BEE – MANDATORY ENERGY AUDIT REPORT OF JAWAHARLAL NEHRU PORT AUTHORITY -SPECIAL ECONOMIC ZONE, URAN, Navi Mumbai

Jawaharlal Nehru Port Authority-Special Economic Zone (JNPA-SEZ)

(Sector: Electricity Distribution Companies)

Address: JNPA-SEZ - Administrative Building, Sheva, Uran, Navi Mumbai pin-400707

Prepared By

EmAEA: ARS ENERGY AUDITORS

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Acknowledgement

A.R.S. Energy Auditors, Mumbai would like to express their sincere thanks **to Jawaharlal Nehru Port Authority- Special Economic Zone (JNPA-SEZ), Uran, Navi Mumbai** or giving the opportunity to carry out Mandatory Energy Audit of Distribution Network at **JNPA-SEZ, Uran, Navi Mumbai.**

A.R.S. Energy Auditors acknowledges with thanks the co-operation and the support extended by the **JNPA-SEZ, Uran, Navi Mumbai DISCOM Team** during the conduct of this report. The interactions and deliberations with the plant personnel were exemplary and the whole exercise was thoroughly a rewarding experience for **A.R.S. Energy Auditors**. We would also like to place on record our sincere thanks and appreciation for all plant executives.

The contribution of **JNPA-SEZ, Uran, Navi Mumbai DISCOM Team** is equally important in this venture. We sincerely acknowledge the contribution of the following engineering team personnel because of whom the study could progress smoothly.

Our Special Thanks to:

- *Mr. B.D. Sinkar .* : *Manager Utility Services, JNPA-SEZ*
- *Mr. Jitendra Nikhare.* : *Deputy Manager, JNPA-SEZ*
- *Mr. Suhas Ambade.* : *Consultant*
- *Mr. Narendra Kumar.* : *Site Incharge, O & M-VEPL.*
- *Mr. Abdullah* : *Sr. Electrical Engineer, O & M-VEPL*

For giving us necessary inputs to carry out this very vital exercise of **BEE Mandatory Energy Audit Assessment.**

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

For A.R.S. Energy Auditors,

Mr. Sachin S. Deshpande. (BEE - Empanelled Accredited Energy Auditor, AEA-0261)
A.R.S. Energy Auditors, Mumbai. (Ph. No: +917507184478.)
E-Mail ID : sachin.ameya@gmail.com , sachin@arsenergyauditors.com

Energy Audit Team Members

Name	Designation	Qualification	Experience In Years
Mr. Sachin Deshpande.	*Chief Consultant*	*BEE-Accredited Energy Auditor (AEA-0261), M.Tech. Energy, B.E. Mechanical Engineering A.M.I.E. In Electrical Engineering Chartered Engineer, ISO 50001 : Lead Auditor(BSI)*	*30*
Mr.Bhaskar Raval	*Sector expert for Discom*	*B.E. Electrical Engineering P.G Diploma in Energy Management and Energy Auditor. Retired Chief Electrical Inspector Govt of Gujarat*	*46*
Mr. Jitendra Vyas	*Certified Energy Manager*	*B.E. Electrical Engineering*	*29*
Mr Narayan Amzare	*Certified Energy Auditor*	*BE in Electronic and power Retired Superintending Engineer MSEDCL, Nagpur*	*33*
Mr. Janardhan Kadhe	*Sr. Consultant*	*Diploma in Electrical Engineering*	*36*
Mr. Anant Kulkarni	*Senior Energy Engineer.*	*BS in Power Engineering.*	*31*
Mr. Pavan Sharma	*Senior Energy Engineer*	*B.E in Electrical Engineering*	*5*
Mr. Ruthik Admane	*Junior Energy Engineer*	*B.E. Electronics and Telecommunication Engineering*	*3*
Mr. Aditya Patane	*Junior Energy Engineer*	*B.E Mechanical Engineering*	*2*
Mr. Shubham Gaikwad	*Junior Energy Engineer*	*B.E Mechanical Engineering*	*2*

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Declaration

We hereby declare that;

- *The data collection has been carried out diligently and truthfully;*
- *All data measuring devices used by the auditor are in good working condition, have been calibrated and have valid certificate from the authorized approved agencies and no tampering of such devices has occurred;*
- *All reasonable professional skill, care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts;*
- *The energy audit has been carried out in accordance with the Bureau of Energy Efficiency Regulation (manner and intervals of time for the conduct of energy audit).*
- *This report is prepared by* ***A.R.S. Energy Auditors, Mumbai*** *for* ***Jawaharlal Nehru Port Authority- Special Economic Zone, Uran***
- *The contents of this report reflect our best judgment in light of the information made available to us at the time of site audit.*
-
- *based on it, are the responsibilities of such third parties.*
- ***A.R.S. Energy Auditors, Mumbai*** *accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.*

Authorized Signature& Seal,

Mr. Sachin S. Deshpande. (BEE - Empanelled Accredited Energy Auditor, AEA-0261)
A.R.S. Energy Auditors, Mumbai. (Ph. No: +917507184478.)
E-Mail ID : sachin.ameya@gmail.com , sachin@arsenergyauditors.com

Abbreviations

ABBREVIATIONS	
Amp	Ampere
Avg	*Average*
BEE	*Bureau of Energy Efficiency*
EE	*Energy Efficiency*
FG	*Flue Gas*
hr	*Hour*
HT	*High Tension*
kV	*kilo Volt*
kVA	*kilo Volt Ampere*
kVAr	*kilo Volt Ampere Reactive*
kW	*kilo Watts*
kWh	*kilo Watt Hour*
kVAh	*Kilo volt amp hours*
Kg	*Kilogram*
LT	*Low Tension*
M	*Meter*
MD	*Maximum Demand*
MU	*Millions of Units*
MWh	*Mega Watt Hour*
NA	*Not Applicable*
No. s	*Numbers*
PF	*Power Factor*
P-P	*Phase to Phase*
Ph-N	*Phase to Neutral*
SLD	*Single Line Diagram*
Temp.	*Temperature*
V	*Volt*
Y.	*Year*

1. Executive Summary

A] DISCOM Energy Scenario Summary (FY 2022-23)

Sr. No.	Details	Unit	FY (2022-23)
A	Net Input Energy Purchase From the Grid	MU	4.98
B	Net Imported Energy From the Grid	MU	4.78
C	Net Exported Energy To the Grid	MU	0
D	Net Input Energy (Received at DISCOM Periphery), D=(B-C)	MU	4.78
E	Total Transmission Losses (outside the DISCOM periphery), E=(A-D)	MU	0.20
F	% Transmission Losses (outside the DISCOM periphery), F=(E/D)*100	%	4.18%
G	Total Metered Energy Billed	MU	4.16
H	Total Un-Metered Energy Billed	MU	0.00
I	Total Energy Billed, I=(G+H)	MU	4.16
J	Total Transmission & Distribution Losses (T&D Losses within DISCOM Periphery), J=(D-I)	MU	0.62
K	% Transmission & Distribution Losses (T&D Losses within DISCOM Periphery), K=(J/D)*100	%	12.96%
L	Billing Efficiency = Total Energy Billed/Net Input Energy (Received at DISCOM Periphery), L=(I/D)*100	%	87.04%
M	Total Amount Billed	Lakh Rs.	406.03
N	Gross Amount Collected	Lakh Rs.	424.13
O	Arrears Collected	Lakh Rs.	3.44
P	Total Amount Collected without Arrears = Gross Amount Collected - Arrears Collected , P = (N-O)	Lakh Rs.	420.69
V	Collection Efficiency = Total Amount Collected without Arrears,/Total Amount Billed, V=(P/M)*100	%	103.61%
W	Aggregate Technical & Commercial Losses = (1-(Billing Efficiency * Collection Efficiency))*100 = (1-(U*V))*100	%	9.81%

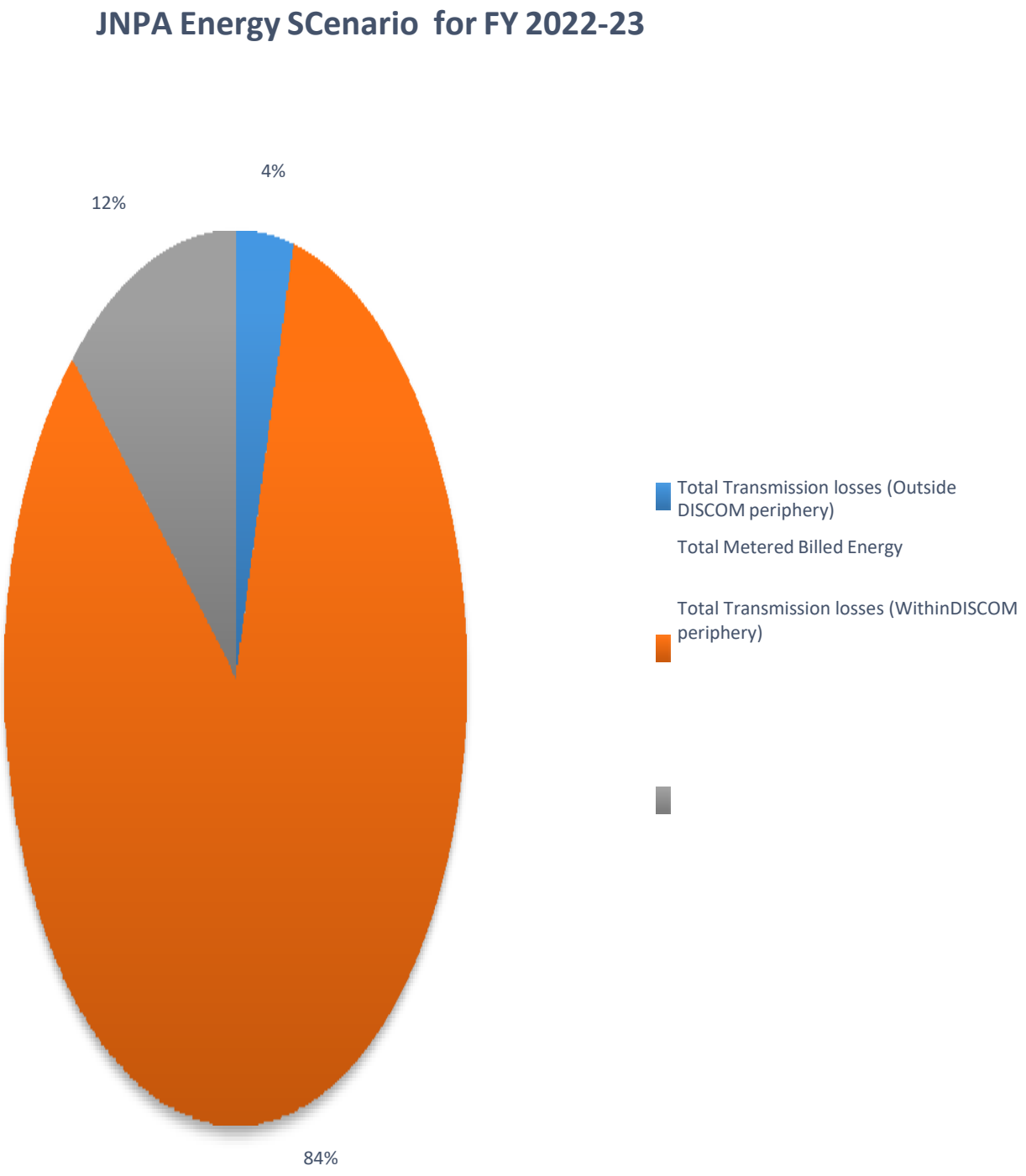


Figure 1 JNPA DISCOM: Energy Consumption Scenario for FY (2022-23

- Out of the net input energy purchased by the DISCOM 84% Energy is billed.
- About 12% of the energy accounts to the transmission losses inside the DISCOM periphery and 4% energy accounts to the transmission losses outside the DISCOM periphery.

B] Critical Observation

1. **Ample scope for load optimization**: There is potential for load optimization within the system. By analyzing the load patterns and demand, adjustments can be made to optimize the distribution of electrical power, ensuring that the load is efficiently distributed and utilized.

2. **To check power leakage detection:** It is important to conduct regular checks to identify any power leakage points within the distribution system. Power leakage can lead to energy wastage and increased losses. Identifying and addressing these leakage points will help in reducing losses and improving overall system efficiency.

3. **To check if utilization of solar power for local loads:** Assess the feasibility of utilizing solar power generated from solar plants within the JNPA SEZ for local loads. By integrating solar power into the distribution system and directing it to local loads, the dependency on conventional power sources can be reduced, leading to energy conservation and cost savings.

4. **Power factor improvement:** Implement measures to improve the power factor within the system. Low power factor can result in increased distribution losses and inefficient utilization of electrical power. Implementing power factor correction techniques and encouraging consumers to maintain a power factor of unity will optimize energy consumption and reduce losses.

5. **To check system reliability and availability:** Regularly monitor and assess the reliability and availability of power within the system. Evaluate factors such as uptime, grid stability, and backup power systems to ensure a reliable and consistent power supply to consumers.

6. **To check feeder losses analysis**: Conduct thorough analysis of feeder losses within the distribution system. Identify feeders with high losses and implement measures to minimize losses, such as system upgrades, load balancing, and infrastructure improvements. This will help in reducing energy wastage and improving the overall efficiency of the distribution network.

Form 1 (Energy Consumption Data as per BEE PAT Regulations)

Form 1				
Details of information regarding Total Energy Consumed and Specific Energy Consumption Per unit of Production				
Section-A (General Information Details)				
Sr No.	General Details	Description		
1	Name of the Unit	Jawaharlal Nehru Port Authority SEZ		
2	(i) Year of Establishment	2014 (Notification of SEZ)		
	(ii) Registration No (As provided by BEE) if applicable	0		
3	Sector and Sub-Sector in which the Designated Consumer falls	Sector	Sub-Sector	
		Electricity Distribution Companies	-	
4. (i)	Complete address of DCs Unit location **(including Chief Executive's name & designation)** with mobile, telephone, fax nos. & e-mail.	Mr. Niteen Borwankar, CEO, Savarkahar, Karal, Sonari and Jaskhar, Raigad, 9819494014, 022 67814181, cme@jnport.gov.in		
(ii)	Registered Office address with telephone, fax nos. & e-mail	Mr. Sanjay Sethi, IAS, Chairman, Administrative Building, Sheva, Uran, Navi Mumbai 400707, Navi Mumbai, Raigad, Maharshtra, 022 67814100		
(iii)	Energy Manager's Name, designation, Registration No., Address, Mobile, Telephone, Fax nos. & e-mail	Mr. Umesh Phatakare, Energy Manger, EM, EA-31077, 8424841657, umesh.phatakare@encosym.com		
Section - B (Production and Energy Consumption Details)				
	Name of Products	Unit	2021-22	2022-23
		(1)	(2)	(3)
5.4	Electricity Distribution Companies notified as Designated Consumer			
(a)	Energy Input Details			
(i)	Input energy purchase	Million kwh	1.49	4.96
(ii)	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	Million kwh	1.44	4.78
(iii)	Total Energy billed (is the Net energy billed, adjusted for energy traded))	Million kwh	0.91	4.16
(b)	Transmission and Distribution (T&D) loss Details	Million kwh	0.53	0.62
		%	37%	13%

I/we undertake that the information supplied in the Form 1 and pro- forma is accurate to the best of my knowledge and the data furnished in Form 1 has been adhered to the data given in the concerned pro forma.

For ENCOSYM Solutions Pvt. Ltd.

Authorised Signatory and Seal

Signature:-
Name of Energy Manager: Mr. Umesh Babu Phatakare
Registration Number: EA-31077

Energy Manager

Name of Authorised Signatory: ANIL T. CHOPADE
Name of the Designated Consumer:
Full Address:- Administrative Bldg.

Deputy General Manager (M & E.E.)
J.N.P.A., Sheva, Navi Mumbai 400707

Seal

Form 2 (Cost Effective Energy Saving Scheme)

FORM 2

Details of energy Saving measures recommended in the energy audit report (2022-2023)

[Refer Regulation 5(2)

Sr.No.	Energy Saving Measures (Suggested categories of areas of improvement and modification for obtaining details of savings)	Investment (Rs Crore)	Date of Completion of measure / likely to completion	Life Cycle Years	Annual Energy Savings				
					Oil	Gas	Coal	Electricity (Lakh KWH/Year)	Other
1	To provide provision of SCADA based communication all outgoing and incoming energy meter substation wise for proper energy accounting with 100% accuracy	-	Within 2 years	-	-	-	-	-	-
2	To provide provision of SCADA based communication to all consumer end energy meter for proper energy accounting with 100% accuracy	-	Within 2 years	-	-	-	-	-	-
3	Conduct demand side management program for energy efficient BLDC fan ,LED, star rating AC , energy efficient HVAC system and energy efficient pumps to consumer end for reducing peak load demand period	-	-	-	-	-	-	-	-

Energy Manager Signature
Name of the Energy Manager: Mr. Umesh Phatakare
BEE Registration No: EA -31077
Name of the company: JNPA-SEZ, Navi Mumbai

For ENCOSYM Solutions Pvt. Ltd.
Energy Manager

BEE Accredited Energy Auditor Signature
Name of the Accredited Energy Auditor: Mr. Sachin S Deshpande
Accreditation Details AEA-0261
Name of the Company: A.R.S Energy Auditors, Mumbai

Form 3 (Saving in Energy Achieved and Progress Made in the Implementation of Recommendations)

Form – 3
[See rule – 3 (2)]
Details of JNPA-SEZ Energy Efficiency improvement measures implemented, investment made and savings in energy achieved and progress made in the implementation of other recommendation.

A. Implemented :

Sl. No.	Description of energy efficiency improvement measure	Category3	Investment (Rupees)	Verified savings4 (Rupees)	Verified energy savings	Units5	Fuel	Remarks
1	All the Street Lights installed under the premises of SEZ are smart LED Lights in place of Halogen Lights for less power consumption	Street Light	-	-	-	-	-	Smart LED Lights implemented since in the projected commissioning stage
2	The Load in Licensee area is negligible as compare to the installed capacity. To optimise the equipment and reduce the distribution loss the transformers are kept in OFF Condition alternately so as minimum capacity transformers are in service. This is carried out at 220kV, 33kV, 11kV at all levels. To reduce the distribution loss possible.	Power & Distribution Transformer	-	-	-	-	-	a) To Optimize the Losses b) To maintain the healthiness of the Transformers

B. Under Implementation:

Sl. No.	Description of energy efficiency improvement measure	Category	Investment (Rupees) estimated	Verified savings (Rupees)	Verified energy savings	Units	Fuel	Status of Implementation
1	Installation of 300KWP Solar Panel is under progress to entire SEZ to Save the Power	Solar Grid	-	-	-	-	-	Under Project Commissioning Stage

For ENCOSYM Solutions Pvt. Ltd.

Signature
Name of the energy manager : Mr Umesh Phatakare (EA-31077)
Name of the company : ENCOSYM Solutions Pvt. Ltd.
Full address : 603, Oriana Business Park, Wagle Industrial Estate, Road no. 22, Thane 400604
Contact person Email address : umesh.phatakare@encosym.com
Telephone/ Fax numbers Plant address : Tele-022 67814100, 220/33kV Sub Station, JNPA-SEZ , Sector 2 Near IOCL, Nava sheva , Uran, Navi Mumbai, Raigad- 400707

Energy Manager

Signature
Name of the accredited energy auditor : Mr. Sachin S. Deshpande
Accreditation details : AEA-0261
Seal

SACHIN S. DESHPANDE (AEA0261) B.E.E. GOV. OF INDIA ACCREDITED ENERGY AUDITORS

Mandatory Energy Audit Report Completion Certificate

M/s **Jawaharlal Nehru Port Authority-Special Economic Zone (JNPA-SEZ), Uran** *has commissioned the* ***A.R.S. Energy Auditors*** *to carry out the* ***Mandatory Energy Audit*** *of its* ***Electrical Distribution Networks****. In the course of the Mandatory Energy Audit,* ***A.R.S.*** *performed the systematic analysis of energy use and energy consumption within a defined energy audit scope, in order to identify, quantify and report on the opportunities for improved energy performance.*

The Energy Audit is based on the on-site measurement carried out by ***A.R.S. Energy Auditors Team on 05/07/2023*** *previous study report, energy calculation spread sheet and supporting documents, data, records made available to the* ***A.R.S. by JNPA-SEZ Uran, Navi Mumbai DISCOM.*** *As the result of the detailed energy audit, the energy team confirms that*

- *Identified energy saving schemes is calculated based on conservative and appropriate manner;*
- *The data collection has been carried out diligently and truthfully;*
- *All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorized and no tempering of such devices has occurred;*
- *All responsible professional skill, care and diligence had been taken in preparing the energy audit report and the contents therefore a true representation of the facts;*
- *Adequate training provided to personnel involved in daily operations during energy audit; and*
- *The energy audit has been carried out in accordance with the Bureau of Energy Efficiency (Manner and Intervals of Time for the Conduct of Energy Audit) Regulations, 2010.*

Authorized Signature& Seal,

Mr. Sachin S. Deshpande. (BEE - Empanelled Accredited Energy Auditor, AEA-0261)
A.R.S. Energy Auditors, Mumbai. (Ph. No: +917507184478.)
E-Mail ID : sachin.ameya@gmail.com , sachin@arsenergyauditors.com

Place: Mumbai.

2. Background

2.1 Extent Regulations and role of BEE

Bureau of Energy Efficiency (BEE) through Ministry of Power, Government of India issued regulations for conduct of Manual Annual Energy Audit and Periodic Accounting in DISCOMs. As per regulation, BEE notification no 18/1/BEE/DISCOM/2021 dated October 7, 2021, all Electricity Distribution Companies are mandated to conduct annual energy audit and periodic energy accounting on quarterly basis.

Owing to the impact of energy auditing on the entire distribution and retail supply business and absence of an existing framework with dedicated focus on the same, it was imperative to develop a set of comprehensive guidelines that all Distribution utilities across India can follow and adhere to. Accordingly, Regulations on Manner and Intervals for conduct of Energy Audit and Accounting in Electricity Distribution Companies has been framed.

2.2 Purpose of Audit and accounting Report

Energy Accounting means accounting of all energy inflows at various voltage levels in the distribution periphery of the network, including renewable energy generation and open access consumers and energy consumption by the end consumers. Energy accounting and a consequent annual energy audit would help to identify areas of high loss and pilferage, and thereafter focus efforts to take corrective action.

2.3 Period of Energy Auditing and Accounting

These Regulations for Energy audit in Electricity Distribution companies provides broad framework for conduct of annual energy audit though and quarterly periodic energy accounting with necessary pre-requisites and reporting requirements to be met.

The period of energy accounting in this report is considered to be FY 2022-23 i.e. from 1st April 2022 to 31st March 2023.

At JNPA the field visit for the purpose of annual energy audit has been conducted on 05/07/2023 .

3. Introduction : JNPA-SEZ, Navi Mumbai

3.1 Background

M/s Jawaharlal Nehru Port Authority – Special Economic Zone (SEZ), the proposed special economic zone at Jawaharlal Nehru Port is the first-of-its-kind at a major port complex in the country and being developed on 277.38 hectares of land along the Panvel – Uran road connecting the cargo terminals to state highways.

The site is around 15 km from Navi Mumbai and around 40 km from Mumbai city. There are three villages and one township within the catchment area, the JNPA Township, Belpada village near the approach road from Panvel, the Jashkar Village and Karal, Sonari, Savarkhar village near the area where the NH 4B and SH 54 meet.

JNPA SEZ procures power through competitive bidding process as per standard guidelines of MoP, GoI on DEEP portal. Presently the power is procured on short term open access from Birla Carbon India Pvt Ltd (Generator), through Manikaran Power limited (Trader) at 220 kV, which is further step down to 33 kV by 2 X 50 MVA Power Transformers.

Details of Transaction Party's to Grid		
	Injecting Entity	**Drawee Entity**
Name of Entity	BIRLA CARBON INDIA PVT LTD	Jawaharlal Nehru Port Trust SEZ
Status of Entity	CPP	
Utility in which it is embedded	MSETCL	MSETCL

Details of Injecting/Drawee Connectivity with Intra-State Transmission System/Distribution			
		Injecting Entity	**Drawee Entity**
Name of Sub Station	Transmission	100 kV Patalganga Substation	220 kV JNPT SEZ Substation
	Distribution		
	Transmission	100/110 kV	220kV

Voltage Level	Distribution		
Name of the Licensee (Owner of S/S)		MSETCL	JNPT-SEZ

Table 1 General Information about DISCOM

Sr. No.	Particulars	Required Details
1	Name of Substation	220/33KV JNPA-SEZ
2	Total Nos. of feeders	11
3	Total Nos. of Distribution Transformers	5
4	Total Nos. of Consumers	18
5	Total length of HT & LT lines	HT Lines: 44 km & LT Lines: 50 km
6	Total Power Transformer installed in the Substation	10
7	Total Nos. of CT & PT units installed in the selected substation	177 & 177
8	Total Nos. of 33 KV and 11 KV feeders meters installed in the substation	25 & 37

- JNPA-SEZ has 33 kV HT Lines of 8.4 km, 11 kV HT lines of 44 km, and LT Lines of 50 km.

JNPA-SEZ DISCOM has only one region and one Circle the details of the same are as given below:

Particulars	Region-1
Region (No.)	NA
Circle (No.)	NA
Division (No.)	NA
Distr. Centre/Zone (No.)	NA
33KV Line (Km)	8.4
11KV Line (Km)	44
33/11 KV Sub Station (No.)	2
11/0.4KV Distr. Transformer	5
LT- No. of Consumers	12
HT- No. of Consumers	6

Table 2 Consumer Details

Sr No.	Meter ID	Consumer No.	NAME OF CONSUMER
1	X2045838	00001	STN TRAFO-500KVA SS
2	X1740547	00008	SARVESHVAR LOGISTICS
3	X1750417	00006	SIMOSIS INTERNATIONAL
4	X1759499	00007	KRISH FOOD INDUSTRY
5	X1833837	00011	R K SWEET MARS
6	X1833838	00013	RUDRA FLEXIPACK LLP
7	XG435467	00003	STN TRAFO-E1 & E2 SS (200KVA)
8	XG435470	00002	ADMIN BUILDING
9	XG495445	00004	STREET LIGHT E1 & E2 SS (200KVA)
10	XG495447	00010	E-3 SS (Street Light)
11	X1920935	00014	STP
12	X1967024	00015	Nava Sheva Business Park
13	X1968511	00016	OIL FIELD (E-07)
14	X1968512	00017	OWS (E-08)
15	15711975	00018	JNPA Fire Station
16	SS21500823	00019	Sadanand Engineering Works
17	SS21519461	00020	State Bank of India
18	SS21454870	00021	R.K.Flexo printers Packers LLP

3.2 General Information of Company (As per Form-Sj)

General Information				
1	**Name of the DISCOM**	Jawaharlal Nehru Port Trust SEZ		
2	**i) Year of Establishment**	2014 (Notification of SEZ)		
	ii) Government/Public/Private	Government		
3	**DISCOM's Contact details & Address**			
i	City/Town/Village	Savarkahar, Karal, Sonari and Jaskhar		
ii	District	Raigad		
iii	State	Maharashtra	Pin	400707
iv	Telephone	022 67814196	Fax	
4	**Registered Office**			
i	Company's Chief Executive Name	Mr Sanjay Sethi, IAS		
ii	Designation	Chairman		
iii	Address	Administrative Building, Sheva, Uran, Navi Mumbai 400707		
iv	City/Town/Village	Navi Mumbai	P.O.	
v	District	Raigad		
vi	State	Maharashtra	Pin	400707
vii	Telephone	022 67814100	Fax	
5	**Nodal Officer Details***			
i	Nodal Officer Name (Designated at DISCOM's)	Mr. Anil T Chopade		
ii	Designation	Dy. General Manager		
iii	Address	Administrative Building, Sheva, Uran, Navi Mumbai 400707		
iv	City/Town/Village	Navi Mumbai	P.O.	
v	District	Raigad		
vi	State	Maharashtra	Pin	400707
vii	Telephone	022 67814196	Fax	

3.3 Energy Manager of Company

Sr. No.	Particulars	Details		
5	**Energy Manager Details**			
i	Name	Mr. Umesh Phatakare		
ii	Designation	Energy Manager	Whether EA or EM	EM
iii	EA/EM Registration No.	EA-31077		
iv	Telephone		Fax	
v	Mobile	8424841657	E-mail ID	Umesh.phatakare@encosym.com

4. Energy Flow Analysis

4.1 Energy Flow across Service levels

The following table gives the details about the outgoing feeders of JNPA-SEZ DISCOM

Table 3 Outgoing feeders of DISCOM

Sr. No.	Voltage Level	Feeder ID	Feeder Name	FY (2022-2023)			Remarks
				Meter S. No	Import (MU)	Export (MU)	(Source of data) Metered/ Unmetered
1	33KV	NA	33KV Stn Tr 1	X2045838	0.172	0	Metered
2	11KV	NA	11KV RMU 1 to 13	JBJ1626434	0.047	0	Metered
3	11KV	NA	11Kv RMU 13 to 1	JBJ1626914	2.319	0	Metered
4	11KV	NA	11Kv RMU 14 to 19	JBJ1626515	0.001	0	Metered
5	11KV	NA	11Kv RMU 19 to 14	JBJ1626906	0.035	0	Metered
6	11KV	NA	11Kv Station TR1	JBJ1626559	0.092	0	Metered
7	11KV	NA	11Kv RMU 20 to 27	JBJ1625507	0.082	0	Metered
8	11KV	NA	11Kv RMU 27 to 20	JBJ1626520	0.026	0	Metered
9	11KV	NA	11Kv RMU 28 to 32	JBJ1626904	0.871	0	Metered
10	11KV	NA	11Kv RMU 32 to 28	JBJ1626522	0.000	0	Metered
11	11KV	NA	11Kv St Lgt TR2	JBJ1628316	0.051	0	Metered
	Total (MU)				**3.70**	**0**	
	Net energy of outgoing feeders (MU)				**3.70**		

- No Energy is exported by JNPA-SEZ DISCOM.
- The Net Input energy for the DISCOM is 4.78 MU, whereas the summation of outgoing feeders is 3.7 MU.
- Due to lower load with 'CT' limitation, the lower load reading has not been recorded in the multifunction meter.

JNPA DISCOM does not export any units to the Grid, does not sell any energy outside DISCOM periphery, and does not do Open Access sale.

4.2 Validation of Metered Data

The following table give detailed information about the metered and Un-Metered Connections of all the consumer categories of the JNPA-SEZ DISCOM.

Table 4 Details of Metered/Un-Metered Connections Consumer-wise

Sr. No.	Name of Circle (Circle Code)	Consumer category	No of connection Metered (No's)	No of connection Un-Metered (No's)	Total Number of Connections (No's)	% of Number of Connections (%)
1	***JNPA-SEZ***	Residential	0	0	**0**	**0%**
		Agricultural	0	0	**0**	**0%**
		Commercial/Industrial-LT	10	0	**10**	**56%**
		Commercial/Industrial-HT	6	0	**6**	**33%**
		Others	2	0	**2**	**11%**
		Total	**18**	**0**	**18**	**100%**

- JNPA-SEZ DISCOM has a total of 18 metered connections out of which there are 10 connections of Commercial/Industrial-LT consumers, 6 connections of Commercial/Industrial-HT consumers and 2 connections of others.
- As observed from the above table there is no Un-Metered Connection in any consumer category.
- 100% metering is provided in the JNPA-SEZ DISCOM.

The Metered/Un-Metered connections distribution of the DISCOM consumer-wise is as depicted in the pie chart given below:

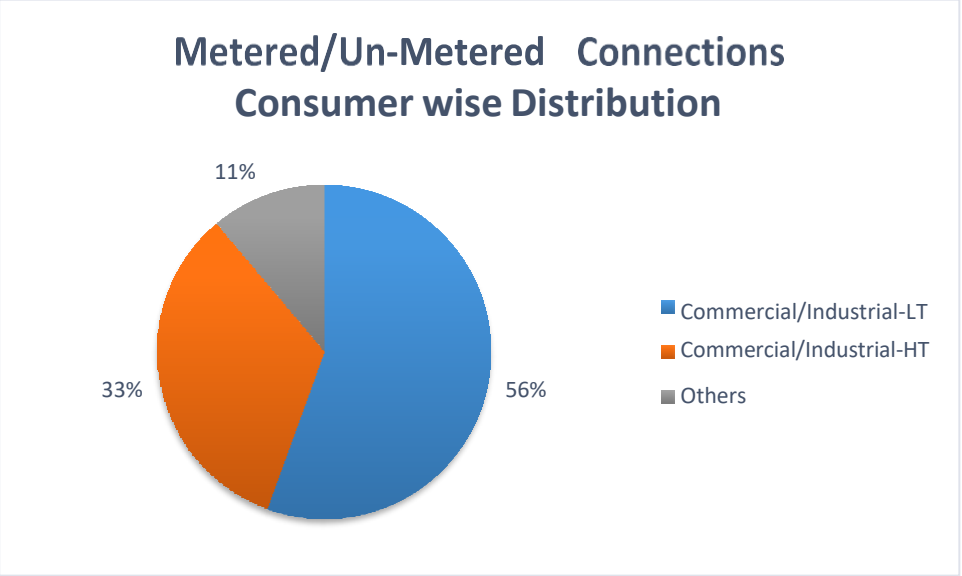


Figure 2 Metered/Un-Metered Connections Consumer-wise Distribution

- Out of the total metered connections, 56% of the connections belong to the Commercial/Industrial-LT consumers.
- 33% of the metered connections are of Commercial/industrial-HT connections and remaining 11% belong to others.

4.3 Validation of Energy Flow data and losses

The following table gives detailed information about the connected load of all the consumer categories of the JNPA-SEZ DISCOM.

Table 5 Details of Connected load consumer-wise

Sr. No.	Name of Circle (Circle Code)	Consumer category	Connected Load Metered (MW)	Connected Load Un-Metered (MW)	Total Connected Load (MW)	%Shares (%)
1	***JNPA-SEZ***	Residential	0.00	0.00	0.00	0.00%
		Agricultural	0.00	0.00	0.00	0.00%
		Commercial/Industrial-LT	519.2	0.00	519.20	19.93%
		Commercial/Industrial-HT	2005.39	0.00	2,005.39	76.99%
		Others	80	0.00	80.00	3.07%
		Sub-total	**2,604.59**	**0**	**2,604.59**	**100.00%**

- JNPA-SEZ DISCOM has a total of 2,604.59 MW of metered connected load.
- The connected load of Commercial/Industrial-HT consumer category is 2,005.39 MW which is the highest share among the remaining consumer categories followed by the Commercial/Industrial-LT category which has a connected load of 519.2 MW.
- The lowest share of the connected load is in the others Consumer category with a connected load of 80 MW.
- A typical bar chart depicting the Metered Connected load consumer-wise is as shown below:

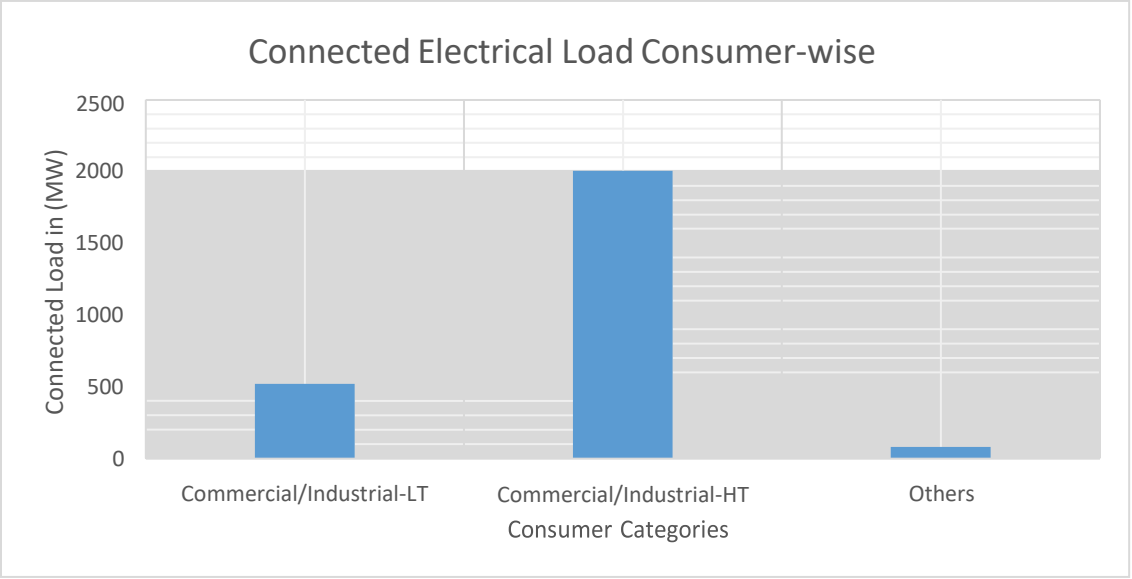


Figure 3 Connected Electrical Load consumer-wise

The Connected load distribution of the DISCOM consumer-wise is as depicted in the pie chart given below:

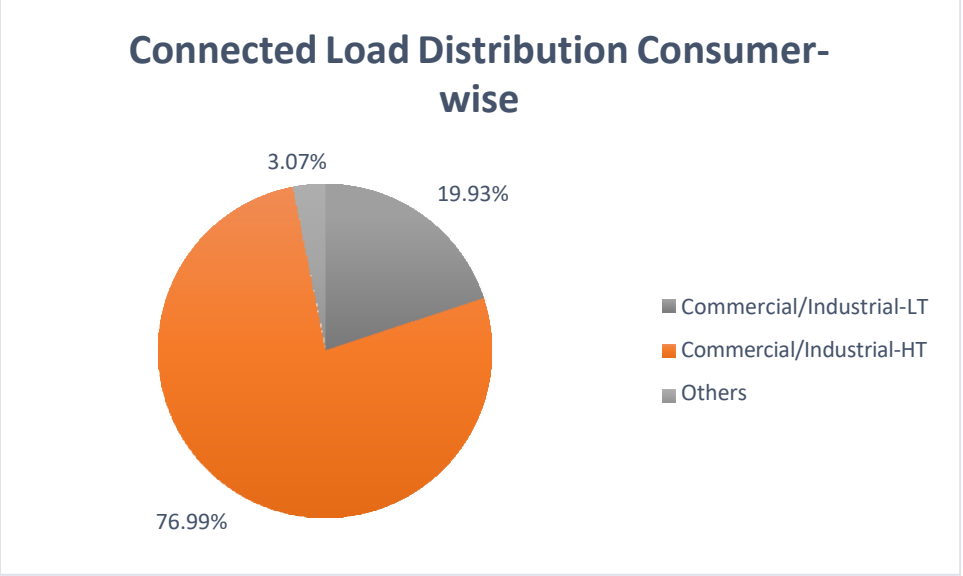


Figure 3 Connected Load Distribution Consumer-wise

- As seen from the above pie-chart the 76.99% of the connected load falls under Commercial/industrial – HT Category followed by 19.93% of the Commercial/Industrial – LT category.

5. DISCOM Losses Computation

5.1 Energy Accounts analysis

The following table gives detailed information about the Energy Metered in the JNPA-SEZ DISCOM.

Table 6 Details of Metered Energy

Sr. No.	Name of Circle (Circle Code)	Consumer category	Metered Billed Energy (MU)	Unmetered Billed Energy (MU)	Total Billed Energy (MU)	% of energy consumption (%)
1	***JNPA-SEZ***	Residential	0.00	0.00	0.00	0.00%
		Agricultural	0.00	0.00	0.00	0.00%
		Commercial/ Industrial-LT	0.422	0.00	0.42	10.14%
		Commercial/ Industrial-HT	3.690	0.00	3.69	88.68%
		Others	0.049	0.00	0.05	1.18%
		Sub-total	**4.16**	**0**	**4.16**	**100.00%**

- All the energy of JNPA DISCOM is metered. No Un-Metered Energy is sold inside and outside the DISCOM Periphery.
- The Commercial/Industrial-HT consumer category has the highest share of energy consumption with 3.69 MU consumed followed by Commercial/Industrial-LT consumer category with 0.422 MU consumed. The energy consumption of the Others is 0.049 MU.

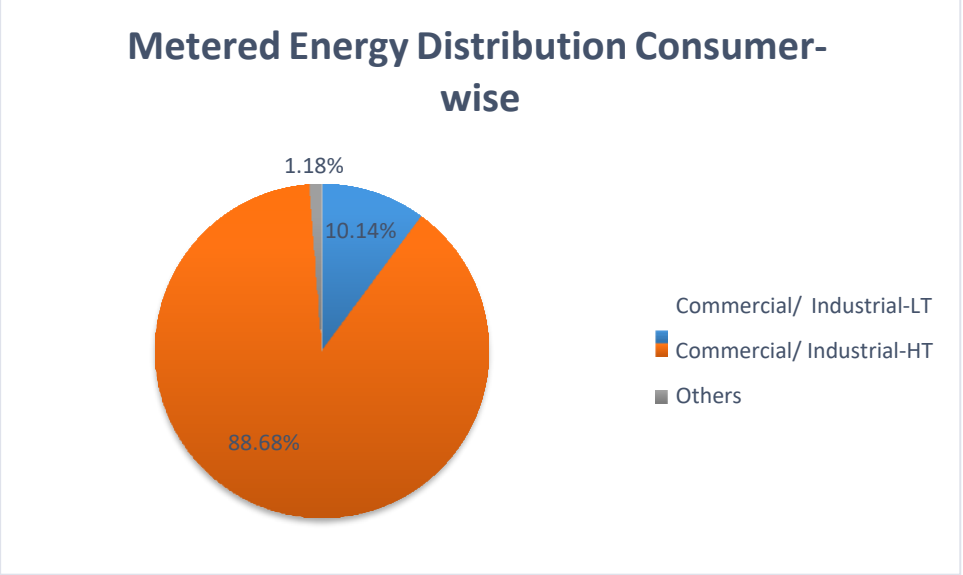


Figure 4 Metered Energy Distribution Consumer-wise

- 88.68% of the total energy consumption is consumed by Commercial/Industrial-HT consumers.
- The Commercial/Industrial-LT consumers consume 10.14% of the total energy.

5.2 Input Energy, AT&C losses

The following table gives detailed information about the Aggregate Technical & Commercial Losses in the JNPA-SEZ DISCOM for the FY 2022-23.

Table 7 JNPA-SEZ AT&C Losses for FY 2022-23

Sr. No.	Name of Circle	Circle Code	Total Amount Billed	Gross Amount Collected	Arrears Collected	Total Amount Collected without Arrears	Billing Efficiency	Collection Efficiency	Aggregate Technical & Commercial Losses
			A_b	A_{gc}	A_{ar}	$A_c = A_{gc} - A_{ar}$	BE Ebill/Ein	CE Ac /Ab	%AT&C Loss = { 1-(BE*CE)}
			(Crore Rs.)	(Crore Rs.)	(Crore Rs.)	(Crore Rs.)	(%)	(%)	(%)
1	***JNPA-SEZ***	***JNPA-SEZ***	***4.06***	***4.24***	**0.03439**	**4.21**	**87.04%**	**103.61%**	**9.81%**

- The AT&C Losses of JNPA-SEZ DISCOM for FY 2022-23 are 9.81 % which are on the higher side.
- These losses represent the difference between the energy billed and the amount collected, taking into account both technical losses (related to power transmission and distribution) and commercial losses (such as theft or non-payment).

6. Energy Audit Findings

6.1 Generalized Method of Evaluating Transmission & Distribution Losses in the Power Distribution System

In an energy audit of a power distribution system, the energy losses are to be computed for each element of the network on the basis of actual energy sent out and actual consumption as recorded by the meters installed on both sides of the element .It may not be possible to conduct energy audit for the entire power system of a utility in one go. This could be due to financial, organizational and logistical constraints. Hence it may have to be conducted in stages. A compact area of the power system would have to be identified and energy audit studies taken up. We now describe briefly the procedure to determine technical and commercial losses for an 11 kV feeder. Procedure to Determine Technical Losses on the 11 kV Feeder Technical losses on the 11 kV feeder are assessed by conducting load flow analysis of the individual 11 kV feeder including distribution transformer and LT distribution losses. We consider the steady state model to find technical losses and take the loads to be of constant impedance.

1. Assessing Load Factor (LF) and Loss Load Factor (LLF):

I. ***Copper losses of all transformers*** *= Copper loss of each transformer capacity wise in kWh x Numbers of transformers capacity wise in the feeder*

II. ***Load Factor (LF)*** *= Energy input to the transformer/ (Peak load of the transformer r during the month × number of hours the transformer is in service during the month)*

III. ***Loss Load Factor (LLF)*** *= 0.3 (LF) + 0.7 (LF)* ^{2}

IV. ***Energy Input to the Transformer*** *= ((Energy sent out on the 11kV feeder from SS –Energy losses in the 11 kV feeder) × Capacity of the transformer)/Total transformer capacities in the feeder*

2. Distribution Transformer Losses:

I. ***No-Load/Iron Losses in kWh*** *= No load loss of transformer in kW x number of hours the transformer was in service during the month*

II. ***Full Load/Copper Losses in kWh*** *= Copper loss of each transformer capacity wise in kW x (Actual load / Full load)* ^{2} *x number of hours the transformer capacity wise was in service during the month x LLF*

3. Calculation of LT Line and Network Losses:

I. ***The losses of LT network*** *of each capacity transformer are computed by averaging the losses of the LT network of all similar capacity transformers.*

II. ***The computed average losses of LT network*** *radiating from each capacity transformer are extrapolated for assessing the total energy losses of LT network on the feeder.*

4. 11 kV Feeder Loss:

The monthly energy losses in the feeder should be computed by extrapolating the daily energy loss proportional to the energy sent out in the feeder, for all feeders for all the months in the audit period.

5. Energy Losses in Loose Jump Connections, Short Circuit and Earth Faults on the Lines, Service Mains and Energy Meters are assumed to be:

I. *1% of the total energy sent out through the 11 kV line from the substation, for the 11 kV lines of 20 km and more, and*

II. *0.5% of the total energy sent out through the 11 kV line from the substation, for the 11 kV lines of less than 20 km.*

The total technical loss in the 11 kV feeder is the sum of the various losses described above.

6. Total Technical Loss on the 11KV Feeder = *11 kV line losses + Distribution transformer (no load and load) losses + LT network losses + Energy losses in loose jump connections, service mains and energy meters.*

7. Energy losses in the feeder *= Energy input to the 11 kV feeder – Energy sales*

8. Commercial Losses: The commercial losses are assessed by deducting technical losses from the total losses of the feeder, i.e., the difference between energy sent out and the energy sold. Thus,

Commercial loss in the feeder *= Energy loss – Technical loss*

The following activities are undertaken to record these losses:

- The meter reading schedules of meter readers are revised and made coterminous with distribution transformers.

- On that day, the distribution transformer meter is also read and comparison is made between distribution transformer meter reading and sum total of consumption recorded in all other consumer meters coming under that distribution transformer.
- The difference is noted. If the losses are found to be high, action is initiated to Fi trace the installation causing losses.
- It is very difficult to get a very accurate picture of these losses due to the following reasons:
  - The energy meters provided on 11 kV feeders are of class 1/class 0.5 accuracy, whereas at consumer installations the meters are of Class 0.2 accuracy;
  - The major loss is contributed due to the No Load Loss of EHV transformers
  - The 11 KV outgoing feeders have less load as compared to CT ratio thus meters are not recording when CT do not sense the current

i. **Total Input Energy, $E_{in} = E_{im} - E_{ep}$.**

ii. **Total Billed Energy, $E_{bill} = E_m + E_{um}$.**

iii. **T&D Losses, $E_{loss} = E_{in} - E_{bill}$.**

iv. **% T&D Losses, $\%E_{loss} = E_{loss}/E_{in}$.**

v. **Total Amount Collected without Arrears, $A_c = A_{gc} - A_{ar}$.**

vi. **Billing Efficiency, $BE = E_{bill}/E_{in}$.**

vii. **Collection Efficiency, $CE = A_c / A_b$.**

viii. **Aggrigate Technical & Commercial Losses, %AT&C Loss = {1-(BE*CE)}.**

Where,

E_{im} – Energy Imported From Grid.
E_{ep} - Energy Exported to the Grid.
A_{gc} - Gross Amount Collected.
A_{ar} - Arrears Collected.A_b
- Total Amount Billed.

6.2 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

- **Auditor: Any Energy Conservation Measures Already Implemented ?**

➢ **Discom JNPA: One of the energy conservation measures that have already been implemented in the SEZ premises is the installation of smart LED lights for all the street lights. These smart LED lights replace the traditional halogen lights, resulting in lower power consumption. This switch to LED lights helps in reducing energy usage and contributes to energy conservation efforts.**

- **Auditor: Any upcoming Plans for Energy Conservation Measures ?**

➢ **Discom JNPA: There is an ongoing project to install a 300 KWP (kilowatt peak) solar plant within the SEZ premises. The purpose of this solar plant is to generate solar energy, which will be utilized for net metering. Net metering allows the excess solar energy generated by the solar plant to be fed back into the grid supply, reducing the reliance on conventional power sources. This upcoming initiative not only promotes the use of renewable energy but also contributes to energy conservation by utilizing clean and sustainable power generation methods.**

- **Auditor: Any energy efficiency measures taken to reduce distribution losses ?**

➢ **Discom JNPA address distribution losses and optimize equipment performance, energy efficiency measures have been implemented in the SEZ. One strategy involves managing the load in the license area. It has been observed that the load within the license area is significantly lower than the installed capacity. To optimize equipment usage and minimize distribution losses, two transformers with a capacity of 50MVA each are operatedalternatively. This means that one transformer remains active while the other is kept off, or one transformer is designated as standby. This approach allows**

for efficient utilization of transformers and helps in reducing both fixed and variable losses associated with distribution.

- **Comments by Auditor: By employing this technique, the JNPA-SEZ aims to enhance energy efficiency and minimize power losses during distribution. The transformers are effectively utilized based on the load requirements, ensuring that energy is distributed with optimal efficiency. This approach not only reduces energy losses but also contributes to cost savings by minimizing wastage and improving the overall performance of the distribution system. These energy efficiency measures highlight the JNPA SEZ's commitment to reducing distribution losses and optimizing the utilization of electrical infrastructure. By implementing this strategy of alternately operating transformers or maintaining one as standby, the JNPA-SEZ can achieve improved energy efficiency, lower losses, and enhanced performance in its distribution network.**

6.3 Inclusions and Exclusions

It is to be noted that no Inclusions and exclusion are made in the report by JNPA-SEZ during the FY 2022-23.

7. Conclusion and Action Plan

7.1 Energy Balance at DISCOM Level: Circle wise Data for FY (2022-23)

Table 8 Energy Balance of DISCOM for FY 2022-23

Sr. No	Details	Units	For FY (2022-2023)					
1	Name of Circle (Circle Code)							
2	Consumer category		Residential	Agricultural	Commercial/ Industrial-LT	Commercial/Industrial-HT	Others	Sub-total
3	No of connection Metered	(No's)	0	0	10	6	2	**18**
4	No of connection Un-metered	(No's)	0	0	0	0	0	**0**
5	Total Number of Connections	(No's)	0	0	10	6	2	**18**
6	% of number of connections	(%)	0.00%	0.00%	55.56%	33.33%	11.11%	**100%**
7	Connected Load metered	(MW)	0.00	0.00	519.2	2005.39	80	**2,604.59**
8	Connected Load Un-metered	(MW)	0	0	0	0	0	**0**
9	Total Connected Load	(MW)	0.00	0.00	519.20	2,005.39	80	**2,604.59**
10	% of connected load	(%)	0.00%	0.00%	19.93%	76.99%	3.07%	**100%**
11	Input Energy	(MU)	**4.78**					**4.78**
12	Billed Metered Energy	(MU)	0.00	0	0.422	3.690	0.049	**4.16**
13	Billed Unmetered Energy	(MU)	0	0	0	0	0	**0**
14	Total Billed Energy	(MU)	**0.00**	**0.00**	**0.42**	**3.69**	**0.05**	**4.16**
15	% of Energy consumption	(%)	0.00%	0.00%	10.14%	88.68%	1.18%	**100%**
16	Transmission & Distribution Losses	(MU)	**0.62**					**0.62**
17	% T&D Losses	(%)	**12.96%**					**12.96%**

- JNPA-SEZ has a total of 18 consumers with a total connected load of 2,604.59 MW. There are no Un-Metered connections.
- The net input energy in the DISCOM for the FY 2022-23 is 4.78 MU whereas the Billed metered Energy is 4.16 MU.
- The Transmission & Distribution Losses (Inside the DISCOM Periphery) of JNPA-SEZ DISCOM for the FY (2022-23) are 12.96% (0.62 MU).

7.2 Graphical Representation of JNPA, Uran Energy Balance

The following table gives month-wise detailed information about the Transmission & Distribution losses of JNPA-SEZ DISCOM for the FY 2022-23

Table 9 Month-wise T&D Losses computation for FY 2022-23

Month	Input Energy Consumption	Client wise Consumption	Billing Efficiency = (Net Sale of Energy/ Net Input Energy)	T & D Loss = 1 - Billing Efficiency	T & D Loss = 1 - Billing Efficiency
	MU	MU	B.E	%	MU
A	B	C	D=C/B	E=1-D	F=E*B
Apr-22	0.31	0.27	86.11%	13.89%	0.04
May-22	0.33	0.29	87.05%	12.95%	0.04
Jun-22	0.36	0.31	86.02%	13.98%	0.05
Jul-22	0.37	0.30	81.73%	18.27%	0.07
Aug-22	0.38	0.30	80.99%	19.01%	0.07
Sep-22	0.38	0.32	82.64%	17.36%	0.07
Oct-22	0.42	0.35	84.79%	15.21%	0.06
Nov-22	0.47	0.42	89.52%	10.48%	0.05
Dec-22	0.45	0.40	88.62%	11.38%	0.05
Jan-23	0.40	0.35	87.33%	12.67%	0.05
Feb-23	0.40	0.37	92.66%	7.34%	0.03
Mar-23	0.50	0.47	93.55%	6.45%	0.03
Total	**4.78**	**4.16**	**87.04%**	**12.96%**	**0.62**
Average	**0.40**	**0.35**	**87.04%**	**12.96%**	**0.05**

- The monthly average Input energy of JNPA-SEZ DISCOM for the FY 2022-23 is 0.4MU with an average client-wise consumption of 0.35MU.
- The monthly average Transmission & Distribution losses of JNPA-SEZ DISCOM for the FY 2022-23 are 0.05 MU.
- The Billing Efficiency is observed to be 87.04%.
- The transmission & Distribution losses for the FY 2022-23 are observed to be 12.96% (0.62 MU).

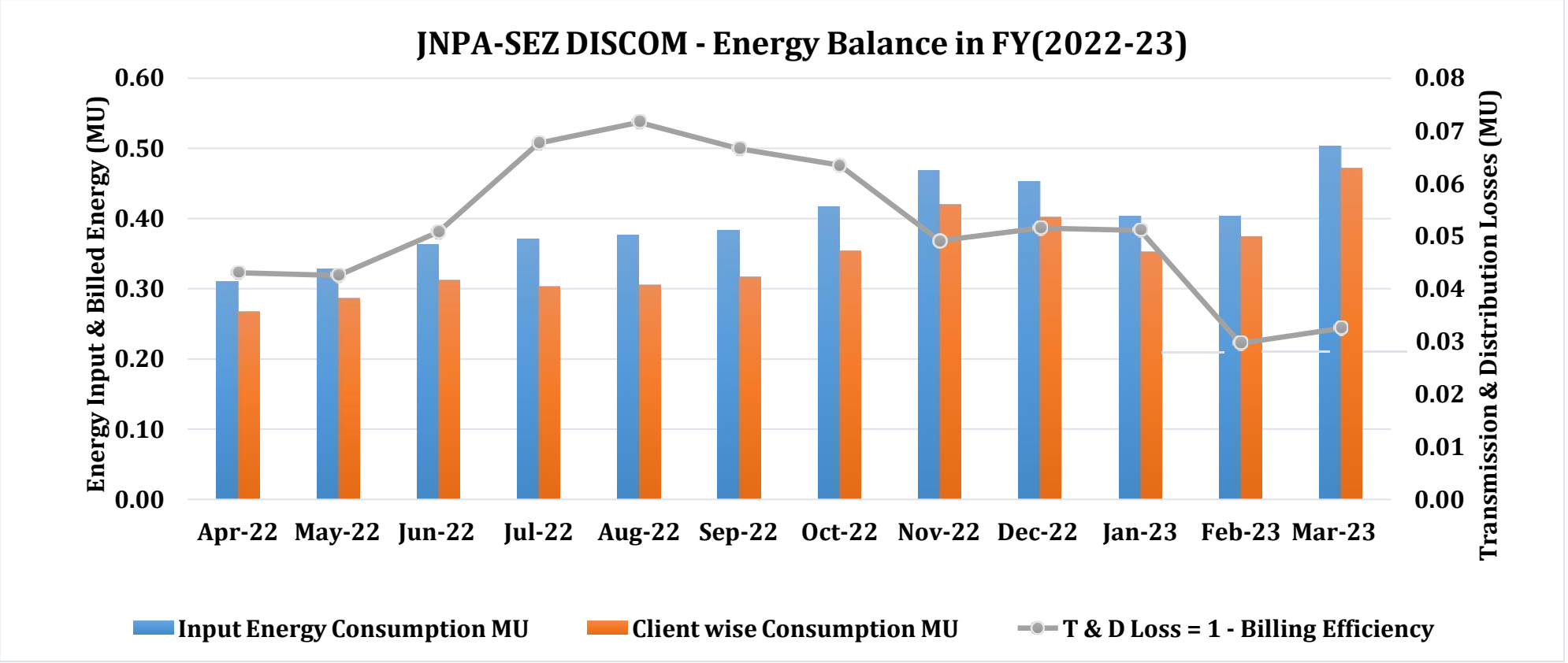


Figure 5 JNPA-SEZ DISCOM Energy Balance for the FY 2022-23

- The T&D loss was observed to be highest in the month of August with 19.01% and the Billing efficiency was 80.99% which was the lowest for the FY 2022-23.
- The T&D loss was observed to be lowest in the month of March with 6.45% and the Billing efficiency was 93.55% which was the highest for the FY 2022-23.

7.3 Summary of critical analysis by Energy auditor

The AT&C losses of 9.81% for JNPA SEZ DISCOM in FY 2022-2023 are considered on the higher side. These losses encompass only technical losses, which occur during power transmission and distribution, with no commercial losses as the metering is the SEZ is a compact area and only 13 consumers, which are closely monitored for their consumption and activities. The billed amount is fully recovered for 100% collection. The high loss is attributed only because of the load is negligible as compared to the installed capacity of network.

7.4 Recommendations and best practices – Energy accounting, loss reduction, and energy conservation.

1. **Implement an Energy Accounting System**: Develop and implement an information technology-enabled energy accounting system to create monthly, quarterly, and yearly energy accounting reports without manual interference. This system should be in compliance with BEE regulations and should be established within the stipulated time frame.

2. **Energy Accounting at Transformer Level**: Conduct energy accounting at the transformer level, including 33kV, 11kV, and feeder-wise. This will help in evaluating transmission and distribution losses as well as transformer losses. Accurate data accounting will aid in identifying areas of improvement and efficiency enhancement.

3. **Install Current Transformers (CTs)** at Substations: Install properly sized CTs at all electrical panels in ES1 and ES2 substations. These CTs will facilitate the recording and monitoring of electrical power, enabling better control and management of energy flow within the distribution system.

4. **Power Factor Correction**: Encourage consumers to maintain a power factor of unity (1.0) at their end. Implement awareness campaigns and incentives for industries and consumers to optimize power factor, leading to reduced distribution losses and efficient power utilization.

5. **Smart LED Street Lighting**: Continue the use of smart LED lights for street lighting across the JNPA SEZ. This initiative should be expanded to cover all public areas, reducing energy consumption and enhancing visibility and safety.

6. **Promote Renewable Energy Integration:** Encourage the installation of renewable energy sources such as solar plants within the JNPA SEZ. This will help in offsetting

conventional energy consumption, reducing dependency on non-renewable sources, and contributing to energy conservation.

7. **Energy Audit and Efficiency Programs:** Conduct regular energy audits for consumers, industries, and the distribution system. Identify energy-saving opportunities and implement energy-efficient technologies and practices to optimize energy consumption.

8. **Demand Side Management**: Implement demand-side management strategies to balance energy supply and demand. Encourage consumers to participate in demand response programs, incentivizing them to reduce energy usage during peak hours.

9. **Loss Reduction Initiatives**: Continuously monitor and analyze distribution losses. Identify areas with high losses and implement targeted initiatives to mitigate losses, such as transformer efficiency improvements, grid optimization, and network upgrades.

10. **Consumer Awareness Campaigns**: Launch awareness campaigns to educate consumers about energy conservation, the benefits of energy-efficient practices, and their role in reducing overall energy consumption.

11. **Upgrade the distribution network**: An aging distribution network can be a major source of energy losses. Upgrading the network with new, more efficient equipment can help to reduce losses.

12. **Use smart meters to track energy consumption**: Smart meters can provide real-time data on energy consumption, which can help to identify areas where losses are occurring.

7.5 Energy Conservation Measures (ENCON Measures)

- To provide provision of SCADA based communication all outgoing and incoming energy meter substation wise for 100% accuracy
- To provide provision of SCADA based communication to all consumer end energy meter for proper energy accounting with 100% accuracy
- Conduct demand side management program for energy efficient BLDC fan, LED, star rating AC, Energy efficient HVAC system and energy efficient pumps to consumer end for reducing peak load demand period

8. Annexure

8.1 Introduction to verification firm

i.	*Name of Firm*	***: A.R.S. Energy Auditors.***
ii.	*Head Office Address*	***: A/1, A/101, Pramodini Palace CHSL, Near Air India Colony, Virar (East), Maharashtra, India. Pin: 401305.***
iii.	*Mobile No.*	***: +91-7507184478.***
iv.	*Email IDs*	***: sachin.ameya@gmail.com*** ***: sachin@arsenergyauditors.com***
v.	*Website*	***: www.arsenergyauditors.com***
vi.	*BEE M&V Empanelled Accredited Energy Audit Firm Registration*	***: EmAEA-060***
vii.	*BEE - Empanelled Accredited Energy Auditor*	***: AEA-0261 - Mr. Sachin S. Deshpande.***

After working in the area of Solar Thermal & PV Projects for four years, Mr. Sachin Deshpande, Director has started Company as SAN Energy System in1996 in the area on the solar projects. The company has their full-fledged manufacturing facility of solar water heater module.

*The company has diversified its business from the Solar Water Heating/ PV Application to the field of Energy Conservation through Energy Audit. With a team of BEE Accredited andCertified Energy Auditors, the company has successfully completed several Energy Audit Assignments with the techno-economic analysis under "**A.R.S. Energy Auditors**". A.R.S. has completed more than 700 audits so far in almost all sectors in India and Abroad. Solar PV project consultancy is also one of the vertical of the company.*

Awards and Recognition

- ✓ ***MEDA – 12th State Level Energy Conservation Award Sector- Energy (Auditor / Consultants) -2018-19.***
- ✓ ***MEDA – 11th State Level Energy Conservation Award Sector- Energy (Auditor / Consultants) -2017-18.***
- ✓ ***Best Speaker (GEDA -EM-EA Meet).***

8.2 Minutes of Meeting with the DISCOM team

MINUTES OF MEETING

Between

1 JNPA-SEZ, Uran , Navi Mumbai (Maharashtra)

2 A.R.S Energy Auditors

Date of visit: 05 July 2023

1. Mr Anant S. Kulkarni and Mr Shubham S. Gaikwad visited office on 05 July 2023

2. The visit was arranged for collecting important data and site measurements

3. At the outset, M/s ARS officials inquired with M/s JNPT officials about existing load scenario. Mr. Suhas Ambade explained in brief the Single Line Diagram and discussed the Radial arrangement of RMUs , DT configuration and metering etc

4. M/s ARS Energy Auditors requested JNPT to depute their person alongside for a inspection round in switchyard and other electrical equipment.

5. Mr. Jitendra Nikhare and Mr. Abdullah accompanied ARS executives and they explained the set up and load distribution

6. With the consent of JNPT officials, photographs of incoming and outgoing side meters were recorded .

7. Further, after the inspection round, ARS Energy Auditors asked for the technical data from JNPT regarding metering philosophy and monthly recorded readings to which JNPT officials readily agreed.

8. It is decided that the remaining data will be share with ARS Energy Auditors by E-mail

From A.R.S Energy Auditors

Mr. *Sachin Deshpande*

AEA-0261

A.R.S. ENERGY AUDITORS VIRAR

SACHIN S. DESHPANDE (AEA0261) B.E.E. GOV. OF INDIA ACCREDITED ENERGY AUDITOR

From JNPA-SEZ, Navi Mumbai

1. Mr. B.D Sinkar
   Manager (Utility Services)
2. Mr. Jitendra Nikhare
   Deputy Manager
3. Mr. Suhas Ambade
   Consultant
4. Mr. Narendra Kumar
   Site Incharge, O & M VEPL
5. Mr. Adullah
   Sr. Electrical Engineer, O & M-VEPL

8.3. Check list prepared by auditing firm

Table 10 Checklist prepared by auditing firm

Checklist		
Sr No	**Data Requirement**	**Remarks**
1	SLD	Data received
2	Energy Audit Report FY 2021-2022	Received
3	Proforma-1 for2021-2022 & 2022-2023	Received
4	Details of JNPA-SEZ customer	Data received
5	Details of JNPA-SEZ energy meter no	Data received
6	CT & PT ratio	Data received
7	BEE form 3	Received
8	Billing ledger April2022-March2023	Data received

8.4. Brief Approach, Scope & Methodology for audit

Energy Audit is the key to systematic approach to for decision making in the area of energy management. It is an effective tool to balance the total energy inputs with its outflows in various energy streams.

The energy audit of electrical distribution network exercise involves the energy accounting followed by the analysis of energy flow data for determination of losses at various steps in transmission & distribution. In the power distribution system, some % of energy is lost invariably during the process of distribution. The profitability of distribution depends on the minimizing of these losses. Since the ultimate burden of these losses has to be borne by the honest consumers in terms of higher tariff rates, the reduction in losses would also be beneficial in the interests of the consumers. Hence in the present era of competition the distributor having minimum losses has an edge over the competitors due to better profitability & economical rates.

The **distribution losses** comprises of technical losses & commercial losses. The **technical losses** are inherent features of the distribution business & are losses in various components of power distribution system up to the point of supply viz; No load & load losses in transformers, losses in conductors of overhead lines or underground cables, switchgears, fuses , meters, dielectric losses in capacitors, cables etc. These losses cannot be totally eliminated but can be reduced by devising proper technical specification while procuring transformers, Switchgears, cables, overhead conductors, capacitors, meters etc., devising & adopting strict testing plans while accepting the material, correct installation & regular maintenance.

The **commercial losses** comprises of incorrect billing, errors in meter reading, defective/ stopped meters, pilferage on account of unmetered unauthorized supply(direct), tampered meters. These losses can be eliminated by proper & continuous vigil.

The objective of the energy audit exercise is,

- to identify the sources of technical & commercial losses,
- quantification of losses,
- suggest the corrective measures for minimizing technical losses,
- To work out the cost benefit analysis of corrective measures as suggested for computing the payback period of the investment involved.

- The exercise of energy audit aims to balance the total energy inputs with its outflows in various energy streams. To achieve this, one has to have energy meters at all incoming & outgoing energy streams i.e. 33 kV& 11 kV feeders, 33/11kV& 11kV/415 Volts Transformers, & all consumers.
- Power distribution system is a dynamic system wherein the energy parameters are changing at every moment. Hence , in addition to installation of meters at all input & output nodes, the other requirement of establishing energy balance is to get simultaneous(Coherent) readings of all these meters in particular period i.e. at beginning of the period & at the end of the period. (This function is better served if the SCADA system is installed to acquire the meter reading data continuously at regular interval or historical data in memory of electronic meters is down loaded using meter reading instrument.)
- Owing to dynamism of the distribution system, simultaneous meter readings of all meter on incoming and outgoing nodes is the primary requisite for energy audit exercise. However it is difficult to meet this condition when computing the energy flow for individual consumers who are spread over entire territory of sq. Km & are provided with conventional meters. Hence it is necessary to carry out this exercise in lowest denomination of the distribution system i.e. Distribution transformer wise & integrate it with supplying feeder.
- In order to accomplish this, it is necessary to install meter for each distribution transformer & tag the consumers with its feeding transformer & supply feeder. With such exercise of consumer indexing & provision of meters for all distribution transformers, the DTC wise & feeder wise energy audit can be carried out.
- In substations of JNPA-SEZ the energy monitoring system has been installed. However due to some localized hardware/ software problems & unavailability of internet connection the system was not fully operational. After fully functional status, various reports such as daily import, export energy reports, loss computation, and maximum-minimum power parameters can be generated.
- The various steps in the methodology for conducting a detailed energy audit for an industry may be outlined as follows:

1. *Gathering and collating information in a specially designed, "Energy Systems Questionnaire" format, for the industry under study*
2. *Inter- and intra-industry comparison of the collected data.*
3. *Assessment of present efficiency index for energy consumption in the industry/process.*
4. *In-depth study of plant operations, equipment and systems for a general review of the energy systems to assess the operational efficiency and potential for economizing.*
5. *Evaluation of the detailed recommendations for energy saving/conservation,*
6. *Formulation of detailed action plans/strategies in consultation with plant management for implementation of the identified energy saving measures.*
7. *Training operating personnel in the specifics of energy conservation to enable them to implement the recommendations and also to monitor the progress on a periodic basis.*

- This methodology can also be applied to the power distribution systems. In the process of supplying electricity to consumers, energy losses occur on account of technical and commercial reasons.
- The technical losses are due to energy dissipation in the conductors and the equipment used for transmission and distribution of power.
- Commercial losses are caused due to pilferage of energy, defective meters, meter reading errors and energy not accounted for (Table).
- Proper and accurate meters, meter reading, meter testing and calibration, billing and collection systems are essential for effective and accurate energy accounting and audit.
- The meters for energy accounting and audit are termed as system meters which basically are meters at S/S, outgoing feeders, distribution transformers, etc. The role of meters for energy accounting and audit, i.e., system meters is to arrive at operating and performance parameters, energy accounting and energy audit. System meters are generally not used for measuring energy for commercial purposes, and hence need not cater to any tariff structure.

Conducting an effective energy audit will be possible only through a perfect mechanism where the required facilities are available.

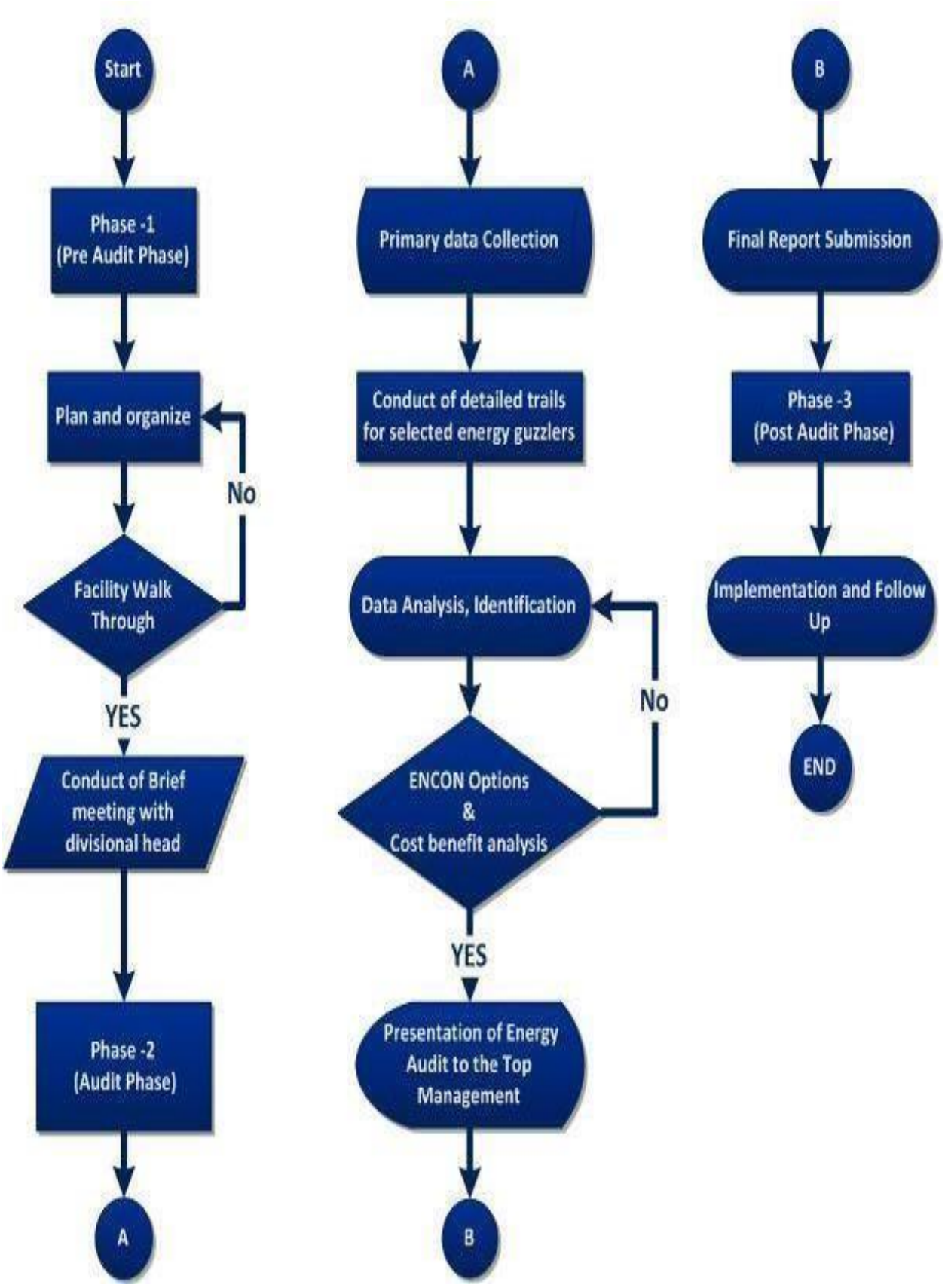


Figure 6 Generalized Approach for Energy Audit

8.5. Infrastructure details

1	Parameters	Total	Covered during in audit	Verified by Auditor in Sample Check	Remarks (Source of data)
i	Number of circles	NA			
ii	Number of divisions	NA			
iii	Number of sub-divisions	NA			
iv	Number of feeders	11			
v	Number of DTs	5			
vi	Number of consumers	18			
2	**Parameters**	**66kV and above**	**33kV**	**11/22kV**	**LT**
a. i.	Number of conventional metered consumers	0	0	0	0
ii	Number of consumers with 'smart' meters	0	0	6	12
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	0
vii	**Number of total consumers**	0	0	6	12
b.i.	Number of conventionally metered Distribution Transformers	0	0	0	5

ii	Number of DTs with communicable meters	0	0	0	0
iii	Number of unmetered DTs	0	0	0	0
iv	**Number of total Transformers**	0	0	0	5
c.i.	Number of metered feeders	0	1	10	0
ii	Number of feeders with communicable meters	0	0	0	0
iii	Number of unmetered feeders	0	0	0	0
iv	**Number of total feeders**	0	1	10	0
d.	Line length (ct km)				
e.	Length of Aerial Bunched Cables				
f.	Length of Underground Cables	52.4Km			

3	Voltage level	Particulars	MU	Reference	Remarks (Source of data)
i	66kV and above	Long-Term Conventional		Includes input energy for franchisees	
		Medium Conventional			
		Short Term Conventional	4.78		MSLDC
		Banking			
		Long-Term Renewable energy			
		Medium and Short-Term RE		Includes power from bilateral/ PX/ DEEP	
		Captive, open access input		Any power wheeled for any purchase other than sale to DISCOM. Does not	

				include input for franchisee.	
		Sale of surplus power			
		Quantum of inter-state transmission loss		As confirmed by SLDC, RLDC etc	
		Power procured from inter-state sources	5	Based on data from Form 5	
		Power at state transmission boundary	5		
ii	33kV	Long-Term Conventional			
		Medium Conventional			
		Short Term Conventional			
		Banking			
		Long-Term Renewable energy			
		Medium and Short-Term RE			
		Captive, open access input			
		Sale of surplus power			
		Quantum of intra-state transmission loss	0		
		Power procured from intra-state sources	0		
iii		**Input in DISCOM wires network**	5		
iv	33 kV	Renewable Energy Procurement			
		Small capacity conventional/ biomass/ hydro plants Procurement			
		Captive, open access input			
v	11 kV	Renewable Energy Procurement			
		Small capacity conventional/ biomass/ hydro plants Procurement			
		Sales Migration Input			

vi	LT	Renewable Energy Procurement			
		Sales Migration Input			
vii		**Energy Embedded within DISCOM wires network**	0		
viii		**Total Energy Available/ Input**	5		

4	Voltage level	Energy Sales Particulars	MU	Reference	
i	LT Level	DISCOM' consumers	0	Include sales to consumers in franchisee areas, unmetered consumers	
		Demand from open access, captive		Non DISCOM's sales	
		Embedded generation used at LT level		Demand from embedded generation at LT level	
		Sale at LT level	0		
		Quantum of LT level losses	0		
		Energy Input at LT level	0		Reading not available taken as same that of billed units
ii	11 kV Level	DISCOM' consumers	1	Include sales to consumers in franchisee areas, unmetered consumers	
		Demand from open access, captive		Non DISCOM's sales	
		Embedded generation at 11 kV level used		Demand from embedded generation at 11kV level	
		Sales at 11 kV level	1		
		Quantum of Losses at 11 kV	-1		
		Energy input at 11 kV level			Reading not available

		DISCOM' consumers	0	Include sales to consumers in franchisee areas, unmetered consumers	
		Demand from open access, captive		Non DISCOM's sales	
iii	33 kV Level	Embedded generation at 33 kV or below level		This is DISCOM and OA demand met via energy generated at same voltage level	
		Sales at 33 kV level	0		
		Quantum of Losses at 33 kV	0		
		Energy input at 33kV Level			
		DISCOM' consumers	0	Include sales to consumers in franchisee areas, unmetered consumers	
		Demand from open access, captive		Non DISCOM's sales	
iv	> 33 kV	Cross border sale of energy			
		Sale to other DISCOMs			
		Banking			
		Energy input at > 33kV Level	5		
		Sales at 66kV and above (EHV)	0		
		Total Energy Requirement	**5**		
		Total Energy Sales	**1**		

Energy Accounting Summary

5	DISCOM	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
i	LT	Not available	0		
ii	11 Kv	Not available	1		
iii	33 kv		NA		
iv	> 33 kv		NA		
6	**Open Access, Captive**	**Input (in MU)**	**Sale (in MU)**	**Loss (in MU)**	
i	LT	NA			
ii	11 Kv	Na			

iii	33 kv	NA			
iv	> 33 kv	Na			

Loss Estimation for DISCOM	
T&D loss	4
D loss	4
T&D loss (%)	0.749538877
D loss (%)	0.749538877

8.6. Power purchase details

Table 11 Power purchase details

Month	Scheduled (kWh)	Actual (kWh)	Deviation (kWh)
Apr-22	311843.52	309795	-2048.52
May-22	343728.20	328079	-15649.20
Jun-22	371252.48	363021	-8231.48
Jul-22	430650.04	370311	-60339.04
Aug-22	410294.88	376584	-33710.88
Sep-22	408987.20	383676	-25311.20
Oct-22	438158.80	417210	-20948.80
Nov-22	460895.20	468380	7484.80
Dec-22	477234.57	452548	-24686.57
Jan-23	460095.12	403078	-57017.12
Feb-23	425704.32	403701	-22003.32
Mar-23	441107.36	503598	62490.64
Total KWH	**4979951.69**	**4779981**	**-199970.69**
Total Mus	**4.97995**	**4.77998**	**-0.19997**

Insights from the table:

1. Seasonal Variations:

- From April to June 2022, the actual consumption was consistently below the scheduled consumption, with the deviation decreasing each month.
- In July 2022, there was a significant drop in actual consumption, resulting in a large negative deviation.
- From August to October 2022, the actual consumption remained below the scheduled consumption, with deviations decreasing but still negative.
- In November and December 2022, the actual consumption exceeded the scheduled values, resulting in positive deviations.
- From January to March 2023, the actual consumption continued to be below the scheduled consumption, with deviations increasing each month.

2. Monthly Deviations:

- The highest negative deviation occurred in July 2022, with a difference of -60,339.04 kWh.
- The highest positive deviation occurred in March 2023, with a difference of 62,490.64 kWh.

3. Overall Trend of Actual Consumption:

- The actual consumption showed a declining trend from April to October 2022, with fluctuations in November and December.
- From January to March 2023, the actual consumption increased, reaching the highest value in March.

8.7. Category of service details

Table 12 Category of service details

Consumer Name	Type of Consumer	Category	Supply Voltage
STN TRAFO-500KVA SS	LT V (ii)	INDUSTRIAL	440 V
SARVESHVAR LOGISTICS	LT II (B)	COMMERCIAL	440 V
SIMOSIS INTERNATIONAL	HT I (A)	INDUSTRIAL	11kV
KRISH FOOD INDUSTRY	HT I (A)	INDUSTRIAL	11kV
R K SWEET MARS	HT I (A)	INDUSTRIAL	11kV
RUDRA FLEXIPACK LLP	HT I (A)	INDUSTRIAL	11kV
STN TRAFO-E1 & E2 SS (200KVA)	LT V (ii)	INDUSTRIAL	440 V
ADMIN BUILDING	LT VII (B) (ii)	PUBLIC SERVICE	440 V
STREET LIGHT E1 & E2 SS (200KVA)	LT II (B)	COMMERCIAL	440 V
E-3 SS (Street Light)	LT II (B)	COMMERCIAL	440 V
STP	HT I (A)	INDUSTRIAL	11kV
Nava Sheva Business Park	HT II	COMMERCIAL	11kV
OIL FIELD (E-07)	LT II (C)	COMMERCIAL	440 V
OWS (E-08)	LT II (C)	COMMERCIAL	440 V
JNPA Fire Station	LT VII (B) (ii)	PUBLIC SERVICE	440 V
Sadanand Engineering Works	LT II (B)	COMMERCIAL	440 V
State Bank of India	LT II (A)	COMMERCIAL	440 V
R.K.Flexo printers Packers LLP	LT II (A)	COMMERCIAL	440 V

Insights from the table:

1. Type of Consumers:

The consumers are categorized into two types: LT (Low Tension) and HT (High Tension). LT consumers are supplied with 440 V voltage, while HT consumers are supplied with 11 kV voltage.

2. Categories of Consumers:

The consumers belong to three main categories: Industrial, Commercial, and Public Service.

Industrial consumers include businesses and industries that require higher power supply at either 440 V (LT) or 11 kV (HT).

Commercial consumers include entities such as businesses, offices, and shops, typically supplied at 440 V (LT).

Public Service consumers are establishments that serve public needs, supplied at 440 V (LT).

3. Supply Voltage and Transformer Capacity:

Industrial consumers are supplied with both LT (440 V) and HT (11 kV) voltage, depending on their requirements.

Commercial consumers and public service entities are supplied at LT (440 V) voltage.

4. Major Consumers:

The industrial category has multiple consumers using HT (11 kV) supply, such as Simosis International, Krish Food Industry, Rudra Flexipack LLP, and STP (Sewage Treatment Plant). The commercial category has prominent consumers like Sarveshvar Logistics, StreetLight E1 & E2 SS, State Bank of India, and R.K. Flexo Printers Packers LLP.

The public service category includes consumers like Admin Building and JNPA Fire Station.

5. Transformer Capacity:

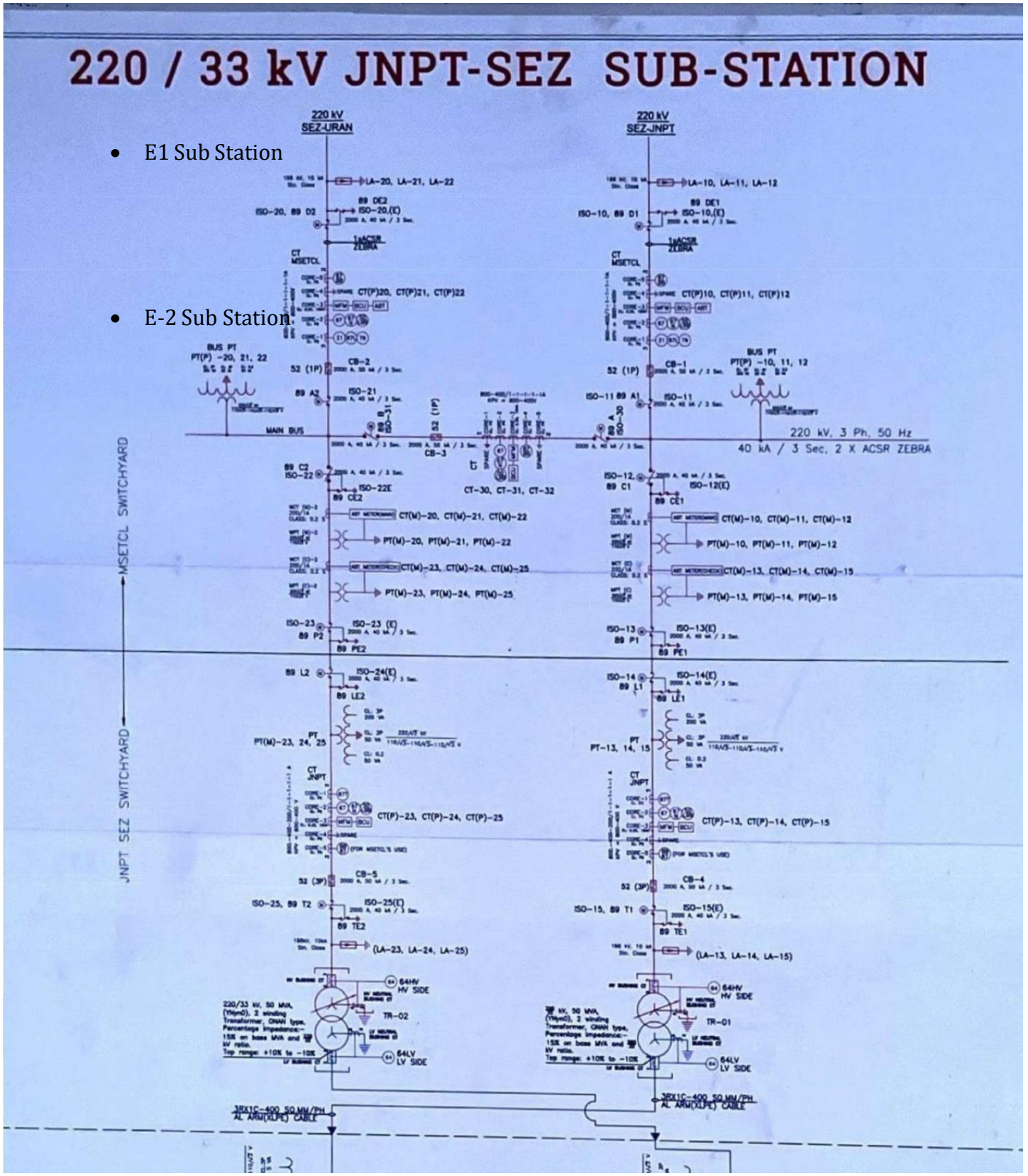
Some industrial consumers are supplied through transformers with capacities of 500 kVA (STN TRAFO-500KVA SS) and 200 kVA (STN TRAFO-E1 & E2 SS).

6. Energy Usage Implications:

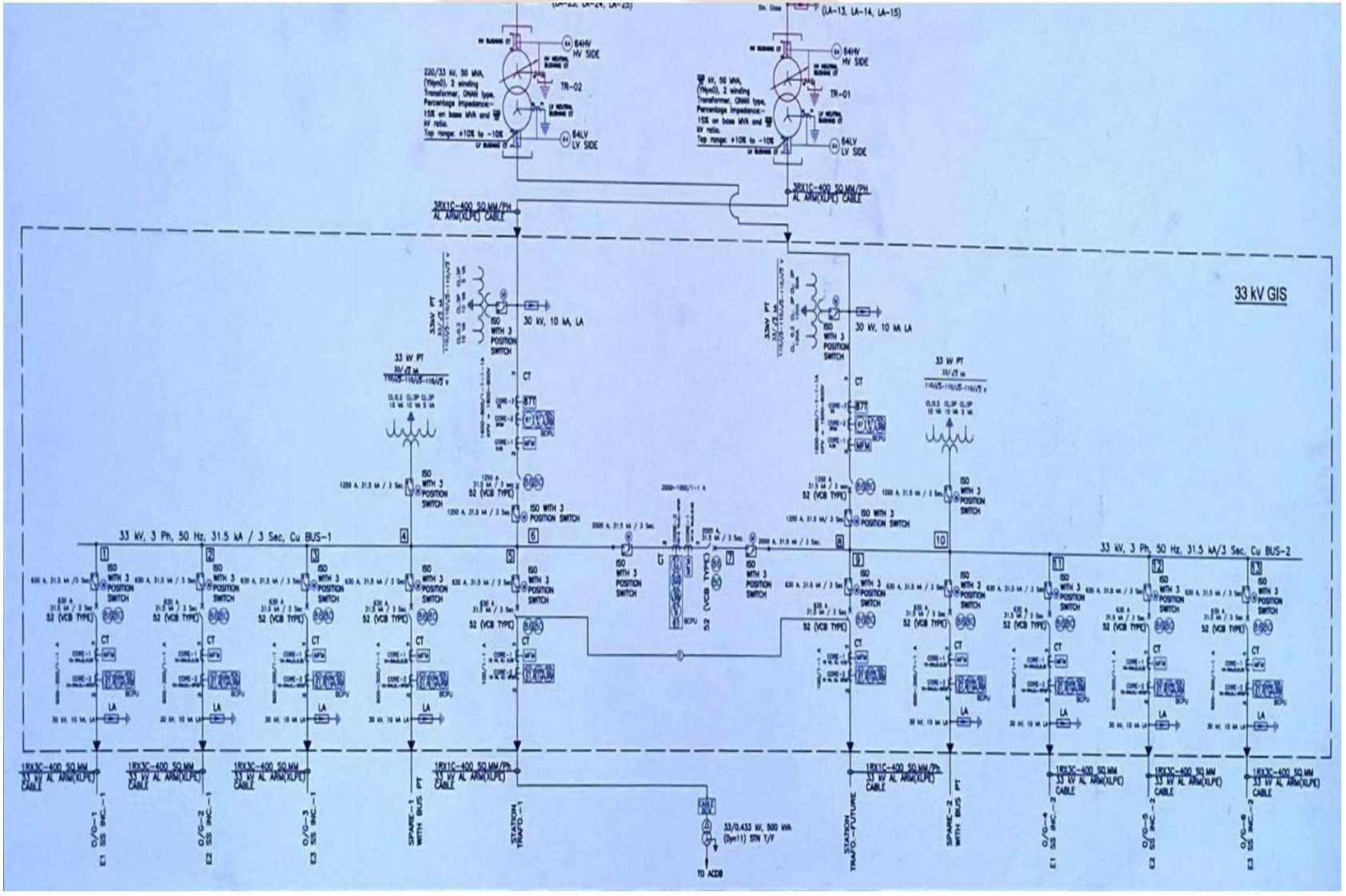
Industrial consumers using HT (11 kV) supply typically have higher energy demands due to their industrial operations. Public service entities and commercial consumers using LT (440 V) supply generally have relatively lower energy requirements.

8.8. Single Line diagram (SLD)

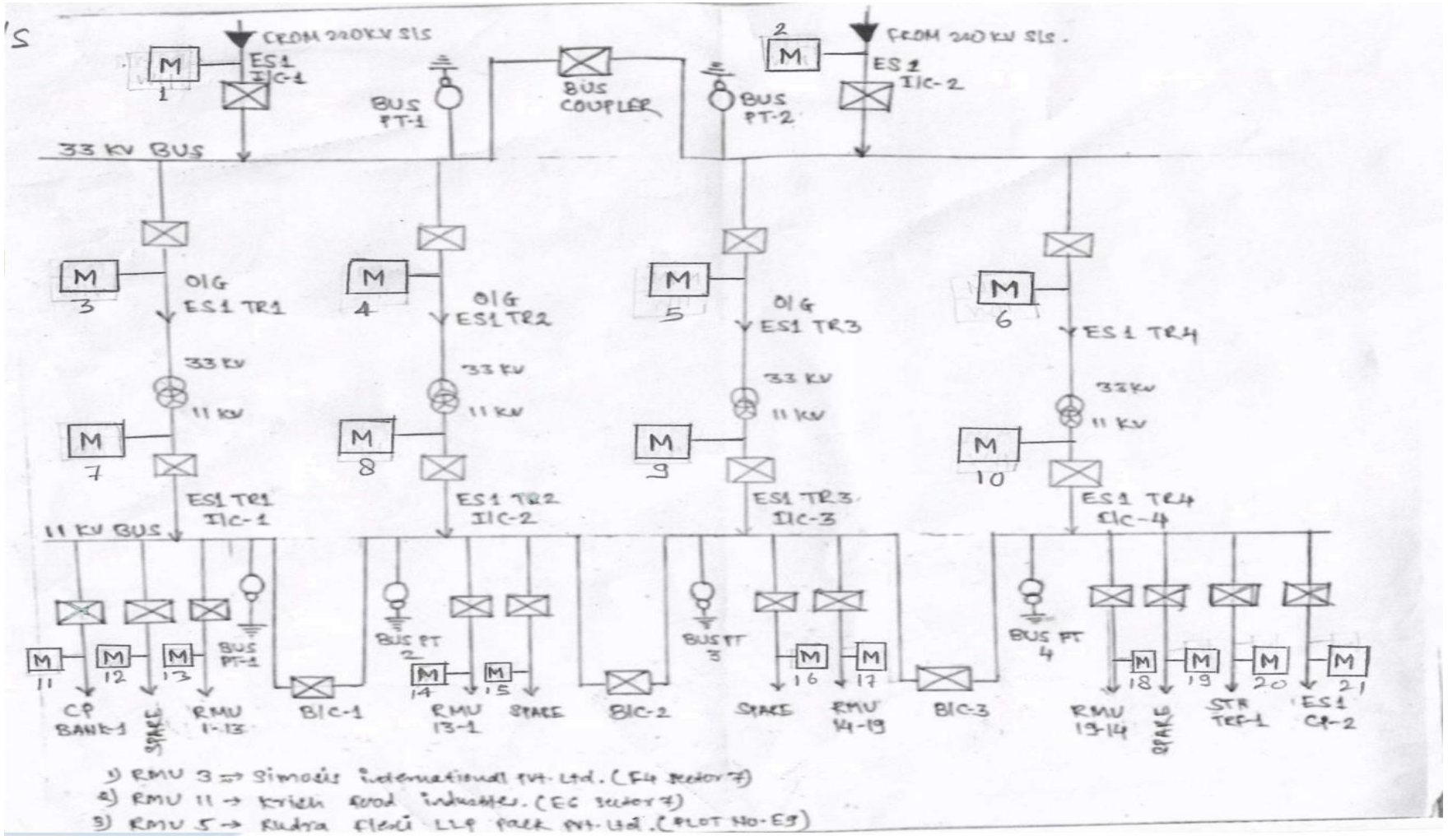
- 220/33KV Sub-Station



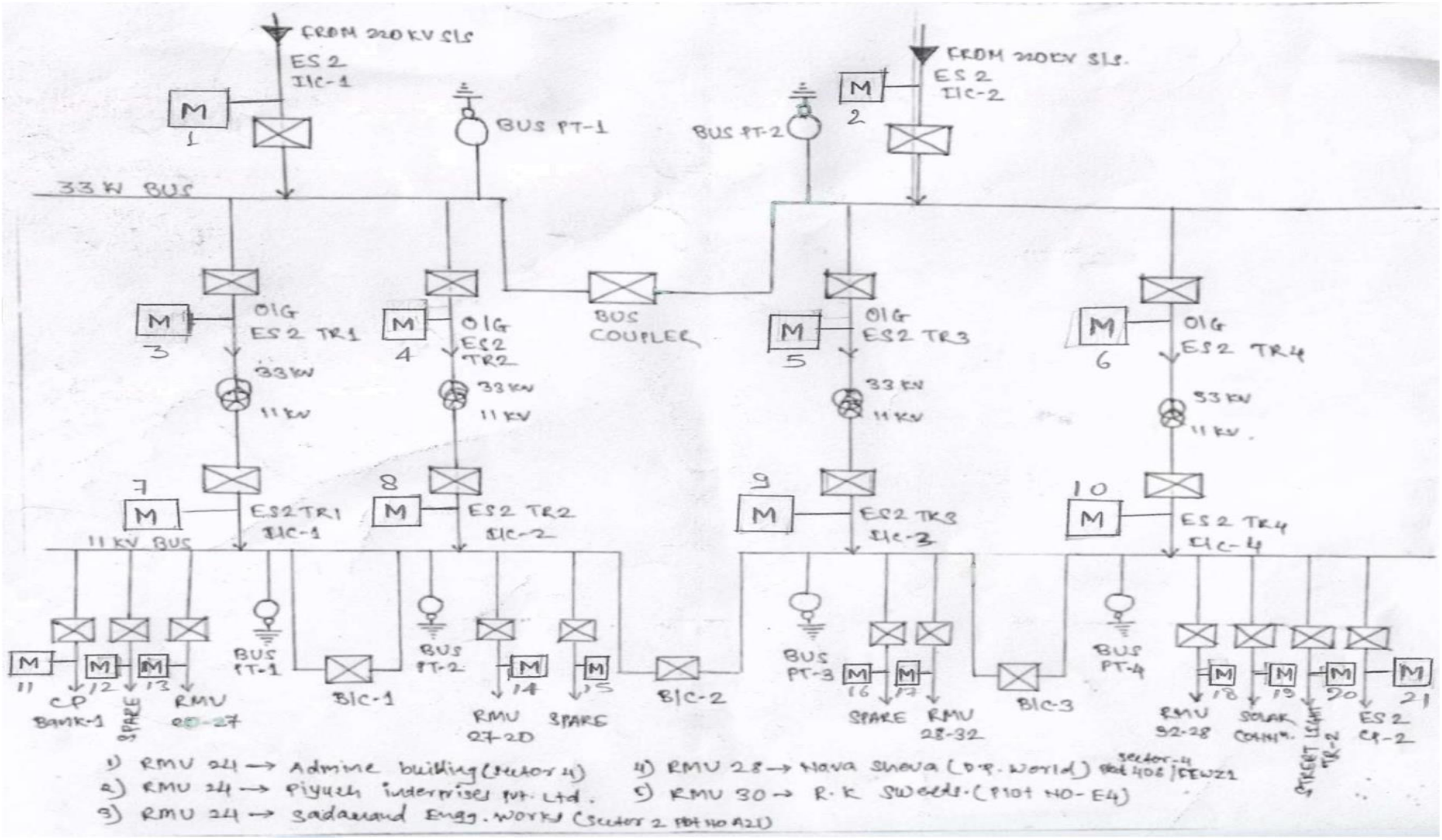
- E1 Sub Station
- E-2 Sub Station


33 kV GIS
33 kV, 3 Ph, 50 Hz, 31.5 kA / 3 Sec, Cu BUS-1
33 kV, 3 Ph, 50 Hz, 31.5 kA/3 Sec, Cu BUS-2
TR-02
TR-01
64HV HV SIDE
64LV LV SIDE
30 kV, 10 kA LA
ISO WITH 3 POSITION SWITCH
52 (VCB TYPE)
SPARE-1 WITH BUS PT
STATION TRAFO.-1
SPARE-2 WITH BUS PT
STATION TRAFO.-FUTURE
TO ACDB

- **E1 Sub Station**



- **E2 Sub Station**



8.9. List of documents verified with each parameter

Summary of Energy input & Infrastructure

A. Summary of energy input & Infrastructure			
S.No	**Parameters**	**Period From 01/04/2022 to 31/03/2023**	**Remarks (Source of data)**
A.1	Input Energy purchased (MU)	4.98	
A.2	Transmission loss (%)	4%	
A.3	Transmission loss (MU)	0.208164	
A.4	Energy sold outside the periphery(MU)		
A.5	Open access sale (MU)		
A.6	EHT sale		
A.7	Net input energy (received at DISCOM periphery or at distribution point)-(MU)	4.78	
A.8	Is 100% metering available at 66/33 kV (Select yes or no from list)	Yes	
A.9	Is 100% metering available at 11 kV (Select yes or no from list)	Yes	
A.10	% of metering available at DT	100%	
A.11	% of metering available at consumer end	100%	
A.12	No of feeders at 66kV voltage level	0	
A.13	No of feeders at 33kV voltage level	1	
A.14	No of feeders at 11kV voltage level	10	
A.15	No of LT feeders' level	0	
A.16	Line length (ckt. km) at 66kV voltage level	0	
A.17	Line length (ckt. km) at 33kV voltage level	0	
A.18	Line length (ckt. km) at 11kV voltage level	0	
A.19	Line length (km) at LT level	0	LT consumer connected to DTC
A.20	Length of Aerial Bunched Cables		
A.21	Length of Underground Cables	52.4	
A.22	HT/LT ratio	0	

Meter reading of input energy at injection points

B. Meter reading of Input energy at injection points

S.No	Zone	Circle	Voltge Level (KVA)	Division (KVA)	Sub-Division (KVA)	Feeder ID	Feeder Name	Feeder Metering Status (Metered/ unmetered/ AMI/AMR)	Status of Meter (Functional/Non-functional)	Metering Date / Date of last actual meter reading / communicatio	Feeder Type (Agri/ Industrial/Mixed)	Status of Communication			Period from...to...				Sales	Remarks (Source of data)	
												% data received through automatically if feeder AMR/A	Number of hours when meter was unable to	Total Number of hours in the period	Meter S.No	CT/PT ratio	Import (MU)	Export (MU)			
B.1	NA	NA	220KV	NA	NA		220Kv Uran	AMR	Functional	daily	Input to DL	100%	0		ABT		4.78	0.00	4.78	MSLDC	

Details of received energy

Details of Input Energy Sources

Period From 01/01/2023 To 31/03/2023

A. Generation at Transmission Periphery (Details)

S.No.	Name of Generation Station	Generation Capacity (In MW)	Type of Station Generation (Based- Solid (Coal ,Lignite)/Liquid/Gas/Renewable (biomass-bagasse)/Othe	Type of Contract (in years/months/ days)	Type of Grid (Intra-state/Inter-state)	Point of Connection (POC) Loss MU	Voltage Level (At input)	Remarks (Source of data)
L	Pvt Ltd	15	Gas	One Year	Intra state	NA	220KV	PPA

Details of Consumer and consumption

(Details of Consumers)						
Summary of Energy						
Period From 01/01/2023 To 31/03/2023						
S.No	Type of Consumers	Category of Consumers (EHT/HT/LT/Others)	Voltage Level (In Voltage)	No of Consumers	Total Consumption (In MU)	Remarks (Source of data)
1	Domestic					
2	Commercial	LT	440	8	0.164570526	
3	IP Sets					
4	Hor. & Nur. & Coffee/Tea & Rubber (Metered)					
5	Hor. & Nur. & Coffee/Tea & Rubber (Flat)					
6	Heating and Motive Power					
7	Water Supply					
8	Public Lighting					
9	HT Water Supply					
10	HT Industrial	HT	11000	5	2.8328945	
11	Industrial (Small)	LT	440	2	0.237465328	
12	Industrial (Medium)					

13	HT Commercial	HT	11000	1	0.876647	
14	Applicable to Government Hospitals & Hospitals					
15	Lift Irrigation Schemes/Lift Irrigation Societies					
16	HT Res. Apartments Applicable to all areas					
17	Mixed Load					
18	Government offices and department	LT	440	2	0.0490425	
19	Others-1 (if any , specify in remarks)					
20	Others-2 (if any , specify in remarks)					
21	Others-3 (if any , specify in remarks)					

22	Others-4 (if any , specify in remarks)					
23	Others-5 (if any , specify in remarks)					
				Total	18	4.16