ENERGY AUDIT REPORT

Of

Pashchimanchal Vidyut Vitran Nigam Limited

2021-22

PPS Energy Solutions

THE POWER OF ENERGY

Energy Audit Report

Pashchimanchal Vidyut Vitran Nigam Limited

Submitted By

PPS Energy Solutions
THE POWER OF ENERGY

SEPTEMBER 2022

Document Submission

Action	By	Date	Version
Submitted	PPS Energy Solutions	12.09.2022	R0

Designation	Name	Signature
Accredited Energy Auditor	Ravi Deshmukh (AEA – 0243)	

Acknowledgement

We express our sincere gratitude to the authorities of Pashchimanchal Vidyut Vitran Nigam Limited (PVVNL) for entrusting and offering the opportunity of energy performance assignment.

We are thankful to Pashchimanchal Vidyut Vitran Nigam Limited (PVVNL) officials for timely guidance and for their positive support in undertaking the task of system mapping and energy efficiency assessment of sampled electrical distribution system. The field studies would not have been completed on time without their interaction and guidance. We admire their cooperation during field studies and providing necessary data for the study.

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Abbreviations	Explanations
PVVNL	Pashchimanchal Vidyut Vitran Nigam Limited
PPSES	PPS Energy Solutions
BEE	Bureau of Energy Efficiency

Electrical Terms

- V (Volt) - Unit of voltage.
- kV (kilovolt) - 1,000 volts.
- W (Watt) - Unit of active power.
- kW (kilowatt) - 1,000 watts.
- MW (Megawatt) - 1,000 kW.
- Wh (watt-hour) - Unit of Energy.
- kWh (kilowatt-hour) - 1,000 Wh.
- MWh (Megawatt-hour) - 1,000 kWh.
- MUs (Million Units)-1kWh x 10^6.
- VA (Volt-ampere) - Unit of apparent power.
- kVA (kilovolt-ampere) - 1,000 VA.
- MVA (Megavolt-ampere) - 1,000 kVA.
- VAr (volt-ampere reactive) - Unit of reactive power.
- Load Factor - Ratio of average power demand to maximum power demand
  Electrical Losses - Difference between energy delivered and energy sent out.
- PF – Power Factor

1 Executive Summary

1.1 PVVNL Introduction

Pashchimanchal Vidyut Vitran Nigam Limited came into existence in July, 2003 as subsidiary company of UPPCL. The Discom covers in its jurisdiction the areas of District Meerut, Baghpat, Ghaziabad, Gautambudh Nagar, Bulandshahar, Hapur, Muzaffarnagar, Saharanpur, Shamli, Bijnor, Moradabad, Sambhal, J.P. Nagar and Rampur. The Discom comprises of 06 distribution zones based at Meerut, Ghaziabad, Bulandshahar, Noida, Saharanpur and Moradabad and each is headed by an officer of the rank of Chief Engineer. The total number of Distribution Circles and Divisions in Different Zones are 29 and 95 respectively along with 29 nos. of Test Divisions. Besides there is 01 circle for store and 02 circle each for works and Civil Construction works under direct control of the Discom Head Quarter. The Discom comprises more then Sixty-Six Lacs of consumers with annual Revenue of around Rs. 16700 Crores in FY2019-20. PVVNL has 1329 of Secondary sub-stations with an installed capacity of 18944 MVA. The total number of distribution transformers are 516497 with installed capacity of 27759 MVA.

PVVNL is trying to implement the best practices in the distribution system. The tools used in achieving the commercial result include the massive disconnection drive against the defaulting consumers, the implementation of the OTS scheme, issuance of notices under section 3 and 5 to the defaulting consumers, bill distribution system through SMS & email, MRI based billing of the consumers with load above 10 KVA and replacement of electro mechanical meters through electronic & smart meters and adopting anti-theft measures i.e. vigorous combing in the high line losses areas, providing ABC conductors in Theft prone areas DT Metering, Double Metering of the consumers, Metering with AMR's. The Discom has achieved the remarkable enhancement in the revenue realization and thru rate. At the same time AT&C losses have come down to 19.66% and collection efficiency is 97.80% at the end of FY2020-2021.

Table 1 PVVNL Network Snapshot

PVVNL Network Snapshot	
Number of circles	29
Number of divisions	95
Number of sub-divisions	255
Number of feeders	7876
Number of DTs	531164
Number of consumers	6951006

1.2 About Assignment

Bureau of Energy Efficiency (BEE) through Ministry of Power, Government of India issued regulations namely Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit in electricity distribution companies) Regulations, 2021 (hereinafter referred as 'BEE EA Regulation 2021'), for Conduct of Annual Energy Audit and Periodic Energy Accounting in DISCOMs.

As per the notification, the work of Energy Audit of PVVNL was awarded to PPS Energy Solutions Pvt. ltd.

Auditors have critically examined the various systems, schemes, devices employed as well as the associated documents at PVVNL for above 11kV, at 11kV and below 11kV as to ascertain its adequacy and efficacy as per the directives of the BEE and guidelines as per regulation.

1.3 Study Team

As per the directives of team given by regulation, the teams were formed by PVVNL and PPSES to conduct the energy accounting and energy audit.

1.3.1 PVVNL TEAM

The submission of reports pertaining to periodic energy accounting, annual audit reports, and appointing AEA for carrying out annual audit reports are being carried through the PVVNL Team.

1.4 Methodology

The methodology adopted,

1. Kick of meeting with PVVNL team to finalize the sample size
2. Survey of the Distribution network
3. Collection of the Primary Data and finalization of the sample size check
4. Site visit and Energy Meter data collection
5. Collection of the Metered Energy Data for the respective voltage level as per the sample size
6. Scrutiny of collected data and Data gaps of the submitted data
7. Loss calculation for the network segment then if required normalization
8. Compilation of the Draft report
9. Presentation on Draft report
10. Final report with incorporation of comments

As per the methodology, after collection of the data, site visit for different substations were conducted in month of June 2022, along with PVVNL Team and consultant team.

1.5 Injection Energy

The total energy purchased by PVVNL from different Generation plants is not available. (Input Energy Is Purchased by UPPCL centrally. Breakup up to DISCOM Level of Input Energy is Not available). The net input energy is 34427.51 MU. The input energy is at various voltage levels.

Table 2 Input MU

DC	Type	Assessment Net Input Energy Consumption (MU)	Remarks
PVVNL	DISCOM	34427.51	The net energy at periphery of PVVNL Network is summation of the division wise input energy. The details are enclosed in Table no 14 - Net Energy at PVVNL Periphery.

1.6 Energy Consumption for 2020-21

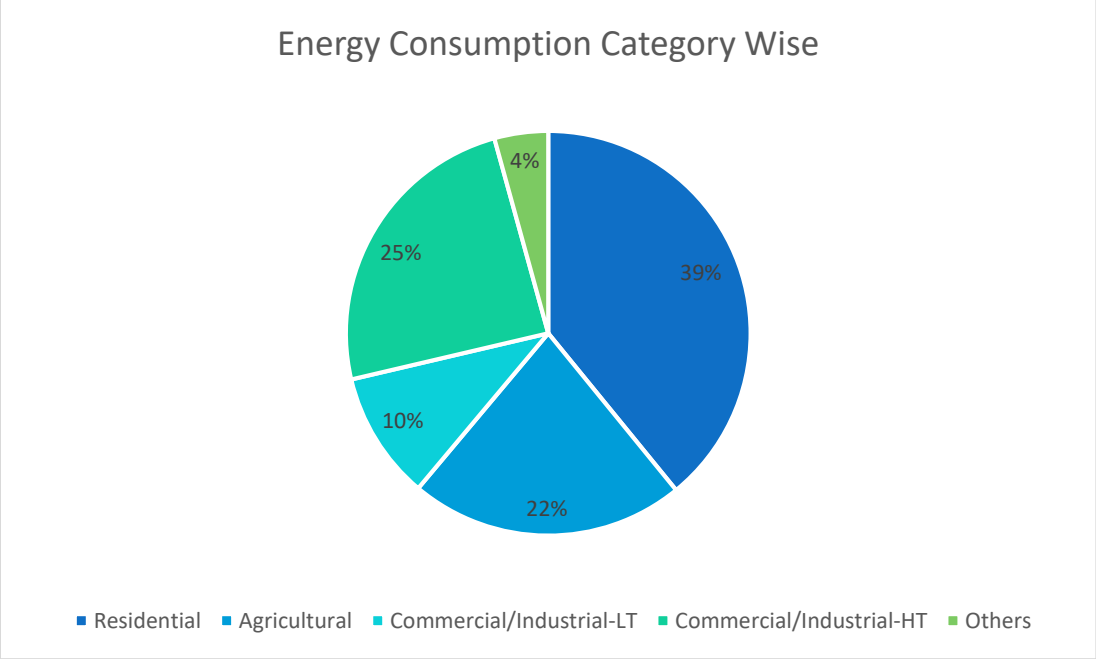


Figure 1 Energy consumption Category Wise of PVVNL

The major energy consumption of 39% is by the Residential Consumers followed by Commercial/Industrial-HT consumers of 25%. Review of the current consumption practices in order to identify the energy loss in the system was carried out.

1.7 Energy Balance at Different Voltage level.

Metering is an inevitable part of the Power Distribution network for evaluating the energy injected and transferred to end consumers. Meter readings are the only way to evaluate the accurate energy balance of the system. Faulty meters, Nonworking meters mislead the losses statement. To evaluate the metering system of the PVVNL, auditors have physically visited the sample grid and inspected the meter working conditions.

The loss at 11kV feeder is calculated by subtracting DCB data of billed energy from the energy injected at 11kV level.

Sometimes boundary meters are not functioning properly and hence the assessment is carried out the division level.

Sub-Division wise loss is calculated by PVVNL. The Difference between Total Input energy arrived by summating all the feeder's injecting energy for a particular Sub-division and the total billed energy of consumers of that Sub division is the loss for that Sub Division.

Sub Division Wise Loss = Net Input Energy of the Particular Sub Division – Billed Energy for that respective sub division.

Net Input Energy for the Particular Sub Division = Sum of all the injected energy – exported energy to other sub division

Billed Energy of respective Sub Division = Sum of all the consumers billed energy for that particular Sub division.

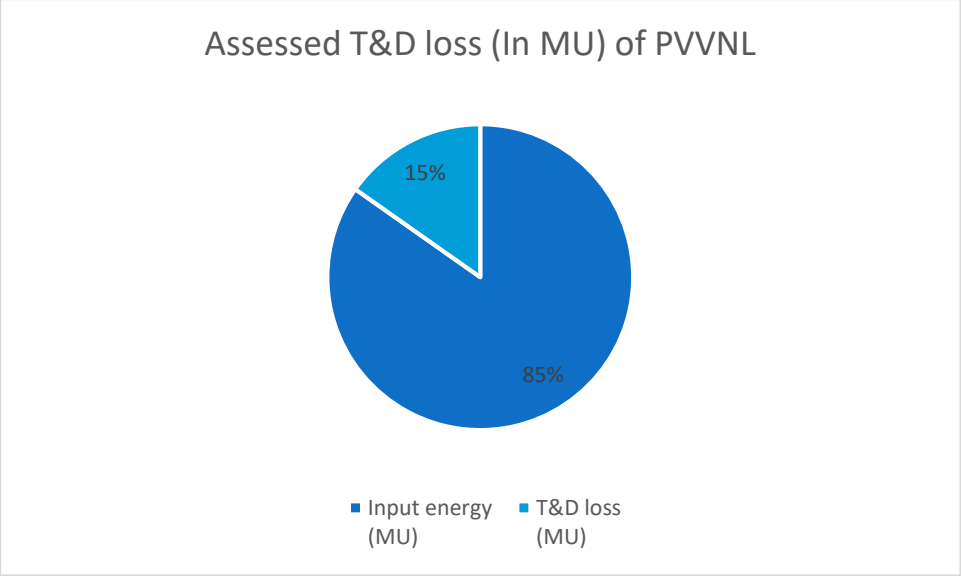


Figure 2 Assessment Of Loss

Table 3 PVVNL loss calculation infra sheet

Loss Estimation for DISCOM	
D loss (MU)	6,189
D loss (MU)	6,189
D loss (%)	18.0%
D loss (%)	18.0%

The AT&C loss level for 2020-21 is more since the collection efficiency and billing efficiency were hit by COVID-19.

The formula used for the AT&C loss calculation

AT & C Loss: [1- Billing Efficiency X Collection Efficiency] X 100%

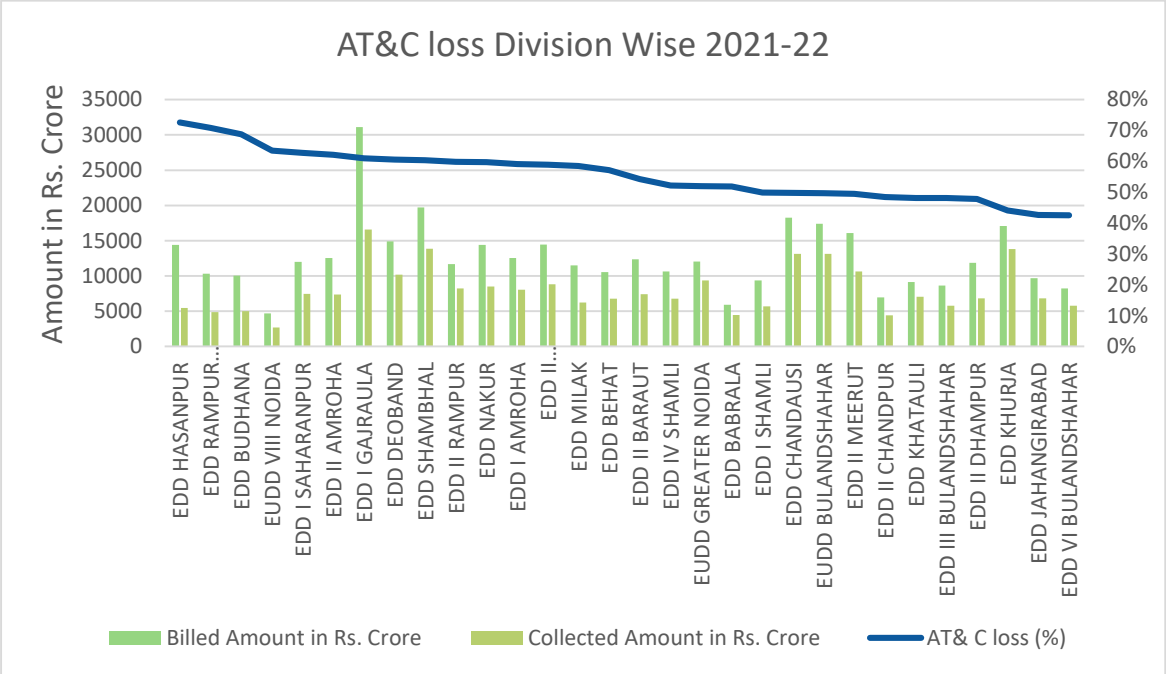


Figure 3 AT&C loss Division Wise 2020-21

The AT&C loss Sub-Division wise is shown in fig no 3.

The overall loss of the PVVNL for 2021-22 year are tabulated below

Table 4 Overall Loss of PVVNL

Performance Summary of Electricity Distribution Companies			
1	Period of Information Year of (FY) information including Date and Month (Start & End)	1st APR, 2021 - 31st MAR, 2022	
2	**Technical Details**		
(a)	**Energy Input Details**		
(i)	Input Energy Purchase (From Generation Source)	Million kwh	-*
(ii)	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	Million kwh	**34427.51**
(iii)	Total Energy billed (is the Net energy billed, adjusted for energy traded))	Million kwh	**28238.70**
(b)	Distribution (D) loss Details -*[1]	Million kwh	**6188.81**
		%	**17.98%**
	Collection Efficiency	%	**89.86%**
(c)	Aggregate Technical & Commercial Loss	%	**26.29%**

*Input Energy Is Purchased by UPPCL centrally. Breakup upto DISCOM Level of Input Energy is Not available.

*1 This loss is only distribution loss since energy is purchased at the periphery of PVVNL

1.8 Recommendations

1.8.1 The residential consumer Metering %

The residential consumers are metered and the percentage is 99.25%.

1.8.2 Input Energy reconciliation

The transmission input energy should be considered as reference data. Every Division shall verify the reading of the meters installed on the input feeder of respective voltage level. This data, which is recorded by division by meter reading, shall be send to PVVNL headquarters for the reconciliation.

Any match has to be rectified by the divisional engineer along with consultation with If rectifies it, then only those data modifications shall be considered on annual energy accounting sheets or quarterly energy accounting.

1.8.3 System automation for loss calculation

The division wise excel sheet shall be automated via some software and the respective changes in the field in order to maintain the supply and meter faults, etc. shall be updated in the software on timely basis.

1.8.4 33/11kV Substation Monitoring System Circle

33/11kV Substation monitoring system shall be implemented. It shall monitor the loading of Transformer, Substations Battery and Feeders. It shall have the capability to show online data.

1.8.5 Distribution Transformer with AMR

Most of the Feeder Meters are having communication facility through AMR and MRI Data (generally, more than feeder meter data is received through AMR or MRI.)

The DTR meter reading shall be AMR based and shall be increased. Proper Monitoring of the DTR meters shall be done.

1.8.6 Transformer Optimization During Off Peak Season

During off-peak periods, PVVNL is expected to minimize the no load losses by maintaining optimal loading of transformers by configuring its network in such a manner that reliability of supply is also not compromised

1.9 Simple Pay Back

The simple payback calculation is enclosed below

Table 5 Simple Pay Back

Sr. Nos	Description	Value	Units
1	Investment		In Lakhs
2	Savings in MU		Million Units
3	Rate Of kWh		Rs/kWh
4	Total Saving		In Lakhs
5	Simple Pay Back		Years

2 Introduction

2.1 Energy Accounting

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.

Bureau of Energy Efficiency (BEE) through Ministry of Power, Government of India issued regulations namely Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit in electricity distribution companies) Regulations, 2021 (hereinafter referred as 'BEE EA Regulation 2021'), for Conduct of Mandatory Annual Energy Audit and Periodic Energy Accounting in DISCOMs. As per the said regulation, all Electricity Distribution Companies are mandated to conduct annual energy audit and periodic energy accounting on quarterly basis. 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 major stake holders of this assignment are PVVNL and PPS Energy Solutions (PPSES).

2.2 Accredited Firm

M/s PPS Energy Solutions Private Limited as have been appointed by PVVNL to carry out the *Energy Audit of Power Distribution Network of PVVNL for year 2020-21.*

2.3 Objective

PVVNL has engaged PPSES to carry out the Energy Audit in PVVNL license area FY 2020-21. The objective of this assignment is to carry out the Annual Energy Audit as per the prescribed formats of BEE EA Regulation 2021 to conduct Energy Audit in PVVNL issued by Bureau of Energy Efficiency, Ministry of Power Government of India.

2.4 Scope of work

1 To carry out Energy Audit in line with the BEE EA Regulation 2021 to Conduct Energy Audit in PVVNL.

- Preparation of checklist/action plan for Energy Audit.
- Pro-forma of Energy Audit will be shared with selected agency after the issuance of Work Award.
- DISCOM visit should be carried out by all team members of the agency as per the team declaration in technical proposal. BEE EA Regulation 2021, proforma (formats) will be used for this audit. The regulations along with proforma (formats) are enclosed at Annexure-1.
- Collection and Review of the energy related data of last Financial Year (FY 2020-21) in the Pro-forma by visiting the DISCOM physically.
- Verification of existing pattern of energy distribution across periphery of electricity distribution Company
- Collection and verification of energy flow data of electricity distribution company at all applicable voltage level of distribution network (please refer energy audit regulation) Collection of data on energy received and distributed by DISCOM and verify the accuracy of data

2 Collection & analysis the data and prepare the same with report;

I. Input energy details:

a. Collection of input energy from recorded system meter reading

b. All the inputs points of transmission system

c. Details provided by transmission unit

d. Recorded meter reading at all export points (where energy sent outside the State (interstate as well as intrastate) is from the distribution system);

e. System loading and Captures infrastructure details (i.e. no of circle, division, sub-division, feeders, DTs, & Consumers)

II. Parameters for computation of distribution losses:

a) Details of open access, EHT sale, HT sale, LT sale and transmission losses

b) Number of consumer's category wise in each circle

c) Consumers connected load category wise in each circle and division

d) Details of billed and un-billed energy category wise of each circle and division

e) Metered and un-metered details.

f) Division and Circle wise losses of all circles under DISCOM periphery

g) Boundary meter details

h) Energy Cost and Tariff data

i) Source of energy Supply (e.g. electricity from grid or self-generation), including generation from renewables;

j) Energy supplied to Open Access Consumers, which is directly purchased by Open Access Consumers from any supplier other than electricity Distribution Company

III. Monitoring and verifications of input energy and consumption pattern at various voltage levels

IV. Identify the areas of energy leakage, wastage or inefficient use;

V. Identify high loss-making areas/networks, for initiating target based corrective action.

VI. Identify overloaded segments of the network for necessary capacity additions.

VII. Computation of agriculture consumption

VIII. Methodology for loss computation various losses.

IX. Computation of Average Billing Rate (ABR)

a) Total revenue billed category wise.

b) Category wise ABR with tariff subsidy.

c) Category wise ABR without tariff subsidy.

X. Collection Efficiency (Category wise) and computation of AT&C loss.

3 Observe and compile various Energy Conservation (ENCON) options implemented by the DISCOM and prepared report containing details of expenditure made by DC along with saving and payback period.

Recommendations to facilitate energy audit, energy accounting and improve energy efficiency.

4 Study the details of loss/gain of PVVNL, analysis of Average Cost of Supply (ACS) and Average Revenue realized (ARR) gap, details of energy charges/Power purchase cost along with the financial analysis.

- Current System Metering Status at various voltage level of DISCOM
- Status of Functional meters for all consumers, transformers and feeders.
- Status of default meters (non-functional meters) for all consumers, transformers and feeders
- Current status of pre-requisites mentioned in regulations (Please refer energy accounting regulation).

- Copies of relevant authentic and certified documents should support the report. Each document should be sealed and signed by DISCOM authorized representative as well as by agency's AEA.

5 Prepare final report of PVVNL as per the scope of work and as per the BEE Energy Audit Regulation, 2021, in a standard format duly indexed, covering profile of the unit and its details of energy related data w.r.t PVVNL analytical & Statistical details and any other relevant information. The indicative report structure is provided in second schedule of BEE EA Regulation 2021.

2.4.1 Deliverables

- Preparation of report as per BEE EA Regulation 2021
- Verify & submit the duly signed annual energy audit report

2.5 Approach

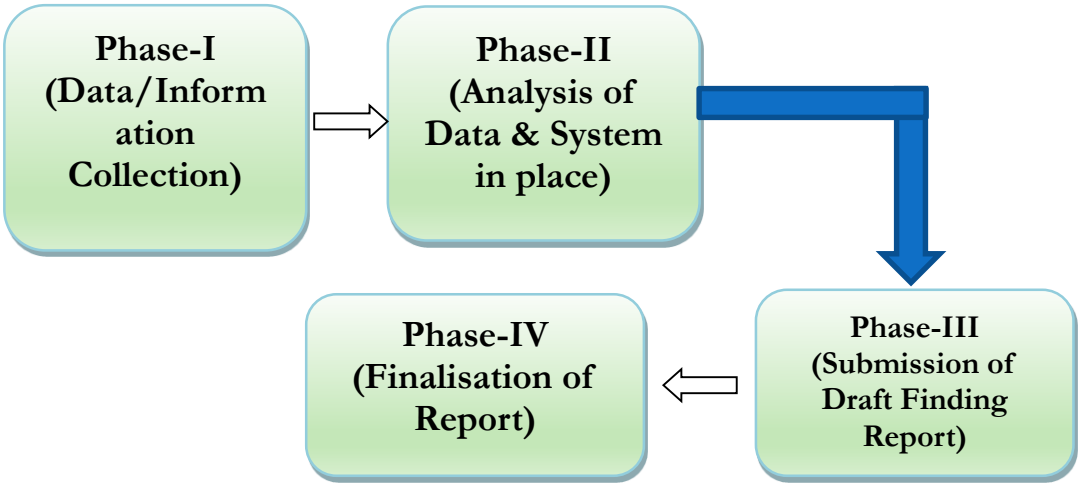
Approach for the assignment, which was scheduled for 1 month, is guided by following points

- **Kick of Meeting:** Offline meeting with PVVNL personnel's and Energy Audit team will be conducted
  1. Communication to the selected the data points like input energy, out energy, renewable open access etc. were pointed out.
  2. Different measures included to account the energy were discussed
- **Site Visit:**

  Site visits were carried out in order to ascertain the meter numbers, boundary location meters, 11kV meters and LT distribution connection.
- **Data analysis and Data Gaps:**

  Data Scrutiny was carried out and the data gaps were raised. The data validation was performed.
- **Deliverable submission**: The Report submission to the BEE will be executed as specified by BEE regulations.

2.6 Methodology



Phase I: Data Collection and Analysis & Approach and methodology document 1 week from work order

(a) Deal with identification of information and data requirement to carry out the Work/Job

(b) Meeting and Discussion with PVVNL to propose a detailed work plan.

Phase II: Data Analysis

(a) Data mining and procedural analysis of system in place for record of sales data.

(b) Meter reading data collection

The team members of Field Team did meter reading and data collection of field.

(c) Analysis of the Meter reading

Our team member with input from the respective experts analyzed the collected data.

(d) Based on the outcomes of the data analysis, a preliminary fact-finding report was submitted highlighting various issues at various sub-division levels.

Phase III: Detailed Analysis and Submission of Draft Report 1 month from work order

(a) Detailed analysis and preparation a draft report highlighting the validity, basis, consistency and objectivity of the approach adopted.

(b) Analysis of Specific Issues such as:

- Analysis of assessed sales in terms of load factor and specific consumption and its comparison with the sales based on actual meter reading.

- Reasons for exceptional high or low-metered sales as reported.
- Consistency in approach for assessed consumption.
- Methodology of assessing consumption and comparison of assessed sales with actual meter reading wherever meter readings are available.
- Comparison of Actual Category-wise Average Billing Rate (ABR) with ABR approved in Order

(b) Assessment of AT&C losses for HT, LT and Total Sales and comparison vis-à-vis as reported in the MIS of PVVNL and Recommendations for reducing AT&C Losses by PVVNL.

Phase IV: Detailed Analysis and Submission of Draft Report within 1 month from work order

(a) Incorporation of the suggestions received and carry out any further analysis as required and incorporate the same in the Final Report with Recommendations to reduce the AT&C losses of PVVNL

Report Submissions

The report submitted as per the deliverables of this assignment.

3 PVVNL Distribution Network

3.1 General information of PVVNL Distribution Network

Pashchimanchal Vidyut Vitran Nigam Limited came into existence in July, 2003 as subsidiary company of UPPCL. The Discom covers in its jurisdiction the areas of District Meerut, Baghpat, Ghaziabad, Gautambudh Nagar, Bulandshahar, Hapur, Muzaffarnagar, Saharanpur, Shamli, Bijnor, Moradabad, Sambhal, J.P. Nagar and Rampur. The Discom comprises of 06 distribution zones based at Meerut, Ghaziabad, Bulandshahar, Noida, Saharanpur and Moradabad and each is headed by an officer of the rank of Chief Engineer.

General Information of the PVVNL is enclosed below.

Table 6 General Information

General Information				
1	**Name of the DISCOM**	PVVNL		
2	**i) Year of Establishment**	2003		
	ii) Government/Public/Private	Govt.		
3	**DISCOM's Contact details & Address**			
i	City/Town/Village	VICTORIA PARK		
ii	District	MEERUT		
iii	State	MEERUT		
iv	Telephone	0121-2665734	Fax	0121-2666062
4	**Registered Office**			
i	Company's Chief Executive Name	MR. ARVIND MALLAPPA BANGARI		
ii	Designation	Managing Director		
iii	Address	MEERUT		
iv	City/Town/Village	MEERUT	P.O.	VICTORIA PARK
v	District	MEERUT		
vi	State	UTTAR PRADESH	Pin	250001
vii	Telephone	0121-2665734	Fax	0121-2666062
5	**Nodal Officer Details***			
i	Nodal Officer Name (Designated at DISCOM's)	Er. Dheeraj Sinha		
ii	Designation	Chief Engineer (Commercial)		
iii	Address	URJA BHAWAN,VICTORIA PARK		
iv	City/Town/Village	MEERUT	P.O.	VICTORIA PARK
v	District			
vi	State	UTTAR PRADESH	Pin	250001
vii	Telephone	0121-2665734	Fax	0121-2666062
6	**Energy Manager Details***			
i	Name	Mr. Anant Govind Bam		
ii	Designation	EA	Whether EA or EM	EA
iii	EA/EM Registration No.	EA 30187		
iv	Telephone		Fax	

v	Mobile	**9822845478**	E-mail ID	bamanant@yahoo.co.in
7	**Period of Information**			
	Year of (FY) information including Date and Month (Start & End)	**1st APR, 2021 - 31st MAR, 2022**		

3.2 Schedule of the work

Initial kick of meeting was arranged between the PVVNL official and the PPSES Team on 10 August 2022. In the kick of meeting the various data, PPSES team raised gaps.

PVVNL officials responded to the data gaps and the plan for the site visit with Accredited Energy Auditor was prepared.

The field visits were conducted in the month of August 2022.The schedule of the visits is as follows. Details along with Photo are enclosed in annexure

Table 7 Schedule of the Work

Date	Places Visited	Information validated	Remarks
10 August 2022	Head Quarters of PVVNL	The energy accounting process validated for each circle. Input energy data cross verification Metering points and their energy break up. Check list submitted to the PVVNL and data gaps of the submitted data explained	
11 August 2022	142 kV s/s Medical College	The input point meter serial number validation is carried out The sending end voltage level .It is injection point of the PVVNL	
11 August 2022	Jagarti Vihar 33 kV substation	GIS network of the PVVNL checked . Network diagram of the few feeders with high loss checked The condition of the conductor and the reason for the loss were discussed	

3.3 Check list Prepared by EmAEA

List of Documents

Sr. No	Description
1	Energy Purchase Documents- Power Purchase report from all sources
2	Consumers Category wise details
3	Billed energy for different category of the consumer
4	Annual Calculation of transmission Loss
5	Annual EHT Sales Report-
6	Sample 33kV input and billed energy
7	DTR and consumer mapping for the LT loss calculation
8	Average Billing Rate for consumer category
9	Feeder wise injected energy into the network
10	Open access consumers and their consumption details
11	Infrastructure details

4 Document verification

The submitted data by the PVVNL has been reviewed as per the guide lines of BEE regulation and comments / remarks are mentioned at respective places

4.1 Energy Distribution Verification

Verification of existing pattern of energy distribution across periphery of electricity Distribution Company.
For the Energy Accounting year 2021-22, The Energy Distribution of PVVNL consumption is tabulated as follows

Table 8 Voltage level wise consumption

	Voltage Level (KVA)	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
i	LT	-	-	-	-
ii	11 kV	31,158	24,979	6,180	19.83%
iii	33 kV	2,473	2,465	9	0.35%
iv	> 33 kV	796	795	0	0.05%

Note above figures are abstracted from input energy sheet of FY 2021-22 Final Pro-forma for DISCOM Energy Accounting for FY 2021-22.

4.2 Verification of periodic Reports

4.2.1 Yearly energy consumption data of consumers

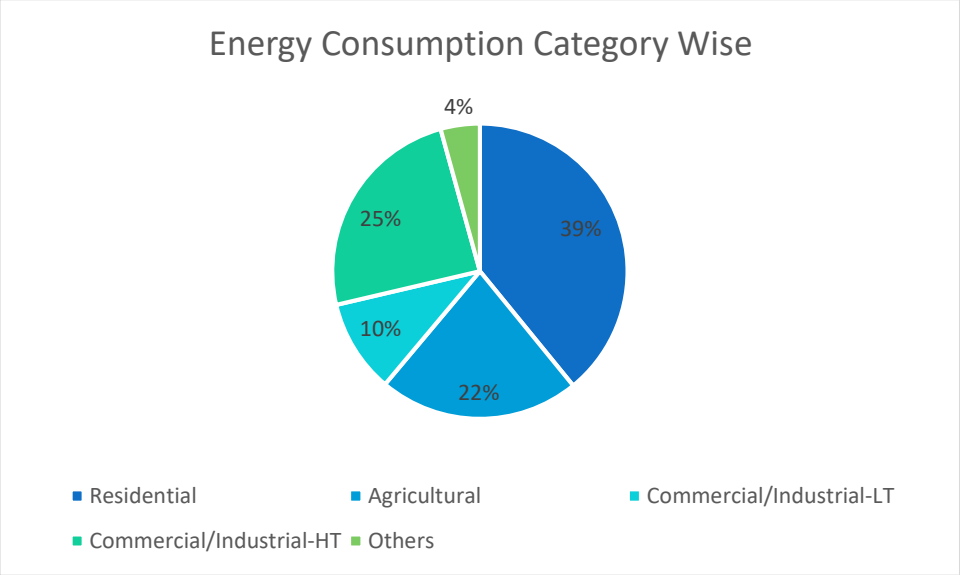


Figure 4 Energy Consumption Consumer Category wise

4.2.2 Source of energy supply (e.g. electricity from grid or self-generation), including generation from renewables

Input Energy Is Purchased by UPPCL centrally, above information upto DISCOM Level is Not available.

4.3 Verification of accounted energy flow

Energy details submitted to BEE by A have been verified from the input meter reading. Following are the observations for the respective energy flow.

4.3.1 T<>D Boundary meter details:

PVVNL has installed 0.2s class SEM/ ABT meters at input points. Voltage level wise audited feeders break up is given in the following table.

Table 9 Voltage wise audited feeders

	Voltage Level (KVA)	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
i	LT	-	-	-	-
ii	11 kV	31,158	24,979	6,180	19.83%
iii	33 kV	2,473	2,465	9	0.35%
iv	> 33 kV	796	795	0	0.05%

The site visits were carried out to ascertain the meter number and the input serial number of the meter. Physical verification along with system data was verified.

4.3.2 Verification of Sales energy

4.3.2.1 Energy accounting verification at LT (0.415 kV) level

PVVNL Consumer Category wise, Consumption is tabulated below

Table 10 PVVNL Consumer Category Wise

Consumers Category	Consumer	CONSUMPTION Metered Units (in MU)
Residential	5845257	11045
Agricultural	479996	6212
Commercial/Industrial-LT	555133	2887
Commercial/Industrial-HT	8487	6882
Others	62133	1213
Grand Total	**6951006**	**28238.7**

4.3.2.2 SUMMARY OF ARR- PVVNL FOR FY 2020-21

Particulars	FY 2020-21			
	Tariff Order for FY 2020-21 dated 11.11.2020	Audited	Claimed	Approved
Cost of Power Procurement (including Inter-State Transmission Charges)	17257.40	19603.83	19603.83	16227.71
Transmission and Load Dispatch Charges (Intra-State Transmission Charges) including additional Gap Recovery for UPPTCL True-up of FY 2020-21	771.48	928.79	928.79	728.30
Gross O&M Expenses	**1,060.57**	**1,776.49**	**1,655.43**	**1,186.08**
Employee Expenses	601.49	628.38	852.68	623.23
R&M Expense	331.97	746.15	609.77	415.05
A&G Expense	127.11	401.95	168.84	147.80
Smart Metering OPEX	0.00	0.00	24.15	0.00
Depreciation	357.65	555.12	748.61	308.91
Interest on Long-Term Loan	193.50	363.53	434.23	287.25
Interest on Security Deposit from Consumers and Distribution system Users	72.97	72.75	72.75	72.69
Finance/Bank Charges	0.00	91.53	91.53	0.00
Interest on Working Capital	84.85	850.29	91.03	60.22
Income Tax	0.00	0.00	0.00	0.00
Gross Expenditure	**19,798.42**	**24,242.33**	**23,626.21**	**18,871.16**
Less: Interest Capitalisation	61.11	86.21	86.21	86.21

Particulars	FY 2020-21			
	Tariff Order for FY 2020-21 dated 11.11.2020	Audited	Claimed	Approved
Less: Employee Capitalisation	272.93	204.13	204.13	204.13
Net Expenditure	**19,464.38**	**23,951.99**	**23,335.88**	**18,580.82**
Bad and Doubtful debts	118.28	75.14	75.14	0.00
Net Expenditure with Provisions	**19,582.66**	**24,027.13**	**23,411.02**	**18,580.82**
Return on Equity	519.48	0.00	631.25	543.90
Less: Non-Tariff Income	17.79	135.9	101.14	135.9
Less: Revenue from Open Access Customers	2.73	23.15	23.15	23.15
Net Annual Revenue Requirement of Licensee	**20,081.62**	**23,868.08**	**23,917.97**	**18,965.67**
Revenue Assessment at Existing Tariff	18849.33	17274.00	17274.00	17274.00
Deemed Revenue (LMV-10)				86.31
Govt. Subsidy Received/Declared	2664.18	2176.20	2176.20	2176.20
Additional Subsidy to be received				620.72
Revenue Gap / (Surplus)	**(1431.89)**	**4417.88**	**4467.78**	**(1191.56)**

4.3.2.3 CATEGORY WISE REVISED SALES OF PVVNL FOR FY 2021-22 (MU)

Category	Claimed in APR
LMV-1: Domestic Light, Fan & Power	12,018.42
LMV-2: Non-Domestic Light, Fan & Power	1,719.24
LMV-3: Public Lamps	186.57
LMV-4 Light, fan & power for public/private institution	156.87
LMV-5: Private Tube Wells/ Pumping Sets	6,185.38
LMV 6: Small & Medium Power upto 100 hp/75kw	1,183.29
LMV-7: Public Water Works	381.80
LMV-8: State Tube Wells & Pump Canal upto 100 HP	374.32
LMV-9: Temporary Supply	97.42
LMV-10: Departmental Employees	143.01
LMV-11: Electrical Vehicles	0.45
HV-1: Non-Industrial Bulk Load	1,533.19
HV-2: Large & Heavy Power above 100 BHP (75 kW)	5,444.23
HV-3: Railway Traction	88.45
HV-4: Lift Irrigation & p. Canal above 100 BHP (75 kW)	1.31
Bulk Supply	-
Extra State Consumer	-
Grand Total	29,513.96

5 Critical Network Analysis

The document verification and reports submitted by the PVVNL provided the insights to the energy consumption pattern it can be seen that 25% of its energy is consumed by Agricultural then followed by Residential consumer.

SCADA is implemented in PVVNL in distribution franchisee area. Due to some communication issues and also updating issues for additional 11 kV feeders and 33/11 kV new substations, 100% data is not available in the SCADA system. The projects to bring all feeders and substations into the system is under progress. Supply sources of the PVVNL as shown below with respective installed percentage.

*Input Energy Is Purchased by UPPCL centrally, above information up to DISCOM Level is Not available.

5.1.1 Purchased Energy for 2020-21

The injected energy is measured at the Generation station.

Table 11 Purchased Energy

DC	Type	Assessment Net Input Energy Consumption (MU)	Remarks
PVVNL	DISCOM	34427.51	Total Energy purchased by PVVNL.

5.1.2 Input Energy

Input Energy Is Purchased by UPPCL centrally. Breakup up to DISCOM Level of Input Energy is Not available.

5.1.3 Billed energy 2020-21

All consumers except Agriculture are billed on monthly basis. Further monthly Ag consumption is being calculated based on the predominantly feeding DTRs. Also, at some places, based on the actual meter reading of AG consumers.

Table 12 Billed energy

Sr. No	Billed Energy (MU)	Data Source
1	28238.7	As per the submitted data by the PVVNL team

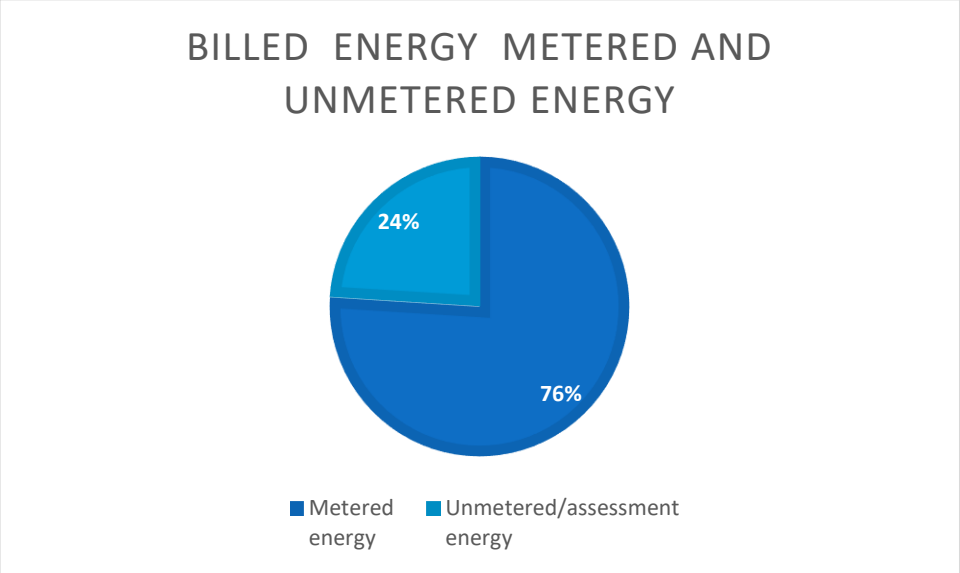


Figure 5 Metered and unmetered

5.2 Distribution Loss calculation

The feeder level energy audit is performed by PVVNL. For a distribution loss calculation, input energy to PVVNL network is calculated by summating energy of all the feeder meters of PVVNL and the total energy billed to the consumers.

Voltage level wise loss calculation is not carried out at PVVNL. The Sub-Division level loss calculation are the carried out and the loss are monitored at Sub-division level. Input to the Sub-divisions are at voltage level 11kV.

5.2.1 Energy Balance Division wise 2020-21 Division wise

Sub-Division Wise Energy Balance Sub-division wise is shown below.

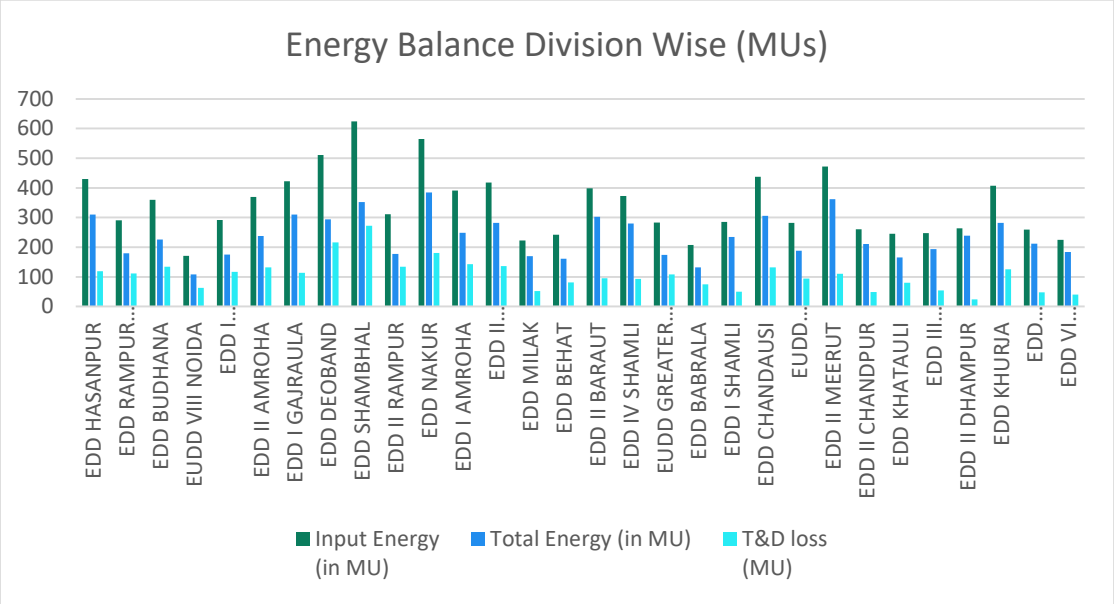


Figure 6 Energy Balance Division Wise (MUs)

Table 13 Input Mus voltage by bifurcation

	Voltage level	Particulars	MU	Reference	Remarks (Source of data)
i	66kV and above	Long-Term Conventional		Includes input energy for franchisees	*Input Energy Is Purchased by UPPCL centrally .Breakup upto DISCOM Level of Input Energy is Not available.
		Medium Conventional			
		Short Term Conventional			
		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	0	Based on data from Form 5	
		Power at state transmission boundary	0		
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		

	Voltage level	Particulars	MU	Reference	Remarks (Source of data)
iii		**Input in DISCOM wires network**	0		
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**	0		

	Voltage level	Energy Sales Particulars	MU	Reference
i	LT Level	DISCOM' consumers		Include sales to consumers in franchisee areas, unmetered consumers
		Demand from open access, captive	0	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		

	Voltage level	Energy Sales Particulars	MU	Reference
ii	11 kV Level	DISCOM' consumers	24,978.61	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	24,979	
		Quantum of Losses at 11 kV	6,180	
		Energy input at 11 kV level	31,158	
iii	33 kV Level	DISCOM' consumers	2,464.81	Include sales to consumers in franchisee areas, unmetered consumers
		Demand from open access, captive		Non DISCOM's sales
		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	2,465	
		Quantum of Losses at 33 kV Level	9	
		Energy input at 33kV Level	2,473	
iv	> 33 kV	DISCOM' consumers	795	Include sales to consumers in franchisee areas, unmetered consumers
		Demand from open access, captive		Non DISCOM's sales
		Cross border sale of energy		
		Sale to other DISCOMs		
		Banking		
		Energy input at > 33kV Level	796	
		Sales at 66kV and above (EHV)	795	
		Total Energy Requirement	**34,428**	
		Total Energy Sales	**28,239**	

Table 14 Energy Accounting Summary MU

	DISCOM	Input (in MU)	Sale (in MU)	Loss (in MU)	Loss %
i	LT	-	-	-	-
ii	11 kV	31,158	24,979	6,180	19.83%
iii	33 kV	2,473	2,465	9	0.35%
iv	> 33 kV	796	795	0	0.05%

Table 15 Transmission and Distribution loss

Loss Estimation for DISCOM	
D loss (MU)	6,189
D loss (MU)	6,189
D loss (%)	18.0%
D loss (%)	18.0%

Total Distribution Loss of the PVVNL is 17.98%, Which is 6,189 MU

5.2.2 Feeder wise assessed loss of PVVNL

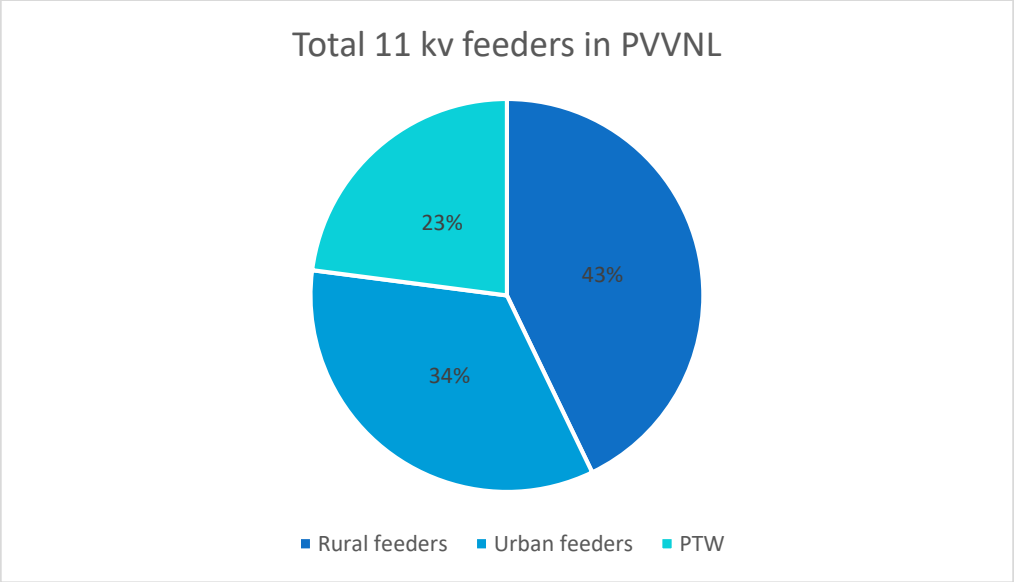


Figure 7 Total 11kv feeders in PVVNL

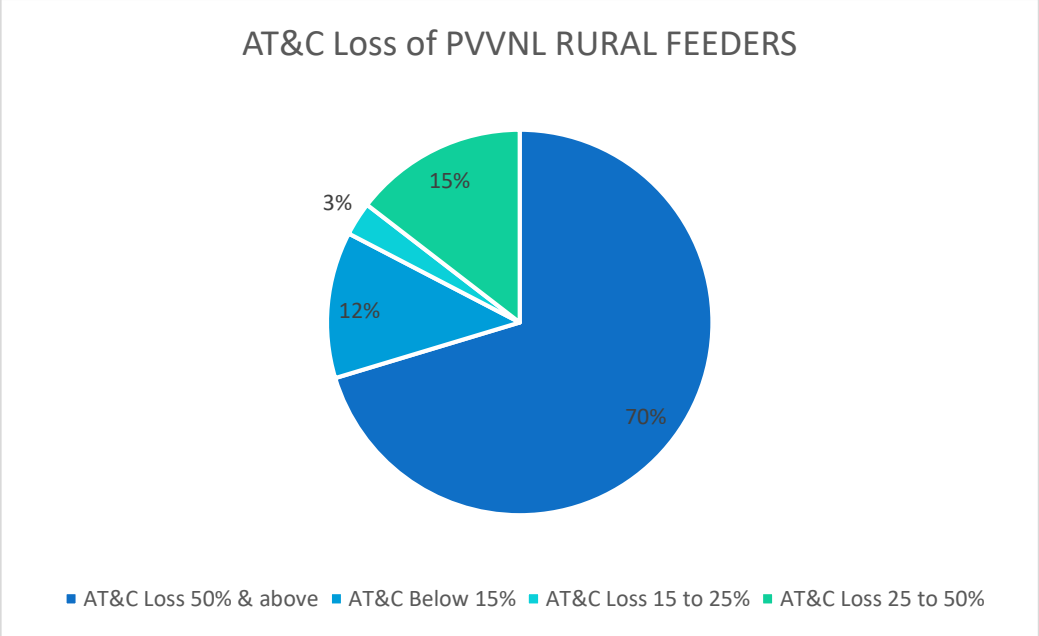


Figure 8 AT&C Loss of PVVNL RURAL FEEDERS

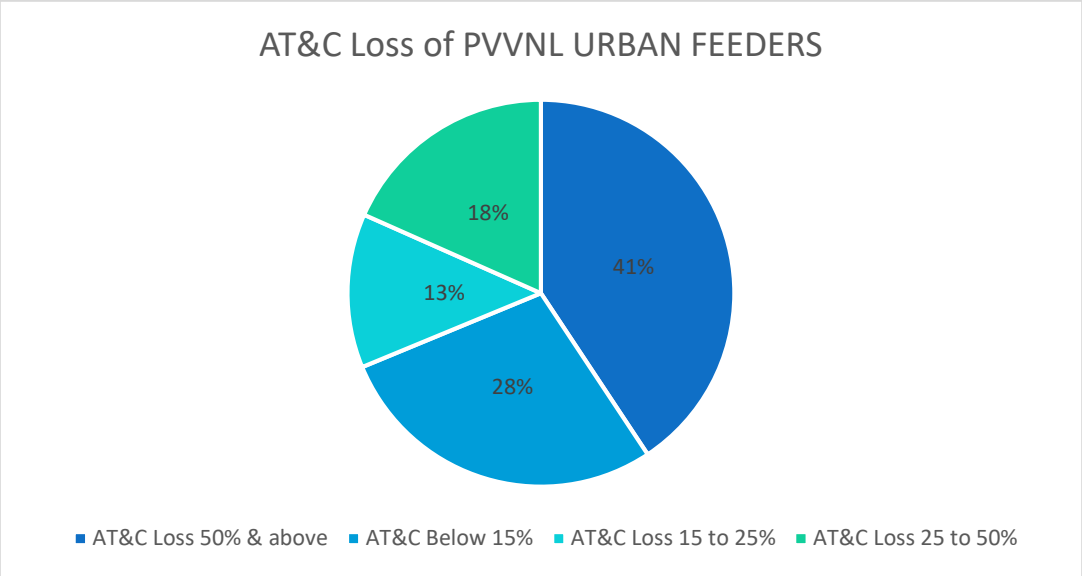


Figure 9 AT&C Loss of PVVNL Urban FEEDERS

5.3 AT&C Losses Computation in PVVNL

Total unit received is computed from the actual meter readings of the interface meter installed at various locations in the system. The units billed are calculated as actual billed to various categories of the consumers.

Determination of Aggregate Technical and Commercial losses (AT&C) involve calculation of T&D Loss (%) as difference between input energy and units billed.

Where T&D loss: $(UI–UB)/\ UI$ %

UI: Units Input (excluding units traded)

UB: Units Billed (to consumers in its licensed area)

- Billing Efficiency = 1- T&D Loss
- Collection efficiency as the ratio of amount collected to amount billed.
- AT&C loss as difference between units input and units realized.

AT & C Loss: [1- Billing Efficiency X Collection Efficiency] X 100%

Table 16 District wise AT&C losses is shown below

Name of District	FY 2020-21
	% AT&C Loss
SAMBHAL	49.42
AMROHA	40.97
SAHARANPUR	38.25
RAMPUR	32.91
SHAMLI	28.95
MUZAFFARNAGAR	26.74
BULANDSHAHAR	23.41
HAPUR	21.56
MEERUT	20.16
BAGHPAT	16.75
BIJNORE	16.09
MORADABAD	15.73
GHAZIABAD	9.55
G.B. NAGAR	7.19
PASCHIMANCHAL	17.23

Table 17 Collection Efficiency Sub-Division wise

Division	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency
EDD HASANPUR	14402	5468	37.97%
EDD RAMPUR MANIHARAN	10302	4876	47.33%
EDD BUDHANA	10051	5005	49.80%
EUDD VIII NOIDA	4710	2716	57.68%
EDD I SAHARANPUR	12002	7473	62.26%
EDD II AMROHA	12533	7372	58.82%
EDD I GAJRAULA	31116	16579	53.28%
EDD DEOBAND	14907	10188	68.34%
EDD SHAMBHAL	19720	13871	70.34%
EDD II RAMPUR	11672	8227	70.49%
EDD NAKUR	14404	8527	59.20%
EDD I AMROHA	12537	8066	64.34%
EDD II MUZAFFARNAGAR	14431	8806	61.02%
EDD MILAK	11511	6245	54.25%
EDD BEHAT	10558	6800	64.40%
EDD II BARAUT	12370	7439	60.14%
EDD IV SHAMLI	10632	6774	63.71%
EUDD GREATER NOIDA	12029	9376	77.95%
EDD BABRALA	5930	4473	75.42%
EDD I SHAMLI	9375	5700	60.81%
EDD CHANDAUSI	18283	13140	71.87%
EUDD BULANDSHAHAR	17397	13126	75.45%
EDD II MEERUT	16106	10620	65.94%
EDD II CHANDPUR	6943	4410	63.52%
EDD KHATAULI	9164	7044	76.87%
EDD III BULANDSHAHAR	8663	5769	66.59%
EDD II DHAMPUR	11883	6832	57.49%
EDD KHURJA	17100	13823	80.83%
EDD JAHANGIRABAD	9672	6818	70.49%
EDD VI BULANDSHAHAR	8234	5762	69.98%

Division	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency
EDD V BULANDSHAHAR	6384	4778	74.84%
EUDD II MUZAFFARNAGAR	15832	11426	72.17%
EDD III SHAMLI	12793	7793	60.92%
EDD I RAMPUR	19687	20979	106.56%
EDD III MORADABAD	8537	6136	71.88%
EDD II SAHARANPUR	13611	11421	83.91%
EDD SAYANA	8130	6328	77.84%
EDD III LONI	11980	11032	92.09%
EDD II MAWANA	6525	4972	76.19%
EDD I MUZAFFARNAGAR	21961	18057	82.23%
EDD GARH	11043	8736	79.11%
EDD BILASPUR	14688	11941	81.30%
EDD I DHAMPUR	10953	8124	74.18%
EUDD III MEERUT	22562	19236	85.26%
EDD MURADNAGAR	24323	21782	89.55%
EDD II BAGHPAT	8777	7682	87.52%
EDD I MAWANA	9648	7817	81.03%
EDD I MORADABAD	23300	19070	81.85%
EDD II MORADABAD	11717	10052	85.79%
EDD I BAGHPAT	10519	8718	82.88%
EDD I LONI	26189	23382	89.28%
EUDD III MORADABAD	19004	18596	97.85%
EDD MODINAGAR	17967	16566	92.20%
EDD IV NOIDA	23999	22597	94.16%
EDD I BARAUT	8614	7583	88.03%
EDD NAJIBABAD	13730	11961	87.12%
EDD II BIJNOR	7295	6125	83.97%
EDD I BIJNOR	12196	11872	97.35%
EDD-2 HAPUR	41269	38225	92.62%
EDD II SHAMLI	11684	11492	98.35%

Division	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency
EDD-1 HAPUR	30710	28798	93.78%
EDD I MEERUT	30096	26746	88.87%
EDD NAGINA	8687	7703	88.68%
EUDD V MEERUT	16773	15811	94.27%
EDD DIBAYEE	7195	6770	94.09%
EDD IV MEERUT	11196	10394	92.84%
EDD II LONI	16316	15536	95.23%
EDD III MEERUT	20703	19189	92.69%
EUDD II MORADABAD	20262	21921	108.19%
EUDD II SAHARANPUR	20841	22571	108.30%
EUDD I MEERUT	15455	15306	99.04%
EUDD I MUZAFFARNAGAR	20954	19866	94.81%
EUDD IV MEERUT	31211	29205	93.57%
EDD I CHANDPUR	12342	12089	97.95%
EUDD II MEERUT	26656	27058	101.51%
EDD I BULANDSHAHAR	40097	38534	96.10%
EUDD IV GHAZIABAD	22850	23221	101.63%
EUDD I SAHARANUR	20660	22330	108.08%
EUDD IX GHAZIABAD	29021	28863	99.45%
EUDD I MORADABAD	24408	26807	109.83%
EUDD III GHAZIABAD	16584	17064	102.90%
EUDD VI GHAZIABAD	40453	39787	98.35%
EUDD XI GZB (KHODA)	10732	11146	103.86%
EUDD X GHAZIABAD	24958	24960	100.01%
EUDD VIII GHAZIABAD	28348	28648	101.06%
EUDD III MUZAFFARNAGAR	28835	29529	102.40%
EUDD I NOIDA	87141	85699	98.35%
EUDD II NOIDA	96302	94154	97.77%
EUDD V NOIDA	67015	69121	103.14%
EUDD VII NOIDA	55546	54996	99.01%

Division	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency
EUDD VII GHAZIABAD	38452	40470	105.25%
EUDD I GHAZIABAD	41958	42099	100.34%
EUDD V GHAZIABAD	30174	31424	104.14%
EUDD II GHAZIABAD	52015	53812	103.45%
EUDD III NOIDA	77839	80519	103.44%

Table 18 Sub-Division wise T & D Loss

Division		Billed energy (MU)				Losses	
	Input energy (MU)	Metered energy	Unmetered /assessment energy	Total energy	% of energy consumption	T&D loss (MU)	T& D loss (%)
EDD HASANPUR	430	90	220	310	100%	119	28%
EDD RAMPUR MANIHARAN	291	73	106	179	100%	112	38%
EDD BUDHANA	359	81	145	225	100%	134	37%
EUDD VIII NOIDA	171	62	46	108	100%	63	37%
EDD I SAHARANPUR	292	120	55	175	100%	117	40%
EDD II AMROHA	369	124	113	238	100%	132	36%
EDD I GAJRAULA	423	177	132	310	100%	113	27%
EDD DEOBAND	510	146	148	294	100%	216	42%
EDD SHAMBHAL	624	198	154	352	100%	272	44%
EDD II RAMPUR	311	141	36	177	100%	134	43%
EDD NAKUR	565	107	277	384	100%	181	32%
EDD I AMROHA	391	106	143	249	100%	142	36%
EDD II MUZAFFARNAGAR	418	146	136	282	100%	136	33%
EDD MILAK	222	118	52	170	100%	52	23%
EDD BEHAT	242	108	53	161	100%	81	33%
EDD II BARAUT	398	125	178	303	100%	95	24%
EDD IV SHAMLI	373	102	178	280	100%	93	25%
EUDD GREATER NOIDA	283	141	33	174	100%	109	38%
EDD BABRALA	208	42	90	132	100%	75	36%
EDD I SHAMLI	285	109	126	235	100%	50	18%
EDD CHANDAUSI	437	178	128	306	100%	132	30%
EUDD BULANDSHAHAR	282	187	1	188	100%	94	33%
EDD II MEERUT	472	207	155	362	100%	110	23%
EDD II CHANDPUR	260	90	121	211	100%	49	19%
EDD KHATAULI	245	93	72	165	100%	80	33%
EDD III BULANDSHAHAR	248	75	118	193	100%	55	22%

Division		Billed energy (MU)				Losses	
	Input energy (MU)	Metered energy	Unmetered /assessment energy	Total energy	% of energy consumption	T&D loss (MU)	T& D loss (%)
EDD II DHAMPUR	263	181	58	239	100%	24	9%
EDD KHURJA	407	200	81	281	100%	125	31%
EDD JAHANGIRABAD	260	83	128	212	100%	48	19%
EDD VI BULANDSHAHAR	224	90	94	184	100%	40	18%
EDD V BULANDSHAHAR	177	69	68	137	100%	39	22%
EUDD II MUZAFFARNAGAR	415	193	143	336	100%	79	19%
EDD III SHAMLI	266	156	99	255	100%	11	4%
EDD I RAMPUR	430	229	8	237	100%	193	45%
EDD III MORADABAD	208	138	32	170	100%	38	18%
EDD II SAHARANPUR	291	141	63	205	100%	87	30%
EDD SAYANA	263	80	129	209	100%	54	20%
EDD III LONI	243	143	21	164	100%	79	33%
EDD II MAWANA	206	70	99	169	100%	37	18%
EDD I MUZAFFARNAGAR	496	258	131	390	100%	106	21%
EDD GARH	353	126	166	293	100%	60	17%
EDD BILASPUR	293	162	78	241	100%	53	18%
EDD I DHAMPUR	229	132	74	206	100%	23	10%
EUDD III MEERUT	332	255	5	260	100%	71	22%
EDD MURADNAGAR	415	278	33	311	100%	104	25%
EDD II BAGHPAT	199	97	58	155	100%	43	22%
EDD I MAWANA	231	109	86	195	100%	35	15%
EDD I MORADABAD	557	303	165	467	100%	89	16%
EDD II MORADABAD	250	153	49	203	100%	48	19%
EDD I BAGHPAT	304	139	124	263	100%	41	14%
EDD I LONI	382	301	11	311	100%	70	18%
EUDD III MORADABAD	285	212	4	216	100%	69	24%
EDD MODINAGAR	324	220	41	261	100%	63	20%
EDD IV NOIDA	444	338	13	352	100%	92	21%
EDD I BARAUT	276	108	128	236	100%	40	15%
EDD NAJIBABAD	283	163	83	246	100%	37	13%
EDD II BIJNOR	171	89	66	155	100%	16	9%
EDD I BIJNOR	265	133	76	209	100%	56	21%
EDD-2 HAPUR	654	478	66	543	100%	111	17%
EDD II SHAMLI	277	130	90	219	100%	58	21%
EDD-1 HAPUR	512	356	73	430	100%	83	16%
EDD I MEERUT	418	348	25	373	100%	45	11%
EDD NAGINA	178	108	51	159	100%	19	10%

Division		Billed energy (MU)				Losses	
	Input energy (MU)	Metered energy	Unmetered /assessment energy	Total energy	% of energy consumption	T&D loss (MU)	T& D loss (%)
EUDD V MEERUT	228	193	0	193	100%	34	15%
EDD DIBAYEE	224	107	84	191	100%	33	15%
EDD IV MEERUT	314	133	138	272	100%	42	13%
EDD II LONI	225	192	0	192	100%	33	15%
EDD III MEERUT	361	248	71	319	100%	42	12%
EUDD II MORADABAD	288	218	7	225	100%	63	22%
EUDD II SAHARANPUR	310	246	0	246	100%	64	21%
EUDD I MEERUT	202	176	0	176	100%	26	13%
EUDD I MUZAFFARNAGAR	312	279	5	284	100%	28	9%
EUDD IV MEERUT	439	380	28	408	100%	31	7%
EDD I CHANDPUR	300	161	106	267	100%	33	11%
EUDD II MEERUT	360	314	0	314	100%	46	13%
EDD I BULANDSHAHAR	520	466	15	481	100%	39	7%
EUDD IV GHAZIABAD	299	262	1	263	100%	36	12%
EUDD I SAHARANUR	301	250	0	250	100%	51	17%
EUDD IX GHAZIABAD	408	371	1	372	100%	36	9%
EUDD I MORADABAD	320	262	5	267	100%	54	17%
EUDD III GHAZIABAD	202	178	6	184	100%	19	9%
EUDD VI GHAZIABAD	496	470	2	472	100%	23	5%
EUDD XI GZB (KHODA)	154	139	1	140	100%	14	9%
EUDD X GHAZIABAD	306	291	2	293	100%	13	4%
EUDD VIII GHAZIABAD	364	345	0	345	100%	19	5%
EUDD III MUZAFFARNAGAR	431	399	6	405	100%	26	6%
EUDD I NOIDA	1025	1000	5	1005	100%	20	2%
EUDD II NOIDA	1104	1073	16	1089	100%	15	1%
EUDD V NOIDA	733	688	5	692	100%	41	6%
EUDD VII NOIDA	563	554	5	558	100%	5	1%
EUDD VII GHAZIABAD	494	451	11	461	100%	32	7%
EUDD I GHAZIABAD	486	480	2	482	100%	4	1%
EUDD V GHAZIABAD	391	371	3	374	100%	17	4%
EUDD II GHAZIABAD	635	624	1	625	100%	10	2%
EUDD III NOIDA	745	737	0	737	100%	7	1%

5.3.1 Total A T&C Loss of PVVNL.

Table 19 Total AT&C Loss of PVVNL

Performance Summary of Electricity Distribution Companies			
1	Period of Information Year of (FY) information including Date and Month (Start & End)	1st APR, 2021 - 31st MAR, 2022	
2	**Technical Details**		
(a)	**Energy Input Details**		
(i)	Input Energy Purchase (From Generation Source)	Million kwh	-*
(ii)	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	Million kwh	**34427.51**
(iii)	Total Energy billed (is the Net energy billed, adjusted for energy traded))	Million kwh	**28238.70**
(b)	Distribution (D) loss Details -*1	Million kwh	**6188.81**
		%	**17.98%**
	Collection Efficiency	%	**89.86%**
(c)	Aggregate Technical & Commercial Loss	%	**26.29%**

*Input Energy Is Purchased by UPPCL centrally. Breakup up to DISCOM Level of Input Energy is Not available.

*1 This loss is only distribution loss since energy is purchased at the periphery of PVVNL

The Total AT&C loss of the PVVNL is 26.29 % for the year 2020-21

5.4 Recommendations

5.4.1 The residential consumer Metering %

The residential consumers are metered and the percentage is 99.25%.

5.4.2 Input Energy reconciliation

The transmission input energy should be considered as reference data. Every Division shall verify the reading of the meters installed on the input feeder of respective voltage level. This data, which is recorded by division by meter reading, shall be send to PVVNL headquarters for the reconciliation.

Any match has to be rectified by the divisional engineer along with consultation with If rectifies it, then only those data modifications shall be considered on annual energy accounting sheets or quarterly energy accounting.

5.4.3 System automation for loss calculation

The division wise excel sheet shall be automated via some software and the respective changes in the field in order to maintain the supply and meter faults, etc. shall be updated in the software on timely basis.

5.4.4 33/11kV Substation Monitoring System Circle

33/11kV Substation monitoring system shall be implemented. It shall monitor the loading of Transformer, Substations Battery and Feeders. It shall have the capability to show online data.

5.4.5 Distribution Transformer with AMR

Most of the Feeder Meters are having communication facility through AMR and MRI Data (generally, more than feeder meter data is received through AMR or MRI.)

The DTR meter reading shall be AMR based and shall be increased. Proper Monitoring of the DTR meters shall be done.

5.4.6 Transformer Optimization During Off Peak Season

During off-peak periods, PVVNL is expected to minimize the no load losses by maintaining optimal loading of transformers by configuring its network in such a manner that reliability of supply is also not compromised

6 Energy Conservation Schemes

1) Brief about Division:

Electricity Urban Dis. Division- I GZB as a subsidiary company of UPPCL. The Division covers in its jurisdiction the areas of Raj Nagar, Kavi Nagar, Govind Puram, Madhuban Bapudham & BSR Road I/A. The Division comprises of 02 Sub-division & Nos of 17 33/11 KV Sub-Station. The Division comprises more than Fifty Six Thousand of consumers with annual Revenue of around Rs. 365.00Crores in FY2019-20. Division has 06 Secondary sub-stations with an installed capacity of 821 MVA. The total number of distribution transformers are 1772 with installed capacity 301.656 MVA.

Sl No	Particulars	Qty.
1	Nos. of Sub-division	02
2	Nos. of Substations	17
3	Nos. of 33 KV independent feeders	3
4	Nos. of 11 KV feeders	97
5	Nos. of Distribution Transformers	1772

EUDD-I GZB is committed to rapid improvements in efficiency of power distribution to achieve 24-hour availability of quality power for all consumers.

Division Operational Performance (Financial Year)

Particulars	Unit	2019-20	2020-21	2021-22 (Upto Feb.-22
Input Energy	MU	474.04	448.75	450.50
Energy Sales	MU	459.93	439.77	448.49
Distribution loss	%	2.98	2.00	0.45
Billing Efficiency	%	97.02	98.00	99.55
Collection Efficiency	%	102.42	101.20	97.60
AT & C losses	%	0.63	0.34	2.84

Mix Consumer of Division wise as follows :-

Category	No of Consumers (Dec-21)		Sanctioned Load (Dec-21)	
	No.	(%)	MW	(%)
Domestic	47678	84.58	166.22	51.03
Commercial	7312	12.95	48.41	14.86
Industrial	1099	1.95	103.34	31.73
Agricultural	30	0.05	0.28	0.09
Govt. Departments	198	0.35	6.84	2.10
(Temporary)	165	0.29	0.56	0.17
Total				

Root case analyses regarding line losses

Component of line losses

a. Losses in 33kv network.

b. Power Transformer Losses.

c. Bus bar Losses.

d. Losses in 11kv network.

e. Distribution Transformer Losses.

f. Losses in LT network.

Over all technical losses in distribution system is nearly 3 to 4 % in a Healthy distribution network. To maintain distribution network nearly to ideal in practically feasible manner following work out has to be done.

a. All the joint including jumper at every voltage level should be tightly bonded so that sparking as well as leakage current could be avoided.

b. To minimize losses on power as well as distribution transformer.

i) Proper loading (nearly 80%) to minimize copper loss.

ii) Good quality transformer & proper size of core to minimize core losses.

2. Losses due to theft & pilferage of energy

a. Direct theft:- In this division, Rahispur, Sadarpur & Indergarhi are sami urban areas where consumer has caught direct theft during morning raid

b. Metered theft: - Raishpur Sadarpur, Indragrahi, Govindpuram & Swram Jyanti puram where about 30 % meters are inside the premises. Probable these houses has done thru bypass the meter to stop this activities meter outside the premises with visible armored cable from pole to meter should be opted.

c. Quality Billing:- 100% metered billing with actual consumption & demand, proper redresal of defective meter and bill.

d. Consumer is to be tagged DT wise.

2) DT WISE ANALYSIS OF LINE LOSSES & TARGETED SAVE ENERGY:-

Financial Viability:

Project cost regarding reduction of line loss	=	277.42 Lacs
Input Energy of 45 DTs (as per Dec-21)	=	3.928 MU
Sold Energy (as per Dec-21)	=	2.960 MU
Loss of Energy per month (Dec-21)	=	0.96 MU
Saving Monthly Energy @50%	=	0.96X0.5=0.48 MU
Saving Energy per Year (Ist Year)	=	0.48X12=5.76 MU =57.6 Lacs units
Average Tariff of LMV-1	=	6.00 Rs/unit
Cost of Saving Energy per Year (Rs)	=	57.6X6=345.6 Lacs

Invested amount will be recovered within Financial Year.

3) Details of replacement of agriculture pump with energy efficient pumps in respect of UDAY Scheme (in nos.)

S1. No	Name Of Circle	Name of Electricity Distribution Division	2019-2020		2020-2021	
			Replacement of energy efficient pumps		Replacement of energy efficient pumps	
			Target set (in nos.)	Actual/Achieved (in nos.)	Target set (in nos.)	Actual/Achieved (in nos.)
1	Gb Nagar	Gb Nagar	1675	149	468	76
2	Ghazibaad	Ghazibaad	NA	NA	289	0
3	Bulandsaher	Bulandsaher	NA	NA	289	0
4	Meerut	Meerut	NA	NA	317	0
5	Baghpat	Baghpat	NA	NA	312	0

- In 2019-2020 Year target for Replacement of energy efficient pumps was 1675 in total & Actual pumps replaced are 149.
- In 2020-2021 Year target for Replacement of energy efficient pumps was 1675 in total & Actual pumps replaced are 76.

4) 10 Qty of Feeder Wise Losses where DT losses are high: -

Line Loss Progressive 2020-21 (%)	Input Energy Progressive (Apr'21 - Feb'22)	Billed Units Progressive (Apr'21 - Feb'22)	Billing Efficiency Progressive (Apr'21 - Feb'22)	Line Loss Dff (MWH)	Collection Efficiency Progressive (Apr'21 - Feb'22)	AT&C Loss Progressive (Apr'21 - Feb'22)	Nos DT Installed 100 KVA	Nos DT Installed Above 100 KVA	Selected DTs for reducing Line lose	Expected saving Energy (MWH)
123.0	67.77	61.22	8.84	6.02	9.7591	1.7528	379	211	45	3.21

Data Gaps & List of Annexures

6.1 Data Gaps raised by AEA

Table 20 Data Gaps

Sr. No	Data Gaps in the Data provided by MESCOM for Annual Energy Audit as per BEE regulation 6th Oct 2021	Remarks
1	Kindly provide the identification and mapping of all of the electrical network assets;	Division Wise schematic were shown
2	Kindly provide the identification and mapping of high tension and low-tension consumers	Schematic maps for 11kV feeder were shown.
3	Kindly provide the details of the energy accounting data - generated from a metering system or till such time the metering system is not in place, by an agreed method of assumption as may be prescribed by the State Commission	Metering is provided and home grown software is used as per tariff category
4	Whether the Metering of distribution transformers at High Voltage Distribution System up to 25KVA is done on cluster metering? If not what is the action plan	No HVDS installation
5	Energy (Electrical) Purchase report for the year 2020-21	Data provided by PVVNL
6	Open access consumer and their details	Data provided by PVVNL
7	Peak Demand of the system	Peak demand of PVVNL is provided
8	High loss Network segments	The segment identification is not possible due to ring main.
09	Energy Conservational Schemes implemented	Data provided by PVVNL
10	Energy conservational Schemes to be implemented	Data provided by PVVNL
11	Power Distribution Transformer	Data provided by PVVNL
12	SAIDI SAIFI Data for 2020-21	Data provided by PVVNL
13	Maintenance practices - Power Substation , HT lines LT lines ,DTR	Data provided by PVVNL
14	Average Billing Rate	Category wise consumer and total billed energy of those consumer is provided by PVVNL

6.2 List of Annexure

1. General Information
2. Minutes of Meeting with the DISCOM team
3. Check List prepared by auditing Firm.
4. Form-Input energy (Details of Input energy & Infrastructure)
5. Infrastructure Details
6. Power Purchase Details
7. Details of Input Energy Sources
8. Details of Consumers & Category of service details
9. Details of Division Wise Losses
10. Detailed Site visit annexed -Site photos