from 2020-21 to 2022-23 and technical measures initiated to reduce the loss are already elaborated in section 5.3.

5.7. Analysis of High Loss areas

The Losses in the following Divisions are more than 10% in 2021-22 and reduced to below 10% during 2022-23.

Table 14: Divisions with high % Losses

Sl No	Name of the Division	2021-22			2022-23		
		Input Energy in	Billed Energy in	% of	Input Energy	Billed Energy in	% of

		MU	MU	Losses	in MU	MU	Losses
1	Gooty	1178.172	1056.736	10.31	1359.17	1248.67	8.13
2	Kalyandurg	815.812	719.955	11.75	783.53	711.127	9.24
3	Pileru	491.031	440.08	10.38	455.5	417.528	8.34

Comments on high loss area

- a) It was observed that in few of the divisions there is increase in % of losses.
- b) In order to reduce the Losses meetings (On virtual basis) are regularly conducted between top officials of APSPDCL and Field Officers and staff. Sample Minutes of a meeting held with Kurnool and Adoni Circle is enclosed for reference in Annexure 10.

5.8. Agriculture Methodology

Computation of energy of Agriculture consumers is done as per below methodology, as given by the DISCOM.

APSPDCL is following the Indian Statistical Institute (ISI) methodology for assessing the free agricultural consumption. Per HP consumption is being arrived from the meters fixed on the LV side of the sampled Agriculture DTRs in different areas and the total agricultural consumption is extrapolated from the per HP consumption. A sample calculation for Kadapa Circle for the month of April 2022 is enclosed at Annexure 11 for reference.

The estimated agricultural consumption per KVA per DTR depends on the total connected load, type of crop raised, seasonal variation, geographical conditions and water table. Therefore, per KVA consumption of sample DTR varies from capacity to capacity and area to area.

APSPDCL has taken initiative as per the Government of Andhra Pradesh directives to provide meters to every unmetered agriculture consumer to implement DBT in the state.

5.9. Agriculture Billing

The schedule approved by the Commission for "Category V for FY 2022-23 : Agriculture & Related" is as given below.

Table 15: Agriculture & related Billing

Sl No	Consumer Category	Low	Tension	High
		Fixed/Demand Charges per Month in INR	Energy Charges in INR per Unit	Fixed/Demand Charges per Month per Kva in INR
I	Agriculture			
a	Corporate Farmers		3.5	
b	Non-Corporate Farmers			
c	Salt Farming Units up to 15 HP		2.5	
d	Sugar Cane Crushing		-	
e	Rural Horticultural Nurseries		-	
f	Flora culture in Green House	75/kW	4.5	
II	Aquaculture and Animal Husbandry	30/kW	3.85	30
III	Poultry & Aquaculture			
a	Poultry Hatcheries & Poultry Feed mixing plants	75/kW		
b)Aqua Hatcheries & Aqua Feed mixing plants	75/kW		
			5	4.75
IV	Agro Based Cottage Industries up to 10HP	20/kW	3.75	-
V	Government/Private Lift Irrigation Schemes			-

5.10. Energy Scenario of APSPDCL for the Last 3 Years

The Energy scenario of APSPDCL for the last 3 years (Including the AY) are shown as under.

Table 16: Consumer details - Year wise

Consumer Category	FY (2020-21)	FY (2021-22)	FY(2022-23)
Residential	4877201	4992917	5101162
Agricultural	1047066	1091412	1273000
Commercial/Industrial-LT	597038	566636	602713
Commercial/Industrial-HT	2403	3247	3429
Others	141137	141821	144807
Total	66664845	6796063	7130061

5.11. Billed Energy (MU)

The Billed Energy of each category of the consumer for the last 3 years is shown as under

Table 17: Billed energy details - Year wise

Consumer Category	FY(2020-21)	FY (2021-22)	FY(2022-23)
Residential	5011.64	5181.95	5228.36
Agricultural	7277.8	7166.64	6944.43
Commercial/Industrial-LT	1241.58	1441.37	1694.33
Commercial/Industrial-HT	4607.64	6010.45	7489.84
Others	3321.55	3372.70	3257.27
Total	21460.2	23173.12	24614.42

Figure 3: Billed energy of various category consumers

Please note that as per the accounting proforma the unmetered agricultural consumption is 6381.86 MU and metered agricultural energy consumption is 526.57 MU. The total works out to be 6944.43 MU and the same value is shown in the above table. The unmetered energy sales reduced from 6493.98 MU during 2021-22 to 6381.86 MU in 2022-23.

Table 18: Performance Summary tables for the Last 3 Years

Summary Table: Feeder wise Energy Input

Description	FY (2020-21)	FY (2021-22)	FY(2022-23)
At 66 kV level and above	12,520	14,111	13551.51
At 33 kV level	3000.7	3,554.7	3438.34
At 11/22 kV +LT level	17,216	17,784.8	18001.565

The total Power purchased from various sources, their fixed cost, variable cost for the FY 2022-23 is shown in Annexure 4.

5.12 DISCOM wise POC Loss statement issued by APSLDC for the FY 2022-23

DISCOM wise POC Loss statement issued by APSLDC for the Financial year 2022-23 all the DISCOMS in the State of Andhra Pradesh) is shown in the following table.

Table 19: APSLDC Discom wise POC loss data for FY 2022-23

Month	CGS actual drawl at APTRANSCO periphery in MU	APTRANSCO Ex-Bus CGS drawl with maps & kaps wh.benefit in MU	Diff	CPDCL	SPDCL
Apr-22	2541.17516	2627.40458	86.22942	20.12595	34.87118
May-22	1863.56957	1930.138981	66.56941	15.5373	26.92067
Jun-22	2254.2939	2333.419475	79.12557	18.46791	31.99838
Jul-22	1344.87441	1395.947888	51.07348	11.92055	20.65412
Aug-22	1616.3007	1676.503463	60.20277	14.05133	24.34600
Sep-22	1759.86799	1819.848063	59.98007	13.99935	24.25594
Oct-22	1936.83701	2007.043331	70.20632	16.38615	28.39144
Nov-22	2208.18928	2294.715075	86.5258	20.19512	34.99103
Dec-22	2112.63284	2199.587531	86.95469	20.29523	35.16448
Jan-23	2408.83045	2517.012219	108.1818	25.24962	43.74871
Feb-23	2404.80017	2504.302441	99.50227	23.22383	40.23872
Mar-23	2461.08924	2557.607889	96.51865	22.52745	39.03214
Total	24912.4607	25863.53094	951.0702	221.9798	384.6128

5.13. A Note on Data Gaps

After verification of the complete documents except for a minor variation there are no data gaps found in the total data submitted by APSPDCL. Since at the time of making the report all the relevant data is not finalised (All the data was provisional) there may be some minor changes in the report once the final annual report gets published.

LIST OF ANNEXURES

- Annexure 1 Copy of Work order/Letter of Intent
- Annexure 2 Copy of Minutes of Meeting
- Annexure 3 Signed Copy of Energy Accounting Proforma
- Annexure 4 Energy Exchange between AP Transco and APSPDCL
- Annexure 5 Details of Sample metering points in various divisions
- Annexure 6 Voltagewise Input, Sales and Loss (Monthwise) during 2022-23
- Annexure 7 Details of ENCON measures initiated by APSPDCL and savings thereof
- Annexure 8 Category wise Monthly Consumption in all Circles (LT&HT)
- Annexure 9 Measures Initiated to reduce Losses
- Annexure 10 Action taken to reduce Losses in High Loss areas
- Annexure 11 Sample Calculations for Agricultural Consumption in April 2022 for Kadapa Circle