ANNUAL ENERGY AUDIT REPORT FOR THE YEAR 2023-24

Of

COCHIN PORT AUTHORITY (CoPA)

Willingdon Island, Cochin

July 2024

conducted by

Centre for Energy, Environment and Productivity

Accredited Energy Auditor – AEA 0133

1039, 26th street, H Block, Ponni Colony

Anna Nagar, Chennai – 600 040

http://tallkumar.wixsite.com/ceep ☎ 044-26163483 9444882553 ✉ tallkumar@gmail.com

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Centre for Energy, Environment and Productivity

Plot No 1039, 26th Street, 'H' Block,
Ponni Colony, Anna Nagar,
Chennai 600040
☎ 044-26163483
9444882553
email: tallkumar@gmail.com

25th July 2024

The Chief Mechanical Engineer,

Cochin Port Authority,

Willingdon Island,

Cochin 682009.

Sir,

Sub: **Energy Audit Report of the Cochin Port Authority (Designated Consumer Number: DIS0048 for the year 2023-24 -Submission -reg**

Ref:

1. 8/1/BEE/DISCOM/2021. Dated 06th October 2021 -Manner and Intervals for Conduct of Energy Audit (Accounting) in Electricity Distribution Companies) Regulations,2021 and subsequent amendments by the Bureau of Energy Efficiency

2. Contract No: GEMC-511687788965203 dated 25th July 2024

   As per the reference cited above, please find enclosed herewith the Energy Audit Report of Cochin Port Authority (Designated Consumer Number: DIS0048KL), for favour of further action.

Yours faithfully

J Nagesh Kumar
Accredited Energy Auditor

Centre for Energy, Environment and Productivity
Plot No. 1039, 26th Street, H-Block,
Ponni Colony, Anna Nagar, Chennai - 600 040.
PH : 044 2616 3483, 9444882553

Enclosure: Energy audit report of Cochin Port Authority for the year 2023-24

ACKNOWLEDGEMENT

On behalf of Centre for Energy, Environment and Productivity (CEEP), Chennai we place on record our sincere gratitude to the management of Cochin Port Authority (CoPA) for awarding us the task of carrying out Mandatory Energy audit, for the kind hospitality and support extended for the study of their services.

We extend our deepest gratitude to Shri V. Thuraipandian, Chief Mechanical Engineer, for his insightful suggestions and the wisdom he generously shared with us throughout the Audit period.

We are tankful to P. Muniasamy, Deputy Chief Engineer, Mechanical for his valuable suggestions and support.

We are also indebted to Shri Ajithkumar D., Superintendent Engineer (Elec) & Nodal Officer, and Smt Jayalakshmy S., Executive Engineer (Elec) & Energy Manager, for their extensive interactions and unwavering support during the study.

Our sincere thanks go to Shri Mathew Paul, Assistant Engineer (Elec), Shri Johny Alumparambil, Assistant Engineer (Elec), and all other officers and staff who enthusiastically participated in and helped organize the audit process. Their dedication was key to successfully achieving the audit's objectives.

J. Nagesh Kumar

Director, /AEA 0133

Centre for Energy, Environment and Productivity

1039,26th Street, H Block, Ponni Colony, Anna Nagar, Chennai-600040.

Email: tallkumar@gmail.com

AUDIT TEAM

S.NO	Name of the officer	Qualification	Designation
1.	Dr. J. Nagesh Kumar	Ph.D.	Accredited Energy auditor Reg No: 0133
2	Shri Sunilkumar V K	B. Tech (Elec)	Sector expert (DISCOM) & Certified Energy Auditor Reg No: EA 3642
3.	Shri Prakashan N.K	B.E.	Electrical Engineer
4.	Shri K.G. Diwakar	M.E.	Certified Energy Auditor

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1. Executive Summary

1.1 About DISCOM

Cochin Port Authority (CoPA) -Distribution -Overview

Overview

Cochin Port Authority (CoPA) operates under the Major Port Authorities Act, 2021 (formerly Cochin Port Trust). It is a Deemed Electricity Distribution Licensee as per the Electricity Act 2003 and a notified Designated Consumer (DC No: DIS0048KL) under PAT Cycle VII, as per the Ministry of Power's notification (S.O.4552(E), dated 26th September 2022).

Electricity Procurement and Distribution

CoPA purchases electricity from Kerala State Electricity Board Limited (KSEBL) and distributes it to consumers in the port areas of Willingdon Island, Vallarpadam, and Puthuvypin.

Power Procurement

- **Willingdon Island**: 6.5 MVA power at 110 KV from KSEBL.
- **Vallarpadam**: 5 MVA power at 11 kV from KSEBL through two feeders:
    - Old feeder: 3 MVA contract demand.
    - New feeder (commissioned in March 2024): 2 MVA contract demand, dedicated to a commercial establishment under the CoPA.

Substations

- **Willingdon Island**: 110kV/11kV Substation with two 10/12.5MVA power transformers.
- **Vallarpadam**: 11kV receiving station with two incoming feeders.

Power Distribution

Power is distributed to consumers through 11kV underground (UG) cables connected via a Ring Main system to ensure a reliable 24x7 supply. Low Tension (LT) feeding is done using LT overhead (OH) and UG cable lines.

Consumer Base

CoPA serves 1,288 consumers as on 31st March 2024.

- **HT consumers**: 37
- **LT consumers**: 1,251

All consumers except 50% of the self-consumption meters and street light meters are SMART meters with Advanced Metering Infrastructure (AMI) features and prepaid facilities. These

meters are connected to a centralized AMI software system via GPRS, with billing and accounting managed through the SAP system.

Feeder and Transformer Infrastructure

- **Willingdon Island**: Eleven 11 kV feeders from the 110/11 kV substation.
- **Vallarpadam & Puthuvypin**: five 11 kV feeders.
- **Transformers**: 30 distribution transformers (11kV/415Volt and 11kV/3.3 kV).

Renewable Energy Initiatives

- **Solar Plants**: 100kWp and 150kWp grid-connected solar plants.
- **Solar Prosumers:** There are 9 solar prosumers as on the end of the FY 2023-24
- **Net Metering**: Available for LT and HT prosumers.
- **Energy Audit**: Solar energy inputs are included in the energy audit.

Key Projects

RDSS Project

- **Funding**: Rs 15.13 Crores under the Revamped Distribution Sector Scheme (RDSS).
- **Goals**: Modernization and loss reduction through:
  - Replacement of old cables, transformers, and Ring Main units.
  - Addition of three 11 kV panels.
  - Completion of metering for 11 kV feeders and distribution transformer (DTR) metering.
  - Implementation of SCADA project.
- **Timeline**: FY 2021-22 to 2025-26

Other Projects

- **Contract Demand Enhancement**: Contract demand will be enhanced to 8 MVA at Vallarpadam by December 2024. (The work is under progress).
- **Shore Power Supply**: Provision of shore power to international cruise vessels by FY 2025-26 with 6 MVA Green Energy through open access.
- **Floating Solar Plant**: Installation of a 1.5MWp grid-connected floating solar plant by the end of FY 2024-2025.
- **350 kWp Roof top SPV by the end of 2024**-25
- **SMART Lighting proposal amounting 2**.05 Cr submitted for MOPSW,

This comprehensive approach ensures CoPA's commitment to reliable power distribution, modernization, and sustainable energy initiatives.

1.2 Energy performance of the DISCOM

1.2.1 Performance summary of the CoPA for the FY 2023-24

S.NO	Energy input details	Units	Quantity
i	Energy purchased	MU	40.12
ii	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	40.43
iii	Energy billed	MU	39.50
iv	T& D Loss	MU	0.933
v	% T&D Loss	%	2.308
vi	Amount of Energy billed	Rs (Crores)	43.18
vii	Amount of collection	Rs (Crores)	43.11
viii	Collection efficiency	%	99.83
ix	% AT&C Loss	%	2.47

- **Energy purchased also includes internal generation and solar roof top.**

Table 1

1.2.2. Quarter wise performance of the CoPA for the FY 2023-24

S.NO	Energy input details	Units	QTR1	QTR2	QTR3	QTR 4
A	Energy purchased	MU	10.38	9.28	9.59	10.87
B	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	10.47	9.35	9.67	10.94
C	Energy billed	MU	**10.201**	9.150	9.466	10.685
D	T& D Loss	MU	0.266	0.205	0.203	0.259
E	% T&D Loss	%	2.54	**2.19**	2.10	**2.37**
G	Amount of Energy billed	Rs (Crores)	10.97	10.01	10.44	11.76
H	Amount of collection	Rs (Crores)	10.95	10.00	10.42	11.74
I	Collection efficiency	%	99.83	99.83	99.83	99.83
J	% AT&C Loss	%	2.70	2.36	2.26	2.54

Table 2

1.2.3 Quarter wise Energy performance of the CoPA for FY 2023-24

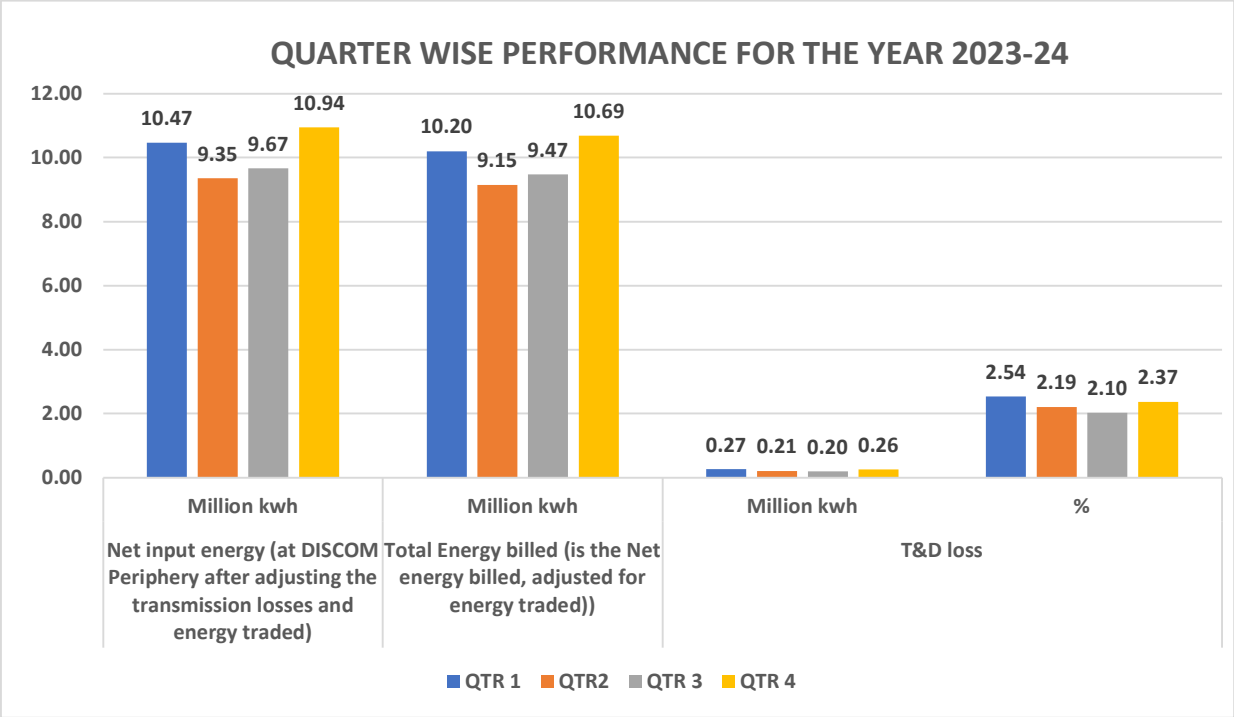

Figure-1

1.2.4 Quarter wise T&D Loss performance for the FY 2023-24

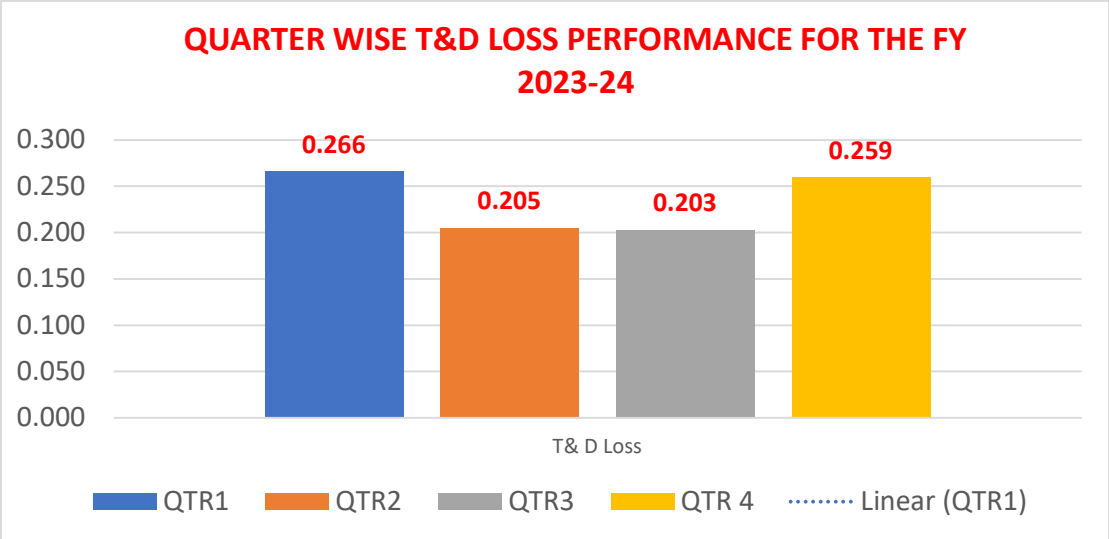

Fig -2

1.3.1 Category wise Consumers and Energy sales for the FY 2023-24

Period From 1st April 2023 to 31st March 2024						
Consumer profile		Energy parameters			Losses	
Consumer category	Total Number of connecti	Input energy (MU)	Total energy	% of energy consumption	T&D loss (MU)	T&D loss (%)
Residential	412	40.43421	0.97	2%	0.933059	2.31%
Agricultural	0		0.00	0%		
Commercial/Industrial-LT	605		4.63	12%		
Commercial/Industrial-HT	30		28.77	73%		
Others	241		5.13	13%		
	1288	**40.43421**	**39.50**	**100%**	**0.933**	**2.308%**

Table 3

1.3.2 Percentage wise Consumption of different category of consumers

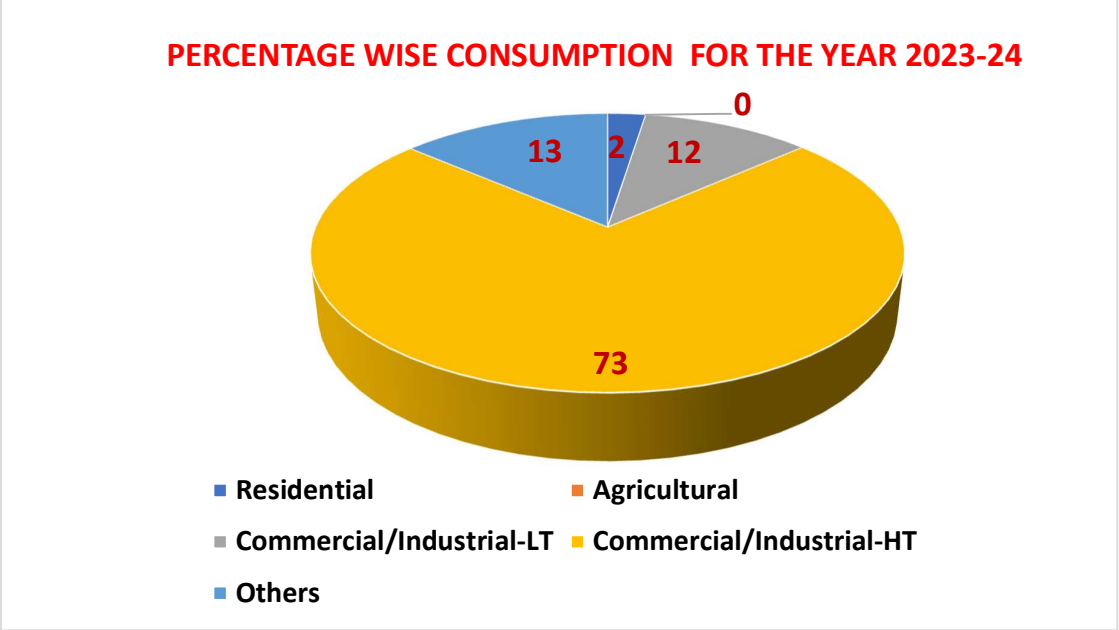

Fig 3

1.4. Infrastructure details

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Form-Details of Input Infrastructure					
1	**Parameters**	**Total**	**Covered during in audit**	**Verified by Auditor in Sample Check**	**Remarks (Source of data)**
i	Number of circles	1	1		In CoPA there is no Division or Subdivision wise formation.
ii	Number of divisions	0			
iii	Number of sub-divisions	0			
iv	Number of feeders	16	16	11	Through AMI meter software for 11 nos out of 16 feeders
v	Number of DTs	30	30	1	No meter is installed
vi	Number of consumers	1288	1288	1288	Through SAP

Table 4

1.5. ENERGY INJECTION & FEEDER WISE ENERGY DISTRIBUTION IN CoPA

1.5.1 Meter readings of energy injection points

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B. Meter reading of Input energy at injection points									
S.No	**Zone**	**Voltge Level (KVA)**	**Feeder Metering Status (Metered/ unmetered/ AMI/AMR)**	**Feeder Type (Agri/ Industrial /Mixed)**	**Period from…to…**				**Remarks (Source of data)**
					Meter S.No	**CT/PT ratio**	**Import (MU)**	**Export (MU)**	
B.1	CoPA	110 kV	AMR	Mixed	17078922	150	28.65	0.00	**Input energy at Transmission boundary**
B.2	CoPA	11	AMR	Mixed	22001331	40	11.00	0.00	
B.3	CoPA	11	AMR	Mixed	23013883	24	0.47	0.00	**New feeder**
B.4	CoPA	0.415	AMI	Mixed			0.31		**Solar energy input**
B.5									

Table 5

1..6 Feeder wise energy import and consumption

Sl No.	Zone	Received at Circle (In MU)	Name of the Station	Feeder Code/ID	Feeder Name	Type of feeder meter (AMI/AMR/ Other)	Received at Feeder (Final in MU)	Feeder Consumption (In MU)	Final Net Export at Feeder Level (In MU)	Remarks
1	CoPA	0.3	Willingdon Island	K01 A	MNC	AMI	0.3	Not recorded	0	Consumer Mapping not completed
2	CoPA	4.5	Willingdon Island	K16	NTRO KV	AMI	4.5	Not recorded	0	do
3	CoPA	2.3	Willingdon Island	3	Q9 1	AMI	2.3	Not recorded	0	do
4	CoPA	5.4	Willingdon Island	4	Q92	AMI	5.4	Not recorded	0	do
5	CoPA	2.2	Willingdon Island	5	MH2	AMI	2.2	Not recorded	0	do
6	CoPA	2.7	Willingdon Island	9	UTL	AMI	2.7	Not recorded	0	do
7	CoPA	6.0	Willingdon Island	10	Q93	AMI	6.0	Not recorded	0	do
8	CoPA	0.2	Willingdon Island	11	MH3	AMI	0.2	Not recorded	0	do
9	CoPA	0.1	Willingdon Island	12	STN TR	AMI	0.1	Not recorded	0	do
10	CoPA	2.3	Willingdon Island	K15	PENNA	AMI	2.3	Not recorded	0	do

11	CoPA	2.6	Willingdon Island	K17	NTRO A2	AMI	2.6	Not recorded	0	do
12	CoPA	0.0	Vallarpadam		MULT RMU NO.1		0.0	Not recorded	0	do
13	CoPA	0.0	Vallarpadam		ICTT		0.0	Not recorded	0	do
14	CoPA	0.0	Vallarpadam		STN TR		0.0	Not recorded	0	do
15	CoPA	11	Vallarpadam		RMU NO.3		11	Not recorded	0	do
16	CoPA	0.477	Vallarpadam		DPWORLD		0.477	Not recorded	0	do

Table 6

1.7 Energy Conservation measures implemented under the DISCOM

PAT-Cycle

NAME OF DISCOM : COCHIN PORT AUTHORITY
Registration no. DIS0048KL

Form 3
[see rule 3(2)]

Details of energy efficiency improvement measures implemented, investment made and savings in energy achieved and progress made in the implementation of other recommendations.

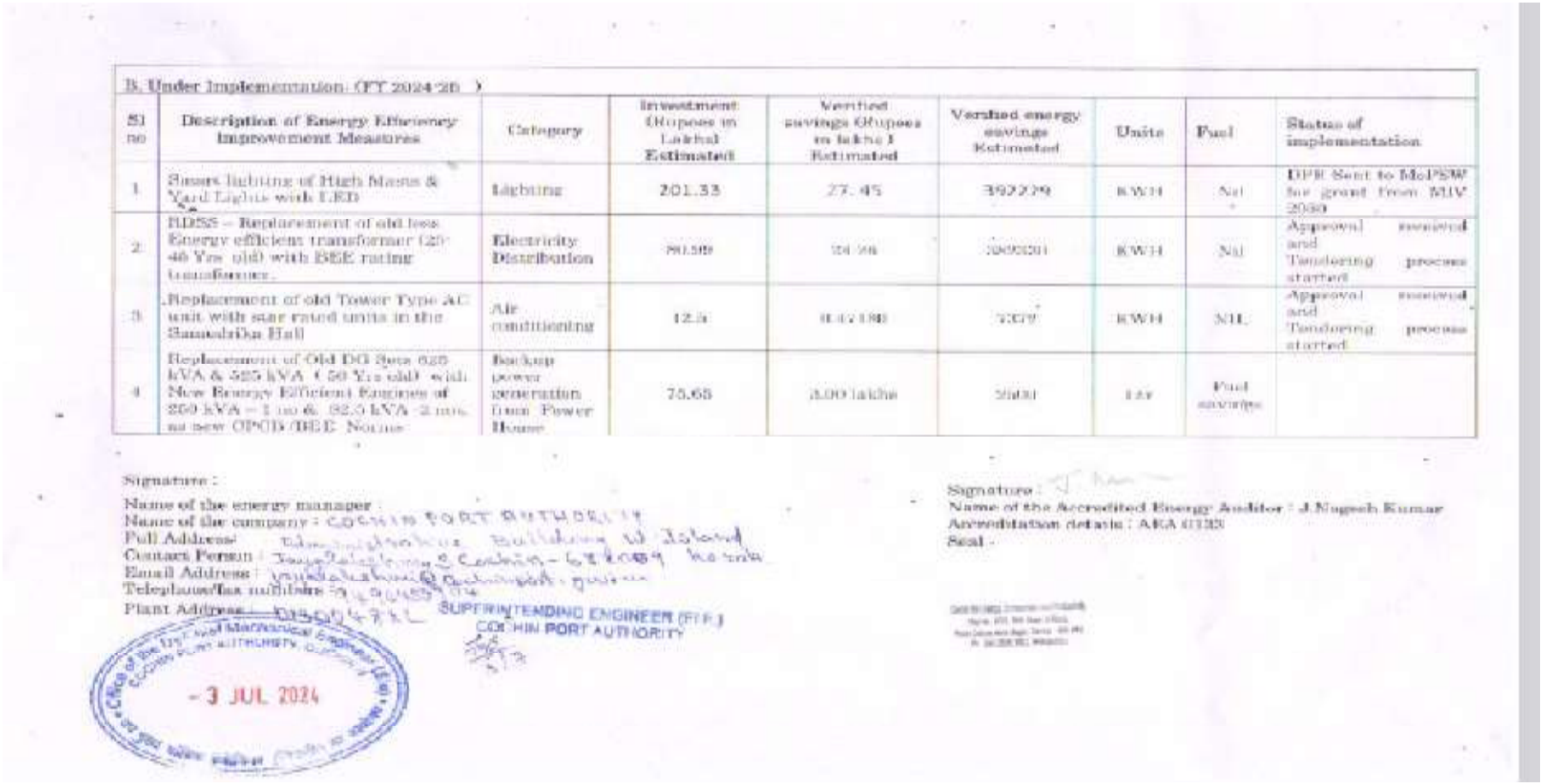
A. Implemented: (FY 2023-24)

Sl no	Description of Energy Efficiency improvement Measures	Category	Investment (Lakhs Rupees)	Verified savings (Lakhs Rupees)	Verified energy savings	Units	Fuel	Remarks
1	Replacement of lamps with LED lamps	Lighting	2.77216	2.47319	35303	KWH		
2	Replacement of Old AC units with 3 Star to 5 Star ACs in various locations	Air Conditioning	1.858519	1.76500	25000	KWH	320	16 nos. of A.Cs replaced with Star rated A.Cs
	Total		10.486519	4.23819	60603	KWH	-	

Name of the Accredited Energy Auditor: J.Nagesh Kumar
Accreditation details: AEA 0133

SUPERINTENDING ENGINEER (T)
COCHIN PORT AUTH

Office of the Chief Mechanical Engineer (T)
COCHIN PORT AUTHORITY, COCHIN-9
- 3 JUL 2024



B. Under Implementation- (FY 2024-25)

Sl no	Description of Energy Efficiency Improvement Measures	Category	Investment (Rupees in Lakhs) Estimated	Verified savings (Rupees in lakhs) Estimated	Verified energy savings Estimated	Units	Fuel	Status of implementation
1	Smart lighting of High Masts & Yard Lights with LED	lighting	201.33	27.45	392229	KWH	Nil	DPR Sent to MoPSW for grant from MIV 2030
2	RDSS – Replacement of old less Energy efficient transformer (20-40 Yrs old) with BEE rating transformers.	Electricity Distribution	80.589	10.99	1569201	KWH	Nil	Approval received and Tendering process started
3	Replacement of old Tower Type AC unit with star rated units in the Samudrika Hall	Air conditioning	12.5	0.17198	2457	KWH	NIL	Approval received and Tendering process started
4	Replacement of Old DG Sets 625 kVA & 525 kVA (-50 Yrs old) with New Energy Efficient Engines of 250 kVA – 2 nos & 82.5 kVA -2 nos as new CPCB/BEE Norms	Backup power generation from Power House	75.65	5.00 lakhs	20830	Ltr	Fuel savings	

Signature :
Name of the energy manager :
Name of the company : COCHIN PORT AUTHORITY
Full Address :
Contact Person :
Email Address :
Telephone/fax numbers :
Plant Address :

SUPERINTENDING ENGINEER (ITF)
COCHIN PORT AUTHORITY

- 3 JUL 2024

Signature :
Name of the Accredited Energy Auditor : J Nagesh Kumar
Accreditation details : AEA 01320
Seal :

Table 7

1.7.2.1 Energy conservation measures proposed during the FY 2023-24

Energy conservation measures Proposed during the FY 2023-24												
S.NO	Energy effeciency measure	QTY (No)	Unit	Captal investment (Rupees in Lakh)	Annual energy saving (kWH)	Annual savings (Rs) (Lakhs)	Discount rate(%)	CASH FLOW (Years)	Simple Pay back Period (Years)	NPV (Lakh Rs)	IRR(%)	Remarks
1	Replacement of Old copper(SWG 8) conductor with 3 PHASE 5 wire LT ABC of size 3x95sqmm+1x70 sqmm+1x 16 sqmm	9.17	kM	70	275549.60	16.53	8	13	4.2	₹ 71.70	26%	
2	Rectification of the inverter and clearing shading of the 100 kW solar power plant	1	NO	3	50000	3.55	8	5	0.8	₹ 12.66	110%	Presently 3 Nos of 30 kVA inverter units are in breakdown condition
				73	325549.60	20.08						

Table 8A

1.7.2.2 Other Energy conservation measures proposed during the FY 2023-24tA

Other measures proposed			
1	Energy conservation measures proposed in the 50 hP Mattanchery Halt water Pump house		
	Observations	Measures recommender	Anticipated svings
a.	Apprciable water leakage observed in the delivery Pipe line.	To arrest the leakage	
b	Pump main delivery pipe Valve found partially throttled for controling the flow.	Up on site analysis there is no flow adgustment required for the operation.Hence the operator to be instructed to ensure the full opening of the delivery valve.	The closing of the Pump valve by 20% will increase the Power consumption by about 1/3.
c	Pump Motor found not fitted any Power factor correction Capacitor	For 50 HP motor the rated power factor correction capacitor is 14 kVAR	The power factor correction capacitor will reduce the apparent power at the load side by 2 kVA.Hence there will be savings due to the line loss also

Table No: 8B

2. Back ground

2.1 Extent of Regulations and role of BEE

The Bureau of Energy Efficiency (BEE), through Ministry of Power, Government of India, notified the regulations viz. 'Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit in Electricity Distribution Companies) Regulations, 2021' vide Notification No.18/1/BEE/DISCOM/2021 dated 6th October 2021, and subsequent amendment issued thereof on 28th Oct. 2022. The extent of regulations specifies the following key aspects related to energy accounting and audit for electricity distribution companies.

I. Intervals of time for conduct of periodic energy accounting and annual energy audit and report submission thereof.
II. Pre-requisites for annual energy audit and periodic energy accounting.
III. Reporting requirements for annual energy audit and periodic energy accounting.
IV. Manner of annual energy audit and periodic energy accounting.
V. Prioritization and preparation of action plan and
VI. Structure of annual energy audit report

These regulations have been issued under the ambit of Energy Conservation Act, 2001, with an overall objective to reduce inefficiencies and losses in distribution sector thereby ensuring financial and economic viability of DISCOMs. These regulations shall apply to all electricity distribution companies specified as designated consumer. They shall come into force on the date of their publication in the Official Gazette.

1.**Intervals of time for conduct of annual energy audit**. - (1) Every electricity distribution company shall conduct an annual energy audit for every financial year and submit the annual energy audit report to the Bureau and respective State Designated Agency which will be made available on the website of the electricity distribution company within a period of four months from the expiry of the relevant financial year. Provided that, on the commencement of these regulations, the first annual energy audit of every electricity distribution company shall be conducted within six months from the date of such commencement, by taking into account the energy accounting of electricity distribution company for the financial year immediately preceding the date of the commencement of these regulations.

2.**Intervals of time for conduct of periodic energy accounting. -**

(1) Every electricity distribution company shall —

(a) ensure that all feeder wise, circle wise and division wise periodic energy accounting shall be conducted by the energy manager of the electricity distribution company for each quarter of the financial year; and

(b) submit the periodic energy accounting report to the Bureau and respective State Designated Agency and also made available on the website of electricity distribution company within forty-five days from the date of the periodic energy accounting.

(2) After the commencement of these regulations, every electricity distribution company shall, notwithstanding anything in sub-regulation (1),

(a) Conduct its first periodic energy accounting, for the last quarter of the financial year immediately preceding the date of such commencement; and

(b) Conduct its subsequent periodic energy accounting for each quarter of the financial year for a period of two financial years from the date of such commencement,

5. Pre-requisites for annual energy audit and periodic energy accounting — Save as otherwise provided, every electricity distribution company shall undertake all actions as may be required for the annual energy audit and periodic energy accounting before the start of the relevant financial year, including the following actions, namely: —

(a) the identification and mapping of all of the electrical network assets;

(b) the identification and mapping of high tension and low-tension consumers;

(c) the development and implementation of information technology enabled energy accounting and audit system, including associated software;

(d) the electricity distribution company shall ensure the installation of functional meters for all consumers, transformers and feeders: Provided that meter installation may be done in a phased manner within a period of three financial years from the date of the commencement of these regulations in accordance with the trajectory set out in the First Schedule;

(e)All distribution transformers (other than high voltage distribution system upto 25kVA and other distribution system below 25 kVA) shall be metered with communicable meters. And

existing noncommunicable distribution transformer meters shall be replaced with communicable meters and integrated with advanced metering infrastructure;

(f)The electricity distribution company shall establish an information technology enabled system to create energy accounting reports without any manual interference: Provided that such system may be established—

(i) within a period of three years from the date of the commencement of these regulations in case of urban and priority area consumers; and

(ii) within five years from the date of the commencement of these regulations in case of rural consumers;

(g) the electricity distribution company shall create a centralized energy accounting and audit cell comprising of— (i) a nodal officer, an energy manager and an information technology manager, having professional experience of not less than five years;

(ii) a financial manager having professional experience of not less than five years; (h) any other requisite that Bureau may direct for energy audit and accounting purpose.

6. Reporting requirements for annual energy audit and periodic energy accounting

(1) Every electricity distribution company shall designate a nodal officer, who shall be a full-time employee of the electricity distribution company in the rank of the Chief Engineer or above, for the purpose of reporting of the annual energy audit and periodic energy accounting and communicate the same to the Bureau.

(2) Every electricity distribution company shall ensure that the energy accounting data is 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.

(3) Metering of distribution transformers at High Voltage Distribution System up to 25KVA can be done on cluster meter installed by each electricity distribution company.

(4) The energy accounting and audit system and software shall be developed to create monthly, quarterly and yearly energy accounting reports.

(5) Every electricity distribution company shall provide the details of the information technology system in place as specified in clause (f) of regulation 5 that ensures minimal manual intervention in creating the energy accounting reports and any manual intervention of any nature, in respect of the period specified therein, shall be clearly indicated in the periodic energy accounting report.

7. Manner of annual energy audit and periodic energy accounting. -

(1) Every annual energy audit and periodic energy accounting under these regulations shall be conducted in the following manner, namely: —

(a) verification of existing pattern of energy distribution across periphery of electricity distribution company; and

(b) verification of accounted energy flow submitted by electricity distribution company at all applicable voltage levels of the distribution network, —

(i) energy flow between transmission and 66kV/33kV/11kV incoming distribution feeders;
(ii) energy flow between 66kV/33kV outgoing and 11kV/6.6kV incoming feeders;

(iii) energy flow between 11 kV/6.6kV feeders and distribution transformers, or high voltage distribution system;

(iv) energy flow between distribution transformer, or high voltage distribution system to end consumer, including ring main system;

(v) energy flow between Feeder to end-consumer; and

(vi) energy flow between 66/33/11 kV directly to consumer.

(2) The accredited energy auditor, in consultation with the nodal officer of the electricity distribution company shall, —

(a) develop a scope of work for the conduct of energy audit required under these regulations;

(b) agree on best practice procedures on accounting of energy distributed across the network; and

(c) collect data on energy received, and distributed, covered within the scope of energy audit.

(3) The accredited energy auditor shall— (a) verify the accuracy of the data collected in consultation with the nodal officer of the electricity distribution companies as per standard practice to assess the validity of the data collected; and (b) analyse and process the data with respect to—

(i) consistency of data monitoring compared to the collected data;

(ii) recommendations to facilitate energy accounting and improve energy efficiency; and

(iii) with respect to the purpose of energy accounting in reducing losses for the electricity distribution company

TRAJECTORY FOR METER INSTALLATION

Timeline for metering—

(i) 100% Communicable Feeder Metering integrated with AMI, by 31 st December 2022 along-with replacement of existing non-communicable feeder meters.

(ii) All Distribution Transformers (other than HVDS DT upto 25kVA and other DTs below 25 kVA) shall be metered with communicable meters. Communicable DT Metering for the following areas / consumers to be completed by December 2023 and in balance areas by December 2025:

- All Electricity Divisions of 500 AMRUT cities, with AT&C Losses > 15%
- All Union Territories (for areas with technical difficulty, non-communicable meters may be installed);
- All Industrial and Commercial consumers;
- All Government offices at Block level and above;
- Other high loss areas i.e. rural areas with losses more than 25% and urban areas with losses more than 15%. Further, existing non-communicable Distribution Transformer meters to be replaced with communicable meters integrated with AMI, within the timelines applicable to the respective areas.

(iii) Prepaid Smart Consumer Metering to be completed for all directly connected meters and AMR in case of other meters, by December 2023 in the following areas:

- All Electricity Divisions of 500 AMRUT cities, with AT&C Losses > 15%; o All Union Territories (for areas with technical difficulty, prepaid meters to be installed);
- All Industrial and Commercial consumers;
- All Government offices at Block level and above; o Other high loss areas i.e. rural areas with losses more than 25% and urban areas with losses more than 15%. The balance areas and consumers may be taken up in a phased manner subsequently. However, Distribution Companies can additionally cover any other areas as well as agricultural consumers, at their option by December 2023. Further, in rural / hilly areas with connectivity or communication issues, wherein installation of smart meters may not be feasible, prepaid meters may be opted for

(iv) Consumer Metering:

- 98% by FY 2022-23
- 99% by FY 2023-24

Meter	2022-23	2023-24	2024-25
Feeder Metering	98.5%	99.5%	995%
DT Metering	90%	95%	98%
Consumer Metering	93%	96%	98%

Table 9

2.2 Purpose of audit and accounting Report

Bureau of Energy Efficiency (BEE) through Ministry of Power, Government of India issued regulations for the Conduct of Mandatory Annual Energy Audit and Periodic Energy Accounting in DISCOMs vide regulation No:

As per the regulation, 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. 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.

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.

2.3 Period of the Energy Audit

The period of the audit is for the year 2023-24. This is the third annual energy audit in the CoPA, as per the BEE Regulations.

3. Introduction of DISCOM

3.1 Name and address of the DISCOM (DC)

Cochin Port Authority (CoPA)

P.O. Willingdon Island

Ernakulam -682009,

Kerala.

3.1 .1 Name and details of Energy Manager and authorized signatory of DISCOM

1	**Energy Manager**	**2**	**Nodal officer**
	Mrs. Jayalakshmy. S Exe. Engineer (Ele)- EM Cochin Port Authority Willingdon Island, Kochi, Kerala 682009 Whether CEA/CEM- Nil **Phone No: 9496450704** **Email: jayalakshmi@cochinport.gov.in**		**Mr. Ajith kumar D** Superintending Engineer (Ele) Cochin Port Authority Willingdon Island, Kochi, Kerala 682009 Phone: 9444610664

Table 10 A

3.1.2 Centralised Energy accounts and Audit Cell in CoPA (Team members)

S.No	Name of the Officer	Official designation	Role
1.	Sri Ajith Kumar D	Superintending Engineer (Ele)	Nodal officer
2.	Smt Jayalakshmy S	Executive Engineer (Ele)	Energy Manager
3.	Sri Vinod C	Senior Deputy Director EDP	I.T Manager
4	Smt Surya Madhu	Senior Accounts officer	Finance Manager

Table 10 B

3.2 Summary profile of the DISCOM with salient features

Cochin Port Authority (CoPA): Electricity Distribution

Overview

Cochin Port Authority (CoPA) operates under the Major Port Authorities Act, 2021 (formerly Cochin Port Trust). It is a Deemed Electricity Distribution Licensee as per the Electricity Act 2003 and a notified Designated Consumer (DC No: DIS0048KL) under PAT Cycle VII, as per the Ministry of Power's notification (S.O.4552(E), dated 26th September 2022).

Electricity Procurement and Distribution

CoPA purchases electricity from Kerala State Electricity Board Limited (KSEBL) and distributes it to consumers in the port areas of Willingdon Island, Vallarpadam, and Puthuvypin.

Power Procurement

- **Willingdon Island**: 6.5 MVA power at 110 KV from KSEBL.
- **Vallarpadam**: 5 MVA power at 11 kV from KSEBL through two feeders:
    - Old feeder: 3 MVA contract demand.
    - New feeder (installed March 2024): 2 MVA contract demand, dedicated to a commercial establishment under CoPA.

Substations

- **Willingdon Island**: 110kV/11kV Substation with two 10/12.5MVA power transformers.
- **Vallarpadam**: 11kV receiving station with two incoming feeders.

Power Distribution

Power is distributed to consumers through 11kV underground (UG) cables connected via a Ring Main system to ensure a reliable 24x7 supply. Low Tension (LT) feeding is done using LT overhead (OH) and UG cable lines.

Consumer Base

CoPA serves 1,288 consumers:

- **HT consumers**: 37
- **LT consumers**: 1,251

All consumers except 50% of the self-consumption meters and street light meters are SMART meters with Advanced Metering Infrastructure (AMI) features and prepaid facilities. These meters are connected to a centralized AMI software system via GPRS, with billing and accounting managed through the SAP system.

Feeder and Transformer Infrastructure

- **Willingdon Island**: Eleven 11 kV feeders from the 110/11 kV substation.
- **Vallarpadam & Puthuvypin**: Six 11 kV feeders.
- **Transformers**: 30 distribution transformers (11kV/415Volt and 11kV/3.3 kV).

Renewable Energy Initiatives

- **Solar Plants**: 100kWp and 150kWp grid-connected solar plants.
- **Net Metering**: Available for four LT and HT prosumers.
- **Energy Audit**: Solar energy inputs are included in the energy audit.

Key Projects

RDSS Project

- **Funding**: Rs 15.13 Crores under the Revamped Distribution Sector Scheme (RDSS).
- **Goals**: Modernization and loss reduction through:
    - Replacement of old cables, transformers, and Ring Main units.
    - Addition of three 11 kV panels.
    - Completion of metering for 11 kV feeders and distribution transformer (DTR) metering.
    - Implementation of SCADA project.
- **Timeline**: FY 2021-22 and 2025-26.

Other Projects

- **Contract Demand Enhancement**: Contract demand will be enhanced to 8 MVA at Vallarpadam by December 2024. (The work is under progress)
- **Shore Power Supply**: Provision of shore power to international cruise vessels by FY 2025-26 with 6 MVA Green Energy through open access.
- **Floating Solar Plant**: Installation of a 1.5MWp grid-connected floating solar plant by the end of FY 2024-2025.
- **350 kWp Roof top SPV by the end of 2024**-25
- **SMART Lighting proposal amounting 2**.05 Cr submitted for MOPSW,
-

This comprehensive approach ensures CoPA's commitment to reliable power distribution, modernization, and sustainable energy initiatives.

3.3 Asset details

3.3.1 Infrastructure details

Form-Details of Input Infrastructure					
1	**Parameters**	**Total**	**Covered during in audit**	**Verified by Auditor in Sample Check**	**Remarks (Source of data)**
i	Number of circles	1	1		In CoPA there is no Division or Subdivision wise formation.
ii	Number of divisions	0			
iii	Number of sub-divisions	0			
iv	Number of feeders	16	16	11	Through AMI meter software for 11 nos out of 16 feeders
v	Number of DTs	30	30	1	No meter is installed
vi	Number of consumers	1288	1288	1288	Through SAP

Table 11 A

3.3.2 Voltage wise consumers metering infrastructures and other assets.

S.NO	Parameters	66kV and above	33kV	11/22kV	LT
a i	Number of conventional metered consumers	0	0	0	89
ii	Number of consumers with 'smart' meters	0	0	37	1162
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	37	1251
b i	Number of conventionally metered Distribution Transformers	0	0	0	0
ii	Number of DTs with communicable meters	0	0	0	0
iii	Number of unmetered DTs	0	0	30	0
iv	Number of total Transformers	0	0	30	
c i	Number of metered feeders	0	0	12	0
ii	Number of feeders with communicable meters	0	0	12	0
iii	Number of unmetered feeders	0	0	4	
iv	Number of total feeders	0	0	16	
d.	Line length (ckt km2	0		85	105
e.	Length of Aerial Bunched Cables (kM)	0	0	0	0
f.	Length of Underground Cables (kM)	0	0	85	

Table 11 B

3.3.3 Power Transformer, Capacitor bank and Distribution Transformer details

S.No	Asset details	Unit	Quantity
1	110kV/11 kV 12.5 MVA Power Transformers	No	2
2	Capacitor bank (PF correction) 1000 kVAR	No	2
3	Distribution Transformer 11kV/415 V 1250 kVA	No	2
4	Distribution Transformer 11kV/415 V 1000 kVA	No	1
5	Distribution Transformer 11kV/415 V 800 kVA	No	3
6	Distribution Transformer 11kV/415 V 630 kVA	No	9
7	Distribution Transformer 11kV/415 V 500 kVA	No	8
8	Distribution Transformer 11kV/415 V 315 kVA	No	3
9	Distribution Transformer 11kV/415 V 300 kVA	No	1
10	Distribution Transformer 11kV/415 V 250 kVA	No	3

Table 11 C

3.3.4.1 ENERGY FLOW DIAGRAM

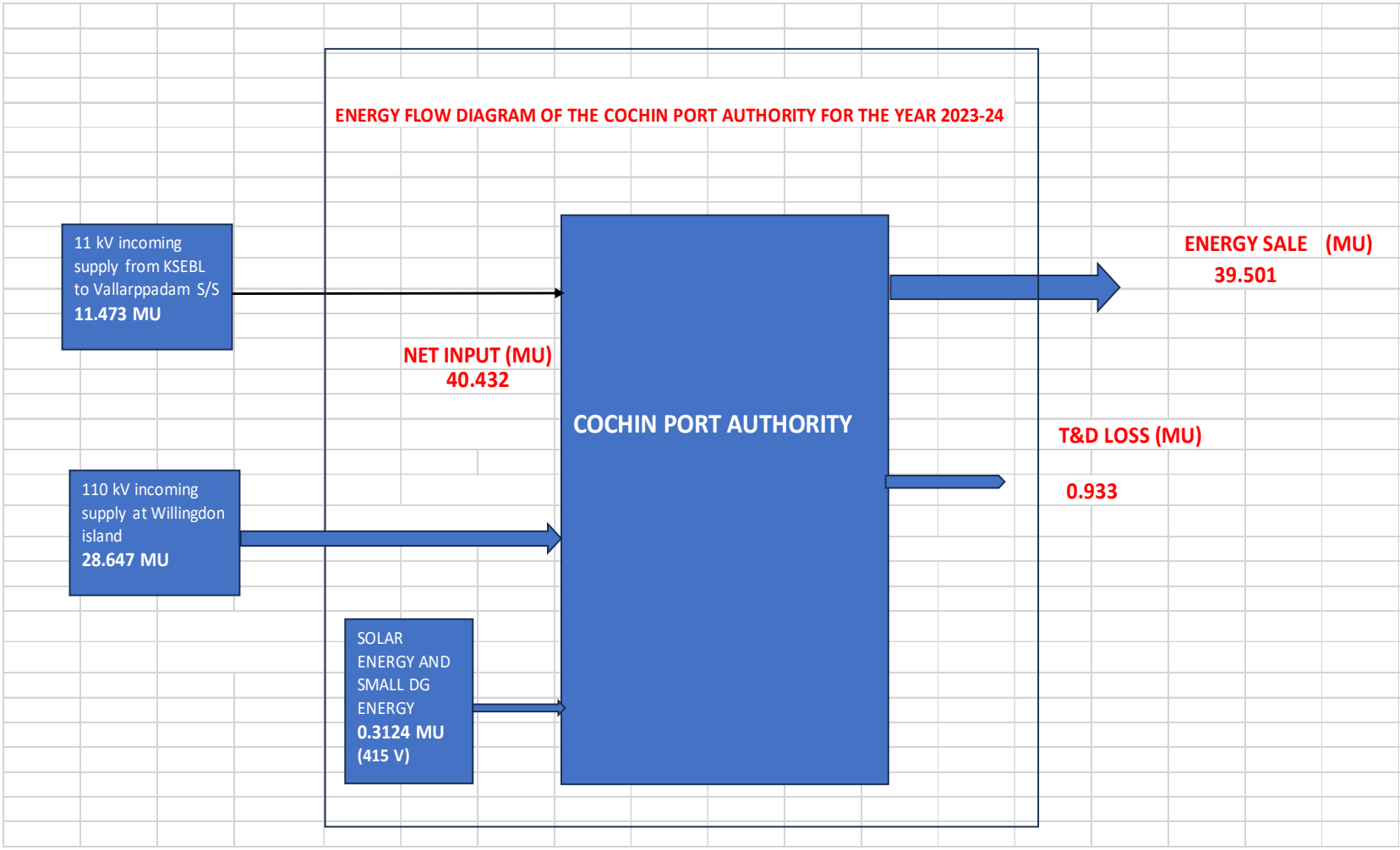


Fig No:4

3.3 4.2 . Performance summary of the CoPA for the FY 2023-24

S.NO	Energy input details	Units	Quantity
1.	Energy purchased	MU	40.12
2.	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	40.43
3.	Energy billed	MU	39.50
4.	T& D Loss	MU	0.93
5.	% T&D Loss	%	2.31
6.	Amount of Energy billed	Rs (Crores)	43.18
7.	Amount of collection	Rs (Crores)	43.11
8.	Collection efficiency	%	99.83
9.	% AT&C Loss	%	2.47

Table 12

3.3.5 Energy Input Particulars of the CoPA for the FY 2023-24

	Voltage level	Particulars	MU
i	66kV and above	Long-Term Conventional	28.65
		Medium Conventional	0
		Short Term Conventional	0
		Banking	0
		Long-Term Renewable energy	0
		Medium and Short-Term RE	0
		Captive, open access input	0
		Sale of surplus power	0
		Quantum of inter-state transmission loss	0
		Power procured from inter-state sources	0.00
		Power at state transmission boundary	28.65
ii	33kV	Long-Term Conventional	0
		Medium Conventional	0
		Short Term Conventional	0

		Banking	**0**
		Long-Term Renewable energy	**0**
		Medium and Short-Term RE	**0**
		Captive, open access input	**0**
		Sale of surplus power	**0**
		Quantum of intra-state transmission loss	**0**
		Power procured from intra-state sources	**0**
iii		**Input in DISCOM wires network**	**0**
iv	**33 kV**	**Renewable Energy Procurement**	**0**
		Small capacity conventional/ biomass/ hydro plants Procurement	**0**
		Captive, open access input	**0**
v	**11 kV**	**Renewable Energy Procurement**	**0**
		Small capacity conventional/ biomass/ hydro plants Procurement	**0**
		Sales Migration Input	**11.47**
vi	**LT**	**Renewable Energy Procurement**	**0**
		Sales Migration Input	**0**
vii		**Energy Embedded within DISCOM wires network**	**0.312**
viii		**Total Energy Available/ Input**	**40.43**

Table 13

3.3.6 Energy sales Particulars of the CoPA for the FY 2023-24

	Voltage level	Energy Sales Particulars	MU
i	LT Level	DISCOM' consumers	8.37
		Demand from open access, captive	0
		Embedded generation used at LT level	0.053
		Sale at LT level	8.42
		Quantum of LT level losses	0
		Energy Input at LT level	9.35
ii	11 kV Level	DISCOM' consumers	31.08
		Demand from open access, captive	0
		Embedded generation at 11 kV level used	0
		Sales at 11 kV level	31.08
		Quantum of Losses at 11 kV	0
		Energy input at 11 kV level	40.12
iii	33 kV Level	DISCOM' consumers	0
		Demand from open access, captive	0
		Embedded generation at 33 kV or below level	0
		Sales at 33 kV level	0
		Quantum of Losses at 33 kV	0
		Energy input at 33kV Level	0
	> 33 kV	DISCOM' consumers	0
		Demand from open access, captive	0
		Cross border sale of energy	0
		Sale to other DISCOMs	0
		Banking	0
		Energy input at > 33kV Level	28.65
		Sales at 66kV and above (EHV)	0
Total Energy Sales			39.50
Total Energy Input			40.43
T&D Loss			0.93

**HT and LT Level losses could not be assessed due to the absence of Feeder meters and DTR meters

Table 14

3.3.7 Category wise consumers

Period From 1st April 2023 to 31st March 2024						
Consumer profile		Energy parameters			Losses	
Consumer category	Total Number of connecti	Input energy (MU)	Total energy	% of energy consumption	T&D loss (MU)	T&D loss (%)
Residential	412	40.43421	0.97	2%	0.933059	2.31%
Agricultural	0		0.00	0%		
Commercial/Industrial-LT	605		4.63	12%		
Commercial/Industrial-HT	30		28.77	73%		
Others	241		5.13	13%		
	1288	**40.43421**	**39.50**	**100%**	**0.933**	**2.308%**

Table 15

3.3.7.2 Percentage wise consumption of different Consumer category of CoPA for the FY 2023-24

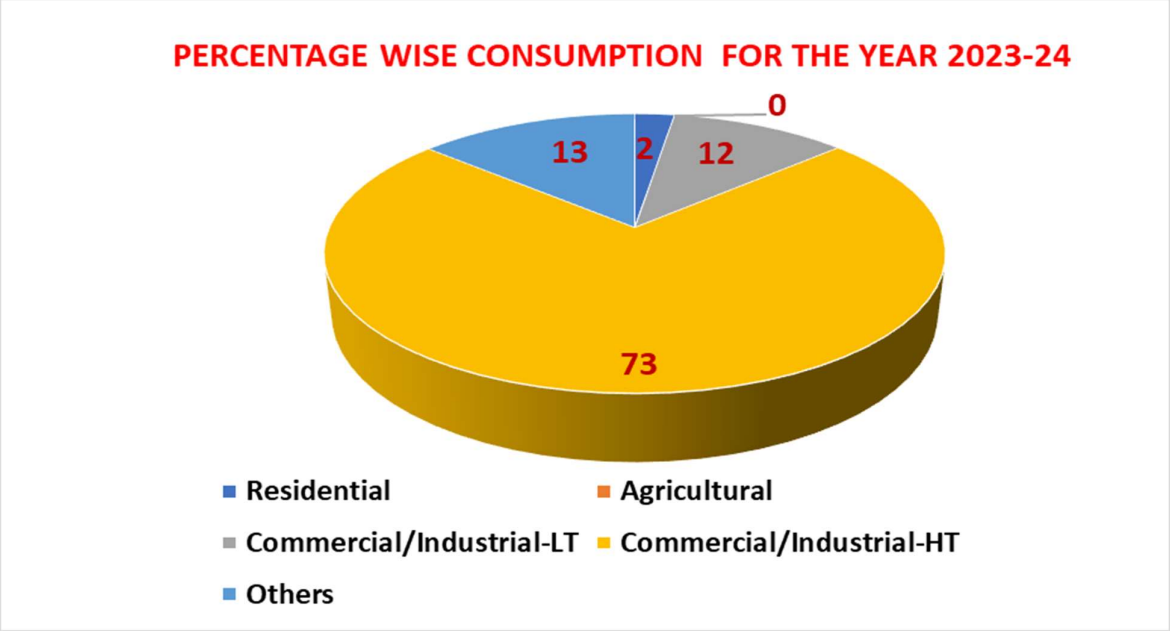
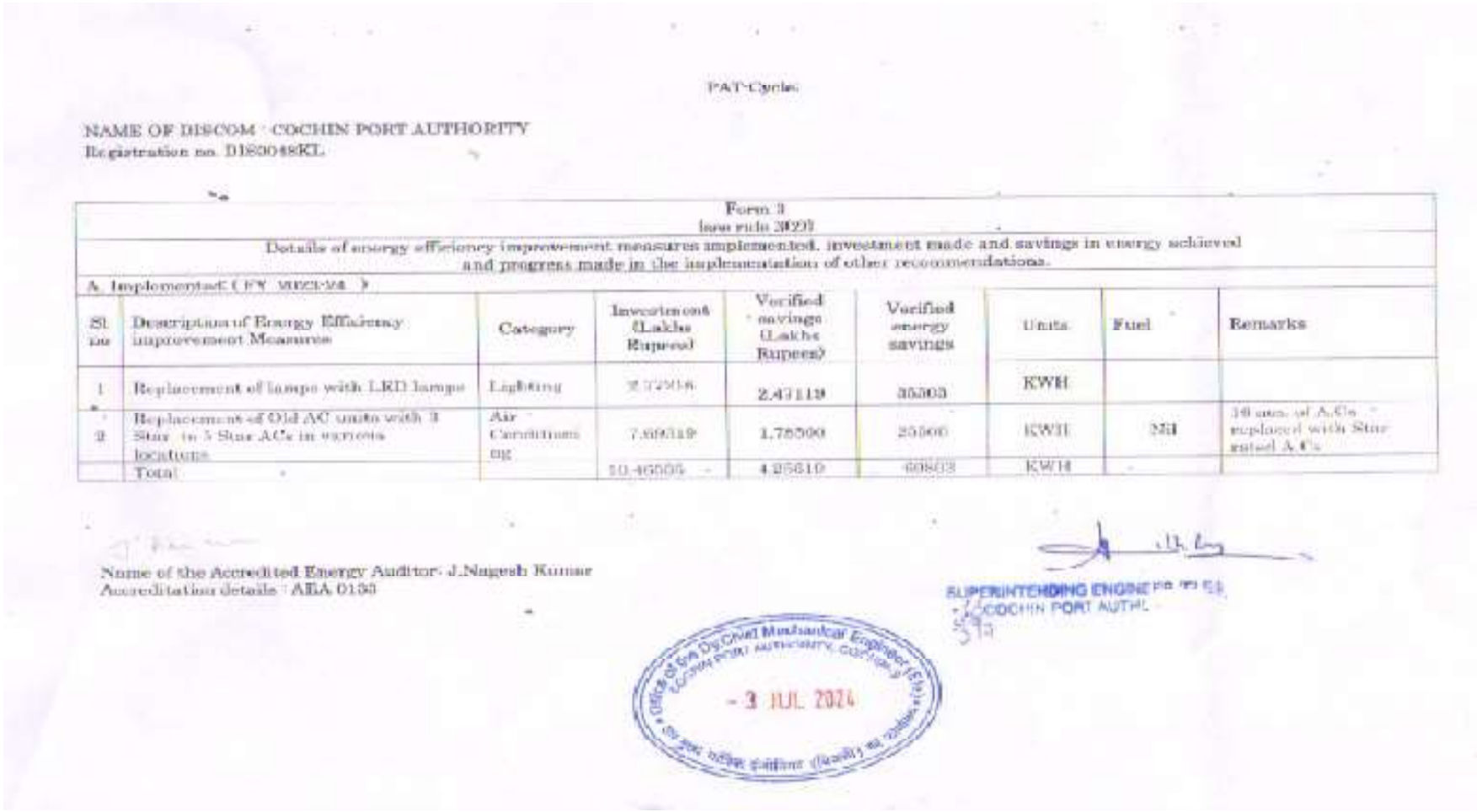


Fig 5

3.4 Energy Conservation measures implemented under the DISCOM



PAT Cycle:

NAME OF DISCOM : COCHIN PORT AUTHORITY
Registration no. DIS/2048/KL

Form 3
[see rule 3(2)]

Details of energy efficiency improvement measures implemented, investment made and savings in energy achieved and progress made in the implementation of other recommendations.

A. Implemented (FY 2022-23)

Sl no	Description of Energy Efficiency improvement Measures	Category	Investment (Lakhs Rupees)	Verified savings (Lakhs Rupees)	Verified energy savings	Units	Fuel	Remarks
1	Replacement of lamps with LED lamps	Lighting	2.72516	2.43119	35303	KWH		
2	Replacement of Old AC units with 3 Star to 5 Star ACs in various locations	Air Conditioning	7.869319	1.78500	25500	KWH	Nil	38 nos. of A.Cs replaced with Star rated A.C's
	Total		10.46505	4.25619	60803	KWH		

Name of the Accredited Energy Auditor: J.Nagesh Kumar
Accreditation details : AEA 0130

SUPERINTENDING ENGINEER (E)
COCHIN PORT AUTH

Office of the Dy.Chief Mechanical Engineer (Electrical)
- 3 JUL 2024

B. Under Implementation: (FY 2024-25)

Sl no	Description of Energy Efficiency improvement Measures	Category	Investment (Rupees in Lakhs) Estimated	Verified savings (Rupees in lakhs) Estimated	Verified energy savings Estimated	Units	Fuel	Status of implementation
1	Smart lighting of High Masts & Yard Lights with LED	Lighting	201.33	27.45	392229	KWH	Nil	DPR Sent to MoPSW for grant from MIV 2080
2	RDSS – Replacement of old loss Energy efficient transformer (20-48 Yrs old) with BEE rating transformers.	Electricity Distribution	80.59	24.26	382580	KWH	Nil	Approval received and Tendering process started
3	Replacement of old Tower Type AC unit with star rated units in the Samadhia Hall	Air conditioning	12.5	0.47180	7872	KWH	NIL	Approval received and Tendering process started
4	Replacement of Old DG Sets 625 kVA & 525 kVA (50 Yrs old) with New Energy Efficient Engines of 250 kVA – 1 no & 82.5 kVA -2 nos as new CPCB /BEE Norms	Backup power generation from Power House	75.66	3.00 lakhs	2500	Ltr	Fuel savings	

Signature :
Name of the energy manager :
Name of the company : COCHIN PORT AUTHORITY
Full Address : Administrative Building at Willingdon Island
Contact Person :
Email Address :
Telephone/fax number :
Plant Address :

SUPERINTENDING ENGINEER (ELE.)
COCHIN PORT AUTHORITY

Office of the Dy. Chief Mechanical Engineer
COCHIN PORT AUTHORITY
- 3 JUL 2024

Signature :
Name of the Accredited Energy Auditor : d Nagesh Kumar
Accreditation details : AEA 0135
Seal :

Table 16

3.5.1.Energy conservation Measure proposed during the FY 2022-23 and pending for Implementations

Energy effeciency measures proposed during the year 2022-23 and pending for implimentation										
S.NO	Energy effeciency measure	QTY (No)	Captal investment (Rupees in Lakh)	Annual energy saving (kWH)	Annual savings (Rs) (Lakhs)	Discount rate(%)	CASH FLOW (Years)	Simple Pay back Period (Years)	NPV (Lakh Rs)	IRR(%)
1	Replacement of one 800 kvA Old Transformer with two new energy effecienct 315 kVA Transformer	2	37.36	42514.8645	2.976041	8	12	12.6	₹ 3.72	-1%
2	Replacement of one 630 kvA Old Transformer with Two new energy effecienct 315kVA Transformer	3	56.64	72405.5886	5.068391	8	12	11.2	₹ 38.20	1%
3	Replacement of one 500 kvA Old Transformer with two new energy effecienct 250 kVA Transformer	1	15.71	13814.52	0.967016	8	12	16.2	₹ 7.29	-4%
4	Replacement of one 500 kvA Old Transformer with one new energy effecienct 500 kVA Transformer	1	11.58	2263.584	0.158451	8	12	73.1	₹ 1.19	-21%
5	Replacement of 315 kvA Old Transformer with two new energy effecienct 160 kVA Transformer	1	11.706	11624.52	0.813716	8	12	14.4	₹ 6.13	-3%
			132.996							

Table 17

3.5.2. Energy conservation Measures proposed during the FY 2023-24

Energy conservation measures Proposed during the FY 2023-24												
S.NO	Energy effeciency measure	QTY (No)	Unit	Captal investment (Rupees in Lakh)	Annual energy saving (kWH)	Annual savings (Rs) (Lakhs)	Discount rate(%)	CASH FLOW (Years)	Simple Pay back Period (Years)	NPV (Lakh Rs)	IRR(%)	Remarks
1	Replacement of Old copper(SWG 8) conductor with 3 PHASE 5 wire LT ABC of size 3x95sqmm+1x70 sqmm+1x 16 sqmm	9.17	kM	70	275549.60	16.53	8	13	4.2	₹ 71.70	26%	
2	Rectification of the inverter and clearing shading of the 100 kW solar power plant	1	NO	3	50000	3.55	8	5	0.8	₹ 12.66	110%	Presently 3 Nos of 30 kVA inverter units are in breakdown condition
				73	325549.60	20.08						

For detailed calculation of energy savings and NPV please refer Page No in the Annexure

Table 17 A

3.5.2 Other Energy conservation Measures proposed during the FY 2023-24

Other measures proposed			
1	Energy conservation measures proposed in the 50 hP Mattanchery Halt water Pump house		
	Observations	Measures recommender	Anticipated svings
a.	Apprciable water leakage observed in the delivery Pipe line.	To arrest the leakage	
b	Pump main delivery pipe Valve found partially throttled for controling the flow.	Up on site analysis there is no flow adgustment required for the operation.Hence the operator to be instructed to ensure the full opening of the delivery valve.	The closing of the Pump valve by 20% will increase the Power consumption by about 1/3.
c	Pump Motor found not fitted any Power factor correction Capacitor	For 50 HP motor the rated power factor correction capacitor is 14 kVAR	The power factor correction capacitor will reduce the apparent power at the load side by 2 kVA.Hence there will be savings due to the line loss also

Table No:17 B

3.5.3 100 kWp AND 150 kWp solar Plant performance during the year 2023-24

SOLAR PRODUCTION							
	M/ Halt (100 KWp Ground)			RNAS (150 KWp Roof)			
M.no. GP4408589		M.F:	50	M.no. GP4408587, M.F:		40	
Month	IR	FR	Production (Units)	IR	FR	Production (Units)	TOTAL
Apr-23	6563	6730	8350	17141	17623	19280	27630
May-23	6730	6887	7850	17623	18069	17840	25690
Jun-23	6887	7002	5750	18069	18400	13240	18990
Jul-23	7002	7120	5900	18400	18688	11520	17420
Aug-23	7120	7282	8100	18688	19088	16000	24100
Sep-23	7282	7397	5750	19088	19367	11160	16910
Oct-23	7397	7536	6950	19367	19722	14200	21150
Nov-23	7536	7622	4300	19722	20071	13960	18260
Dec-23	7622	7705	4150	20071	20433	14480	18630
Jan-24	7705	7789	4200	20433	20817	15360	19560
Feb-24	7789	7841	2600	20817	21093	11040	13640
Mar-24	7841	7902	3050	21093	21459	14640	17690
		TOTAL	66950		TOTAL	172720	239670

Table 18

3.5.4. 100 kWp solar Plant Month wise generation graph

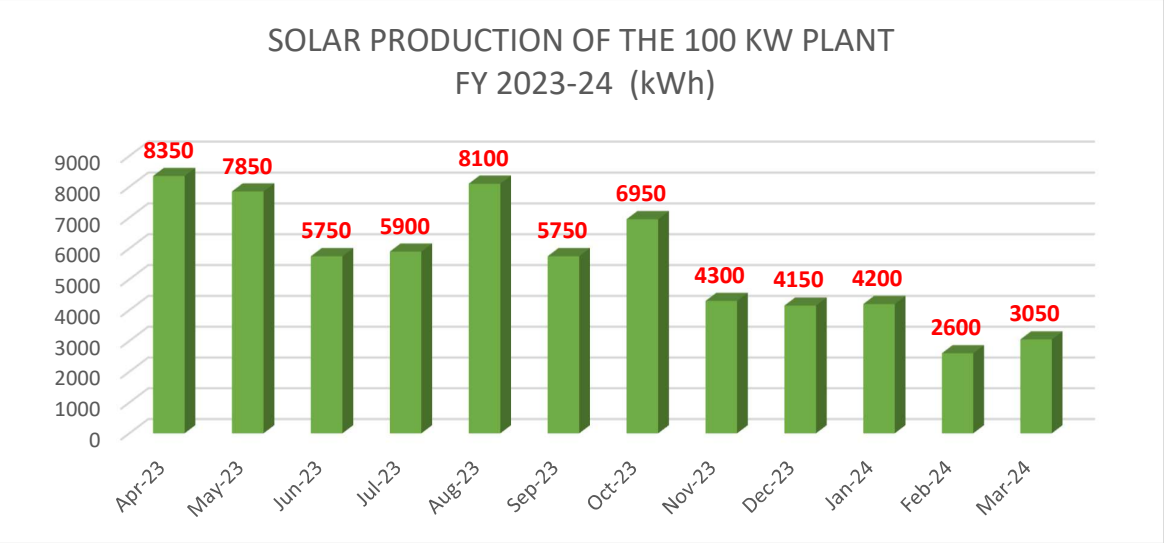


Fig 6 A

3.5.5. 150 kWp solar Plant Month wise generation graph

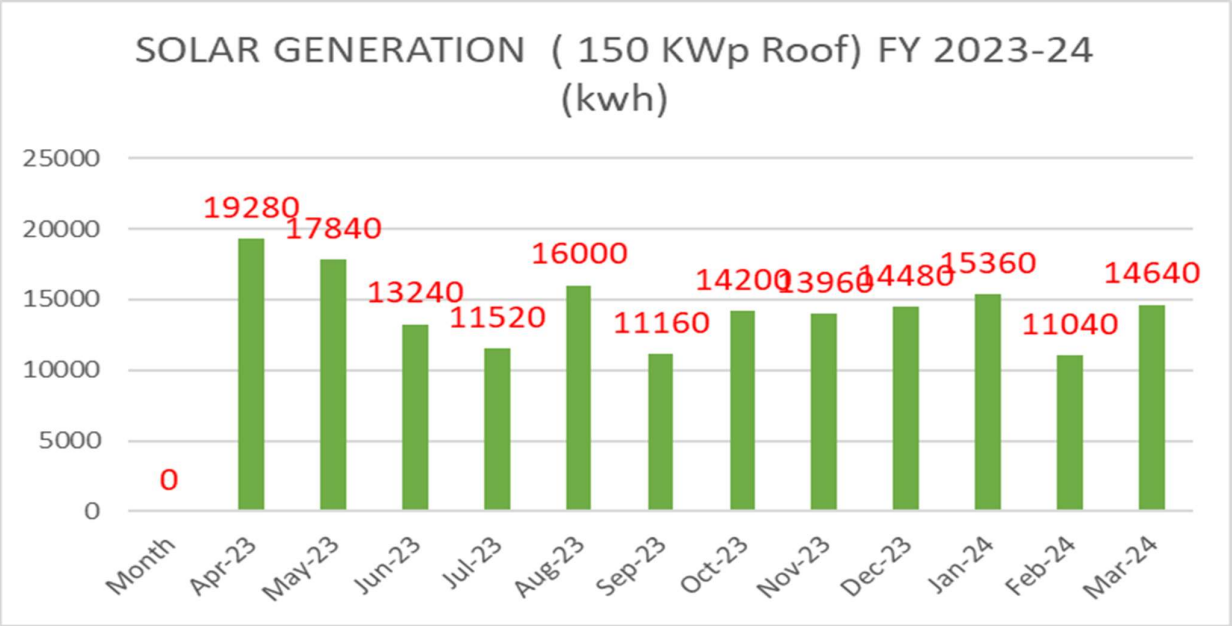
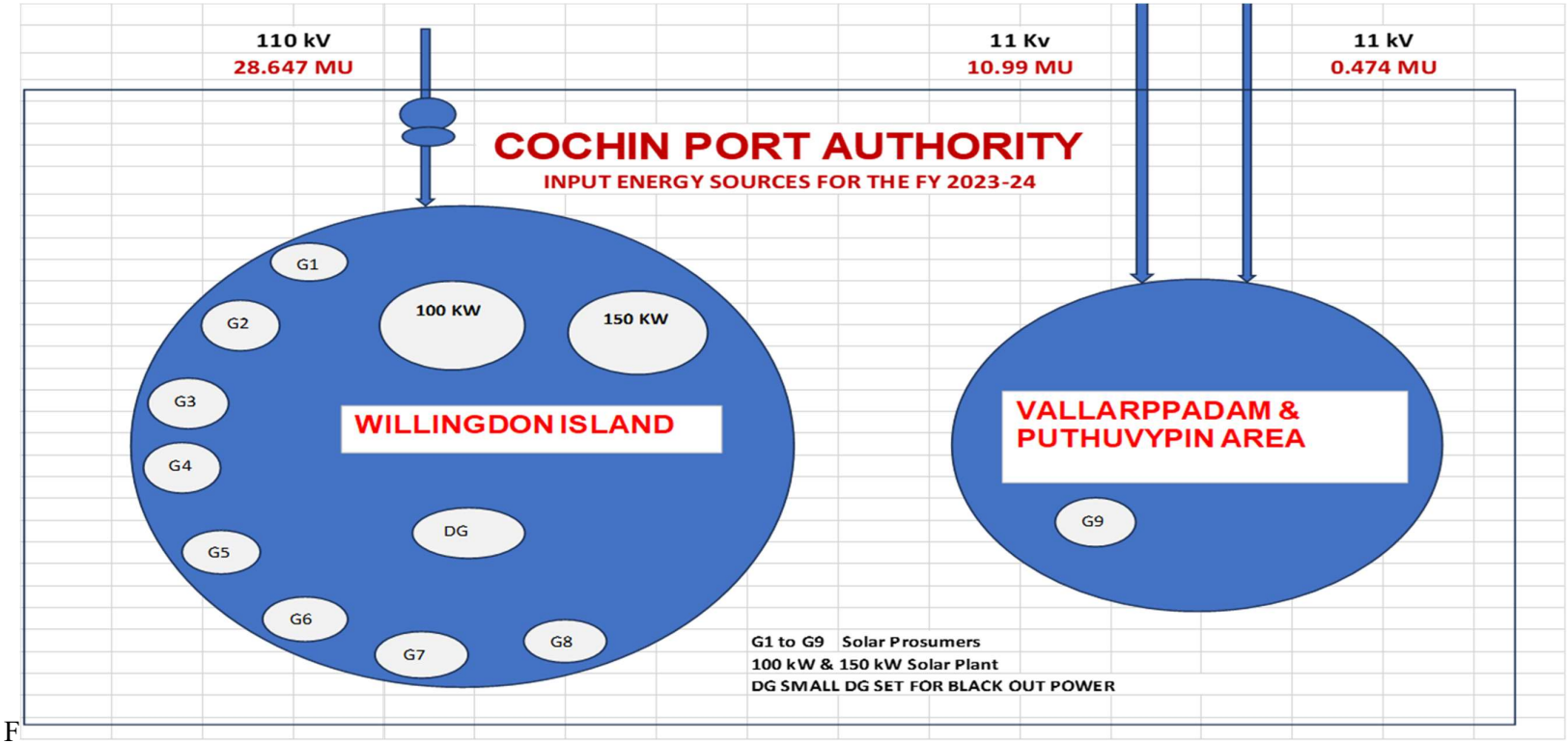


Fig 6 B

Energy flow analysis

4.1. Energy flow across 5 service levels

In CoPA presently the Energy consumption is only in 11 KV and LT Levels. Power is received in Willingdon Island at 110 kV and stepdown to 11 kV level. Renewable injection is at LT levels. Due to non-installation of meters in all the 11 kV feeders and DTRs, losses cannot be segregated at feeder level and DTR level. However, the energy is distributed by the CoPA in two separate geographical areas without any border sharing. Hence presently loss can be assessed only at the DISCOM level and at the area level in the two distribution areas. The power input at the two areas is indicated in the following diagram.


110 kV
28.647 MU
11 Kv
10.99 MU
11 kV
0.474 MU
COCHIN PORT AUTHORITY
INPUT ENERGY SOURCES FOR THE FY 2023-24
G1
G2
G3
G4
G5
G6
G7
G8
100 KW
150 KW
DG
WILLINGDON ISLAND
VALLARPPADAM &
PUTHUVYPIN AREA
G9
G1 to G9 Solar Prosumers
100 kW & 150 kW Solar Plant
DG SMALL DG SET FOR BLACK OUT POWER

F

Fig 7

4.1.1 ENERGY INPUT PARTICULARS OF CoPA for the FY 2022-23

	Voltage level	Particulars	MU
i	66kV and above	Long-Term Conventional	28.65
		Medium Conventional	0
		Short Term Conventional	0
		Banking	0
		Long-Term Renewable energy	0
		Medium and Short-Term RE	0
		Captive, open access input	0
		Sale of surplus power	0.0
		Quantum of inter-state transmission loss	0
		Power procured from inter-state sources	0.00
		Power at state transmission boundary	28.65
ii	33kV	Long-Term Conventional	0
		Medium Conventional	0
		Short Term Conventional	0
		Banking	0
		Long-Term Renewable energy	0
		Medium and Short-Term RE	0
		Captive, open access input	0
		Sale of surplus power	0
		Quantum of intra-state transmission loss	0
		Power procured from intra-state sources	0
iii		Input in DISCOM wires network	0
iv	33 kV	Renewable Energy Procurement	0
		Small capacity conventional/ biomass/ hydro plants Procurement	0
		Captive, open access input	0
v	11 kV	Renewable Energy Procurement	0
		Small capacity conventional/ biomass/ hydro plants Procurement	0
		Sales Migration Input	11.474
vi	LT	Renewable Energy Procurement	0
		Sales Migration Input	0
vii		Energy Embedded within DISCOM wires network	0.312
viii		Total Energy Available/ Input	40.434

Table 19

4.1.2 Energy sales Particulars for the FY 2022-23

	Voltage level	Energy Sales Particulars	MU
i	LT Level	DISCOM' consumers	8.37
		Demand from open access, captive	0
		Embedded generation used at LT level	0.052
		Sale at LT level	8.42
		Quantum of LT level losses	0
		Energy Input at LT level	9.35
ii	11 kV Level	DISCOM' consumers	31.08
		Demand from open access, captive	0
		Embedded generation at 11 kV level used	0
		Sales at 11 kV level	31.08
		Quantum of Losses at 11 kV	0
		Energy input at 11 kV level	40.12
iii	33 kV Level	DISCOM' consumers	0
		Demand from open access, captive	0
		Embedded generation at 33 kV or below level	0
		Sales at 33 kV level	0
		Quantum of Losses at 33 kV	0
		Energy input at 33kV Level	0
	> 33 kV	DISCOM' consumers	0
		Demand from open access, captive	0
		Cross border sale of energy	0
		Sale to other DISCOMs	0
		Banking	0
		Energy input at > 33kV Level	28.65
		Sales at 66kV and above (EHV)	0
Total Energy Sales			39.50
Total Energy Input			40.43
T&D Loss			0.93

**HT and LT category level losses could not be assessed due to the absence of Feeder meters and DTR meters

Table 20

4.2 Validation of metered data

S.NO	ENERGY PARTICULARS	METERING INFRASTRUCTURE	NUMBER OF METERS	FUNCTIONAL STATUS	SAMPLE CHECKED	REMARKS
1	Energy input points					
i	110 Kv Wellingdon island	1	1	Utility side meter	1	Verified supplier invoice and also check reading taken on 10/07/2024
ii	11 kV Vallarppadam S/s	2		Utility side meter	2	Verified supplier invoice and also check reading taken on 10/07/2024
iii	150 Kw SOLAR PLANT	1	1	Functional	1	Verified meter readins from the AMI software
iv	100 Kw SOLAR PLANT	1	1	Functional	1	Verified meter readins from the AMI software
v	SOLAR PROSUMERS	9	9	Functional	9	Verified meter readins from the AMI software
vi	DG SETS	3	3	Functional	3	Verified meter readins at the DG Sets
Energy consumption Points						
vii	11 kV feeders	17	13	Functional	13	Check reading taken on 10/04/2024 and verified the monthly readings from the AMI software
viii	Distribution Transformers	30	4	Non functional	4	DTR meter not installed
IX	CONSUMER METERS	1288	1288	Functional	1288	Full Month data verified through the AMI software

Table 21

4.2.1 Physical verification of meters at Substation

Willingdon Island

S.NO	FEEDER NAME	Meter S.NO	Meter reading	Date of reading
1	Q91	GP4409885	624154	11/07/24
2	Q92	GP4409882	536353	11/07/24
3	PENNA	GP4409879	362016	11/07/23
4	NTRO A2	GP4409899	181904	11/07/24

Table 22

4.3. Verification and Validation of input energy

4.3.1. Verification of Purchase bill

4.3.1.1 Power purchase details of the Willingdon Island

Consumer No: 1355410002636								
Contract demand :6500								
	MD Charges			Energy charges				Total charges
BILL MONTH	Maximum demand	Rate /KVA	MD Charge	Consumpti	Unit rate	Energy charges	PF Incentive/	Total charges
May-23	6270	380	2382600	2524050	6.25	15775312.5	315506	17843964
Jun-23	6430	380	2443400	2851650	6.25	17822812.5	356456	19909947
Jul-23	5124	380	1947120	2296800	6.25	14355000	358875	15975405
Aug-23	5261	380	1999180	2384550	6.25	14903437.5	372585	16533630
Sep-23	5728	380	2176640	2473360	6.25	15458500	386460	17248616
Oct-23	4875	380	1852500	2041650	6.4	13066560	319007	14300777
Nov-23	5436	380	2065680	2193150	6.4	14036160	342679	15430188
Dec-23	5585	400	2234000	2196300	6.4	14056320	351408	15941366
Jan-24	5866	400	2346400	2403900	6.4	15384960	384624	17349082
Feb-24	5589	400	2235600	2369400	6.4	15164160	379104	17024628
Mar-24	5824	400	2329600	2299650	6.4	14717760	367944	16681882
Apr-24	6468	400	2587200	2613450	6.4	16726080	418152	18897487
Total				**28647910**				203136972

Table 23

4.3.1.2 Power Purchase details of the Vallarpadam & Puthuvypin area through Feeder 1

Consumer No: 1355xxxxx3590								
Contract demand 3000								
	MD Charges			Energy charges				
MONTH	Maximum demand	Rate KVA	MD Charges	Consumptio	Unit rate	Energy charge	PF Incentive	Total charges (Including duty and surcharge
May-23	2461	340	836740	1023560	6.25	6397250	127945	7418478
Jun-23	2250	340	765000	914560	6.25	5716000	114320	6668899
Jul-23	2250	380	783200	772560	6.25	4828500	97900	5787348
Aug-23	2250	380	855000	766360	6.25	4789750	95795	5747854
Sep-23	2250	380	829440	783200	6.25	4895000	97900	5863255
Oct-23	2250	380	855000	829440	6.25	4396750	6131582	6131582
Nov-23	2250	400	900000	914880	6.4	5855232	114360	6695688
Dec-23	2250	400	900000	856120	6.4	5479168	109583	6468940
Jan-24	2250	400	900000	1027400	6.4	6575360	131507	7637787
Feb-24	2571	400	1028400	1038040	6.4	6643456	132869	7807503
Mar-24	2647	400	1058800	1133120	6.4	7251968	108779.52	8504841
Apr-24	2798	400	1119200	939920	6.4	6015488	120309	7218263
Total				10999160				81950438

Table 24 A

4.3.1.3 Power Purchase details of the Vallarpadam & Puthuvypin area through Feeder 2

Consumer No:1355650096081								
Contract demand 2000								
	MD Charges			Energy charges				
MONTH	Maximum demand	Rate KVA	MD Charges	Consumptio	Unit rate	Energy charges	PF Incentive	Total charges (Including duty and surcharg
Apr-24	1319	400	527600	474744	6.4	3038361.6	15192	3550770
Total				474744				3550770

Table 24 A

4.3.2 Validation of Input energy

A. Month wise statements generated from Software

Billing Month	Energy input to Distribution Network					
		(1) Purchase	(2) Internal Generation			(3) Total: (1) + (2)
			Solar Plant	Solar Prosumers	DG Sets Port	
May-23	W/Island	25,24,050	27,630	4,512	113	25,56,305
	Vallarpadam	1023560	0	0	0	10,23,560
	Total	**35,47,610**	**27,630**	**4,512**	**113**	**35,79,865**
Jun-23	W/Island	28,51,650	25,690	2,914	542	28,80,796
	Vallarpadam	914560	0	0	0	9,14,560
	Total	**37,66,210**	**25,690**	**2,914**	**542**	**37,95,356**
Jul-23	W/Island	22,96,800	18,990	2,689	147	23,18,626
	Vallarpadam	772560	0	0	0	7,72,560
	Total	**30,69,360**	**18,990**	**2,689**	**147**	**30,91,186**
Aug-23	W/Island	23,84,550	17,420	5,006	1	24,06,977
	Vallarpadam	766360	0	60	0	7,66,420
	Total	**31,50,910**	**17,420**	**5,066**	**1**	**31,73,397**
Sep-23	W/Island	24,73,350	24,100	6,809	34	25,04,293
	Vallarpadam	783200	0	464	0	7,83,664
	Total	**32,56,550**	**24,100**	**7,273**	**34**	**32,87,957**
Oct-23	W/Island	20,41,650	16,910	4,451	113	20,63,124
	Vallarpadam	829440	0	1008	0	8,30,448
	Total	**28,71,090**	**16,910**	**5,459**	**113**	**28,93,572**
Nov-23	W/Island	21,93,150	21,150	6,519	11	22,20,830
	Vallarpadam	914880	0	452	0	9,15,332
	Total	**31,08,030**	**21,150**	**6,971**	**11**	**31,36,162**
Dec-23	W/Island	21,96,300	18,260	5,357	210	22,20,127
	Vallarpadam	856120	0	408	0	8,56,528

	Total	**30,52,420**	**18,260**	**5,765**	**210**	**30,76,655**
Jan-24	W/Island	24,03,900	18,630	5,487	76	24,28,093
	Vallarpadam	1027400	0	44	0	10,27,444
	Total	**34,31,300**	**18,630**	**5,531**	**76**	**34,55,537**
Feb-24	W/Island	23,69,400	19,560	6,422	186	23,95,568
	Vallarpadam	1038040	0	372	0	10,38,412
	Total	**34,07,440**	**19,560**	**6,794**	**186**	**34,33,980**
Mar-24	W/Island	22,99,650	13,640	5,980	1,805	23,21,075
	Vallarpadam	1133120	0	260	0	11,33,380
	Total	**34,32,770**	**13,640**	**6,240**	**1,805**	**34,54,455**
Apr-24	W/Island	26,13,450	17,690	8,319	1,204	26,40,663
	Vallarpadam	1414664	0	764	0	14,15,428
	Total	**40,28,114**	**17,690**	**9,083**	**1,204**	**40,56,091**

Table 25

4.3.3. Consolidated details of the Energy input under the CoPA

For the year 2023-24

S.NO	Energy import details	MU	Remarks
1.	Energy purchase through Willingdon Island (110 kV)	28.647	At 110 kV input
2	Energy purchase through Vallarppadam - Feeder 1	10.999	At 11 kV
3	Energy purchase through Vallarppadam - Feeder 2	0.4747	Do
4	Total energy injection from the Solar power plant (250 kWp)	0.2397	At LT level
5	Embedded energy from the Solar prosumers	0.0683	Do
6	Small energy injection from the Diesel generator set for essential load during the black out period	0.0004	Do
	Total input	40.43	

Table 26 A

4.3.4. Validation of Energy Sale Particulars

2023-24 Q1		W/Island				Vallarpadam			
Cons.	**Billing**	**Net input**	**Billed**	**Loss**	**% Loss**	**Purchase**	**Billed**	**Loss**	**% Loss**
Apr	May	25,56,305	24,77,359	78,946	3.088	10,23,560	10,04,683	18,877	1.844
May	Jun	28,80,796	27,92,925	87,871	3.050	9,14,560	9,00,678	13,882	1.518
Jun	Jul	23,18,626	22,64,134	54,492	2.350	7,72,560	7,60,931	11,629	1.505
TOTAL		**77,55,727**	**75,34,418**	**2,21,309**	**2.853**	**27,10,680**	**26,66,292**	**44,388**	**1.638**

2023-24 Q2		W/Island				Vallarpadam			
Cons.	**Billing**	**Net input**	**Billed**	**Loss**	**% Loss**	**Net input**	**Billed**	**Loss**	**% Loss**
Jul	Aug	24,06,977	23,33,804	73,173	3.040	7,66,420	7,64,763	1,657	0.216
Aug	Sep	25,04,293	24,29,916	74,377	2.970	7,83,664	7,80,404	3,260	0.416
Sep	Oct	20,63,124	20,13,929	49,195	2.384	8,30,448	8,26,991	3,457	0.416
TOTAL		**69,74,394**	**67,77,649**	**1,96,745**	**2.821**	**23,80,532**	**23,72,158**	**8,374**	**0.352**

2023-24 Q3		W/Island				Vallarpadam			
Cons.	**Billing**	**Net input**	**Billed**	**Loss**	**% Loss**	**Net input**	**Billed**	**Loss**	**% Loss**
Oct	Nov	22,20,830	21,53,755	67,075	3.020	9,15,332	9,10,844	4,488	0.490
Nov	Dec	22,20,127	21,67,023	53,104	2.392	8,56,528	8,50,675	5,853	0.683
Dec	Jan	24,28,093	23,62,891	65,202	2.685	10,27,444	10,20,412	7,032	0.684
TOTAL		**68,69,050**	**66,83,669**	**1,85,381**	**2.699**	**27,99,304**	**27,81,931**	**17,373**	**0.621**

2023-24 Q4		W/Island				Vallarpadam			
Cons.	**Billing**	**Net input**	**Billed**	**Loss**	**% Loss**	**Net input**	**Billed**	**Loss**	**% Loss**
Jan	Feb	23,95,568	23,12,357	83,211	3.474	10,38,412	10,34,765	3,647	0.351
Feb	Mar	23,21,075	22,54,086	66,989	2.886	11,33,380	11,19,172	14,208	1.254
Mar	Apr	26,40,663	25,61,255	79,408	3.007	14,15,428	14,03,403	12,025	0.850
TOTAL		**73,57,306**	**71,27,699**	**2,29,607**	**3.121**	**35,87,220**	**35,57,340**	**29,880**	**0.833**

Table No:26. B

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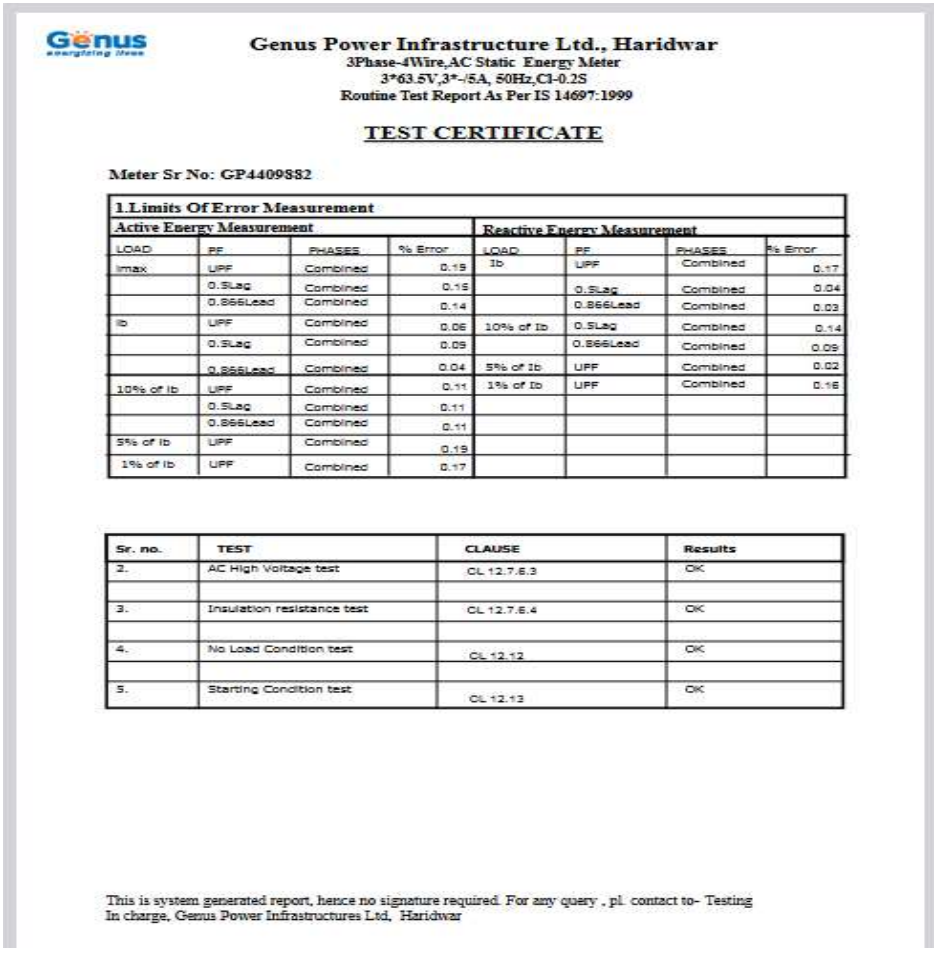
4.3.5. Calibration report of the Feeder meters

The feeder meters and consumer meters are new and the manufactures calibration report verified.



Genus

Genus Power Infrastructure Ltd., Haridwar
3Phase-4Wire,AC Static Energy Meter
3*63.5V,3*-/5A, 50Hz,C1-0.2S
Routine Test Report As Per IS 14697:1999

TEST CERTIFICATE

Meter Sr No: GP4409882

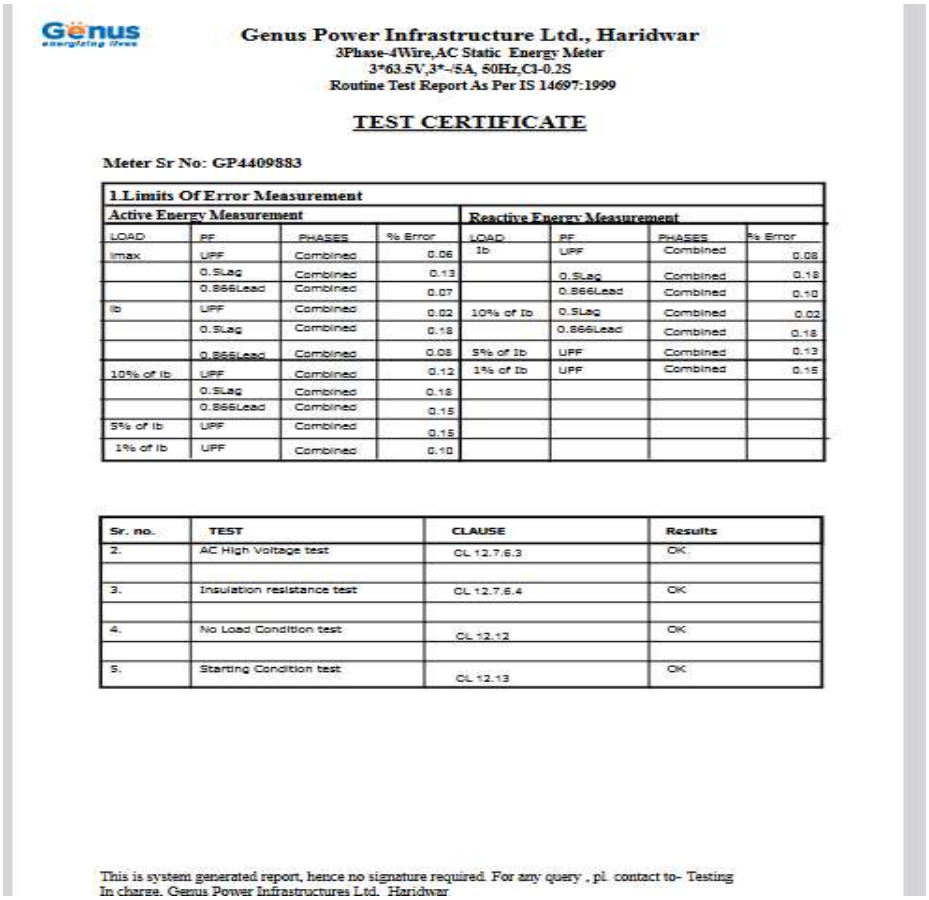
1.Limits Of Error Measurement

Active Energy Measurement				Reactive Energy Measurement			
LOAD	PF	PHASES	% Error	LOAD	PF	PHASES	% Error
Imax	UPF	Combined	0.19	Ib	UPF	Combined	0.17
	0.5Lag	Combined	0.15		0.5Lag	Combined	0.04
	0.866Lead	Combined	0.14		0.866Lead	Combined	0.03
Ib	UPF	Combined	0.06	10% of Ib	0.5Lag	Combined	0.14
	0.5Lag	Combined	0.09		0.866Lead	Combined	0.09
	0.866Lead	Combined	0.04	5% of Ib	UPF	Combined	0.02
10% of Ib	UPF	Combined	0.11	1% of Ib	UPF	Combined	0.16
	0.5Lag	Combined	0.11				
	0.866Lead	Combined	0.11				
5% of Ib	UPF	Combined	0.19				
1% of Ib	UPF	Combined	0.17				

Sr. no.	TEST	CLAUSE	Results
2.	AC High Voltage test	CL 12.7.6.3	OK
3.	Insulation resistance test	CL 12.7.6.4	OK
4.	No Load Condition test	CL 12.12	OK
5.	Starting Condition test	CL 12.13	OK

This is system generated report, hence no signature required. For any query , pl. contact to- Testing In charge, Genus Power Infrastructures Ltd, Haridwar

FIG 8A



Genus Power Infrastructure Ltd., Haridwar
3Phase-4Wire,AC Static Energy Meter
3*63.5V,3*-/5A, 50Hz,C1-0.2S
Routine Test Report As Per IS 14697:1999

TEST CERTIFICATE

Meter Sr No: GP4409883

1.Limits Of Error Measurement

Active Energy Measurement				Reactive Energy Measurement			
LOAD	PF	PHASES	% Error	LOAD	PF	PHASES	% Error
Imax	UPF	Combined	0.06	Ib	UPF	Combined	0.08
	0.5Lag	Combined	0.13		0.5Lag	Combined	0.18
	0.866Lead	Combined	0.07		0.866Lead	Combined	0.10
Ib	UPF	Combined	0.02	10% of Ib	0.5Lag	Combined	0.02
	0.5Lag	Combined	0.18		0.866Lead	Combined	0.18
	0.866Lead	Combined	0.08	5% of Ib	UPF	Combined	0.13
10% of Ib	UPF	Combined	0.12	1% of Ib	UPF	Combined	0.15
	0.5Lag	Combined	0.18				
	0.866Lead	Combined	0.15				
5% of Ib	UPF	Combined	0.15				
1% of Ib	UPF	Combined	0.10				

Sr. no.	TEST	CLAUSE	Results
2.	AC High Voltage test	CL 12.7.6.3	OK
3.	Insulation resistance test	CL 12.7.6.4	OK
4.	No Load Condition test	CL 12.12	OK
5.	Starting Condition test	CL 12.13	OK

This is system generated report, hence no signature required. For any query , pl. contact to- Testing In charge. Genus Power Infrastructures Ltd. Haridwar

Fig 8B

Losses and Subsidy computation

5.1. Energy accounts of the Previous Years

S.NO	Energy input details	Units	2020-21	2021-22	2022-23
A	Energy purchased	MU	35.581	36.719	36.534
B	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	35.581	36.719	36.534
C	Energy billed	MU	34.219	35.405	35.611
D	T& D Loss	MU	1.362	1.313	0.923
E	% T&D Loss	%	3.82	3.577	2.53

Table 27

5.2 Input Energy, AT&C losses-aggregate, Voltage wise, category wise and Area wise

5.2.1 Energy account and performance for the FY 2023-34

S.NO	Energy input details	Units	Quantity
1.	Energy purchased	MU	40.12
2.	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	40.43
3.	Energy billed	MU	39.50
4.	T& D Loss	MU	0.93
5.	% T&D Loss	%	2.31
6.	Amount of Energy billed	Rs (Crores)	43.18
7.	Amount of collection	Rs (Crores)	43.11
8.	Collection efficiency	%	99.83
9.	% AT&C Loss	%	2.47

Table 28

5.2.2 Quarter wise energy input to the CoPA for the FY 2023-24

Voltage level	Energy input particulars	QTR 1 (MU)	QTR 2 (MU)	QTR 3 (MU)	QTR 4 (MU)	Year 2023-24 (MU)
66kV and above	Long-Term Conventional	7.67	6.90	6.79	7.28	28.65
	Medium Conventional	0.00	0.00	0.00	0.00	0.00
	Short Term Conventional	0.00	0.00	0.00	0.00	0.00
	Banking	0.00	0.00	0.00	0.00	0.00
	Long-Term Renewable energy	0.00	0.00	0.00	0.00	0.00
	Medium and Short-Term RE	0.00	0.00	0.00	0.00	0.00
	Captive, open access input	0.00	0.00	0.00	0.00	0.00
	Sale of surplus power	0.00	0.00	0.00	0.00	0.00
	Quantum of inter-state transmission loss	0.00	0.00	0.00	0.00	0.00
	Power procured from inter-state sources	0.00	0.00	0.00	0.00	0.00
	Power at state transmission boundary	7.67	6.90	0.00	7.28	28.65
33kV	Long-Term Conventional	0.00	0.00	0.00	0.00	0.00
	Medium Conventional	0.00	0.00	0.00	0.00	0.00
	Short Term Conventional	0.00	0.00	0.00	0.00	0.00
	Banking	0.00	0.00	0.00	0.00	0.00
	Long-Term Renewable energy	0.00	0.00	0.00	0.00	0.00
	Medium and Short-Term RE	0.00	0.00	0.00	0.00	0.00
	Captive, open access input	0.00	0.00	0.00	0.00	0.00
	Sale of surplus power	0.00	0.00	0.00	0.00	0.00
	Quantum of intra-state transmission loss	0.00	0.00	0.00	0.00	0.00
	Power procured from intra-state sources	0.00	0.00	0.00	0.00	0.00
	Input in DISCOM wires network	7.67	6.90	6.79	7.28	28.65
33 kV	Renewable Energy Procurement	0.00	0.00	0.00	0.00	0.00
	Small capacity conventional/ biomass/ hydro plants procurement	0.00	0.00	0.00	0.00	0.00
	Captive, open access input	0.00	0.00	0.00	0.00	0.00

11 Kv	**Renewable Energy Procurement**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
	Small capacity conventional/ biomass/ hydro plants Procurement	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
	Sales Migration Input	**2.71**	**2.38**	**2.80**	**3.59**	**11.47**	
LT	**Renewable Energy Procurement**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
	Sales Migration Input	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
	Energy Embedded within DISCOM wires network	**0.08**	**0.08**	**0.08**	**0.08**	**0.31**	
	Total Energy Available/ Input	**10.47**	**9.35**	**9.67**	**10.94**	**40.43**	

Table 29

5.2.3. Quarterwise Energy sales of CoPA for the FY 2023-24

	YEAR	QTR 1	QTR 2	QTR 3	QTR 4	2023-24
Voltage level	**Energy Sales Particulars**	**MU**	**MU**	**MU**	**MU**	**MU**
LT Level	DISCOM' consumers	2.03	1.86	2.15	2.32	**8.37**
	Demand from open access, captive	0.00	0.00	0.00	0.00	0.00
	Embedded generation used at LT level	0.01	0.01	0.01	0.02	0.05
	Sale at LT level	2.04	1.87	2.16	2.34	**8.42**
	Quantum of LT level losses	**	**	**	**	**
	Energy Input at LT level	2.3	2.08	2.37	2.60	9.35
11 kV Level	DISCOM' consumers	8.16	7.28	7.30	8.34	**31.08**
	Demand from open access, captive	0.00	0.00	0.00	0.00	0.00
	Embedded generation at 11 kV level used	0.00	0.00	0.00	0.00	0.00
	Sales at 11 kV level	8.16	7.28	7.30	8.34	**31.08**
	Quantum of Losses at 11 kV	**	**	**	**	**
	Energy input at 11 kV level	10.38	9.28	9.59	10.87	**40.12**
33 kV Level	DISCOM' consumers	0.00	0.00	0.00	0.00	0.00
	Demand from open access, captive	0.00	0.00	0.00	0.00	0.00
	Embedded generation at 33 kV or below level	0.00	0.00	0.00	0.00	0.00
	Sales at 33 kV level	0.00	0.00	0.00	0.00	0.00
	Quantum of Losses at 33 kV	0.00	0.00	0.00	0.00	0.00
	Energy input at 33kV Level	0.00	0.00	0.00	0.00	0.00

> 33 kV	DISCOM' consumers	0.00	0.00	0.00	0.00	0.00
	Demand from open access, captive	0.00	0.00	0.00	0.00	0.00
	Cross border sale of energy	0.00	0.00	0.00	0.00	0.00
	Sale to other DISCOMs	0.00	0.00	0.00	0.00	0.00
	Banking	0.00	0.00	0.00	0.00	0.00
	Energy input at > 33kV Level	7.67	6.90	6.79	7.28	**28.65**
	Sales at 66kV and above (EHV)	0.00	0.00	0.00	0.00	0.00
Total Energy sales		**10.20**	**9.15**	**9.47**	**10.69**	**39.50**
Total Energy input /requirement		**10.47**	**9.35**	**9.67**	**10.94**	40.43
	T&D Loss (%)	**2.54**	**2.19**	**2.10**	**2.37**	**2.31**

**HT and LT Level losses could not be assessed due to the absence of Feeder meters and DTR meters

Table 29 B

ANNUAL T&D LOSS PERFORMANCE AGAINST THE PAT TARGET

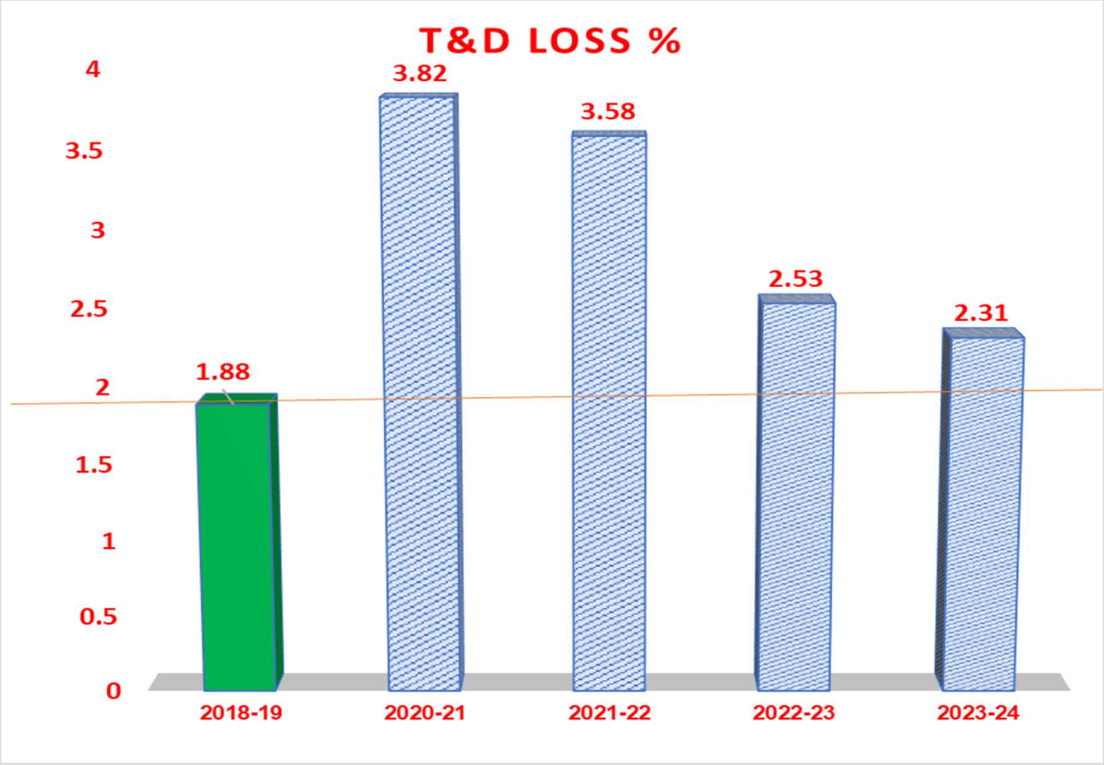


Fig 9

Quarter Vise T&D Loss performance for the year 2023-24

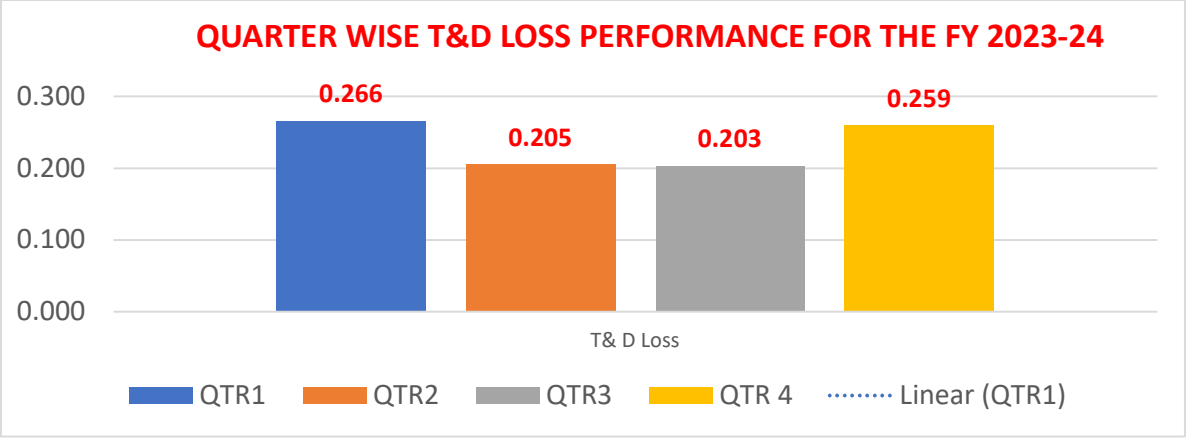


Fig 9A

5.2.4 Loss analysis of the Two Distribution areas under the CoPA for the FY 2023-24

5.2.4.2 Month wise T&D loss performance for the two distribution areas

Month wise T&D loss performance of the Willingdon Island and Vallarpadam area.

Energy	WILLINGDON ISLAND			VALLARPADAM		
	Net Energy input (MU)	ENERGY SALE(MU)	T&D LOSS (MU)	Net Energy input (MU)	ENERGY SALE(MU)	T&D LOSS (MU)
Apr-23	2.56	2.48	0.08	1.02	1.00	0.019
May-23	2.88	2.79	0.09	0.91	0.90	0.014
Jun-23	2.32	2.26	0.05	0.77	0.76	0.012
Jul-23	2.41	2.33	0.07	0.77	0.76	0.002
Aug-23	2.50	2.43	0.07	0.78	0.78	0.003
Sep-23	2.06	2.01	0.05	0.83	0.83	0.003
Oct-23	2.22	2.15	0.07	0.92	0.91	0.004
Nov-23	2.22	2.17	0.05	0.86	0.85	0.006
Dec-23	2.43	2.36	0.07	1.03	1.02	0.007
Jan-24	2.40	2.31	0.08	1.04	1.03	0.004
Feb-24	2.32	2.25	0.07	1.13	1.12	0.014
Mar-24	2.64	2.56	0.08	1.42	1.40	0.012
ANNUAL TOTAL	28.96	28.12	0.83	11.48	11.38	0.10
T& D Loss %			3.03%			1.09%

Table 30

5.2.4.3 T&D LOSS TREND IN THE TWO AREAS

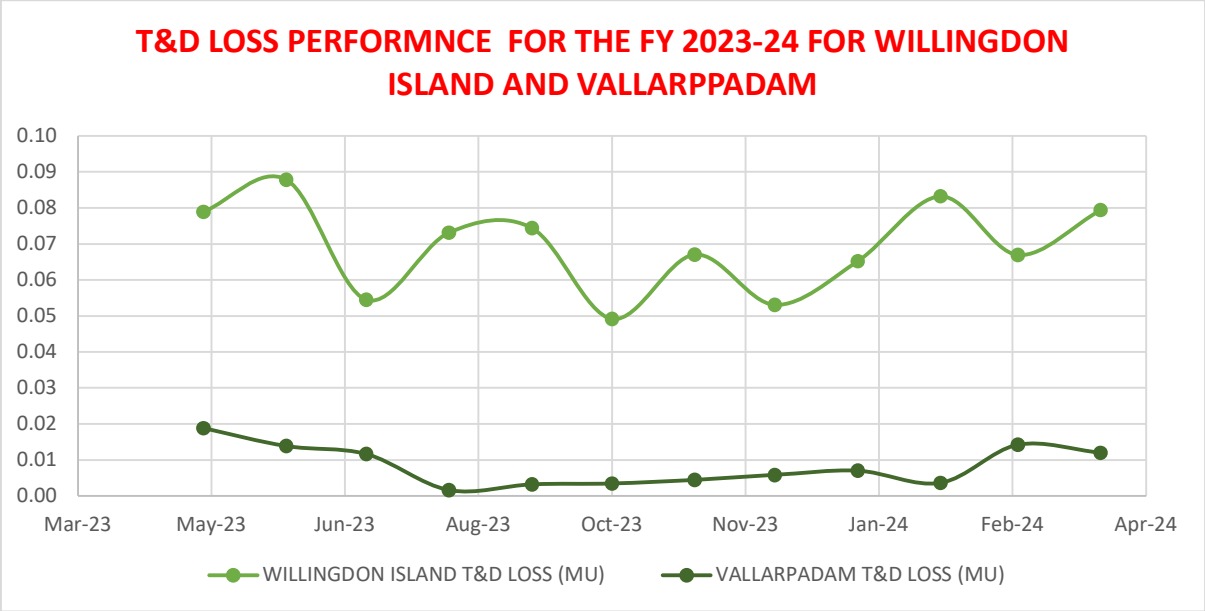


Fig 10

5.2.5. Feeder wise energy distribution in Willingdon Island

(Feeder wise loss could not be assessed due to the absence of functional meters in DTRs.

Feeder wise Energy Distribution under the CoPA for the FY 2022-23

Sl. no.	Panel no.	Feeder	Meter S.NO	IR (Apr 23)	FR (Mar 24)	M.F	Consumption (kWh)
1	K01A	MNC	GP4409886	11419.35	18147.7	40	269134
2	K16	NTRO KV	GP4409880	130181.6	241756.7	40	4463004
3	3	Q9-1	GP4409885	537287	595587.5	40	2332020
4	4	Q9-2	GP4409882	357795.1	491819.2	40	5360964
5	5	MH-2 (MH)	GP4409887	84682.55	139551.2	40	2194746
6	9	UTL	GP4409883	292001.9	360528.9	40	2741080
7	10	Q9-3	GP4409888	185909.1	336236	40	6013076
8	11	MH-3 (ISRF)	GP4409884	28039.75	33997.50	40	238310
9	12	STN. TR	GP4409889	159792.9	203332.8	2	87080
10	K 15	PENNA	GP4409879	264799.7	323235.3	40	2337424
11	K 17	NTRO A2	GP4409890	92608.15	156496.8	40	2555546
Total							2,85,92,384
(The above readings are taken from 1st day 00:00 Hrs to last day 00:00 Hrs)							

Table No:31

5.3.1. Category wie and quarter wise energy consumption and Loss

Division Wise Losses																
		Period From 1st April 2023 to 31st March 2024														
S.No	Name of circle	Consumer profile			Energy parameters					Losses		Commercial Parameter				Average billing rate (Rs)/Unit
		Consumer category	Total Number of connections	% of number of connections	Input energy (MU)	Billed energy (MU)			% of energy consumption	T&D loss (MU)	T&D loss (%)	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency		
						Metered energy	Unmetered/assessment energy	Total energy								
1		Residential	419	34%	10.46641	0.26	0	0.26	3%	0.265698	2.54%	**0.18**	**0.18**	100.00%	QTR 1	6.906622
		Agricultural	0	0%		-	0	0.00	0%			**0.00**	**0.00**	0.00%		0
		Commercial/Industrial-LT	545	44%		1.07	0	1.07	11%			**1.37**	**1.37**	100.00%		12.76102
		Commercial/Industrial-HT	29	2%		7.56	0	7.56	74%			**8.28**	**8.28**	100.00%		10.94832
		Others	255	20%		1.31	0	1.31	13%			**1.14**	**1.14**	100.00%		8.764262
Sub-total			**1248**	**100%**	**10.46641**	**10.20071**	**0**	**10.2007**	**100%**	**0.266**	**2.54%**	**10.97**	**10.95**	**99.83%**	**2.70%**	10.75539
2		Residential	410	33%	9.354926	0.22	0	0.22	2%	0.205119	2.19%	**0.15**	**0.15**	100.00%	QTR 2	6.491637
		Agricultural	0	0%		-	0	0.00	0%			**0.00**	**0.00**	0.00%		0
		Commercial/Industrial-LT	544	44%		0.97	0	0.97	11%			**1.27**	**1.27**	100.00%		13.0703
		Commercial/Industrial-HT	29	2%		6.74	0	6.74	74%			**7.53**	**7.53**	100.00%		11.16117
		Others	252	20%		1.21	0	1.21	13%			**1.07**	**1.07**	100.00%		8.850743
Sub-total			**1235**	**100%**	**9.354926**	**9.149807**	**0**	**9.149807**	**100%**	**0.205119**	**2.19%**	**10.01**	**10.00**	**99.83%**	**2.36%**	10.94501
3		Residential	407	32%	9.668354	0.23	0	0.23	2%	0.202754	2.10%	**0.15**	**0.15**	100.00%	QTR 3	6.758131
		Agricultural	0	0%		-	0	0.00	0%			**0.00**	**0.00**	0.00%		#DIV/0!
		Commercial/Industrial-LT	563	45%		1.22	0	1.22	13%			**1.58**	**1.58**	100.00%		12.93164
		Commercial/Industrial-HT	29	2%		6.74	0	6.74	71%			**7.57**	**7.57**	100.00%		11.23087
		Others	258	21%		1.28	0	1.28	14%			**1.14**	**1.14**	100.00%		8.885179
Sub-total			**1257**	**100%**	**9.668354**	**9.46560**	**0**	**9.4656**	**100%**	**0.202754**	**2.10%**	**10.44**	**10.42**	**99.83%**	**2.26%**	11.02551
4		Residential	412	32%	10.94453	0.26	0	0.26	2%	0.259488	2.37%	**0.19**	**0.19**	100.00%	QTR 4	7.281203
		Agricultural	0	0%		-	0	0.00	0%			**0.00**	**0.00**	0.00%		#DIV/0!
		Commercial/Industrial-LT	605	47%		1.36	0	1.36	13%			**1.75**	**1.75**	100.00%		12.81439
		Commercial/Industrial-HT	30	2%		7.73	0	7.73	72%			**8.62**	**8.62**	100.00%		11.16117
		Others	241	19%		1.33	0	1.33	12%			**1.20**	**1.20**	100.00%		8.983226
Sub-total			**1288**	**100%**	**10.94453**	**10.68504**	**0**	**10.68504**	**100%**	**0.259488**	**2.37%**	**11.76**	**11.74**	**99.83%**	**2.54%**	11.00572
76	Total	Residential	**412**	32%	40.43421	0.97	0	0.97	2%	0.933059	2.31%	0.67	0.67	100.00%	2023-24	6.877225
		Agricultural	**0**	0%		0.00	0	0.00	0%			0.00	0.00	0.00%		#DIV/0!
		Commercial/Industrial-LT	**605**	47%		4.63	0	4.63	12%			5.96	5.96	100.00%		12.88674
		Commercial/Industrial-HT	**30**	2%		28.77	0	28.77	73%			32.00	32.00	100.00%		11.12156
		Others	**241**	19%		5.13	0	5.13	13%			4.55	4.47	98.41%		8.871756
77	company level		**1288**	**100%**	**40.43421**	**39.50115**	**0**	**39.501**	**100%**	**0.933**	**2.31%**	**43.18**	**43.11**	**99.83%**	**2.47%**	10.93175
** Note - It shall be mandatory to record the energy supplied separately for each category of consumers which is being provided a separate rate of subsidy in the tariff, by the state																

Table No:3

5.3.2 Trend analysis

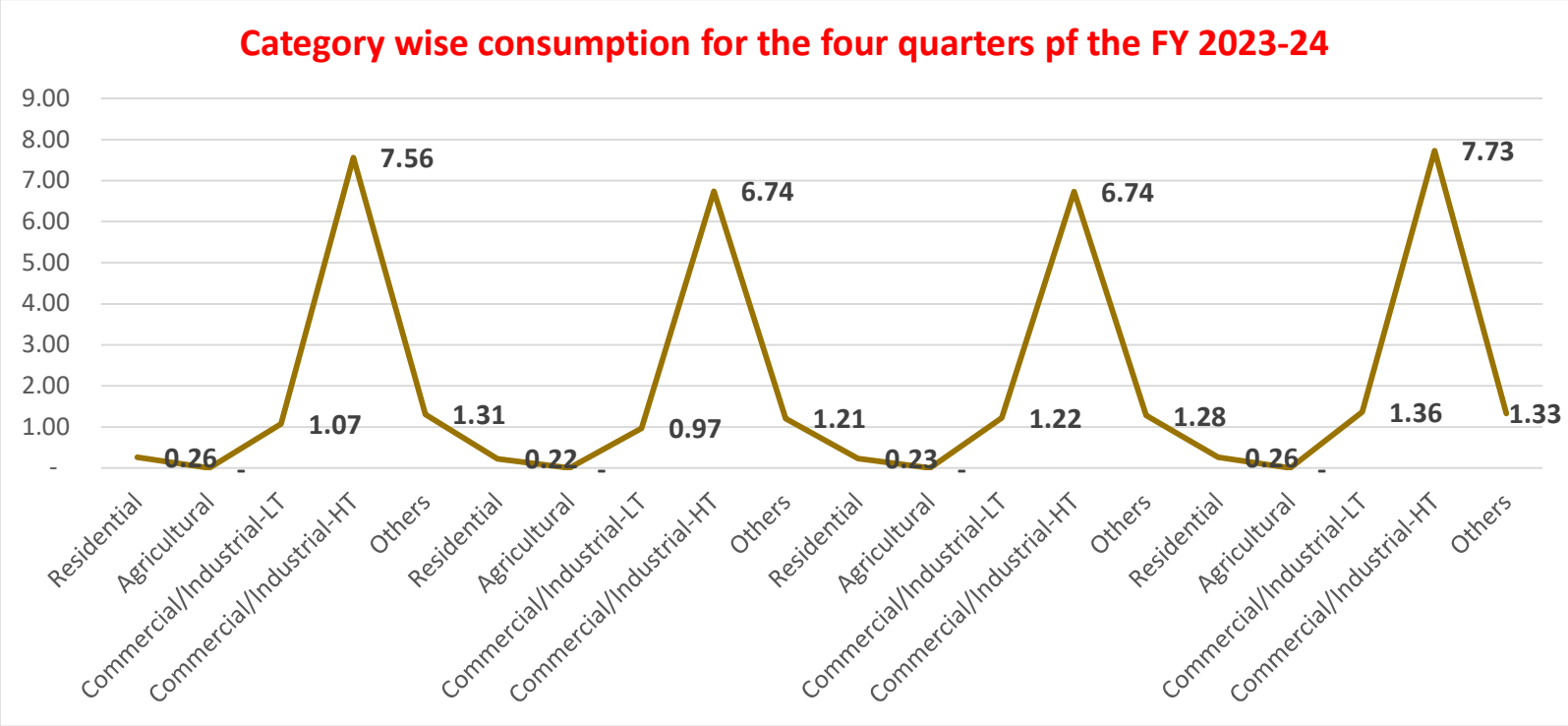


Fig 11

5.4 Subsidy computation and analysis based on the quarterly data

B.Details of Consumer Category-wise Subsidy Billed/Received

Period From Jan 2024 to March 2024(not applicable)

Consumer Category (Separate for each subsidised consumer category)	Billed Energy			Subsidised Billed Energy			Applicable rate of Subsidy as notified by State govt.		Subsidy Due from State Govt.			Subsidy Actually Billed / claimed from State Govt. (As against col.12)	Subsidy Received from State Govt. (As against col.13)	Balance Subsidy yet to be Received from State Govt.
	Metered	Un-metered*	Total	Metered (out of col.2)	Un-metered*(out of col.3)	Total	Metered Energy**	Un-metered Energy**	Metered Energy	Un-metered Energy	Total			
	(in kWh)			(in kWh)			(in Rs/kWh)		(in Rs. Cr.)			(in Rs. Cr.)	(in Rs. Cr.)	(in Rs. Cr.)
1	2	3	4=2+3	5	6	7=5+6	8	9	10=5X8	11=6x9	12=10+11	13	14	15=13-14
Residential	0.97	0	0.97	No subsidy claim by the DISCOM			No subsidy rate notification by the Government		Np subsidy due from the Government			0	0	0
Agricultural	0.00	0	0.00											
Commercial/Industrial-LT	4.63	0	4.63											
Commercial/Industrial-HT	28.77	0	28.77											
Other (Specify)	5.13	0	5.13											
Total	39.50	0	39.50											

Table No:33

In CoPA there is no subsidy claim or payment by the Government.

5.4.1 Category wise consumption, Loss and average billing rate of CoPA for thee FY 2023-24

Period From 1st April 2023 to 31st March 2024											
Consumer profile		Energy parameters			Losses		Commercial Parameter				
Consumer category	Total Number of connecti	Input energy (MU)	Total energy	% of energy consumption	T&D loss (MU)	T&D loss (%)	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency	AT & C loss (%)	Average billing rate (Rs./kw)
Residential	412		0.97	2%			**0.67**	**0.67**	100.00%		**6.88**
Agricultural	0		0.00	0%			**0.00**	**0.00**	0.00%		**0.00**
Commercial/Industrial-LT	605	40.43421	4.63	12%	0.933059	2.31%	**5.96**	**5.96**	100.00%		**12.89**
Commercial/Industrial-HT	30		28.77	73%			**32.00**	**32.00**	100.00%		**11.12**
Others	241		5.13	13%			**4.55**	**4.47**	98.41%		**8.73**
	1288	**40.43421**	**39.50**	**100%**	**0.933**	**2.308%**	**43.18**	**43.11**	**99.8325%**	**2.47%**	**10.91**

Table No: 33 A

5.4.2 Average billing rate

As per revenue analysis the average billing rate of the CoPA for the FY 23-24 is Rs 10.90

6 Energy audit Findings

6.1. Review of Capacity of the DISCOMS Energy Accounting and Audit Cell

Overview

As per Bureau of Energy Efficiency (BEE) regulations, the DISCOM has established a centralized energy accounting and audit cell. This cell oversees the entire consumer base, which predominantly uses advanced SMART meters with Advanced Metering Infrastructure (AMI) features. There are some exceptions, such as a few streetlight meters and self-consumption meters. The AMI server collects readings from these SMART meters and is integrated with the accounting SAP system.

Changes in Energy Input Structure

In the fiscal year 2023-24, there was a significant change in the energy input structure of the DISCOM. In March 2024, a new 11 kV feeder was commissioned to import 2 MVA of power from KSEBL and allocated as a dedicated feeder to an HT Consumer in Vallarppadam area by the Cochin Port Authority (CoPA) .

Energy Accounting Practices

Quarterly energy accounts are prepared manually by the DISCOM This involves extracting data from the AMI software and SAP system and after making manual adjustments for the following consumptions.

1. Energy used by solar prosumers after adjusting their grid exports.
2. Energy sold to ships for minor works in the port, recorded in the respective month but accounted for in the subsequent month.

Energy purchase details are manually entered into the software based on the meter readings from supplier invoices, as there is no communicable check meter on the DISCOM side.

Compliance with Energy Audit Regulations

Energy input, sales, and loss details must be prepared on a Distribution Transformer (DTR) wise, Feeder wise, Low Tension (LT) wise, and High Tension (HT) wise basis for micro-analysis of losses. However, CoPA faces challenges in meeting these requirements due to:

a. Incomplete DTR wise and feeder wise consumer mapping.
b. Pending installation of DTR meters.
c. Only 12 out of 16 feeder meter installations completed.
d. Feeder connections in a Ring main system, making feeder wise loss assessment inaccurate.

Action Plan and Compliance

The DISCOM has committed to the following actions, which are yet to be complied with:

1. Complete DTR wise and Feeder wise Consumer mapping and incorporate it into the AMI software.
2. Installations of feeder meters in the remaining 4 feeders.
3. Installation of DTR meters.in all DTRs

A revised action plan with clear target dates needs to be submitted.

Internal Generation and Sales Report Observations

The DISCOM has internal generation using three diesel generator sets for maintaining supply for essential supply during blackouts. This power is combined with renewable energy in the distribution format.

Up on sales report review for March 2024 showed that 109 consumers previously categorized under self-consumption have been accounted in respective tariff categories in the sales report as per the direction of the KSERC.

Subsidy and Loss Analysis

According to the DISCOM energy audit regulations, details of subsidies provided, claimed, and sanctioned by the government must be furnished. However, CoPA reported that no subsidized consumers.in CoPA.

Revenue and Collection Efficiency

.Collection efficiency is reported at 99.84 % for all consumer categories.

Prepaid Billing Implementation

Although SMART meters with prepaid facilities are installed, the prepaid billing feature has not been activated. This implementation must follow the timeline set by the BEE.

Poor state of the LT Distribution Lines

Up on site patrolling the LT Distribution lines in 9 locations it is observed that distribution lines are very old copper conductors with multiple joints .Also the lines are found SWG 8 type conductor with excessive sag and touching. Moreover, the service connections are found effected by improper joints using aluminium service wire.

Loss of generation due to the breakdown of inverters in the two Solar plant.

The renewable energy generation found reduced considerably due to the failure of inverters in the two solar plants. The solar generation from the 100-kW solar plant found decreased by

about 63 % and the 150-kW solar plant found decreased by about 24% when comparing the generation in the month of April 2023 and March 2024.

Energy saving opportunities in the Mattanchery halt Pump house

Mattanchery halt Pump house is pumping the water to three locations.

1. Mattanchery Warf
2. Ernakulam Warf
3. RNA Quarters
   The destination point from the pump house are about 4 km.The pump house consists of 2 pumps with 31.73 kW each.The Motor rating is 50 HP. Out of the three pump one is operating at a time. The storage tank consists of 12 tanks with 450 Tonne capacity each. The discharge capacity of the Pump is 230 m3 /hour.

The pump house operation and maintenance is not up to the mark and there is scope for energy saving due to the followings reasons.

1. Up on inspection the delivery pipe valve found partially throttled for controlling the flow rate.
2. There is appreciable water leak in the Pipe.
3. No power factor correction capacitor connected to the motor.
4. Also the present pump operating schedule is from 8AM to 9 PM . which includes the peak hours.

Based on the field inspection the following suggestions are required

1. The delivery valve should not be throttled. Throttling the valve will cause additional friction loss and hence more energy consumption. Therefore the better method for achieving the reduced flow on a permanent basis is by trimming the impeller. Or the Pump manufacturer may be contacted for an impeller with reduced Diameter
2. Water leak in the pipe to be arrested
3. Power factor correction capacitor to be installed at the Motor terminal. This will reduce loss due to the reactive energy flow. The recommended value of the capacitor for the 50 HP motor is 14 kVAR.
4. Operating the pump during the peak hour will cause increased power consumption due to reduced voltage. Hence operation schedule of the motor may be altered by avoiding the evening peak hour.

6.2. Critical Analysis by Energy Auditor

As per the regulations, the compliance of the DISCOM was verified for the status and progress to prerequisites, reporting requirements and other technical aspects and the compliance status are furnished below with detailed responses of the DISCOM Management.

6.2.1 Status and progress in compliance with the prerequisites for energy accounting

S.NO	Parameters verified as per the Energy audit regulation for the DISCOM 2021	Relevant regulation number	Whether the DISCOM Complied or not	Comments by the DISCOM management
1	Pre-requisites for annual energy audit and periodic energy accounting	Reg No: 5		
a)	The identification and mapping of all of the electrical network assets;	Clause (a)	Not yet completed The mapping of feeders, DTR and consumers are pending.	The work is proposed under the RDSS Scheme.
(b)	The identification and mapping of high tension and low-tension consumers;	Clause (b)	Not fully completed.	Proposed under the RDSS Scheme.
(c)	The development and implementation of information technology enabled energy accounting and audit system, including associated software.	Clause (c)	Not fully complied.	Proposed under the RDSS Scheme. Presently the quarterly and annual Energy account reports are prepared based on the AMI software and SAP System.
(d)	100% Communicable Feeder Metering integrated with AMI, by 31 st December 2022 along-with replacement of existing non-communicable feeder meters.	The first schedule. Trajectory for meter installation	Not yet complete.	Pending for installation in 4 feeders. Proposed under the RDSS Scheme
(e)	All Distribution Transformers (other than HVDS DT up to 25kVA and other DTs below 25 kVA) shall be metered with communicable meters. Communicable DT Metering for the following areas / consumers to be completed by December 2023 and in balance areas by December 2025:		Not yet complied.	Proposed under the RDSS Scheme.

(f)	All Electricity Divisions of 500 AMRUT cities, with AT&C Losses > 15 %		Not Applicable.	
(g)	All Industrial and Commercial consumers;		Yes complied.	All HT and LT Consumers are fitted with SMART Meters with AMI features.
(h)	All Government offices at Block level and above;		Yes complied.	
(i)	Other high loss areas i.e. rural areas with losses more than 25% and urban areas with losses more than 15%.		Not applicable	
(j)	Further, existing non-communicable Distribution Transformer meters to be replaced with communicable meters integrated with AMI, within the timelines applicable to the respective areas		Not applicable	
(iii)	Prepaid Smart Consumer Metering to be completed for all directly connected meters and AMR in case of other meters, by December 2023 in the following areas:		Yes complied.	The SMART Meter installed have prepaid facility.
(a)	All Electricity Divisions of 500 AMRUT cities, with AT&C Losses > 15%		Not applicable	
(b)	All Industrial and Commercial consumers;		Yes	
(c)	All Government offices at Block level and above;		Yes complied.	
(d)	Other high loss areas i.e. rural areas with losses more than 25% and urban areas with losses more than 15%.		Not applicable	
(iv)	Targets for the installation of functional meters.	Year 2022-23		
	Meter type	Target	Achievement	Remarks
(a)	Feeder metering (%)	98.5%	73 % (12/17)	Proposed under the RDSS Scheme.
(b)	DT metering (%)	90%	0%	Do
(c)	Consumer metering (%	93%	100 %	Complied.

(v)	Whether created a centralized energy accounting and audit cell comprising of— (i) a nodal officer, an energy manager and an information technology manager, having professional experience of not less than five years; and (ii) a financial manager having professional experience of not less than five years	Regulation 5(g)	Yes complied.	The DISCOM has a centralised energy accounting and audit cell comprising of a Nodal officer, Energy Manager, I.T Manager and a Financial Manager.

Table 33 B

6.2.2.1 Status and progress in compliance with the reporting requirements of the regulation (Refer regulation No: 6)

	Parameters verified as per the Energy audit regulation for the DISCOM 2021	Relevant regulation number	Whether the DISCOM Complied or not	Comments by the DISCOM management
(i) a	Every electricity distribution company shall designate a nodal officer, who shall be a full-time employee of the electricity distribution company in the rank of the Chief Engineer or above, for the purpose of reporting of the annual energy audit and periodic energy accounting and communicate the same to the Bureau.	Regulation No: 6(1)	Yes complied.	**Mr. Ajithkumar D** Superintending Engineer (Ele) Nodal officer, Cochin Port Authority is a small distribution licensee with hardly 1288 consumers under the port area. Hence the nodal officer is in the rank of of the Superintend Engineer.
(i) b	Intervals of time for the conduct of annual energy audit	6(1)	Yes	1. Energy audit report for the year 2022-23 is submitted with in the stipulated time. 2. Energy audit report for the year 2023-24 is prepared and is under submission.

(i) c	Intervals of time for the conduct of periodic energy accounting		Yes	Periodic energy accounting for Q1 FY23-24 been submitted to BEE and SDA and also at the website of the DC within the scheduled time.
				P Periodic energy accounting for Q2 to Q3 OF FY22-23 have been submitted to BEE and SDA and also at the website of the DC within the scheduled time
(ii)	Every electricity distribution company shall ensure that the energy accounting data is 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	Regulation No: 6(2)	Yes complied.	The energy accounting data is generated from metering system. Hence there are no assumptions.
(iii)	Metering of distribution transformers at High Voltage Distribution System up to 25KVA can be done on cluster meter installed by each electricity distribution company	Regulation No: 6(3)	Not applicable.	There is no HVDS in CoPA.
(iv)	The energy accounting and audit system and software shall be developed to create monthly, quarterly and yearly energy accounting reports.	Regulation No: 6(4)	Not complied to the fullest extent.	The installation of functional meters for the feeders and DTRs are yet to be completed. Presently, all the consumer meters and 12 Nos of Feeders are installed with SMART meters. In CoPA, AMI Software is used to fetch data from smart meters installed at consumer premises and integrated with SAP system. Monthly Invoices are generated from SAP by accounts Department. Various reports including preparation of energy audit and accounting reports are generated from

				SAP system with manual intervention.
(v)	Every electricity distribution company shall provide the details of the information technology system in place as specified in clause (f) of regulation 5 that ensures minimal manual intervention in creating the energy accounting reports and manual intervention of any nature, in respect of the period specified therein, shall be clearly indicated in the periodic energy accounting report.	Regulation No: 6(5)	Not yet complied.	In CoPA, AMI Software is used to fetch data from smart meter and same software is integrated with SAP. In the Finance department, SAP is used to generate Monthly invoice for the individual consumers. Presently the energy account and audit reports are prepared manually using the SAP and AMI Software data. The information technology system as per clause (f) of regulation 5 is proposed under the RDSS system

Table 33 C

6.2.2.2. Compliance report of the reporting requirement

Reporting requirement -Compliance of the BEE Regulation						
No. 18/1/BEE/DISCOM/2021,Manner and Intervals for Conduct of Energy Audit (Accounting) in Electricity Distribution Companies) Regulations 2021 dated 6th October 2021						
Clause No	Clause details	Time period for submission and display in the website	Period of the Energy audit /Account report	Target date as per regulation	Whether complied or not	Remarks
3(1)	Intervals of time for conduct of annual energy audit.-	Within a period of four months from the expiry of the relevant financial year:	1. Energy audit for the year 2022-23	31-07-2023	Annual report submitted on 21/08/2023	The delay occurred due to the delay in finalising the tender for the Energy audit.Request for extension sought to BEE vide letter 14/07/2023.
			2. Complience of comments if any from BEE	15-12-2023	Yes Complied the BEE comments. Submitted on 14/12/2023	
			3. Energy audit for the year 2023-24	31-07-2023		
4.1(a) & (b)	Intervals of time for conduct of periodic energy accounting.-	within 45 days from the date of the periodic energy accounting (After two years)	Energy account of the 1ST quarter of the year 2023-24	15-08-2023	Yes. Submitted on 05/09/2023. Extension sought from BEE.	The delay occurred due to the delay in finalising the tender for the Energy audit.Request for extension sought to BEE Wide letters attached as annexure 1 &2 dated 27/05/2022 & 14/07/2023 respectively.
			1. Complience of comments if any from BEE	04-03-2024	05-03-2024	
			Energy account of the2nd quarter of the year 2023-24	15-11-2023	24-11-2023	
			. Complience of comments if any from BEE	18-03-2024	21-03-2024	
			Energy account of the3rd quarter of the year 2023-24	15-02-2024	22-02-2024	
			. Complience of comments if any from BEE	04-07-2024	04-07-2024	
			Energy account of the 4th quarter of the year 2023-24	15-05-2024	28-05-2024	Extension sought to BEE since the bills for March 2024 was not received inMay 20 by M/s KSEBL for the newly energised 2 MVA feeder.
			Complience of comments if any from BEE	Not yet recived		

Table 33 D

6.2 3. Management Analysis

The key aspects of the regulations are, the conduct of the annual energy audit in DISCOMs by an external accredited auditor every year and submission of regular quarterly energy account report to the BEE and to the SDA prepared by the Energy Manager of the DISCOM within the time frame. There are clear guidelines in regulation for the preparation of quarterly accounts and the manner of conducting energy audit. The Energy accounting for all energy inflows in the distribution system, including renewable energy generation, open access

consumers, and energy consumption by the end consumers, shall be conducted on a periodic basis. This necessitates the availability of energy accounting data at consumer, transformer, feeder and system level. Energy accounting will help the DISCOM to identify areas of heavy loss and pilferage, and thereafter, focused efforts can be made by the DISCOMs to take corrective action.

- The installation of 4 Nos Feeder meters and 30 Nos DTR meters are proposed under the RDSS scheme. The work was delayed due to the delay in obtaining sanction from the PFC.Now sanction obtained and the tender process initiated .
- The change of the input structure is incorporated in the accounting report
- 109 Nos of the consumer under the self-consumption category was recategorized in to the respective tariff category based on the purpose of usage as pointed out by the KSERC.
- The metering works and consumer mapping was delayed due to the delay in obtaing sanction for the RDSS project. Revised action plan for the metering works and other works prepared and will be completed within the schedule.
- Prepaid billing system will be implemented once the billing software work is completed under the RDSS scheme.
- LT Distribution maintenance will be undertaken immediately for the reshackling and line touching clearence.LT Line Conductor changing works are proposed under the RDSS scheme and the work is under the tendering process.
- The two number solar plant breakdown work will undertake immediately. The quotation for the inverter repair is already invited.
- Action will be initiated for the installation of the Power factor correction capacitor at the Mattancherry halt water pump house. Rectification of the water leak will be carry out immediately and the operator will be instructed not to throttle the delivery valve.

Summary of the critical observation made by the Energy auditor and the management response analysis are furnished below:

1. The mapping of consumers with DTR and Feeders is the prime requirement for the Energy accounting of Feeders and Distribution Transformers. This is essential for tracking the loss and weak points of the DISCOM. But the mapping of the consumers with DTR and Feeders are yet to completed in CoPA.

The Management has reported that the mapping work will be complete by the DISCOM along with the completion of feeder meters proposed under the RDSS scheme. The management has also promised to complete the task by the year 2024-25.

2. As per the trajectory set by the regulation, the installations of functional meters for all feeders shall be completed by the DISCOM before 31st December 2022.But it is seen that, CoPA has installed functional meters only in 12 feeders out of the 16 feeders. Moreover, the feeders are arranged in Ring main system consisting of multiple feeders. There is no proper monitoring system for the ring arrangement. This is a major bottle neck for assessing the feeder wise energy accounting. The Energy auditor has recommended a proper monitoring system for the Ring main arrangement with optimal load distribution in the feeders.

   The installation of 4 Nos Feeder meters and 30 Nos DTR meters are proposed under the RDSS scheme. The work was delayed due to the delay in obtaining sanction from the PFC. Now sanction obtained and the tender process initiated. Revised action plan prepared. Also action will be initiated for monitering the Ring network through SCADA, proposed under the RDSS scheme.
3. Subsidy account: There is no subsidy payment by the Government.
4. The 11 kV distribution is through UG cables with RMU system. The loading in feeders is also low. Hence the distribution loss is relatively low in feeder
5. Regarding the failure of the inverters in the 100 kW and 150 kW solar plant.

   The management promised for immediate action for the rectification of the inverters and for the clearing of the solar panel shade.
6. *One major observation made by the Energy auditor is that majority of the Distribution transformers are old with higher capacity compared to the load requirement. On, sample verification of DTR load an unbalance is seen in the LT feeding. Hence there is scope for loss reduction in DTR through load balancing.*

   The management explained that CoPA has already proposed the replacement of 20 Transformers with energy efficient transformers and has also ensured that immediate action will be initiated for regular load monitoring and balancing of load in distribution transformers.

7. The CoPA is not yet equipped with a software for the energy account and audit without manual intervention.

   The Management explained that all the consumers are fitted with SMART Meters with AMI feature. Moreover, all SMART meters are connected with AMI software through GPRS system The AMI software is integrated with the SAP system. Hence system loss assessment is prepared manually based on the data from the SAP system. Further, the creation of software for Energy accounts as stipulated by the regulation is proposed under the RDSS scheme and will be completed by the year 2024-25.

6.3. Revised findings based on the data validation and field verification and corrective action proposed.

As per the BEE regulation, energy flow is to be monitored at all voltage levels. But based on the data validation and field verification, the following observations are made for necessary corrections.

1. There is no input meter on the DISCOM side for the 110 kV supply input at the Willingdon Island and the 11 kV supply input at Vallarpadam. The monthly meter readings are recorded in the CoPA register, while taking the meter reding by the KSEBL. Also input energy is accounted from the purchase bill. Hence functional meters are to be installed at the supply input points on the 11 kV side, both at the Willingdon Island and at Vallarpadam. This is essential for automated energy accounting.
2. The 11 kV distribution is connected in Ring main system by connecting multiple feeders for ensuring better supply reliability. But there is no proper monitoring system for the Ring feeding arrangement. This makes it difficult for the load assessment in feeders. Hence for assessing the feeder wise load and loss the following measures to be adopted:
   a. All the ring networks are to be properly defined based on the optimal load condition in the feeders with separate identification number for each ring and subring.
   b. There shall be proper monitoring for the ring main network operations from the substation or from other control centre. Ring network diagram is to be placed in the substations.
   c. Border meter has to be installed at the identified feeder changing points in the ring network.
   d. Consumer, DTR and feeder mapping has to be completed at the earliest.

6.4 Inclusion and exclusion.

- All energy input sources are included in the energy accounting including the roof top solar energy from the solar prosumers ,Energy from the internal solar plant and the energy from DG for black out supply .
- The loss report is prepared only on circle wise and area wise. As there are no division or subdivision wise formation in the Cochin Port Authority.
- The Feeder wise and DTR wise energy loss report could not be furnished due to the non-completion of the consumer mapping and the Feeder and DTR metering.

6.5 Recommendations for Loss reduction

Energy losses occur in the process of supplying electricity to consumers due to technical and commercial reasons. The technical losses are due to energy dissipated in the conductors, transformers and other equipment's used for transmission, , sub-transmission and distribution of power. These technical losses are inherent in a system and can be reduced to a certain level.

Pilferage by hooking, bypassing meters, defective meters, errors in meter reading and in estimating un-metered supply of energy are the main sources of the commercial losses. When Commercial losses are added to Technical losses, it gives Transmission & Distribution (T&D) loss.

There is another component of commercial losses, which is attributable to non-recovery of the billed amount and is reflected in collection efficiency. T&D losses together with loss in collection give us Aggregate Technical & Commercial (AT&C) losses.

Based on the field visit and sample load study on the Transformer loading under the CoPA, the following recommendations are offered for the loss reduction:

Low cost and high yield saving proposals

1. LT Line reshackling and clearing the touching's and use best construction practises for the service connection.
2. Do best operating practises for the water pump operation as detailed below
    a. Do not throttle the delivery valve for flow control
    b. Do regular maintenance on the pump.
    c. Check for the flow quantity of the Pump and Load current at regular interval
3. Monitor the generation output of the solar plants and do routine maintenance.
4. Under loaded transformers: - On sample verification it is observed that, high capacity DTR are employed in majority of the locations, when compared to the actual load. Hence, load has to be redistributed among transformers based on the best efficiency conditions. While procuring new energy efficient transformers, transformer capacity is to be selected based on the actual load requirement.
5. Tighten all loose joints at the transformer cables and service lines to reduce joint loss.

Medium cost and high yield energy saving measures

1. Conductor change: -Replace old conductors with higher cross section AB Conductors
2. Provide duplicate feeder for the overloaded feeder
3. Reroute the long LT line if feasible

4. Provide appropriate power factor compensation capacitors on the secondary side of the distribution transformers.
5. Provide LT service connection box
6. Convert long and loaded single-phase line to three phase line.
7. Convert loaded long three phase line to HT line by installing transformer near the load centre.

Best practises in Distribution management

1. Feeder automation with automated switches in Ring main unit. The existing Ring main unit can be converted as SCADA compatible RMU.
2. Implementation of Advanced SCADA System in Distribution.
3. Implementation of advanced EMS (Energy Management Software for the optimal load management and energy accounting.

7. Conclusion and action Plan

7.1.Summary of the Critical Analysis by Energy Auditor

The key aspect of the regulations is the conduct of the annual energy audit in DISCOMs by an external accredited auditor in every year and submission of regular quarterly energy account report to the BEE and to the SDA prepared by the Energy Manager of the DISCOM within the time frame. There is clear guide lines in the regulation for the preparation of quarterly accounts and the manner of conduct of the energy audit. The Energy accounting for all energy inflows in the distribution system, including renewable energy generation, open access consumers, and energy consumption by the end consumers, shall be conducted on a periodic basis. This necessitates that energy accounting data is made available at a consumer, transformer, feeder and system level. Energy accounting will help the DISCOM to identify areas of high loss and pilferage, and thereafter, focused efforts can be made by the DISCOMs to take corrective action

On scrutiny of the prerequisite conditions, reporting requirements and other technical and commercial aspects, the following observatory remarks are made by the Energy auditor for which reply has been submitted by the Management of the DISCOM. Summary of the critical observation made by the Energy auditor and the management response analysis are furnished below:

1. The mapping of consumers with DTR and Feeders is the prime requirement for the Energy accounting of Feeders and Distribution Transformers. This is essential for tracking the loss and weak points of the DISCOM. But the mapping of the consumers with DTR and Feeders are yet to be completed in CoPA.

   The Management has reported that the mapping work will be complete by the DISCOM along with the completion of feeder meters proposed under the RDSS scheme. The management has promised to complete the task by the year 2024-25. The Management also ensured that it will check the reason for the variation in the T&D loss in the Vallarpadam area.
2. As per the trajectory set by the regulation, the installations of functional meters for all feeders shall be completed by the DISCOM before 31st December 2022.But CoPA installed functional meters only in 12 feeders out of the 16

feeders. Moreover, the feeders are arranged in Ring main system consisting multiple feeders. There is no proper monitoring system for the ring arrangement. This is a major bottle neck for assessing the feeder wise energy accounting. The Energy auditor has recommended a proper monitoring system for the Ring main arrangement with optimal load distribution in feeders.

The DISCOM management has replied that the installation of functional meters in all the feeders are the top priority and the same will be completed by the DISCOM before 31st December 2025.Further, arrangements will be made for proper monitoring of the Ring network with optimal load distribution in the 11 kV feeders.

3. Presently no meters are installed in DTRs in CoPA. –
   The Management of the DISCOM has explained that the DTR meter installations are already proposed under the RDSS scheme and will be completed before 31st March 2025.
4. Installation of SMART prepaid meters for the LT and HT consumers:
   The CoPA has already completed the work for the consumers. These meters are connected with an AMI software through mobile network using GPRS ..This is a major advantage for the CoPA.
5. Formation of Centralised energy auditing and accounting cell
   CoPA has a Centralised Energy auditing and accounting cell consisting of a Nodal officer, Energy Manager, IT Manager and the Financial Manager.
6. The CoPA is a small distribution licensee with hardly 1288 consumers in two separate areas without any border sharing. Hence energy accounting is relatively easy. The 73 % of the energy consumption is by the Commercial sectors.
7. Subsidy account: There is no subsidy payment by the Government. The 11 kV distribution is through UG cables with RMU system. Also the loading in the feeders are low. Hence the distribution loss will be relatively low in feeders.
8. One major observation made by the Energy auditor is that majority of the Distribution transformers are old with high capacity compared to the load requirement. On sample verification of DTR load an unbalance is seen in the LT feeding Hence there is scope for loss reduction in DTR through load balancing.

The management explained that the CoPA has already proposed the replacement of 20 Transformers with energy efficient transformers and has also ensured that immediate action will be initiated for regular load monitoring and balancing of load in distribution transformers.

9. The CoPA is not yet equipped with a software for the energy account and audit without manual intervention.

   The Management explained that all the consumers are fitted with SMART Meters with AMI feature. Also, all the SMART meters are connected with the AMI software through GPRS system. .The AMI software is integrated with the SAP system. Hence system loss assessment is prepared manually based on the data from the SAP system. Further the creation of software for Energy accounts as stipulated by the regulation is proposed under the RDSS scheme and will be completed by the year 2024-25.

7.2 Summary of Key findings

As per the BEE regulation energy flow to be monitored at all voltage levels. But based on the data validation and field verification the following observations are made and to be corrected.

1. There is no input meter on the DISCOM side for the 110 kV supply input at the Willingdon Island and at the 11 kV supply input at the Vallarpadam. Presently the input energy is accounted from the purchase bill. And based on the Energy meter reading of the utility. Hence functional meters are to be installed at the supply input points on the 11 kV side both at the Willingdon Island and at Vallarpadam. This is essential for energy audit purpose.
2. The 11 kV distribution is connected in Ring main system by connecting multiple feeders for ensuring better supply reliability. But there is no proper monitoring system for the Ring feeding arrangement. This makes it difficult for the load assessment in feeders. Hence for assessing the feeder wise load and loss the following measures to be adopted.
   a. All the ring networks to be properly defined based on the optimal load condition in the feeders with separate identification number for each ring and subring.
   b. There shall be proper monitoring for the ring main network operations from the substation or from other control centre. Ring network diagram to be placed in the substations.
   c. Border meter has to be installed at the identified feeder changing points in the ring network.
   d. Consumer, DTR and feeder mapping to be completed at the earliest.
   e. Feeder meter installations to be completed on top priority.

3. Up on scrutiny of the quarterly account report the following anomalies are noted

I. Small quantum of DG energy is found clubbed with the Renewable energy input. But presently there is no provision to add this in the LT system in the Format. This will be taken up with the BEE.

II. Higher -capacity transformers are found used for Distribution and based on sample verification; majority of the Transformers are found underloaded.

III. Up on sample verification of the peak load measurement on transformers the Transformer LT supply is found in unbalanced conditions

7.3 Recommendations and best practises for Energy accounting and loss reduction

1. Energy losses occur in the process of supplying electricity to consumers due to technical and commercial reasons. The technical losses are due to energy dissipated in the conductors, transformers and other equipment's used for transmission, , sub-transmission and distribution of power. These technical losses are inherent in a system and can be reduced to a certain level.
2. Pilferage by hooking, bypassing meters, defective meters, errors in meter reading and in estimating un-metered supply of energy are the main sources of the commercial losses when Commercial losses are added to technical losses, it gives Transmission & Distribution (T&D) loss.
3. There is another component of commercial losses, which is attributable to non-recovery of the billed amount, which is reflected in collection efficiency. T&D losses together with loss in collection give us Aggregate Technical & Commercial (AT&C) losses.
4. Based on the field visit and sample load study on the Transformer loading under the CoPA the following recommendations are offered for the loss reduction.
5. **Low cost and high yield saving proposals**

(i) Unbalanced load condition in transformers. Up on sample load verification in transformers, it is observed heavy unbalance load conditions in transformers. Balancing the load will substantially reduce the loss. Hence transformer load to be monitored on regular interval and load balancing to be undertaken urgently.

(ii) Under loaded transformers: - Up on sample verification it is observed higher capacity DTR are employed in majority of the locations, when compared to the actual load requirement. Hence load to be redistributed among transformers based on the best efficiency conditions. While procuring new energy efficient transformers, transformer capacity to be selected based on the actual load requirement.

(iii) Tighten all the loose joints at the transformer cables and service lines, this will reduce joint loss.

(iv) Check the transformer earthing and also measure the neutral current on regular interval.

(v) The load in the two 12.5 MVA Power transformers are found below 30%. Hence switching off one transformer alternatively will reduce the transmission loss.

6. **Medium cost and high yield energy saving measures**

i. Conductor changing: Replace old conductors with higher cross section new conductors.

ii. Provide appropriate power factor compensation capacitors on the secondary side of the distribution transformers.

iii. Convert long and loaded single-phase line to three phase line.

iv. Convert long three phase line to HT line by installing transformer near the load centre.

7. Best practises in Distribution management

(i) Feeder automation with automated switches in Ring main unit. The existing Ring main unit can be converted as SCADA compatible RMU.

(ii) Implement Advanced SCADA System in Distribution

(iii) Implement advanced EMS (Energy Management Software for the optimal load management and energy accounting

7.4. 1. Action Plan for monitoring and reporting

Action plan for monitoring and reporting					
S.NO	TASK	Approximate cost	Benefit	Time frame for implementation	Remarks (Reason for the delay)
1	Completion of the Mapping of the Consumers with the connecting DTR	405000	Loss reduction , consumer load details, DT load optimisation and complying the regulation	31-03-2025	Work being included in RDSS work. Intial tender discharged by KSEBL , Retendering of work by COPA is in progrees. Final completion by 30-12-25
2	Since the 11 kV distribution is through Ring main system, the ring networks to be properly defined with normal feeding arrangement, considering the optimal load through the feeder.	14625000	Efficient monitoring of the distribution system , optimisation of load requirements , Load flow measurements and remote switching of feeders to reduce the down time.	30-06-2026	Optimisation and final completion will be done after implemendation SCADA system in the RDSS work being taken up with KSEBL including CoPA works as per PFC direction.
3	Set up a monitoring system for the Ring operation either at the Substation control room or in another place.	22750000	Efficient monitoring of the distribution system , optimisation of load requirements for feeders , Load flow measurements and remote switching of feeders to reduce the down time.	30-06-2026	After implemendation SCADA system in the RDSS work being taken up with KSEBL as per PFC direction.
4	Mapping of the DTR with the Feeders	180000	Loss reduction , optimisation of load requirements , Load flow measurements	31-03-2025	Work being included in RDSS work. Intial tender discharged by KSEBL , Retendering of work by COPA is in progrees. Final completion by 30-12-25
5	Completion of the Feeder meter installations in all feeders	3960000	Uploading of data as per requirements Optimisation of load requirements , Load flow measurements	31-03-2025	It has been included in RDSS works, but PFC asked COPA to do the work directly by CoPA. Hence separate tender has to be invited by COPA for doing the work by
6	Incorporation of the DTR and Feeder Mapping DATA in the existing AMI software so that DTR wise and Feeder wise Energy loss statement can be generated	8320000	Loss reduction , Efficient monitoring of the distribution system , optimisation of load requirements , Load flow measurements .	30-06-2026	After implemendation SCADA system in the RDSS work being taken up with KSEBL as per PFC direction.
7	Completion of the DTR Meter installations	3960000	Loss reduction , Efficient monitoring of the distribution system , optimisation of load requirements , Load flow measurements and remote switching of feeders to reduce the down time.	31-12-2024	It has been included in RDSS works, but PFC asked COPA to do the work directly by CoPA. Hence separate tender has to be invited by COPA for doing the work by OWN fund.

Table No: 34 A

7.4 .2. Action Plan for automated Energy accounting

Action Plan for automation					
1	Task details	Approximate cost (Lakhs)	Benefit /Saving	Payback period	Remarks
1	Distribution SCADA implementation	542	Advanced load monitoring and control. Better supplier reliability parameters and hence high revenue and customer satisfaction.	To be worked out based on the existing parameters.	
2	Implement the advanced EMS software in the Distribution	15	Complete energy management solutions and revenue management.		

Table No: 34 B

8. ANNEXURES

8.1 Introduction of the Verification team

The audit is conducted by M/s Centre for Energy, Environment and Productivity (CEEP) an Empanelled accredited auditing firm in DISCOM. The details of the auditing team members are furnished below.

AUDIT TEAM

S.NO	Name of the officer	Qualification	Designation
1.	Dr. J. Nagesh Kumar	Ph.D.	Accredited Energy auditor Reg No: 0133
2	Shri Sunilkumar V K	B. Tech (Elec)	Sector expert (DISCOM) & Certified Energy Auditor Reg No: EA 3642
3.	Shri Prakasan N.K	B.E.(Ele)	Electrical Engineer
4.	Shri K.G. Diwakar	M.E.	Certified Energy Auditor

Table 35

8.2 Minutes of the Meeting with DISCOM

Minutes of the Opening Meeting held with Chief Mechanical Engineer on the Mandatory Annual Energy Audit in Electricity Distribution Companies under purview of Energy Conservation Act, 2001 on 11/07/2024 at 10.45 am.

Present :

- Sri.V.Thuraipandian, Chief Mechanical Engineer
- Sri.P. Muniyasamy, Dy.Chief Mechanical Engineer.(Electrical)
- Smt.Humblie Ursala John, Exe.Engineer, (Electrical)
- Smt.Jayalakshmi, Executive Engineer (Electrical)
- Smt.V.Mini, Asst.Exe.Engineer (Electrical)
- Sri.Mathew Paul, Asst.Engineer (Electrical)
- Sri.Jolly Antony, Asst.Engineer (Electrical)

Representing M/s Centre for Energy Environment and Productivity

- Shri Sunilumar V K ,Sector Expert (Discom) & Certified Energy Auditor
- Shri Prakasan N K ,Electrical Engineer

Read 1. Contract No: GEMC-511687788965203 dated 04th July 2023

The meeting started at 11 AM in the chamber of the Chief Mechanical Engineer (CME) of the Cochin Port Authority, with the CME presiding. The Chair welcomed all the members and emphasized the importance of the PAT regulation. He then asked the Deputy Chief Mechanical Engineer (DCME) to actively follow up on the PAT activities. The DCME informed that he has been following up on the PAT audit activities. The Chair then invited Shri Sunilkumar V.K, the Energy Auditor, to explain the energy audit findings and the further course of actions to be completed.

Shri Sunilkumar V.K., the Energy Auditor of M/s Centre for Energy, Environment and Productivity, Chennai, the accredited auditing firm, informed that they had started the audit on 09/07/2024, and it is under progress . He stated that over the past two days, they have completed the inspection of the energy injection points at the 110 KV Willingdon Island substation, the 11 KV Vallarpadam substation, the 100 KW solar plant site, the Diesel Generator site for check readings, and approximately five distribution transformer yards, as well as LT line routes to explore energy conservation opportunities. He also mentioned that the draft annual accounting report for the year 2023-24 has already been prepared.

He reminded the Chair that the current year is the assessment year for the PAT target, and they need to achieve the T&D loss target of 1.88% during the current year. He also noted that the Cochin Port Authority has successfully reduced the T&D loss target steadily over the past three years due to systematic actions.

T&D Loss performance

S.NO	Quarter wise performance Year 2023-24	Net input energy (at DISCOM Periphery (after adjusting the transmission losses) (MU)	Total Energy billed (MU)	T&D Loss (MU)	T&D Loss (%)
1	1st Quarter (April to June)	10.47	10.20	0.27	2.5
	2nd Quarter	9.35	9.15	0.21	2.2
	3rd Quarter	9.67	9.47	0.19	2.0
	4th Quarter	10.94	10.68	0.27	2.4
	Year 2023-24	**40.43**	**39.50**	**0.93 ***	**2.3**

- 0.01 rounding error

S.NO	Year	T&D Loss (MU)	T&D Loss (%)
1	2020-2021	1.36	3.82
2	2021-2022	1.31	3.58
3	2022-2023	0.92	2.51
4	2023-24	0.93	2.30

Shri Sunilkumar V.K. informed that under the existing conditions, the Cochin Port Authority needs to reduce another 2 lakh units to attain the target through various energy conservation measures. He then pointed out the grey areas for improvement based on the audit findings:

1. **Transformer Load Balancing**:
   - Although some measures have been taken by the Cochin Port Authority for the load balancing of five transformers, the remaining transformers also need to be checked for load balance.
   - He highlighted the difficulty in taking the transformer load at the site due to the sealing of the transformer's terminal and the busbar panel.
   - The expected annual savings from transformer load balancing will be approximately 30,000 units annually.
2. **Non-installation of Capacitors at the Water Pump House**:
   - The pump house, with two 50 HP motors, is operating without any power factor correction capacitors, causing reactive loss in the line.
   - Leakage was observed in the line, and the valves were found to be partially closed.
   - The pump operating schedule is reported as from 8 AM to 9 PM in two shifts.
   - The following corrections were suggested: a. Install power factor correction capacitors on both motor terminals. b. Fix the pipe line leakage and instruct the operator to ensure the valves are fully open. c. The pump discharge is

reported as 100 tonnes/hour at the delivery point, while the rated discharge capacity is 230 KL / hour, indicating that the pump is not operating at its best efficiency point. d. Reschedule the operation to avoid peak hours, specifically from 6 PM to 9 PM.

:

3. **Poor Maintenance of the Distribution Overhead Lines**:
    1. The LT distribution lines are found touching the trees and overhang in many places.
    2. A majority of the lines are copper conductors (approximately SWG 8) with multiple joints and sagging.
    3. Lines need to be maintained properly by clearing the touchings, re-shackling, and replacing line spans with multiple joints.
    4. The Chair directed the maintenance wing to schedule the maintenance. However, the maintenance AE reported that the LT lines are proposed for replacement with ABC lines under the RDSS scheme and will be undertaken within six months.
    5. The Chair reiterated the urgency and directed the maintenance team to complete the maintenance of the lines without waiting for the RDSS project.

4. **Solar Plant Issues**:

    The solar plant generation has reduced considerably due to the breakdown of the inverters (four inverter units in the 100 kW plant and one inverter unit in the 150 kW plant), causing valuable green energy loss, for which CME replied that action is being taken to rectify the defective inverters.

5. Additionally, some panels are under the shade

6. **Pending Actions to be Completed** :

    i. **Installation of Feeder Meters in Four Feeders at Vallarpadam Substation**: - This is to be completed urgently to comply with the Energy Audit regulation. - The Chair directed the urgent purchase of four feeder meters to meet the regulation requirements.

    ii. **Incorporation of Transformer Details in the AMI Software**: - Transformer details need to be incorporated based on feeder-wise and transformer-wise consumer mapping data to enable the software to provide feeder-wise loss details. - The Chair directed the exploration of incorporating this data into the software. - **Action Target Date**: 31/12/2024..

    iii. **Installation of DTR Meters in All Transformers**: - This is necessary to comply with the Energy Audit regulation and to help identify high-loss areas. - The Superintending Engineer (Electrical) informed that the DTR meters and feeder meters are proposed under the RDSS scheme. The delay is due to pending sanction from PFC, and the work is currently in the tender stage. - **Target Completion Date**: 31/03/2025

7.Development of Software for Energy Audit Reports:

- The Energy Auditor informed that, as per the Energy Audit regulation, the DISCOM needs to develop software to prepare the quarterly energy account report and annual energy account report without any manual intervention.
- He suggested modifying the current accounting software (SAP) to comply with this requirement.
- The Chair directed the exploration of the feasibility of this modification.

8. Presentation of Energy Audit Findings:

a. The Chair directed the Energy Auditor to present the energy audit findings and PAT pending actions in a Power Point presentation.

b. The Energy Auditor agreed, and the presentation was conducted for 12:30 PM in the conference room. The meeting concluded at 11:30 AM.

CME

Dy. CME(E)

SUNIL KUMAR V.K
Certified Energy Auditor
Reg. No: EA 3642

8.3 Checklist prepared by the Empanelled Accredited auditing Firm

1.Opening meeting and information gathering about the DISCOM operations

For understanding about business of the DISCOM and planning the course of the audit and capture the following information

a. Overall structure of the DISCOM and business
b. Number of circles, Division, subdivision and section
c. Number of substations voltage levels and metering status and SLD
d. Major energy inflows and voltage levels, metering status and trading
e. Number of border sharing and metering status

2.Checking the regulatory Compliance of the DISCOM

- Check for the compliance of the prerequisites for the annual energy audit and periodic energy accounting reports and understanding the new energy audit regulation by the DISCOM
- Check for the compliance of the reporting requirement for annual energy audit and periodic energy account

3.Data Collection and Analysis:

- Collect the quarterly energy account reports of the four quarters and monthly reports
- Collect monthly data for the energy inputs and sales
- Collect the Energy purchase bills and internal generation data including the renewable energy sources
- Collect meter reading data and metering details of Input points, feeders, Border meters and Distribution transformers and consumer points
- Collect data regarding the infrastructure of the distribution like number of Distribution transformers, capacity Line length,UG cable length, and Metering infrastructure
- Analyse the monthly data and quarterly reports and check for any variance

7**. Review billing and metering data for accuracy.**

Collect monthly collection efficiency data overall and unit wise

Collect annual reports of the previous year and analyse the overall performance and trend

o 4.Verication and validation of Data

a) Verify and check the current metering status

- At the sample input injection points,
- feeder import points and export points,
- generation input points,
- Distribution transformers and
- Consumer points and validate the same

.

b) Verify the mapping status of the feeder, Distribution transformers and the consumers

c) Verification of energy flow data within DISCOM at all applicable voltage levels of distribution network as specified in the regulations.

d)The service level wise energy flow data is to be computed by the DISCOM on a monthly basis, and it would submit a consolidated Quarter wise report to the validation through sample data checks and field visits:

e. Evaluate DSM programs and their effectiveness.

f. Assess customer-side energy management initiatives.

5.Vation of Energy inflows and outflows data:

Based on data available in 11 kV Feeder meter at substation for a sample size of 10% for which documentary evidence to be captured in the audit report.

- Min. 10 or 1% (whichever is higher) of DISCOM's input energy metering points between Transmission and 66kV/33kV/11kV distribution feeders by checking functional and communication status of meters etc.
- For all Divisions with AT&C losses greater than 25% or at-least 1/3 of the total Divisions of DISCOM,
- verify: Total of min. 10 or 1% of metering points (whichever is higher) between 220132 110- 66 /33 kV outgoing and 22kV-11kV-6.6kV-3kV incoming feeders/ direct end-consumer by checking functional and communication status of meters.
- In an Urban High Loss Division, check 5 or 1% of Metering points (whichever higher) at DTs where communicable meters were already installed under other schemes such as R-APDRP and IPDS. o Total of min. of 10 or 1% of metering points (whichever is higher) between11kV/6.6kV feeders and DTs by checking functional and communication status of meters, foot survey of feeder to check for thefts/ hooking etc.
- Verify metering and connection status of min. of 10 or 2% consumers of the Division (whichever is higher) of the following category of consumers

- Agriculture (Metered and Un-metered),
- Govt. category connection (ULB, RLB etc.), and LT Industry

6.. Infrastructure Assessment:

- Inspect distribution transformers, lines, and substations for losses and inefficiencies.
- Assess the condition of equipment and identify areas of energy wastage.
- Check for power factor improvement opportunities.

7.. Demand Side Management (DSM):

8. Energy Efficiency Measures:

- Review the effectiveness of energy-saving measures previously implemented.
- Identify new opportunities for energy efficiency improvements.
- Consider energy-efficient technologies for grid management.

9.. Tariff Analysis:

- Review tariff structures and assess their impact on energy consumption.

10. Reporting and Compliance Documentation:

- Prepare a comprehensive energy audit report.
- Include findings, recommendations, and a plan for implementation.
- Ensure all required documentation for regulatory compliance is complete.

8.4. Brief approach, Scope and methodology of the audit

I. The objectives of the work

As per notification No: 18/1/BEE/DISCOM/2021 dated 6th October 2021 (Manner and interval for conduct of energy audit (accounting) in Electricity Distribution companies regulations issued by the BEE, MOP and amendment issued thereof on 28th October 2022,every Distribution companies shall conduct an annual energy audit by an external accredited auditor for every financial year and submit the annual energy audit report to the Bureau of Energy Efficiency and respective SDA and also made available on the website of the DISCOM within a period of four months from the expiry of the relevant financial year.

The objectives of the work are to conduct a comprehensive energy audit and submit the report containing the details as stipulated by the regulation with recommendations and action plan with time frame and priority to reduce the loss and best practises in energy accounting and energy conservation techniques so as to improve the efficiency and the financial viability of the DISCOM

II. Approach and methodology of the work

The proposed audit will be conducted in the following three phases.

1. Pre-audit phase

I. Discussion and review meeting(s) with DISCOMs and Energy Manager(s) to ensure reliable and timely data availability

II. A review of the Macro level data in order to assess the areas of high losses and data gaps

III. Planning field visits to verify and collect data

IV. Planning and phasing of various steps involved in audit exercise including data collection, manpower/team deployment,

V. Organizing the structure of the audit report in consonance with energy accounting regulations notified by BEE; and the output required for corrective action and decision making

VI. Undertake a review of the capacity of the centralized energy accounting and audit cell created at the DISCOM in terms of adequate representation from professional backgrounds of IT Manager, Energy Manager and Financial Manager

2.Audit phase

a) Review of present structure of energy flow in DISCOM at different levels - State level, transmission, sub-transmission, DT level, feeder level to end consumer etc.

Capture details of DISCOM infrastructure - no. of circles, divisions, sub-divisions, sections, Substations, total No. of Power Transformers with capacity in MVA, total No. of Capacitor Banks in Substations and capacity in MVAR, feeders, DTs with capacity in MVA, boundary meters, category wise consumers and

b) Voltage level for each consumer category etc. (Refer Regulation 5)

c) Stakeholder interactions with DISCOM, Energy Manager, SE (Circle level), XEN (Division level) for data accuracy and other issues.

d) Verify, check and validate current metering status (operational/ faulty/ unmetered) and type (communicable/ static etc.) at various voltage levels (feeders, DTs, consumers) and Metering details (such as Meter Sl. Number, Meter reading date and the Mu34ltiplying Factor) through sample field visits and available records with DISCOM.

e) Verification of energy flow data within DISCOM at all applicable voltage levels (Refer Regulation 7) of distribution network as specified in the regulations. The service level wise energy flow data is to be computed by the DISCOM on a monthly basis, and it would submit a consolidated Quarter wise report to the Energy Auditor, who would only verify the same

f) Validation through sample data checks and field visits:

   a. Validation of feeder data: Based on data available in 11 kV Feeder meter at substation for a sample size of 10% for which documentary evidence will be captured in the audit report.

   b. Validation of energy flow data and losses: Based on field survey as per the following sample size:

I. Min. 10 or 1% (whichever is higher) of DISCOM's input energy metering points between Transmission and 66kV/33kV/11kV distribution feeders by checking functional and communication status of meters etc.

II. For all Divisions with AT&C losses greater than 25% or at-least 1/3 of the total Divisions of DISCOM, verify: - Total of min. 10 or 1% of metering points (whichever is higher) between 220-132-110- 66 /33 kV outgoing and 22kV-11kV-6.6kV-3kV incoming feeders/ direct end consumer by checking functional and communication status of meters.

III. In an Urban High Loss Division, check 5 or 1% of Metering points (whichever is higher) at DTs where communicable meters were already installed under other schemes such as R-APDRP and IPDS.

IV. Total of min. of 10 or 1% of metering points (whichever is higher) between 11kV/6.6kV feeders and DTs by checking functional and communication status of meters, foot survey of feeder to check for thefts/ hooking etc.

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

VI.

g) Computation of AT&C losses for each division:

I. Input energy data: Identification of all input points of transmission system, collection of input energy from recorded system, meter reading including energy received and distributed by DISCOM, recorded meter reading at all DISCOM export points, system loading, source of energy supply including generation from RE, etc.

II. Billing and collection data: Feeder wise and category wise no. of consumers, Voltage

Level for every consumer category, metered and un-metered, connected load, billed and unbilled energy, details of open access, EHT sale, HT sale, LT sale and transmission losses, etc.

III. Computation of distribution loss, collection efficiency and AT&C loss at Feeder level, DT Level and Utility level

a. **T&D LOSS**

(NET INPUT ENERGY / TOTAL ENERGY BILLED)

b. **BILLING EFFECIENCY (%)**

(**(TOTAL ENERGY BILLED /NET INPUT ENERGY)**

c. **COLLECTION EFFECIENCY (%)**

{AMOUNT COLLECTED /AMOUNT BILLED}

d. **AT&C LOSS (%)**

(1-BILLING EFFECIENCY X COLLECTION EFFECIENCY)

IV. Identify high-loss Feeder and network segments: Based on energy loss

V. losses, wastage or inefficient use of electricity etc. for initiating target based corrective action

VI. Identify overloaded segments/ infrastructure: Based on sample assessment and data analysis, make recommendations on undertaking necessary capacity augmentations in substations, Feeders, Transformers and up to consumer end as observed.

h) Computation of subsidy assessed based on energy accounting data:

i) Revise the findings accordingly as per the field visits undertaken as mentioned above

j) Trend analysis with quarterly audit findings, past data review

k) Exception analysis and aberrations if any observed in audit exercise

3. Post Audit and Reporting phase

a) Detailed Energy Audit Report preparation and submission as per BEE energy accounting regulations (Refer Regulation 9)

b) Audit report should include energy accounting data captured on a quarterly basis for the FY.

c) The audit report should point out variances in quarterly and annual data and recommendations for alignment of periodic accounting and annual energy audit report, key data gaps, assumptions and exceptions.

d) Wherever available and feasible, validate Energy Audit report with the Energy Audit report generated by the DISCOM for smart meters – for this, the DISCOM would facilitate data/ report availability from the respective AMISP.

iv. Submit an Action Plan in the Energy Audit Report, which should necessarily capture the following:

a) Provide recommendations w.r.t energy accounting, loss reduction, subsidy accounting, consumption analysis etc. This should include cost-benefit analysis, payback periods etc.,

b) accompanied by a detailed implementation plan and a mechanism for regular review and monitoring so that desired objectives are achieved within stipulated timelines.

c) Develop a comprehensive action plan for monitoring of energy flow at each voltage level (Refer Regulation 8)

d) Recommendations to also include that energy accounts prepared and submitted to BEE to be used for financial audit reporting.

e) Auditor to obtain detailed action plan from the DISCOM to establish an IT enabled system to create energy accounting reports without any manual interference. This should include timelines for completion of Smart metering of Feeders and DTs, and generation of automated energy accounting reports through an IT platform/ solution. Detailed action plan to form part of energy audit report for regular review and monitoring.

f) Auditor should observe and compile various Energy Conservation options implemented by the DISCOM and prepare report containing details of expenditure done by DISCOM along with saving and payback period.

v. Assessment details and recommendations related to annual energy audit of previous year

8.5 Infrastructure details

Form-Details of Input Infrastructure					
1	**Parameters**	**Total**	**Covered during in audit**	**Verified by Auditor in Sample Check**	**Remarks (Source of data)**
i	Number of circles	1	1		In CoPA there is no Division or Subdivision wise formation.
ii	Number of divisions	0			
iii	Number of sub-divisions	0			
iv	Number of feeders	16	16	11	Through AMI meter software for 11 nos out of 16 feeders
v	Number of DTs	30	30	1	No meter is installed
vi	Number of consumers	1288	1288	1288	Through SAP

Table 36

8.5.1. Voltage based consumers and metering infrastructure

S.NO	Parameters	66kV and above	33kV	11/22kV	LT
a i	Number of conventional metered consumers	0	0	0	89
ii	Number of consumers with 'smart' meters	0	0	37	1162
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	37	1251

b i	Number of conventionally metered Distribution Transformers	0	0	0	0
ii	Number of DTs with communicable meters	0	0	0	0
iii	Number of unmetered DTs	0	0	30	0
iv	Number of total Transformers	0	0	30	
c i	Number of metered feeders	0	0	12	0
ii	Number of feeders with communicable meters	0	0	12	0
iii	Number of unmetered feeders	0	0	4	
iv	Number of total feeders	0	0	16	
d.	Line length (ckt km2	0		85	105
e.	Length of Aerial Bunched Cables (kM)	0	0	0	0
f.	Length of Underground Cables (kM)	0	0	85	

Table 37

8.5.2. Detailed list of Transformers

LIST OF TRANSFORMERS						
Sl. No.	Transformer Details				Location	
	Type & Capacity	Make	Maker's Sl.no.	Yr. of mfr.		
1	11 KV/433 V, 630 KVA	KEL	26643	1992	Mattancherry Halt S/s.	Wellingdon Island
2	11 KV/433 V, 315 KVA	Crompton parkison Ltd	29826V	1975	Mattancherry Halt Qtrs.	
3	11 KV/433 V, 500 KVA	KEL	58942	2008	SBI RMU (Coal Stacking Area)	
4	11 KV/433 V, 250 KVA	Unipower	2263	2011	A3 Area, IMU Campus	
5	11 KV/433 V, 500 KVA	Megawin	947	2014	Subramaniyam Road	
6	11 KV/433 V, 630 KVA	Intrans	T-2676	2019	New Leasing Area	
7	11 KV/433 V, 500 KVA	KEL	4821	1979	110 KV Substation compound	
8	11 KV/433 V, 630 KVA	Talwane	TPE 740	2009	RNAS	
9	11 KV/433 V, 630 KVA	Intrans	T-2677	2018	RNAS	
10	3.3 KV/433 V, 500 KVA	Intrans	T-1653	2012	Hospital Substation	
11	11 KV/433 V, 630 KVA	Intrans	T-2678	2019	Konkan - 2	
12	11 KV/433 V, 250 KVA	Resi Tech	TR-205	2018	Walkway RMU Premise	
13	11 KV/433 V, 315 KVA	Resi Tech	TR-205	2018	Tropicana RMU Premise	
14	11 KV/433 V, 800 KVA	KEL	5115	1981	N.End SSn	
15	11 KV/433 V, 800 KVA			2001	BTP Substation	
16	11KV/3.3KV - 630kVA		Sl.no. 1599, Intrans	2012	E/Wharf :Substation premises	
17	11KV/433V - 500 KVA		Sl.no. 46534, KEL	2002	E/Wharf :Substation premises	
18	11`KV/433V - 630 KVA		Sl.no. 36884	1996	Old leasing Area	
19	11`KV/433V - 630 KVA		Sl,no. 48824, KEL	2004	Old leasing Area	
20	11 KV/433 V - 500 KVA		Sl.no. 5895, Indian Transformers Ltd	1978	SAGARIKA Cruise Terminal	
21	11 KV/433 V -1250 KVA		Sl.no.739	2009	Q9 Substation	
22	11 KV/433 V - 630 KVA		Sl.no.16969	1977	Q5 Substation	
23	11 KV/433 V - 800 KVA		Sl.no. 8333, KEL	1986	Q10 Substation CFS	
24	11 KV/433 V - 500 KVA		Sl.no. 52888	2005	CWC	
25	11KV/3.3 KV, 1250 KVA		TR12, Indoor NPH		NPH	
26	11 KV/3.3 KV, 1000 KVA		TR13, Indoor NPH		NPH	
27	11 KV/433 V, 500 KVA				VALLARPADOM SUBSTATION	Vallarppadam
28	11 KV/433 V, 250 KVA				Near IOC	
29	11 KV/433 V, 315 KVA				Near SEZ Bldg. (Gate)	
30	11 KV/433 V, 300 KVA				MULT	

Table No: 38

8.6. Electrical Distribution system

Cochin Port Authority (CoPA) is a Body Corporate under the Major Port Authorities Act, 2021 (formerly Cochin Port Trust). CoPA is also a Deemed Electricity Distribution Licensee as per the Electricity Act 2003 and a notified DC (DC No: DIS0048KL) under the PAT Cycle VII vide notification No: S.O.4552(E) dated 26th September 2022 by the Ministry of Power, GOI.

CoPA purchases electricity from M/s Kerala State Electricity Board Limited (KSEBL), a major distribution licensee, and distributes it to consumers in the Port area under its jurisdiction in Willingdon Island, Vallarpadam, and Puthuvypin. CoPA avails 6.5 MVA power at a 110 kV system from KSEBL in Willingdon Island and 3 MVA power at 11 kV in Vallarpadam, distributing electricity to consumers within the Port premises.

Presently, CoPA operates a 110kV/11kV Substation with two 10/12.5 MVA power transformers and associated switchgears and control gears at Willingdon Island, and an 11 kV Receiving Station at Vallarpadam with two feeders. The 11 kV power is distributed to consumers through 11 kV underground (UG) cables, dedicated 11 kV UG cables, and linked through a Ring Main system for redundancy in supply, ensuring 24x7 supply. Low Tension (LT) feeding is by means of LT overhead (OH) and UG cable lines.

Currently, CoPA has 1288 consumers, including 36 High Tension (HT) consumers and 1220 LT consumers. Consumer metering is 100% SMART meters for all categories of consumers. However, self-consumption and street light supply are metered through SMART meters/electronic meters. Action has already been taken to purchase SMART meters to replace the electronic meters with SMART meters. SMART meters are equipped with Advanced Metering Infrastructure (AMI) features and prepaid facilities. All the SMART meters are connected to a centralized AMI software system through a mobile network using GPRS. Billing and accounting are done using the SAP system.

There are eleven 11 kV feeders emanating from the 110/11 kV substation at Willingdon Island and five 11 kV feeders at Vallarpadam and Puthuvypin areas. Additionally, there are 30 distribution transformers with specifications of 11kV/415Volt and 11 kV/3.3 kV.

CoPA has commissioned 100 kWp and 150 kWp grid-connected solar plants. CoPA has also permitted net metering facilities for solar plants of nine LT and HT prosumers. Import/export of energy from the solar plants is accounted for through SMART meters. The energy inputs from the solar plants are also covered in the Energy audit.

8.6.1 .Feeder wise load distribution under the Willingdon Distribution System

Sl. no.	Panel no.	Feeder	Meter S.NO	IR (Apr 23)	FR (Mar 24)	M.F	Cons. (Units)	Feeder load %
1	K01A	MNC	GP4409886	11419.35	18147.7	40	269134	0.9
2	K16	NTRO KV	GP4409880	130181.6	241756.7	40	4463004	15.6
3	3	Q9-1	GP4409885	537287	595587.5	40	2332020	8.2
4	4	Q9-2	GP4409882	357795.1	491819.2	40	5360964	18.7
5	5	MH-2 (MH)	GP4409887	84682.55	139551.2	40	2194746	7.7
6	9	UTL	GP4409883	292001.9	360528.9	40	2741080	9.6
7	10	Q9-3	GP4409888	185909.1	336236	40	6013076	21.0
8	11	MH-3 (ISRF)	GP4409884	28039.75	33997.50	40	238310	0.8
9	12	STN. TR	GP4409889	159792.9	203332.8	2	87080	0.3
10	K 15	PENNA	GP4409879	264799.7	323235.3	40	2337424	8.2
11	K 17	NTRO A2	GP4409890	92608.15	156496.8	40	2555546	8.9
Total							2,85,92,384	100.0
(The above readings are taken from 1st day 00:00 Hrs to last day 00:00 Hrs)								

Table 39

On analysing the feeder loads, major loads are found in 3 feeders namely, NTROKV, Q92 and Q93. The load in the rest of the feeders are found very low. Hence there is scope for energy saving through optimal load sharing of feeders

8.6.2 Energy performance of the previous years

S.NO	Energy input details	Units	2020-21	2021-22	2022-23
A	Energy purchased	MU	35.581	36.719	36.534
B	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	MU	35.581	36.719	36.534
C	Energy billed	MU	34.219	35.405	35.611
D	T& D Loss	MU	1.362	1.313	0.923
E	% T&D Loss	%	3.82	3.577	2.53

Table 40

8.6.3 Analysis of performance in the two Distribution areas under the CoPA

Energy	WILLINGDON ISLAND			VALLARPADAM		
	Net Energy input (MU)	ENERGY SALE(MU)	T&D LOSS (MU)	Net Energy input (MU)	ENERGY SALE(MU)	T&D LOSS (MU)
Apr-23	2.56	2.48	0.08	1.02	1.00	0.019
May-23	2.88	2.79	0.09	0.91	0.90	0.014
Jun-23	2.32	2.26	0.05	0.77	0.76	0.012
Jul-23	2.41	2.33	0.07	0.77	0.76	0.002
Aug-23	2.50	2.43	0.07	0.78	0.78	0.003
Sep-23	2.06	2.01	0.05	0.83	0.83	0.003
Oct-23	2.22	2.15	0.07	0.92	0.91	0.004
Nov-23	2.22	2.17	0.05	0.86	0.85	0.006
Dec-23	2.43	2.36	0.07	1.03	1.02	0.007
Jan-24	2.40	2.31	0.08	1.04	1.03	0.004
Feb-24	2.32	2.25	0.07	1.13	1.12	0.014
Mar-24	2.64	2.56	0.08	1.42	1.40	0.012
ANNUAL TOTAL	28.96	28.12	0.83	11.48	11.38	0.10
T& D Loss %			3.03%			1.09%

Table 41

Month wise and area wise T&D Loss curve for the year 2023-24

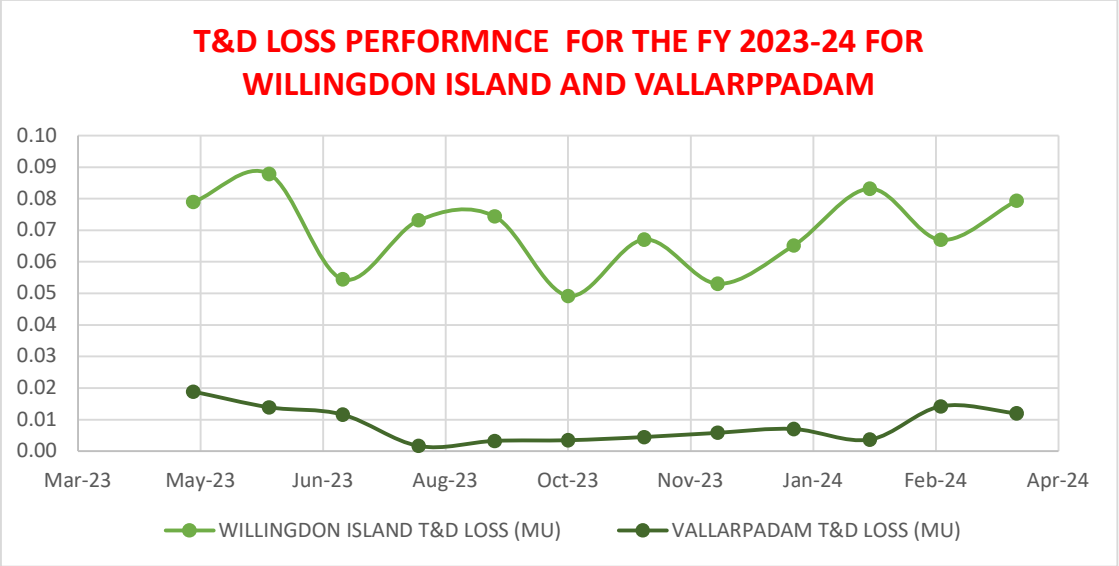


Fig 12

8.7 POWER PURCHASE DETAILS

CoPA imports Power from KSEBL through two locations as listed below.

8.7.1 Power purchase details of the Willingdon Island

Consumer No: 1355410002636								
Contract demand :6500								
	MD Charges			Energy charges				Total charges
BILL MONTH	Maximum demand	Rate /KVA	MD Charge	Consumpti	Unit rate	Energy charges	PF Incentive/	Total charges
May-23	6270	380	2382600	2524050	6.25	15775312.5	315506	17843964
Jun-23	6430	380	2443400	2851650	6.25	17822812.5	356456	19909947
Jul-23	5124	380	1947120	2296800	6.25	14355000	358875	15975405
Aug-23	5261	380	1999180	2384550	6.25	14903437.5	372585	16533630
Sep-23	5728	380	2176640	2473360	6.25	15458500	386460	17248616
Oct-23	4875	380	1852500	2041650	6.4	13066560	319007	14300777
Nov-23	5436	380	2065680	2193150	6.4	14036160	342679	15430188
Dec-23	5585	400	2234000	2196300	6.4	14056320	351408	15941366
Jan-24	5866	400	2346400	2403900	6.4	15384960	384624	17349082
Feb-24	5589	400	2235600	2369400	6.4	15164160	379104	17024628
Mar-24	5824	400	2329600	2299650	6.4	14717760	367944	16681882
Apr-24	6468	400	2587200	2613450	6.4	16726080	418152	18897487
Total				**28647910**				203136972

Table 42

8.7.2. Power Purchase details of Vallarpadam . through Feeder 1

Consumer No: 1355xxxxx3590								
Contract demand 3000								
	MD Charges			Energy charges				
MONTH	Maximum demand	Rate KVA	MD Charges	Consumptio	Unit rate	Energy charge	PF Incentive	Total charges (Including duty and surcharge
May-23	2461	340	836740	1023560	6.25	6397250	127945	7418478
Jun-23	2250	340	765000	914560	6.25	5716000	114320	6668899
Jul-23	2250	380	783200	772560	6.25	4828500	97900	5787348
Aug-23	2250	380	855000	766360	6.25	4789750	95795	5747854
Sep-23	2250	380	829440	783200	6.25	4895000	97900	5863255
Oct-23	2250	380	855000	829440	6.25	4396750	6131582	6131582
Nov-23	2250	400	900000	914880	6.4	5855232	114360	6695688
Dec-23	2250	400	900000	856120	6.4	5479168	109583	6468940
Jan-24	2250	400	900000	1027400	6.4	6575360	131507	7637787
Feb-24	2571	400	1028400	1038040	6.4	6643456	132869	7807503
Mar-24	2647	400	1058800	1133120	6.4	7251968	108779.52	8504841
Apr-24	2798	400	1119200	939920	6.4	6015488	120309	7218263
Total				10999160				81950438

Table 43

8.7.2. Power Purchase details of Vallarpadam . through Feeder 2

Consumer No:1355650096081								
Contract demand 2000								
	MD Charges			Energy charges				
MONTH	Maximum demand	Rate KVA	MD Charges	Consumptio	Unit rate	Energy charges	PF Incentive	Total charges (Including duty and surcharg
Apr-24	1319	400	527600	474744	6.4	3038361.6	15192	3550770
Total				474744				3550770

Table 44

8.8 . SINGLE LINE DIAGRAM OF THE DISTRIBUTION SYSTEM

1. SLD OF THE WILLINGDON ISLAND

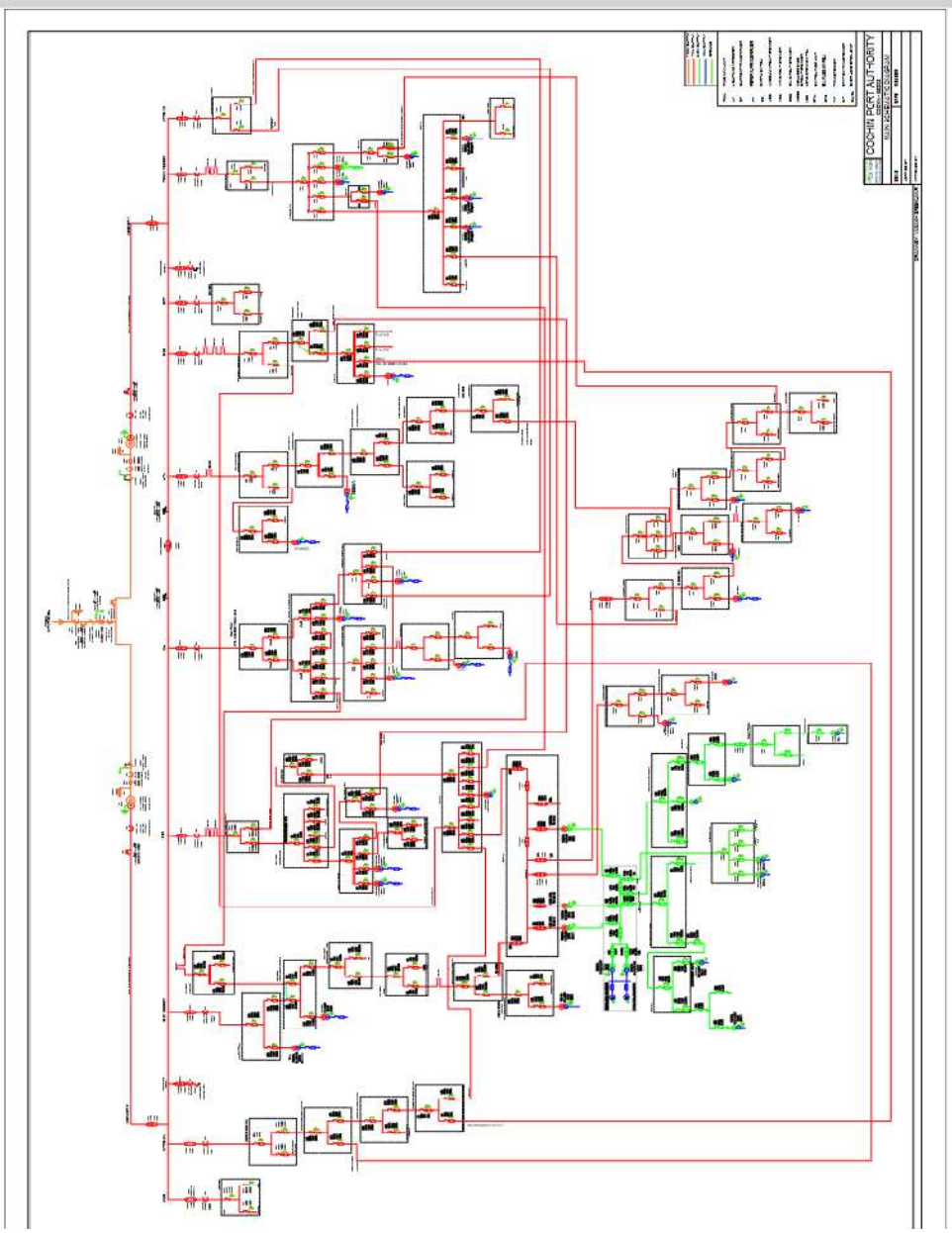


Fig 13

SINGLE LINE DIAGRAM OF THE -VALLAPADAM AREA

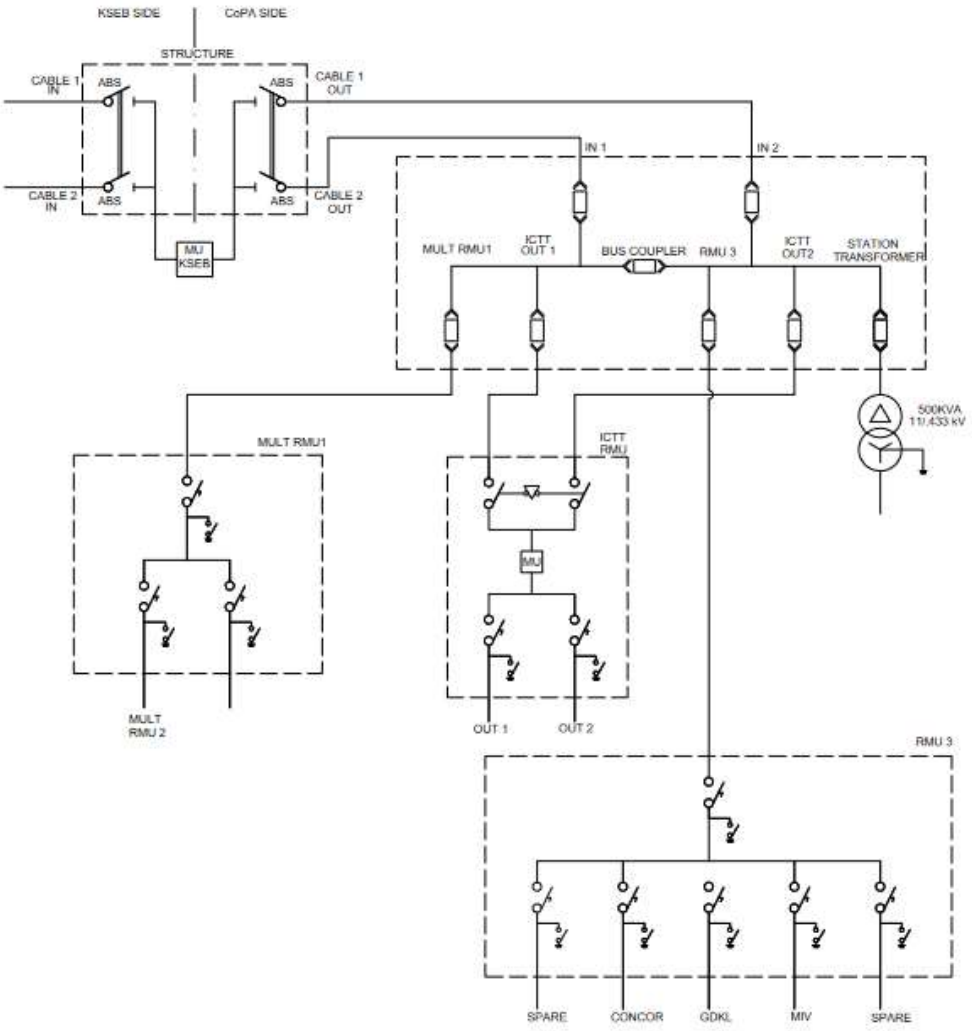


Fig 14

8.9 .1.Category vise consumers and average billing rate

Period From 1st April 2023 to 31st March 2024											
Consumer profile		Energy parameters			Losses		Commercial Parameter				
Consumer category	Total Number of connecti	Input energy (MU)	Total energy	% of energy consumption	T&D loss (MU)	T&D loss (%)	Billed Amount in Rs. Crore	Collected Amount in Rs. Crore	Collection Efficiency	AT & C loss (%)	Average billing rate (Rs./kw)
Residential	412		0.97	2%			0.67	0.67	100.00%		6.88
Agricultural	0		0.00	0%			0.00	0.00	0.00%		0.00
Commercial/Industrial-LT	605	40.43421	4.63	12%	0.933059	2.31%	5.96	5.96	100.00%		12.89
Commercial/Industrial-HT	30		28.77	73%			32.00	32.00	100.00%		11.12
Others	241		5.13	13%			4.55	4.47	98.41%		8.73
	1288	40.43421	39.50	100%	0.933	2.308%	43.18	43.11	99.8325%	2.47%	10.91

Table 45 A

8.9.2 Pending arrear details in CoPA for the year 2023-24

Pending arrear details in CoPA for the Year 2023-24			
S.NO	B.P NO	B.P Name	Amount(Rs)
1	100534	Udayan	232
2	1001836	Police	190636
3	1001838	Commisssioner of customs	86187.84
3	1001840	Corporation of Cochin	445045.57
4	1001920	K.P Sebastian	254
5	1004367	Mercury Cab	602.53
6	1005030	Paid & Unpid Trainee Mech Engg	122.12
			723080.06

Table 45 B

8.10 Details of the consumers and consumption for the year 2023-24

(Details of Consumers)						
Summary of Energy						
Period From 1st April 2023 to 31st March 2024						
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	LT	415V/230 V	412.00	0.97	
2	Commercial	LT	415 V /230 V	590.00	4.34	
3	IP Sets	0				
4	Hor. & Nur. & Coffee/Tea & Rubber (Metered)	0				
5	Hor. & Nur. & Coffee/Tea & Rubber (Flat)	0				
6	Heating and Motive Power	0				
7	Water Supply	0				
8	Public Lighting	LT	415 V	63	0.28	
9	HT Water Supply	0				
10	HT Industrial	HT	11 kV	1	0.82	
11	Industrial (Small)	LT	415 V	15.00	0.29	
12	Industrial (Medium)	0				
13	HT Commercial	HT	11 kV	29	27.95	
14	Applicable to Government Hospitals & Hospitals	0				
15	Lift Irrigation Schemes/Lift Irrigation Societies	0				
16	HT Res. Apartments Applicable to all areas	0				
17	Mixed Load	HT	11 kV		0	
18	Government offices and department	HT	11 KV	7	2.31	
19	Government offices and department	LT	415 V	121	1.63	
20	Mixed load	LT	415V/230 V	50.00	0.91	
21	Others-3 (if any , specify in remarks)					
22	Others-4 (if any , specify in remarks)					
23	Others-5 (if any , specify in remarks)					
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
			Total	1288	39.50	

Table 46

8.11 List of documents verified with each Parameters

S.NO	List of Parameters verified	Reference documents /Criteria
1.	Broad system of the DISCOM	1. Single line diagram of the Distribution system 2. Site visit at incoming substations 3. Overall visit of the Distribution area
2.	DISCOM input energy for the FY 2023-24	1. Energy account reports prepared by the Energy Manager of the DISCOM 2. Power purchase bills from KSEBL for the year 2023-24 3. Verification of the Solar energy input & DG input from monthly report & sample readings
3.	DISCOM Category wise Sale of Energy	1. SAP Report 2. AMI software report 3. Quarterly account report prepared by the Energy Manager of the DISCOM
4.	T&D Loss	1. Through calculation 2. Energy account report prepared by the Energy Manager of the DISCOM.
5.	Subsidy account	1. Tariff petition filed by the DISCOM **No subsidy Payment from the Government to the CoPA**.
6.	Energy conservation measures implemented by the DISCOM and under implementations	1. Previous Energy audit report for the Year 2022-23 2. Report submitted by the DISCOM
7.	Compliance of the reporting requirement	1. Previous accounts report and audit reports submitted by the DISCOM 2. Previous Energy audit report 3. Website of the DISCOM

Table 47

8.12 Brief Description of the Unit

Since the CoPA is a small Licensee with hardly 1288 consumers under the Port area there is no Division, Sub Division or Section wise formation.

8.13 List of Parameters arrived through calculation

All consumptions are metered.

8.13.1A . Energy saving proposal-for the FY 2023-24

Energy conservation measures Proposed during the FY 2023-24												
S.NO	Energy effeciency measure	QTY (No)	Unit	Captal investment (Rupees in Lakh)	Annual energy saving (kWH)	Annual savings (Rs) (Lakhs)	Discount rate(%)	CASH FLOW (Years)	Simple Pay back Period (Years)	NPV (Lakh Rs)	IRR(%)	Remarks
1	Replacement of Old copper(SWG 8) conductor with 3 PHASE 5 wire LT ABC of size 3x95sqmm+1x70 sqmm+1x 16 sqmm	9.17	kM	70	275549.60	16.53	8	13	4.2	₹ 71.70	26%	
2	Rectification of the inverter and clearing shading of the 100 kW solar power plant	1	NO	3	50000	3.55	8	5	0.8	₹ 12.66	110%	Presently 3 Nos of 30 kVA inverter units are in breakdown condition
				73	325549.60	20.08						

Table No:48 A

8.13.1 B. Other Energy saving project proposal

Other measures proposed			
1	Energy conservation measures proposed in the 50 hP Mattanchery Halt water Pump house		
	Observations	Measures recommender	Anticipated svings
a.	Apprciable water leakage observed in the delivery Pipe line.	To arrest the leakage	
b	Pump main delivery pipe Valve found partially throttled for controling the flow.	Up on site analysis there is no flow adgustment required for the operation.Hence the operator to be instructed to ensure the full opening of the delivery valve.	The closing of the Pump valve by 20% will increase the Power consumption by about 1/3.
c	Pump Motor found not fitted any Power factor correction Capacitor	For 50 HP motor the rated power factor correction capacitor is 14 kVAR	The power factor correction capacitor will reduce the apparent power at the load side by 2 kVA.Hence there will be savings due to the line loss also

Table 48 B

8.13.2 Replacement of Copper conductor with LT ABC -Energy saving calculation

	Total 9.1 KM OH ABC		Assume average load current A and balanced load	Assume distributed load Calculated, Loss/km for 3 phase line with SWG 8 Copper conductor (kW)	Loss due to the proposed length (kW)	Assume distributed load Calculated loss/km for 3 phase 95 sqmm LT ABC (kW)	Loss due to the proposed length (kW)	Net energy saving due to conductor replacement(kWH)	Total annual Energy savings (kWh)
Sl.No.	Route	Length	A	B	C=BX Length	D	E=D X Length	F=(C-E)	8760XF
1	North end SBI to Zuari Jn	0.29	70	6.0264	1.72	1.488	0.43	0.23	2048.34
2	North end cross Roads	0.67	70	6.0264	4.02	1.488	0.99	2.53	22159.30
3	Inside subramaniyan Rd	0.24	70	6.0264	1.43	1.488	0.35	-0.05	-465.53
4	Approach roads to new cruise terminal	0.48	70	6.0264	2.87	1.488	0.71	1.38	12103.82
5	front of HDFC banh to bristow rd	0.17	70	6.0264	1.03	1.488	0.26	-0.45	-3984.95
6	Uthra tech cement to DLB Jn	1.19	70	6.0264	7.17	1.488	1.77	5.69	49811.86
7	Terminals Jn to CFS	1.45	70	6.0264	8.74	1.488	2.16	7.25	63512.45
8	Ntro to Masthyafed Jn	0.31	70	6.0264	1.87	1.488	0.46	0.38	3305.27
9	Bristow Rd to Malabar gate	0.52	70	6.0264	3.16	1.488	0.78	1.67	14617.69
10	Temple Jn to market	0.19	70	6.0264	1.15	1.488	0.28	-0.34	-2979.40
11	Bristow Rd to behind south club Rd.	0.24	70	6.0264	1.43	1.488	0.35	-0.05	-465.53
13	DLB to M/W	0.36	70	6.0264	2.15	1.488	0.53	0.66	5819.14
14	M/w to FCI- ammonia tank	0.86	70	6.0264	5.17	1.488	1.28	3.68	32214.77
15	IG rd to Ambuja cement	0.26	70	6.0264	1.58	1.488	0.39	0.09	791.40
16	Cross Rd near hospital / customs quraters	1.14	70	6.0264	6.89	1.488	1.70	5.40	47297.99
17	Marar Rd	0.43	70	6.0264	2.58	1.488	0.64	1.09	9589.95
18	Civil Water tank to temple Jn	0.38	70	9.951	3.79	1.488	0.57	2.30	20173.03
	Total	9.17			56.75		13.64	31.46	275549.6043

Table No:48 C

8.13.3 Replacement of Copper conductor with LT ABC-Load loss calculation

Calculation of loss/kW							
Assume distributed load and load is distribued uniformly at every 100 meter							
Average LT feeder phase current	70 A						
	A	B	C	D	E	F	
Length of the section (Km)	0.1	0.1	0.1	0.1	0.1	0.5	
				SWG 8 Copper conductor			
	70	60	50	40	30	20	
	SECTION LENGTH	RESITANCE/KM	CURRENT	SECTION RESISTA	Power loss W	Loss (kW)	
Load loss at section A	0.1	1.296	70	0.1296	635.04	0.63504	70X 70(O.1X2.14)
Load loss at section B	0.1	1.296	60	0.1296	466.56	0.46656	60X60X(0.1X2.14)
Load loss at section C	0.1	1.296	50	0.1296	324	0.324	50X50X(0.1X2.14)
Load loss at section D	0.1	1.296	40	0.1296	207.36	0.20736	40X40X(0.1X2.14
Load loss at section E	0.1	1.296	30	0.1296	116.64	0.11664	30X30X(0.1X2.14)
Load loss at section F	0.5	1.296	20	0.648	259.2	0.2592	20X20X(0.5X2.14)
Total load loss /km						2.0088	
				LT ABC 95 SQMM PHASE CONDUCTOR			
	70	60	50	40	30	20	
	SECTION LENGTH	RESITANCE/KM	CURRENT	SECTION RESISTA	Power loss W	kW loss	
Load loss at section A	0.1	0.32	70	0.032	156.8	0.1568	70X 70(O.1X2.14)
Load loss at section B	0.1	0.32	60	0.032	115.2	0.1152	60X60X(0.1X2.14)
Load loss at section C	0.1	0.32	50	0.032	80	0.08	50X50X(0.1X2.14)
Load loss at section D	0.1	0.32	40	0.032	51.2	0.0512	40X40X(0.1X2.14
Load loss at section E	0.1	0.32	30	0.032	28.8	0.0288	30X30X(0.1X2.14)
Load loss at section F	0.5	0.32	20	0.16	64	0.064	20X20X(0.5X2.14)
Total load loss /km						0.496	
Load loss /km per conductor of SWG 8 CONDUCTOR		2.0088					
Load loss per km of the three phase line		6.0264					
Load loss /km per conductor of 95 sqmm LT AB CONDUC		0.496					
Load loss per km of the three phase line		1.488					

Table 48 D

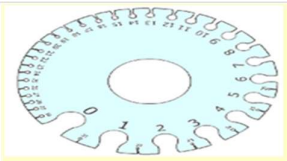
8.13.4.SWG 8 Copper conductor and 95 sqmm LT ABC Resistance specification

Cnonductor specification	Overall dia of the conductor(m.m)	Conductor resitance ohm/kM	weight /km
Copper bare conductor SWG 8	4.064	1.296	130
Copper bare conductor SWG 10			70
Copper bare conductor SWG 12			40
LT ABC 3X95+1X70+1X16 SQMM			
ABC 95 SQMM CONDUCTOR	11.3	0.32	

8

Table 48 E

8.13.5 SWG Copper conductor -Diameter specification



SWG - Standard Wire Gauge - Diameter

Diameter		
inches		mm
4	0.232	5.893
5	0.212	5.385
6	0.192	4.877
7	0.176	4.470
8	**0.160**	**4.064**
9	0.144	3.658
10	0.128	3.251

Table 48 F:

8.13.6 NPV Calculation for the Conductor replacement work

Work name: Conductor replacement		
IRR AND NPV Calculation		
*All amounts in Lakhs		
		item
1		-70
2		19.56
3		19.56
4		19.56
5		19.56
6		19.56
7		19.56
8		19.56
9		19.56
10		19.56
11		19.56
12		19.56
13		19.56
NPV		₹ 71.70
IRR		26%

Table 48 G

100 kW Solar plant Inverter rectification and maintenance.	
1	-3
2	3.55
3	3.20
4	3.20
5	3.20
6	3.20
7	₹ 12.66
8	110%

Table 48 H

8.13.7 Energy saving opportunities in the Water Pump house in Mattachery Halt.

1. Energy saving oppertunities by employing best operating practises					
	Pump rated (kw)	**Throttling %**	**Energy loss due to throttling(kW)**	**Daily operating hours of the Pump (H)**	**Annual energy loss kWh**
Removing the throtteling in the delivery valve					
The valve found throttled by about 20%	**31.7**	**20**	**11.412**	**11**	**45191.52**
**	**Pump throttling loss - Rated Power of the Pump x(1-(1-throttling %)^2)**				

Table 49:

8.13.7.2.Energy saving oppertunities due to the installation of PF correction Capacitor

2. Energy saving due to the installation of the Power factor capacitor				
Motor rating (kW)	Present Power factor of the Motor	Proposed PF	KVAR Rating of the Capacitor	Increase of KVA load due to reactive load
37.3	0.8	0.95	14	2.53

Table 50

8.13. 7..3 Calculation of the taken back copper scrap.

Calculation of taken back value of Old copper scrap								
S.NO		**Existing conductor**		PROPOSED DISMANTLING LENGTH(KM)	*WEIGHT (KG/KM	TOTAL TAKEN BACK LENGTH (KM)**	TAKEN BACK SCRAP WIGHT (KG)	AMOUNT OF TAKEN BACK ITEM(RS ***
1		CONDUCTOR SWG 8 Copper		27.51	130	10.92	1419.6	780780
2		Neutral SWG 10 Copper		9.17	70	3.668	256.76	141218
3		SWG 12 Copper street main		9.17	40	3.668	146.72	80696
				Total				1002694
*		From copper conductor specification						
**		Taken back scrap length taken only 40% of the original length due to wear and mixing of aluminium conductor etc.						
***		Scrap value of copper is taken @ Rs 550 /Kg						

Table 51:

8.14 . Photos of the CoPA substation and site

Incoming feeders from KSEBL at Vallarppadam 11 kV S/S

Fig 15

Fig 16

Vallarppadam 11 kV S/S

New dedicated feeder from Vallarppadam S/S

Fig 17

Fig 18

100 kWp Solar plant site in Mattanchery Halt

L.T.Distribution Line

Fig 19

8.15 ENERGY AUDIT FORMATS

1.General information

1.General information

General Information				
1	Name of the DISCOM	Cochin Port Authority		
2	i) Year of Establishment	1956		
	ii) Government/Public/Private	Public		
3	DISCOM's Contact details & Address			
i	City/Town/Village	Cochin		
ii	District	Ernakulam		
iii	State	Kerala	Pin	682009
iv	Telephone	0484-2668200	Fax	0484-2666512
4	Registered Office			
i	Company's Chief Executive Name	B. KASIVISWANATHAN IRS ME		
ii	Designation	Chairman		
iii	Address	Cochin Port Authority, W.Island		
iv	City/Town/Village	Cochin	P.O.	W.Island
v	District	Ernakulam		
vi	State	Kerala	Pin	682009
vii	Telephone	0484-2668566	Fax	0484-2668163
5	Nodal Officer Details*			
i	Nodal Officer Name (Designated at DISCOM's)	AJITHKUMAR D		
ii	Designation	Superintendent Engineer (ELE)		
iii	Address	Cochin Port Authority, W.Island		
iv	City/Town/Village	Cochin	P.O.	W. Island
v	District	Ernakulam		
vi	State	Kerala	Pin	682009
vii	Telephone	0484-2582320	Fax	0484-2666639
6	Energy Manager Details*			
i	Name	JAYALAKSHMY S		
ii	Designation	Executive Engineer(Ele)	Whether EA or EM	EM
iii	EA/EM Registration No.	Nil		
iv	Telephone	0484-2382360	Fax	0484-2666639
v	Mobile	9496430704 / E-mail ID	jayalakshmi@cochinport.gov.in	
7	Period of Information			
	Year of (FY) information including Date and Month (Start & End)	1st April 2023 to 31st March 2024		

SUPERINTENDING ENGINEER (ELE.)
COCHIN PORT AUTHORITY
28/8

1.2. Performance summary of the DISCOM

1.2. Performance summary of the DISCOM

Performance Summary of Electricity Distribution Companies			
1	Period of Information Year of (FY) Information including Date and Month (Start & End)	1st April 2023 to 31st March 2024	
2	**Technical Details**		
(a)	**Energy Input Details**		
(i)	Input Energy Purchase (From Generation Source)	Million kwh	40.12
(ii)	Net input energy (at DISCOM Periphery after adjusting the transmission losses and energy traded)	Million kwh	40.43
(iii)	Total Energy billed (is the Net energy billed, adjusted for energy traded))	Million kwh	39.50
(b)	Transmission and Distribution (T&D) loss Details	Million kwh	0.933
		%	2.31
	Collection Efficiency	%	99.83
(c)	Aggregate Technical & Commercial Loss	%	2.47

I/We undertake that the information supplied in this Document and Pro-forma is accurate to the best of my knowledge and if any of the information supplied is found to be incorrect and such information result into loss to the Central Government or State Government or any of the authority under them or any other person affected, I/we undertake to indemnify such loss.

Authorised Signatory and Seal

SUPERINTENDING ENGINEER (ELE.)
COCHIN PORT AUTHORITY

Name of Authorised Signatory : Ajithkumar .D
Name of th Cochin Port Authority
Full Addre W.Island , Cochin -682009, Kerala

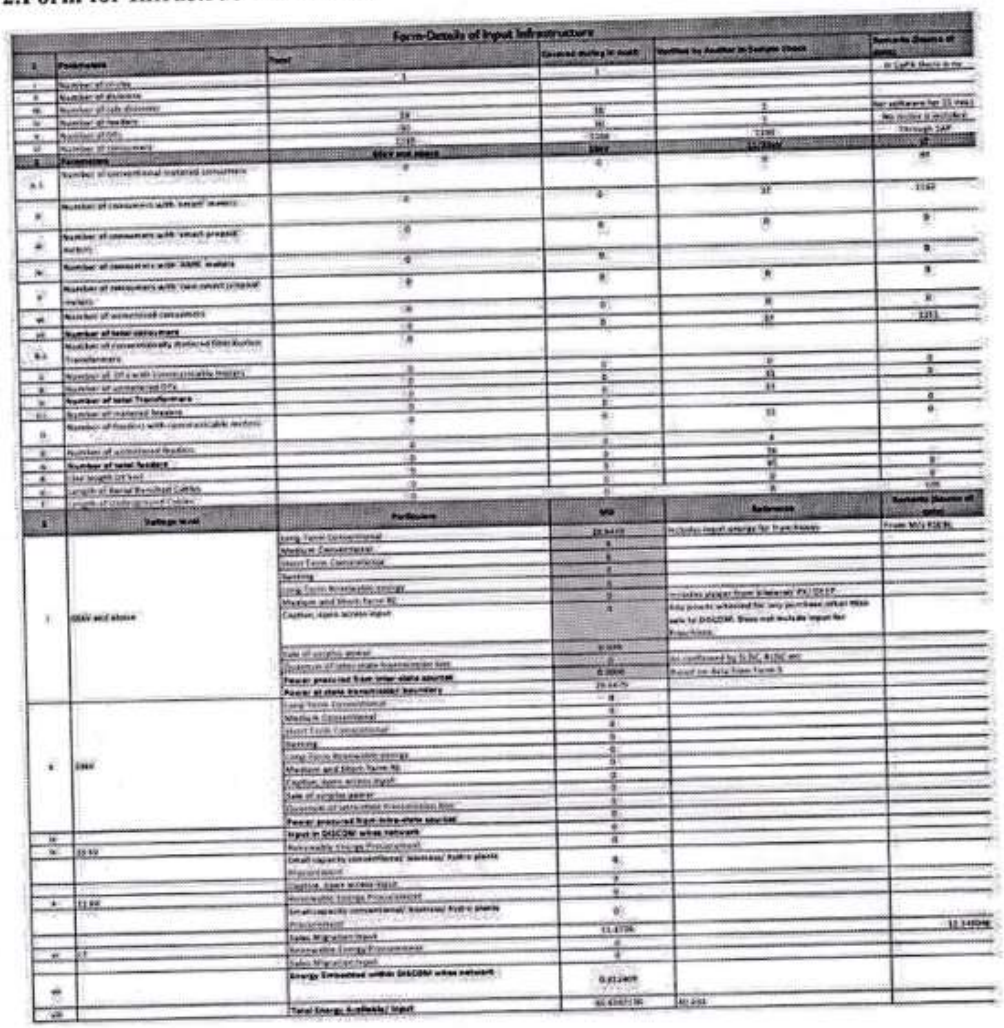
Signature:-
Name of Energy Manager*:
Registration Number:

J.Nagesh Kumar

AEA0133

Centre for Energy, Environment and Productivity
Plot No. 1030, 26th Street, H-Block,
Anna Nagar, Chennai - 600 040.
Ph : 044 2616 3483, 9444482553

2.Form for Infrastructural details



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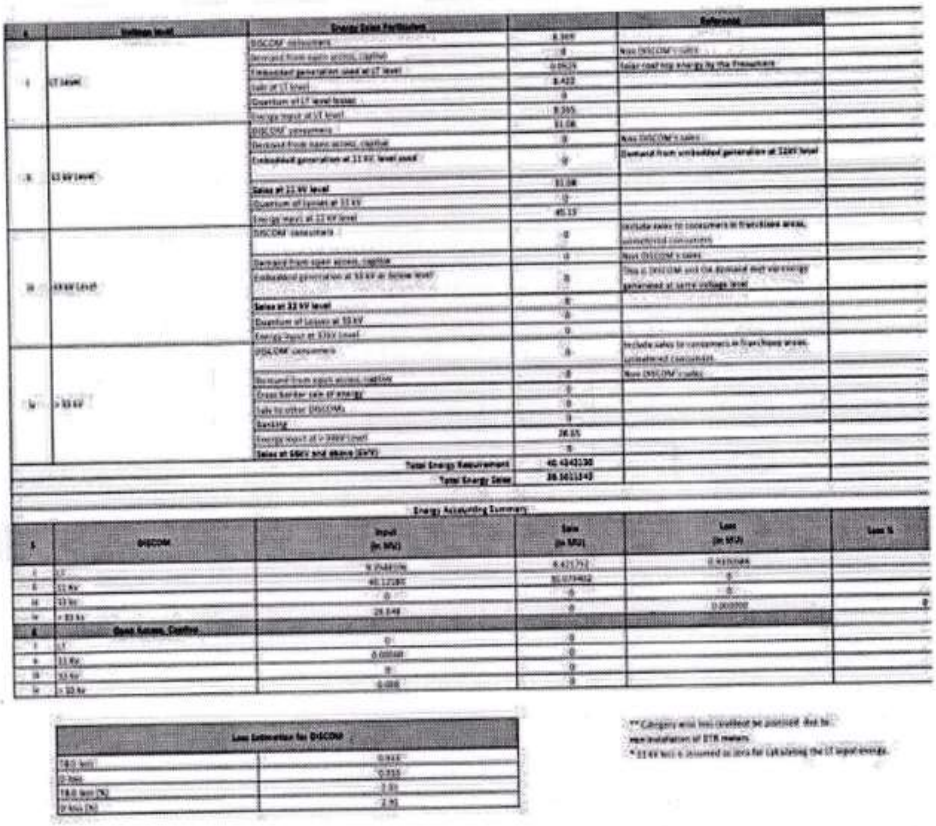

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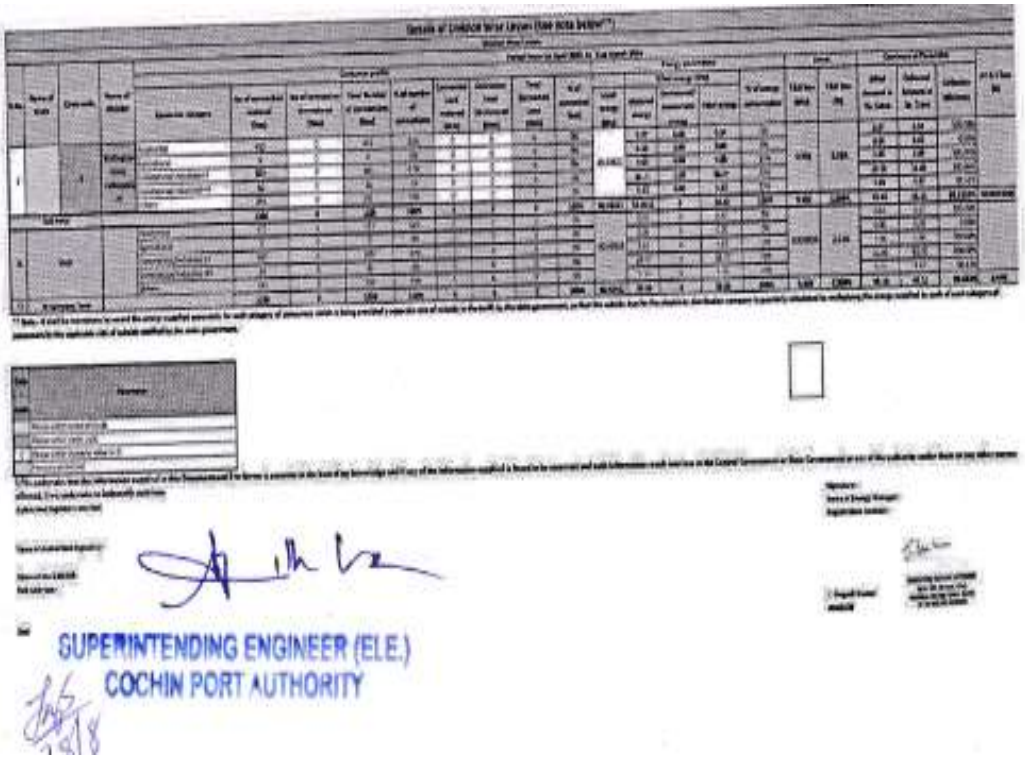
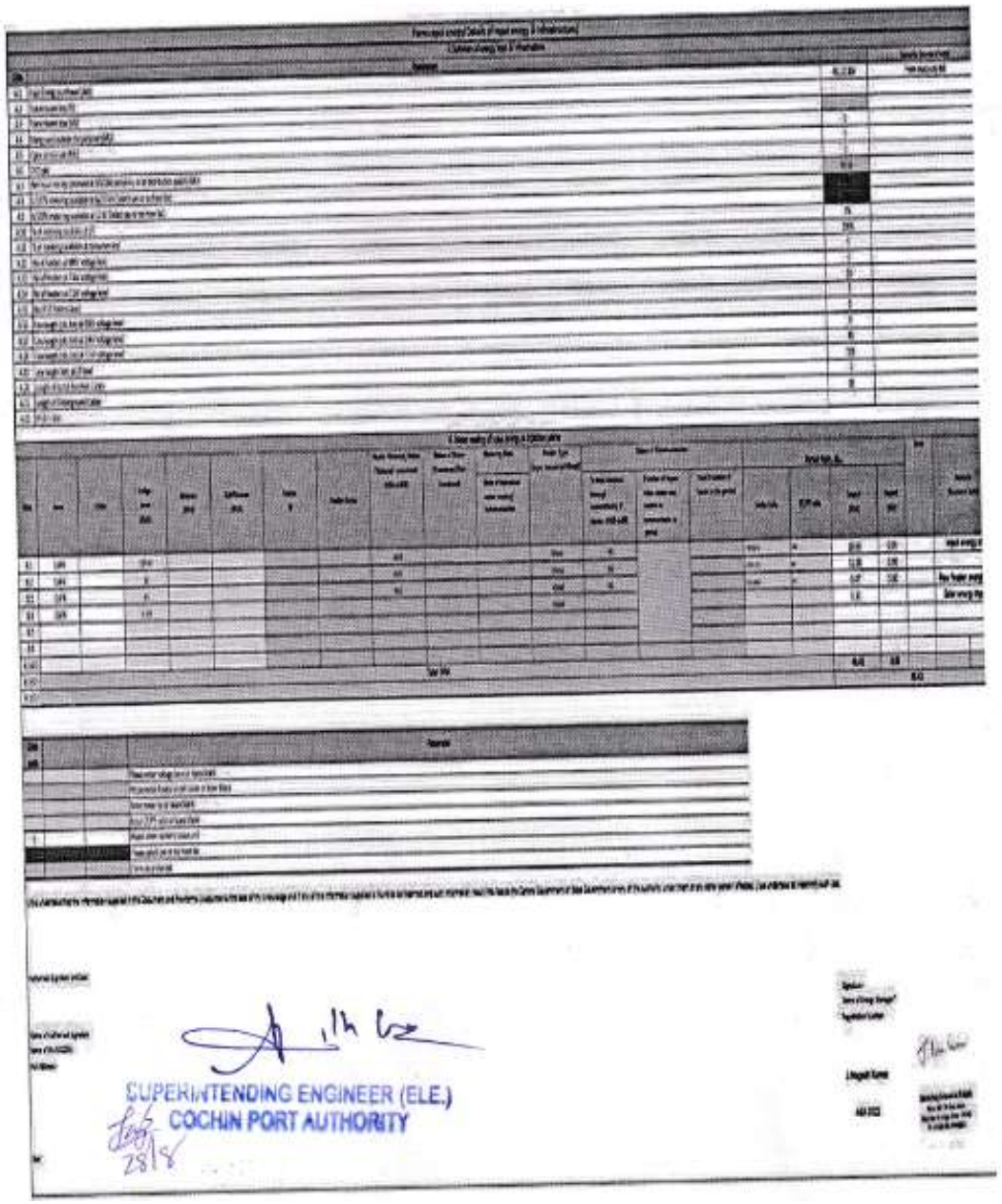
PH : 044 2616 5483, 9444882553

3.Division wise Losses for the FY 2023-24



4.Form of Input Energy



5.Details of consumers

(Details of Consumers)
Summary of Energy
Period from 1st April 2023 to 31st March 2024

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	LT	415V/230 V	412.00	0.97	
2	Commercial	LT	415 V /230 V	540.00	4.34	
3	IP Sets	0				
4	Hor. & Nur. & Coffee/Tea & Rubber (Metered)	0				
5	Hor. & Nur. & Coffee/Tea & Rubber (Flat)	0				
6	Heating and Motive Power	0				
7	Water Supply	LT	415 V	63	0.28	
8	Public Lighting	0				
9	HT Water Supply	HT	11 kV	1	0.82	
10	HT Industrial	LT	415 V	15.00	0.29	
11	Industrial (Small)	0				
12	Industrial (Medium)	HT	11 kv	29	27.95	
13	HT Commercial	0				
14	Applicable to Government Hospitals & Hospitals	0				
15	Lift Irrigation Schemes/Lift Irrigation Societies	0				
16	HT Res. Apartments Applicable to all areas	HT	11 kV		2	
17	Mixed Load	HT	11 KV	7	2.31	
18	Government offices and departsment	LT	415 V	121	1.63	
19	Government offices and department	LT	415V/230 V	50.00	0.91	
20	Mixed load					
21	Others-3 (if any , specify in remarks)					
22	Others-4 (if any , specify in remarks)					
23	Others-5 (if any , specify in remarks)					
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
			Total	1288	39.50	

SUPERINTENDING ENGINEER (ELE.)
COCHIN PORT AUTHORITY

Centre for Energy, Environment and Productivity
Plot No. 1039, 28th Street, H-Block,
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PH : 044 2616 3433, 9444882553

6.Details of Received sources

Details of Input Energy Sources

Period from 1st April 2023 to 31st March 2024

A. Generation at Transmission Periphery (Details)

S.No	Name of Generation Station	Generation Capacity (in MW)	Type of Station Generation (Based- Solar / Coal / Lignite / Liquid/Gas/Renewable / biomass-bagasse/Others)	Type of Contract (In years/month/day)	Type of Grid (Intra-state/inter-state)	Point of Connection (POC) Location [illegible]	Voltage Level (At input)	Remarks (Source of data)

6.1Details of Embedded generation in DISCOM area

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1			[illegible]	[illegible]	[illegible]	[illegible]			[illegible]							
2			[illegible]	[illegible]	[illegible]	[illegible]			[illegible]							
3			[illegible]	[illegible]	[illegible]	[illegible]			[illegible]							
4			[illegible]	[illegible]	[illegible]	[illegible]										

7.Details of Feeder level information

Details of Feeder-wise losses

[illegible]
[illegible]

SUPERINTENDING ENGINEER (ELE.)
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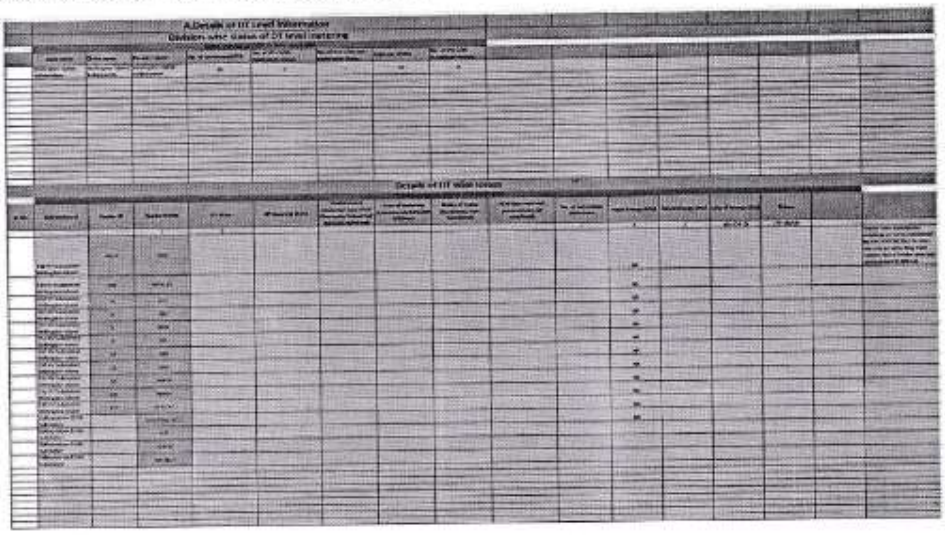
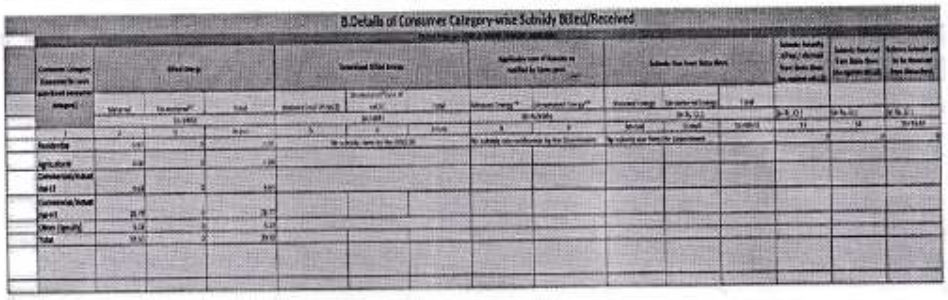
PH : 044 2616 3453, 9444442553

7.1Details on DT Wise information and Losses



7.2 Details of consumer category wise subsidy billed/received



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Plot No. 1232, 25th Street, H-Block,
Panai Colony, Anna Nagar, Chennai - 600 040.
PH : 044 2616 3483, 9444582553

8.16 .1 Energy Purchase bill for the supply of Energy at Vallarpadam (Feb 2024-Supplier KSEBL.

KERALA STATE ELECTRICITY BOARD LIMITED

Office of the Special Officer(Revenue), Pattom,Thiruvananthapuram

DEMAND NOTICE FOR FEBRUARY 2024

(As per CHAPTER VII OF KERALA ELETRICITY SUPPLY CODE -2014)

Con.	1355650004530	Bill Date	02-Feb-2024	Due Date	08-Feb-2024	Bill No	21028111144284 Ver : 0
Tariff	Licensee: CPT			DC Date	24-Feb-2024	CD	5522420 BG 1554920

COCHIN PORT TRUST-VALLARPADAM
JOINT DIRECTOR,PORT BASED SEZ,
COCHIN PORT TRUST,VALLARPADAM,
ERNAKULAM,,COCHIN- 9
Mobile no--9446448101

LCN :5/6403

SBI Virtual A/c No(IFS Code:SBIN0070493)-KSEBHT5C5403

Consumer GSTIN_ID- /KSEB (L)GST ID=32AAECK2277NBZ1

Arrears as on 31-Dec-2023				Date of Previous Reading	31-Dec-2023	dycmeele@cochinport.gov.in		
Disputed	0	Undisputed	14367297	Date of Present Reading	31-Jan-2024	Supply Voltage	11 kV	HT

Contract Demand(kVA)	75% of CD (KVA)	130% of CD (KVA)	Connected Load (kW)	Average			Billing Type	Non-DPS
				MD (kVA)	Consumption (kWh)	PF	Section	Vypeen
3000.0	2250.0	3900.0	615	2614.13	990680	0.99	Circle	Ernakulam

Reading Details of meter 22001331-Working (KVA,KWh,KVAh & KVArh) for 01-2024

1. Energy Consumption(KWh)

Zone	FR	IR	MF	Units
1	154780.00	143382.00	40.000	455920
2	74316.00	69249.00	40.000	202680
3	139435.00	129949.00	40.000	379440
			Total	1038040

2. Energy Consumption(KVAh)

Zone	FR	IR	MF	Units
1	156709.00	145139.00	40.000	462800
2	74657.00	69556.00	40.000	204040
3	140158.00	130604.00	40.000	382160
			Total	1049000
Ave.PF=KWh/KVAh				0.99

3. Energy Consumption(KVArh) Lag and kVARh (Lead)

Zone	FR	IR	MF	Units	FR	IR	Units
1	13879.0	12321.0	40.000	62320	3021.00	2972.00	1960
2	4355.00	3891.00	40.000	18560	988.00	958.00	1240
3	8040.00	7208.00	40.000	33640	2588.00	2520.00	2760
			Total kVArh(Lag)	114520	kVArh(Lead)		5960

4. Demand (KVA)

	Readings	MF	Units
1	54.35	40.000	2174.0
2	64.27	40.000	2570.8
3	55.26	40.000	2210.4
5.Factory Lighting			0.0
6.Colony Lighting			0.0
7.Generator			0

INVOICE

	Unit	Rate	Amount (Rs)
1.Total Demand Charge			
a. Demand Charge	2571.0	400.000	1028400.00
b.	0.0	400.000	0.00
c.	0.0	400.000	0.00
d. Excess Demand Charge	0	200.000	0.00
e.		200.000	0.00
f.		200.000	0.00
Sub Total (a+b+c+d+e+f)			**1028400.00**
2.Total Energy Charges			
a. Energy charges	1038040	6.40000	6643456.00
b.		9.60000	0.00
c.		4.80000	0.00
Sub Total(a+b+c)			**6643456.00**
3.PF Incentive / Disincentive			-132869.12
Total Energy Charge			**6510586.88**
4.Energy Charges on Lighting load			
a.Factory Lighting	0	0.2	
b.Colony Lighting	0	0.2	0.00
Sub Total(a+b)			
5.Electricity Duty	6643456	0.100	
6.Ele. Surcharge	1038040	0.025	
7.Duty on self generated energy	0	0.150	0.00
8.Penalty for non-segn. of light load			

	Amount
9.Other Charges	
Reconnection Fee	0.00
Charges for Belated Payments	258517.00
10.Total(add 1 to 8)	**7507603.88**
Plus/Minus (Round off)	0.12
UnDisputed Arr Amount	14367297.00
Loss 1. Advance / Credit	
2. CD Interest	0.00
3. CD/Oth Ref	0.00
Net Payable	**22174801.00**

(Rupees Two Crore Twenty One Lakh Seventy Four Thousand Eight Hundred One Only)

E & O.E

Balance Advance at Credit, If any

As per Regulation 130 of Kerala Electricity Supply Code 2014 any complaint regarding accuracy of a bill shall be first taken up with the officer designated to issue the bill (Special Officer(Revenue)). Please follow our official Facebook page fb.com/ksebl for information &announcements.(Please see the instructions overleaf)

SPECIAL OFFICER (REVENUE)

1355650004530 21028111144284 Rs.22174801.00 February 2024

COCHIN PORT TRUST-VALLARPADAM

DD/Payment Instruction Name of the Date

8.16.2 Energy purchase bill for the Willingdon Island (April 2024)-Supplier KSEBL

KERALA STATE ELECTRICITY BOARD LIMITED

Office of the Special Officer(Revenue), Pattom, Thiruvananthapuram

DEMAND NOTICE FOR APRIL 2024

(As per CHAPTER VI OF KERALA ELECTRICITY SUPPLY CODE -2014)

Con.	1355410000636	Bill Date	05-Apr-2024	Due Date	12-Apr-2024	Bill No	11028111166036 Ver : 0
Tariff	Licensee: CPT			DC Date	27-Apr-2024	CD	[illegible]

COCHIN PORT TRUST
Office fo the Executive Engineer (Ele.), I.G.Road, Cochin-3,
Indiragandhi Road, Cochin-3,
ERNAKULAM,682003
Mobile no--9847078217
LCN :21/1135

SBI Virtual A/c No(IFS Code:SBIN0070493)-KSEBHT21C1135
Consumer GSTIN_ID- [illegible]
TDS u/s 194Q : 18887.49

Arrears as on 29-Feb-2024			
Disputed		Undisputed	
Contract Demand(KVA)	75% of CD (KVA)	130% of CD (KVA)	Connected Load (KW)
6500.0	4875.0	8450.0	0

Date of Previous Reading	29-Feb-2024	[illegible]@cochinport.gov.in	
Date of Present Reading	31-Mar-2024	Supply Voltage	110 kV / EHT
Average		Billing Type	Non-DPS
MD (KVA) / Consumption (kWh) / PF		Section	110 KV Sub Station.
6017.75 / 3411075 / 0.99		Circle	Transmission Circle.

Reading Details of meter 17073822-Working (KVA,KWh,KVAh & KVArh) for 03-2024

1. Energy Consumption(KWh)

Zone	FR	IR	MF	Units
1	654482.00	644926.00	150.000	1433400
2	200238.00	197284.00	150.000	443100
3	318658.00	313785.00	150.000	730950
		Total		2613450

3. Energy Consumption(KVArh) Lag and KVARh (Lead)

Zone	FR	IR	MF	Units	FR	IR	Units
1	37072.0	36036.0	150.000	155550	1241.00	1222.00	2850
2	32459.0	32274.0	150.000	27750	169.00	164.00	750
3	44451.0	44204.0	150.000	37050	1500.00	1476.00	3600
		Total KVArh(Lag)		220350	KVArh(Lead)		7200

2. Energy Consumption(KVAh)

Zone	FR	IR	MF	Units
1	[illegible]	653741.00	150.000	1443900
2	203416.00	200456.00	150.000	444000
3	329650.00	316696.00	150.000	758150
		Total		[illegible]
Avg.PF(KWh/KVAh)	1.00			

4. Demand (KVA)

	Readings	MF	Units
1	43.123	150.000	6468.45
2	31.599	150.000	4739.85
3	26.869	150.000	4030.35
5.Factory Lighting			0.0
6.Colony Lighting			0.0
7.Generator			0

INVOICE

	Unit	Rate	Amount (Rs)
1.Total Demand Charge			
a. Demand Charge	6468.0	400.000	2587200.00
b.	0.0	400.000	0.00
c.	0.0	400.000	0.00
d. Excess Demand Charge	0	200.000	0.00
e.		200.000	0.00
f.		200.000	0.00
Sub Total (a+b+c+d+e+f)			**2587200.00**
2.Total Energy Charges			
a. Energy charges	2613450	6.40000	16726080.00
b.		5.60000	0.00
c.		4.80000	0.00
Sub Total(a+b+c)			**16726080.00**
3.PF Incentive / Disincentive			-418152.00
Total Energy Charge			**16307928.00**
4.Energy Charges on Lighting load			
a.Factory Lighting	0	0.1	
b.Colony Lighting	0	0.1	0.00
Sub Total(a+b)			
5.Electricity Duty	16726080	0.100	
6.Ele. Surcharge	2613450	0.025	
7.Duty on self generated energy	0	0.150	0.00
8.Penalty for non-segn. of light load			

	Amount
9.Other Charges	
Reconnection Fee	0.00
Charges for Belated Payments	2309.00
Green Energy Charge	0.00
10.Total(add 1 to 9)	18897487.00
Plus/Minus (Round off)	0.00
UnDisputed Arr Amount	
Less: 1. Advance / Credit	
2. CD Interest	0.00
3. CD/Oth Ref	0.00
Net Payable	**18897487.00**

(Rupees One Crore Eighty Eight Lakh Ninety Seven Thousand Four Hundred Eighty Seven Only)

E & O.E

Balance Advance at Credit, if any

As per Regulation 130 of Kerala Electricity Supply Code 2014 any complaint regarding accuracy of a bill shall be first taken up with the officer designated to issue the bill (Special Officer(Revenue)). Please follow our official Facebook page fb.com/ksebl for information &announcements (Please see the instructions overleaf)

SPECIAL OFFICER (REVENUE)

1355410000636 11028111166036 Rs.18897487.00 April 2024

COCHIN PORT TRUST

DD/Payment Instruction Name of the Date

8.17 Photos of functional feeder meters installed in Willingdon substation

Feeder Name: Q9-2

Fig 20

Feeder Name PENNA

Fig 21

Feeder Name: Q9-1

Fig 22

Feeder Name: NTRO A2

Fig 23

8.18 FEEDER METER READINGS DOWNLOADED FROM AMI SOFTWARE

1. FEEDER NAME : Q9-1

RTC	MeterNo	KWH_Import	KWH_Export	KVAH_Import	MD_KW	MD_kVA	KVAR	Current_IR	Current_IY	Current_IB
11-07-2024 23:06	GP4409885	605852.5	0	624172.7	7.8	8.5	-1.1	-0.06	-0.07	-0.06
11-07-2024 22:08	GP4409885	605852.3	0	624171.5	7.8	8.5	-1.1	-0.06	-0.07	-0.06
11-07-2024 21:10	GP4409885	605851.8	0	624170.4	7.8	8.5	-1.1	-0.06	-0.07	-0.06
11-07-2024 20:19	GP4409885	605851.5	0	624169.4	7.8	8.5	-1.09	-0.06	-0.07	-0.06
11-07-2024 19:09	GP4409885	605850.7	0	624168.1	7.8	8.5	-1	-0.06	-0.07	-0.06
11-07-2024 18:07	GP4409885	605849.8	0	624166.8	7.8	8.5	-0.9	-0.06	-0.07	-0.07
11-07-2024 17:09	GP4409885	605848.9	0	624165.4	7.8	8.5	-0.92	-0.09	-0.09	-0.08
11-07-2024 16:09	GP4409885	605847.6	0	624163.8	7.8	8.5	-0.57	-0.15	-0.15	-0.13
11-07-2024 15:09	GP4409885	605846	0	624162.1	7.8	8.5	-0.88	-0.09	-0.07	-0.08
11-07-2024 14:07	GP4409885	605844.7	0	624160.6	7.8	8.5	-0.74	-0.08	-0.07	-0.08
11-07-2024 13:32	GP4409885	605843.9	0	624159.7	7.8	8.5	-0.93	-0.08	-0.07	-0.08
11-07-2024 13:22	GP4409885	605840.4	0	624155.6	7.8	8.5	-0.52	-0.1	-0.09	-0.1
11-07-2024 10:44	GP4409885	605839.4	0	624154.6	7.8	8.5	-0.47	-0.16	-0.15	-0.15
11-07-2024 08:05	GP4409885	605835.5	0	624149.8	7.8	8.5	-1.13	-0.06	-0.06	-0.07
11-07-2024 07:08	GP4409885	605835.3	0	624148.7	7.8	8.5	-1.1	-0.06	-0.06	-0.06
11-07-2024 06:07	GP4409885	605835	0	624147.6	7.8	8.5	-1.1	-0.06	-0.07	-0.06
11-07-2024 05:09	GP4409885	605834.6	0	624146.4	7.8	8.5	-1.11	-0.06	-0.07	-0.07
11-07-2024 04:10	GP4409885	605834.2	0	624145.3	7.8	8.5	-1.12	-0.06	-0.07	-0.07
11-07-2024 03:11	GP4409885	605833.9	0	624144.1	7.8	8.5	-1.12	-0.06	-0.07	-0.07
11-07-2024 02:05	GP4409885	605833.5	0	624142.9	7.8	8.5	-1.11	-0.06	-0.06	-0.07
11-07-2024 01:14	GP4409885	605833.2	0	624141.9	7.8	8.5	-1.11	-0.06	-0.07	-0.06
11-07-2024 00:27	GP4409885	605832.8	0	624141	7.8	8.5	-1.11	-0.06	-0.07	-0.07

Fig 24

2. FEEDER NAME : Q9-2

RTC	MeterNo	KWH_Import	KWH_Export	KVAH_Import	MD_KW	MD_kVA	KVAR	Current_IR	Current_IY	Current_IB
11-07-2024 23:06	GP4409882	532215.8	0	536564.5	22.4	22.4	-0.27	0.71	0.74	0.66
11-07-2024 22:08	GP4409882	532203	0	536551.7	22.4	22.4	-0.54	0.71	0.73	0.68
11-07-2024 21:10	GP4409882	532187.9	0	536536.6	22.4	22.4	-0.35	0.83	0.84	0.82
11-07-2024 20:10	GP4409882	532173.7	0	536522.2	22.4	22.4	0.65	0.69	0.72	0.67
11-07-2024 19:09	GP4409882	532159	0	536507.6	22.4	22.4	0.65	0.79	0.8	0.76
11-07-2024 18:07	GP4409882	532143.8	0	536492.4	22.4	22.4	-0.36	0.73	0.72	0.7
11-07-2024 17:09	GP4409882	532128.4	0	536477	22.4	22.4	-0.96	0.9	0.91	0.85
11-07-2024 16:09	GP4409882	532110.7	0	536459.1	22.4	22.4	-0.7	1.1	1.08	1.04
11-07-2024 15:09	GP4409882	532090.4	0	536438.8	22.4	22.4	-0.58	1.18	1.16	1.12
11-07-2024 14:07	GP4409882	532068.5	0	536416.9	22.4	22.4	0.04	1.15	1.13	1.09
11-07-2024 13:22	GP4409882	532053.4	0	536401.7	22.4	22.4	-0.41	1.03	1.02	0.98
11-07-2024 11:06	GP4409882	532005.4	0	536353.5	22.4	22.4	-0.04	1.1	1.09	1.06
11-07-2024 10:22	GP4409882	531989.8	0	536337.9	22.4	22.4	0.25	1.2	1.17	1.18
11-07-2024 08:05	GP4409882	531948.1	0	536296.1	22.4	22.4	-0.26	0.74	0.71	0.69
11-07-2024 07:08	GP4409882	531937	0	536284.9	22.4	22.4	-0.32	0.68	0.66	0.65
11-07-2024 06:07	GP4409882	531925.5	0	536273.3	22.4	22.4	-1.65	0.57	0.57	0.55
11-07-2024 05:09	GP4409882	531914.8	0	536262.7	22.4	22.4	-0.99	0.58	0.6	0.55
11-07-2024 04:10	GP4409882	531904	0	536251.7	22.4	22.4	-0.33	0.62	0.64	0.61
11-07-2024 03:11	GP4409882	531892.7	0	536240.5	22.4	22.4	-1.32	0.59	0.58	0.56
11-07-2024 02:05	GP4409882	531880.6	0	536228.3	22.4	22.4	-0.65	0.57	0.6	0.56
11-07-2024 01:08	GP4409882	531870.3	0	536217.8	22.4	22.4	-0.78	0.65	0.67	0.64
11-07-2024 00:12	GP4409882	531858.5	0	536206	22.4	22.4	-0.75	0.69	0.7	0.66

Fig 25

3. FEEDER NAME : PENNA

RTC	MeterNo	KWH_Import	KWH_Export	KVAH_Import	MD_KW	MD_kVA	KVAR	Current_IR	Current_IY	Current_IB	Voltage_VR	Voltage_VY	Voltage_VB	PF
11-07-2024 23:06	GP4409879	355548.4	0	362105.5	15.9	16.9	-0.72	0.18	0.16	0.2	6245	6288	6235	0.98
11-07-2024 22:08	GP4409879	355545.4	0	362102.5	15.9	16.9	-0.6	0.18	0.15	0.2	6295	6311	6281	0.98
11-07-2024 21:10	GP4409879	355542.2	0	362099.1	15.9	16.9	-0.6	0.18	0.16	0.2	6289	6303	6275	0.98
11-07-2024 20:10	GP4409879	355538.9	0	362095.8	15.9	16.9	-0.62	0.2	0.17	0.22	6268	6299	6245	0.99
11-07-2024 19:09	GP4409879	355535	0	362091.8	15.9	16.9	-0.31	0.25	0.22	0.25	6248	6272	6220	1
11-07-2024 18:07	GP4409879	355529.7	0	362086.6	15.9	16.9	-0.04	0.32	0.29	0.33	6272	6316	6265	1
11-07-2024 17:09	GP4409879	355522.5	0	362079.3	15.9	16.9	0.87	0.47	0.41	0.47	6291	6320	6273	1
11-07-2024 16:09	GP4409879	355513.2	0	362070	15.9	16.9	0.68	0.58	0.51	0.56	6232	6254	6217	1
11-07-2024 15:09	GP4409879	355502.5	0	362059.3	15.9	16.9	1.55	0.63	0.59	0.61	6202	6206	6192	0.99
11-07-2024 14:07	GP4409879	355491.8	0	362048.5	15.9	16.9	1.27	0.59	0.57	0.6	6189	6184	6173	0.99
11-07-2024 13:22	GP4409879	355484.4	0	362041.1	15.9	16.9	0.61	0.52	0.46	0.52	6249	6251	6240	1
11-07-2024 11:06	GP4409879	355460.1	0	362016.5	15.9	16.9	1.07	0.56	0.53	0.55	6226	6235	6212	0.99
11-07-2024 10:22	GP4409879	355452.3	0	362008.7	15.9	16.9	1.59	0.62	0.56	0.62	6231	6245	6219	0.99
11-07-2024 08:05	GP4409879	355434.3	0	361990.6	15.9	16.9	0	0.21	0.17	0.2	6270	6310	6255	1
11-07-2024 07:08	GP4409879	355431.5	0	361987.6	15.9	16.9	-0.79	0.13	0.13	0.18	6242	6257	6222	0.95
11-07-2024 06:07	GP4409879	355428.9	0	361984.9	15.9	16.9	-0.96	0.15	0.14	0.18	6188	6197	6167	0.94
11-07-2024 05:09	GP4409879	355426	0	361982	15.9	16.9	-0.99	0.16	0.13	0.19	6230	6241	6211	0.94
11-07-2024 04:10	GP4409879	355423.4	0	361979.1	15.9	16.9	-0.86	0.17	0.14	0.19	6231	6249	6216	0.96
11-07-2024 03:11	GP4409879	355420.5	0	361976.2	15.9	16.9	-0.91	0.16	0.14	0.19	6281	6285	6258	0.95
11-07-2024 02:05	GP4409879	355417.4	0	361973	15.9	16.9	-0.87	0.16	0.13	0.18	6306	6334	6282	0.96
11-07-2024 01:08	GP4409879	355414.7	0	361970.1	15.9	16.9	-0.9	0.17	0.14	0.19	6291	6311	6280	0.95
11-07-2024 00:12	GP4409879	355412	0	361967.3	15.9	16.9	-0.77	0.16	0.14	0.18	6319	6324	6304	0.97

Fig 26

4. FEEDER NAME: NTRO A2

RTC	MeterNo	KWH_Import	KWH_Export	KVAH_Import	MD_KW	MD_kVA	KVAR	Current_IR	Current_IY	Current_IB
11-07-2024 23:06	GP4409890	176175.1	0	182012.6	12.5	12.9	1.16	0.44	-0.42	-0.4
11-07-2024 22:08	GP4409890	176167.8	0	182005.2	12.5	12.9	0.66	0.44	-0.44	-0.41
11-07-2024 21:10	GP4409890	176161.2	0	181998.5	12.5	12.9	0.41	0.34	-0.34	-0.33
11-07-2024 20:26	GP4409890	176156.7	0	181994.1	12.5	12.9	0.36	0.36	-0.35	-0.33
11-07-2024 19:09	GP4409890	176147.9	0	181985.2	12.5	12.9	1.75	0.43	-0.42	-0.41
11-07-2024 18:14	GP4409890	176140.4	0	181977.6	12.5	12.9	0.68	0.44	-0.41	-0.41
11-07-2024 17:24	GP4409890	176133	0	181969.9	12.5	12.9	2.4	0.53	-0.49	-0.5
11-07-2024 16:46	GP4409890	176127.3	0	181964	12.5	12.9	2.44	0.54	-0.51	-0.49
11-07-2024 15:09	GP4409890	176110.8	0	181947	12.5	12.9	2.54	0.6	-0.6	-0.6
11-07-2024 14:22	GP4409890	176102.3	0	181938.3	12.5	12.9	2.74	0.69	-0.67	-0.67
11-07-2024 13:22	GP4409890	176093	0	181928.8	12.5	12.9	1.94	0.5	-0.51	-0.52
11-07-2024 11:06	GP4409890	176068.9	0	181904.2	12.5	12.9	2.61	0.6	-0.59	-0.57
11-07-2024 10:22	GP4409890	176061.6	0	181896.8	12.5	12.9	0.97	0.51	-0.5	-0.5
11-07-2024 08:05	GP4409890	176044.5	0	181879.5	12.5	12.9	0.09	0.3	-0.29	-0.27
11-07-2024 07:08	GP4409890	176038.9	0	181873.9	12.5	12.9	0.92	0.35	-0.33	-0.33
11-07-2024 06:07	GP4409890	176032.6	0	181867.6	12.5	12.9	-0.58	0.32	-0.31	-0.29
11-07-2024 05:09	GP4409890	176026.8	0	181861.7	12.5	12.9	-0.05	0.34	-0.33	-0.32
11-07-2024 04:10	GP4409890	176020.7	0	181855.6	12.5	12.9	0.35	0.37	-0.35	-0.34
11-07-2024 03:11	GP4409890	176013.8	0	181848.8	12.5	12.9	0.75	0.39	-0.38	-0.38
11-07-2024 02:05	GP4409890	176006.6	0	181841.4	12.5	12.9	0.16	0.36	-0.35	-0.34
11-07-2024 01:08	GP4409890	176000.5	0	181835.4	12.5	12.9	0.02	0.35	-0.34	-0.33
11-07-2024 00:19	GP4409890	175995.6	0	181830.4	12.5	12.9	0.01	0.35	-0.34	-0.32

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