

ENERGY AUDIT REPORT FOR FY2022-23

ARUNACHAL PRADESH, DEPT. OF POWER

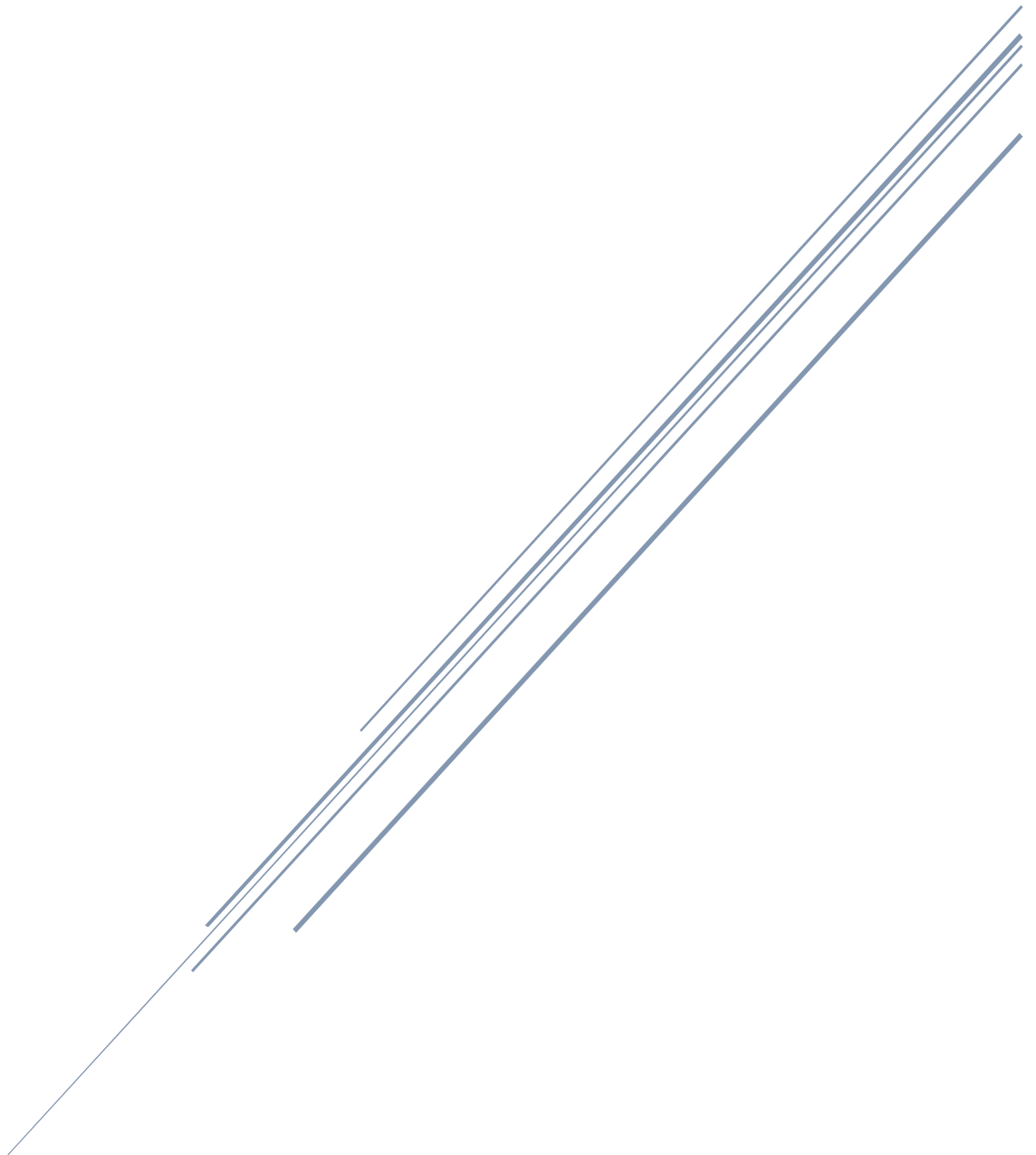


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1. ACKNOWLEDGEMENT

We express sincere gratitude to the management of Arunachal Pradesh, Department of Power for giving us the opportunity to conduct 'Energy Audit' for financial year 2022-23.


We are thankful to the following officials of Arunachal Pradesh, Department of Power (APDOP) for their kind support extended during Annual Energy Audit:

Mr. Made Nalo- SE (Com), Energy Manager

Mr. Zomba Nasho - EE (com)

Mr. Rajesh Sharma- JE (Com)

We also wish to thank all other officers and staff of APDOP for their excellent cooperation and support for successful completion of Energy Audit.


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Signature:

2. EXECUTIVE SUMMARY

- i. The study covers mainly verification process for monitoring of input energy and consumption pattern at various voltage levels, identification of area of energy leakage, wastage or inefficient use, identification of high loss-making areas and networks, identification of overloaded/underloaded segments of the network for necessary capacity additions, highlighting the strengths and weaknesses of the DISCOM in the management of energy and energy resources with a focus mainly on proposals and recommendations on Energy Conservation.
- ii. Energy Accounting summary for the financial year 2022-23:

Sr. No.	parameters	Unit	FY-2022-23
1	Energy purchased	MU	1397.894
2	State own Generation	MU	125.258
3	Total Energy Input	MU	1523.152
4	Energy Exported & sale	MU	450.815
5	Energy at DISCOM periphery (3-4)	MU	1072.337
6	Transmission Loss	MU	33.795
7	Energy available for sale (3)	MU	1038.542
8	Energy Billed	MU	582.102
9	T&D Loss (4-5)	MU	456.440
10	T&D Loss (6/4)	%	43.96
11	Billed Amount	Rs. Cr	264.26
12	Collection Amount	Rs. Cr	206.32
13	Collection Efficiency (9/8)	%	78.08
14	Total revenue collected (9+11)	Rs. Cr	206.32
15	Aggregate Technical & Commercial Loss	%	56.25

- iii. When reconciling the Data collected from divisions, it was found that the net input energy available for sale is 1060.77 MU which is 22.23 MU higher than the actual data maintained at HQ. Also, the total energy billed figure was found by adding all the divisions sale was 598.27MU which is 15.91MU higher than the figure booked in the

tariff order. The audit team tried to find out this anomaly. The answer came to surface when the audit team visited the sub-station and divisions and the probable reasons are:

- a. There is no SOP followed at the sub-station for energy accounting and therefore, the record keeping is based on the discretion of the engineer deputed at the sub-station
- b. During malfunctioning of energy meter/CT-PT, the engineer records the value of energy input at the sending end not the receiving end. This sending end energy data includes the line loss which is booked under the head of 'net input energy'

iv. Infrastructure summary for the financial year 2022-23:

Number of circles	8
Number of divisions	31
Number of sub-divisions	63
Number of total feeders [including LT]	6434
Number of metered consumers	140310
Number of unmetered consumers	158137
Number of total consumers	298447
Metering available at consumer end	47%
Number of conventionally metered Distribution Transformers	627
Number of DTs with communicable meters	0
Number of unmetered DTs	7107
Number of DTs	7734
DT metering available	8%
Number of total feeders	585
Feeder metering available	28%
Line length (ckt. km) at HT level	19574
Line length (km) at LT level	12869
Length of Aerial Bunched Cables	167.5
Length of Underground Cables	13.06
Total Line length (ct km)	32623.56
HT,LT ratio	1.52

v. Consumer category wise energy billing summary for the financial year 2022-23:

Consumer Type	Metered	Unmetered	Total	Total Billed (MU)	Total Input (MU)
Residential	118320	145557	263877	582.102	1038.542
Agricultural	2	18	20		

Consumer Type	Metered	Unmetered	Total	Total Billed (MU)	Total Input (MU)
Commercial/Industrial-LT	21152	11253	32405		
Commercial/Industrial-HT	322	173	495		
Others	514	1136	1650		
Total	140310	158137	298447		

3. SUMMARY OF CRITICAL ANALYSIS BY ENERGY AUDITOR AND MANAGEMENT ANALYSIS

3.1 status and progress in compliance to prerequisites to energy accounting


Sr. No.	Pre-requisites	Status & Progress
a	Identification and mapping of all of the electrical network assets	Identification of electrical network assets are already in place. Mapping of the assets are yet to be done. Mapping of consumers at each voltage level with their metering communication status is in progress. Energy injection at each voltage level and feeder level is in progress
b	Identification and mapping of high tension and low- tension consumers	Mapping of consumers as per HT & LT status are already in place
c	Development and implementation of information technology enabled energy accounting and audit system, including associated software	9 nos. of R-APDRP towns are under online billing. 16 IPDS-II towns are on the verge of completion of migrating to online billing system. GIS mapping of 9 R-APDRP towns have been completed and operational. GIS mapping of 16 IPDS-II towns is completed. In Miao Electrical Division Spot billing & collection is active. No IT systems carry out Meter data Analysis effectively to identify under-recording / pilferage cases in a timely manner
d	Electricity distribution company ensures the installation of functional meters for all consumers, transformers and feeders. Meter installation is done in a phased manner within a period of three financial years from the date of the commencement	47% consumers are metered. 08% DTs are metered. 28% feeders are metered. Details about defective meters and their replacement tracking have to be established. Also the all meters have to be communicable.

Sr. No.	Pre-requisites	Status & Progress
	of these regulations in accordance with the trajectory set out in the First Schedule	
e	all distribution transformers (other than high voltage distribution system up to 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	Under progress
f	Electricity distribution company has established an information technology enabled system to create energy accounting reports without any manual interference	Yet to incorporate
g	Electricity distribution company has 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	The DC has created a Centralized Energy Accounting and Audit Cell with the following officer 1. One Nodal Officer 2. One nominated Energy Manager 3. One IT Manager 4. One Financial Manager

3.2 Management Analysis

Sr. No.	Comments by Auditor	Responses of DISCOM Management
a	Metering for all the feeders not available. No record for defective meters or defective CT/PT	Due to lack of manpower and funds, replacement of defective meters & CT/PT are taking longer time
b	All 11kV & 33kV feeders are not communicable meters	Management is taking initiatives under RDSS to install communicable metering for 100% feeders
c	Energy input, export and sale details not available at each voltage level	no such accounting system followed. DISCOM agreed to make such arrangement as per BEE guideline

Sr. No.	Comments by Auditor	Responses of DISCOM Management
d	Absence of assessed energy (in MU) reported in accounting sheet for consumers having defective meters.	Consumers with defective meter are billed based on the assessment at sub-division level and re-assessment of load also conducted at sub-division level. Although these data is not separately captured
e	Division wise energy input data is partially metered and rest estimated as boundary metering is available partly at sub divisional level	DISCOM understood the importance of 100% boundary metering for pin pointing the grey area in the network to formulate proper strategy for network efficiency improvement
f	No standard energy accounting format is maintained at sub-division level for input (feeder wise metered data) and billing data (with assessment unit for defective meters)	DISCOM will look into it and take necessary steps
g	Absence of communicable DT meters preventing DISCOM to identify the network where leakages, wastage is happening	DT metering project initiated under RDSS scheme
h	Overall collection efficiency is 78%.	One of the key reasons for low collection efficiency is outstanding dues from the existing customers. DISCOM need to be more efficient in vigil, identification, strict action to increase collection efficiency
i	Billing efficiency is poor (53%)	52% of the consumers are unmetered resulting in low billing efficiency. Average billing is performed for unmetered consumers and defective metered consumers. Another reason for low billing efficiency is Scattered and migrated population
j	Distribution network diagram is not available for all division and overall state level	DISCOM will take necessary initiative
k	Low Metering Coverage including low coverage of AMR / reading through IrDA port	Coverage of AMR reading do not exist as there is no smart metering penetration in the state
l	There is no agriculture feeder segregation	DISCOM will take necessary initiative
m	Presence of HVDS system	Currently, No HVDS system exists in the State
n	Condition Monitoring	There is no IT system for tracking / monitoring / recording preventive maintenance activities & Inadequate technology usage for condition monitoring


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3.3 Recommendations to improve performance of DISCOM

- i. Stress given to identify the gaps on accounting of the AT&C loss including T&D loss & billing efficiency. For improving billing efficiency an AI-based app that can autofill units consumed in discom bills. Bills are generated based on images captured by meter readers, so no manual overriding is possible. Though APDOP started the same.
- ii. Engagement of collection-based distribution franchisee in rural areas will improve efficiency. Collection-based distribution franchisee model will create rapid improvements in metering, billing, collection, and a reduction in AT & C loss. Simultaneously reduction of administrative overheads, and regularization of unauthorized connections as well.
- iii. Launching performance-based incentive schemes to reward employees for actions taken to maintain or reduce AT&C losses and ACS-ARR gap. Accountability for loss monitoring resides with dedicated substation and feeder-level managers. They have to regularly monitor MIS reports and have to institutionalized the following actions to ensure that there are no revenue leakages:
 - Investigating frequent zero and average billed connections through onsite visits, phone calls and notices
 - Removing service lines from permanently disconnected consumers to prevent misuse
 - Bringing all newly energized connections under the billing cycles
 - Identifying and investigating high loss and low consumption connections
- iv. All consumers are not shifted to smart meters yet. AMR System should be implemented for each incoming & outgoing feeder of every Sub-station with particular emphasis to Bulk Load Consumers. Technical loss at consumer end meters can be avoided if the following points are checked at regular interval for bulk load consumer
 - Poor accuracy of meters,
 - Large error in capital CTs / PTs,
 - Voltage drops in PT cables,

- Loose connection in PT wire terminations,
 - Overburdened CT,
 - Incorrect multiplying factor,
 - Software bugs
- v. For DTR Metering AMR System should be implemented for detection of overload, unbalance load by DTR level smart meter.
- vi. Increase in HT/LT ratio – It is well known that for high HT/ LT ratio, the losses will be lesser. The losses for a given quantum of power supplied by a line are inversely proportional to the square of its operating voltage. Higher the operating voltage, lower will be the line losses. Therefore, by increasing the HT lines the losses will be reduced.
- vii. Connected load data acquisition process have to be completed asap to collect good amount fixed charges based on load. Besides, Connected load vs billing energy assessment need to be done and accordingly the load may be reassessed to increase fixed charges amount in billing
- viii. Loss Figures should be ascertained with actual Load Flow Study.
- ix. Calibration of all types of Meters should be done periodically.
- x. For ascertaining Sub-Division level losses proper accounting to be done.
- xi. To reduce technical loss, each & every Sub-Station should be in the Load Centre.
- xii. DISCOM should encourage industrial loads to shift to HT connection to reduce technical loss for distribution
- xiii. DISCOM may adapt special tamper proof paper seal for low and medium voltage service installation to detect pilferage at consumer service box
- xiv. It is suggested to replace rewirable fuse cut-outs at the service termination with MCB/MCCB inside an enclosure with special type of seals to prevent unauthorised access to service parts

- xv. It is suggested to install specially designed anti-theft pillar box in pilfer prone pockets. Anti-theft pillar box comprises of door locking arrangement with insulated bus bar inside.
- xvi. Consumer awareness is required to reduce commercial loss by Media, Camp & Leaflets etc. Partnering with post offices and gram panchayats and deploying dedicated agents to improve rural collections may help discom with large rural territories to improve their collection efficiency. To educate consumers about electricity usage can shifts in consumer behaviour.
- xvii. Simplification and integration of payment method like use of digital channels (web, mobile apps, etc.) for billing and payments to improve collection efficiency.
- xviii. DISCOM need to create a centralized energy accounting and audit cell with adequately qualified personnel. Special Team comprising finance, technical & HR officials from Head Quarter to be deployed for surprise visit to the consumer's premises to reduce commercial loss. The team constantly should change its action plan with regard to mode, manner and timing of anti-pilferage activities. High end commercial & industrial consumer should be monitored by IT based system. IT based system should comprise of loss reduction cell information management, criminal case information management, inspection cum disconnection reporting, consumer information system database.
- xix. To reduce commercial loss HVDS (High Voltage Distribution System), AB Cable (Aerial Bunched Cable), should be used for power distribution purposes. Besides, in order to combat high loss/pilferage prone areas, co-axial cable may be used because of its inherent construction which will result in cable fault alarm if such attempts are made the pilferers.
- xx. Use of booster auto transformer in remote areas to control load voltage. In remote areas, the voltage available across load often fluctuates due to drop in feeder lines. Therefore, to compensate this fluctuation and keeping load voltage within

permissible limits, booster auto transformers with feedback controller are to be used in load centre.

- xxi. To reduce technical loss & also to enhance reliability of power supply, UG Cables should be used in Urban Areas. Network Re-configuration, bifurcating feeders based on loading, re-routing feeders and replacing conductors to reduce technical losses.
- xxii. Segregation of loads at DTR level for different consumer categories like residential, agriculture etc will ease of monitoring and planning for loss minimization
- xxiii. Operational efficiencies of discom will be improved through smart metering and upgradation of the distribution infrastructure, including the segregation of agriculture feeders and strengthening the system.
- xxiv. Standard operating procedure to be developed and maintained by the DISCOM in each administrative and operation level for energy accounting, billing, collection, monitoring etc.

4. ENERGY AUDIT TEAM

Sl. No.	Name	Qualification	CEM/CEA/AEA	Experience
1	Prodip Golder	AMIE (Electrical) Chartered Engineer, B.O.E AEA, CEA	CEA – 11726 AEA- 282	25 Years
2	Dr. Sumimal Roy Barman	Ph.D in Electrical Engineering	Sector Expert	37 years
3	Shubhrangsu Gongopadhyay	B.E. (Mechanical), B.O.E, CEA	CEA – 11727	26 years
4	Arup Narayan Singha	AMIE (Mechanical) B.O.E, CEA	CEA – 29699	25 years
5	Somnath Sarkar	MBA (Energy), CEM, CMVP	CEM-5313	14 years

5. BACKGROUND

5.1 Extant Regulations and role of BEE

The Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit (Accounting) in Electricity Distribution Companies) Regulations, 2021, were published vide notification No.18/1/BEE/DISCOM/2021, dated the 15th April, 2021 in the Gazette of India, Extraordinary, Part III, Section 4, as required under sub-section (1) of section 58 of the Energy Conservation Act, 2001 (52 of 2001) inviting objections and suggestions from all persons likely to be affected thereby within forty five days from the date of publication of the Notification in the Official Gazette;

AND WHEREAS objections and suggestions received with respect to the said draft regulations within the specified period aforesaid have been duly considered;

NOW, THEREFORE, in exercise of the powers conferred by clause (g) of sub-section (2) of section 58, read with clause (q) of sub-section (2) of section 13 of the Energy Conservation Act, 2001 (52 of 2001), the Bureau of Energy Efficiency, with the previous approval of the Central Government, hereby makes the following regulations, namely:--

1. **Short title, application and commencement.** — (1) These regulations may be called the Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit in electricity distribution companies) Regulations, 2021.
 - (2) These regulations shall apply to all electricity distribution companies specified as designated consumer.
 - (3) They shall come into force on the date of their publication in the Official Gazette.
2. **Definitions.-** (1) In these regulations, unless the context otherwise requires, —
 - (a) “Act” means the Energy Conservation Act, 2001 (52 of 2001);
 - (b) “annual energy audit” means the energy audit conducted by an accredited energy auditor on annual basis in accordance with these regulations;
 - (c) “annual energy audit report” means the report on annual energy audit;
 - (d) “circle” means the demarked area of the electricity distribution company in which electricity distribution company is divided.

- (e) “consumer” shall have the meaning assigned to it under clause (15) of section 2 of the Electricity Act, 2003 (36 of 2003);
 - (f) “division” means an administrative unit in which an electricity distribution company is divided for the purpose of ease of operation;
 - (g) “electricity distribution company” means a distribution licensee as defined in clause (17) of section 2 of the Electricity Act, 2003 (36 of 2003);
 - (h) “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;
 - (i) “periodic energy accounting” means the energy accounting conducted on quarterly basis as mentioned in regulation 4;
 - (j) “periodic energy accounting report” means the report on periodic energy accounting submitted and signed by the energy manager;
- (2) Words and expressions used herein and not defined but defined in the Act shall have the meanings respectively assigned to them in the Act.
- 3. 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 and also made available on the website of the electricity distribution company within a period of four months from the expiry of the relevant financial year:
- 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) Where a new electricity distribution company is established after the commencement of these regulations, such electricity distribution company shall conduct its first annual energy audit on completion of the first financial year from the date of being notified as designated consumer.

Explanation. — If any entity created as a result of merger, demerger, slump sale, acquisition, change of control or any other corporate restructuring of, or involving, any existing electricity distribution company, such entity shall not be considered as a new electricity distribution company for the purposes of this sub-regulation.

4. 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, and submit the periodic energy accounting report within sixty days from the date of periodic energy accounting.

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 up to 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; and
- (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 upto 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.
- 8. Prioritization and preparation of action plan.-** (1) The annual energy audit report submitted by accredited energy auditor in consultation with the nodal officer and periodic energy accounting report submitted by energy manager of the electricity distribution company shall include following activities, namely:—
- (I) data collection and verification of energy distribution—
- (a) monthly energy consumption data of consumers and system metering from electricity distribution company at following voltage levels —
 - (i) 33/66/132 kV levels, including 33/66/132kV feeder and Sub-station;
 - (ii) 11/22 kV levels, including 11/22 kV feeder and Distribution Sub-station;

- (iii) 440 V level, including Distribution Transformer and low tension consumer;
 - (b) input energy details for all metered input points;
 - (c) boundary meter details;
 - (d) source of energy supply (e.g. electricity from grid or self-generation), including generation from renewables.
 - (e) review of the current consumption practices in order to identify the energy loss in the system;
- (II) data verification, validation and correction—
- (a) a monitoring and verification protocol to quantify on annual basis the impact of each measure with respect to energy conservation and cost reduction for reporting to Bureau and the concerned State designated agency;
 - (b) verification and correction of input energy, taking into account the following —
 - (i) recorded system meter reading by metering agency;
 - (ii) all the input points of transmission system;
 - (iii) details provided by the transmission unit;
 - (iv) relevant records at each electricity test division for each month;
 - (v) recorded meter reading at all export points (where energy sent outside the State is from the distribution system); and
 - (vi) system loading and corresponding infrastructure;
 - (c) energy supplied to Open Access Consumers which is directly purchased by Open Access Consumers from any supplier other than electricity distribution company; and
 - (d) verify and validate the system metering data provided by metering agency through random field visit (particularly for data irregularity).

9. Structure of the annual energy audit report.- (1) The structure of annual energy audit report shall be prepared in the format as set-out in the Second Schedule.

- (2) 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 Government, so that the subsidy due for the electricity distribution company is quarterly calculated by multiplying the energy supplied to each of such category of consumers by the applicable rate of subsidy notified by the State Government.
- (3) The annual energy audit report shall—
 - (a) provide for monitoring of input energy and consumption pattern at various voltage levels;
 - (b) identify the areas of energy leakage, wastage or inefficient use;
 - (c) identify high loss-making areas and networks, for initiating target based corrective action; and (d) identify overloaded segments of the network for necessary capacity additions.
- (4) The accredited energy auditor shall highlight the strengths and weaknesses of the electricity distribution company in the management of energy and energy resources in the annual energy audit report and recommend necessary action to improve upon method of reporting data, energy management system in detail along with their underlying rationale.
- (5) The accredited energy auditor shall sign the energy audit report under the seal of its firm giving all the accreditation details along with details of manpower employed in conducting the annual energy audit.

10. Report of Bureau.- On receipt of the annual energy audit report, the Bureau may—

- (a) direct the electricity distribution company to take such actions as it may consider appropriate; and (b) make such recommendations to the Central Government as it may consider necessary.

THE FIRST SCHEDULE [See regulation 5(d)] TRAJECTORY FOR METER
INSTALLATION

(A) Timeline for metering—

- (i) 100% Communicable Feeder Metering integrated with AMI, by 31st 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:

- o All Electricity Divisions of 500 AMRUT cities, with AT&C Losses > 15% ;
- o All Union Territories (for areas with technical difficulty, non-communicable meters may be installed);
- o All Industrial and Commercial consumers; o 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%.

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:

- o 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); o All Industrial and Commercial consumers; o 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: o 98% by FY 2022-23 o 99% by FY 2023-24

(B) Targets for functional meters—

Meter	FY 22-23	FY 23-24	FY24-25
Feeder metering	98.5%	99.5%	99.5%
DT metering	90%	95%	98%
Consumer metering	93%	96%	98%

5.2 Purpose of audit & accounting report

Basic objective or purpose of the audit and accounting report is described below:

- i. development of a comprehensive energy accounting system to quantify and determine actual losses in the power distribution system, segregated across technical and commercial losses.
- ii. Identification of areas of leakage, theft, wastage or inefficient use, thereby paving the way for tackling the present challenges of high Transmission and Distribution (T&D) losses.
- iii. to enable and ensure an independent 3rd party energy audit of the distribution system to arrive at a true and fair picture of T&D losses.
- iv. to enable the Distribution utilities to undertake targeted efficiency improvement activities to reduce Distribution losses in priority areas / customer segments.

5.3 Period of Energy Auditing & accounting

- v. 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 and also made available on the website of the electricity distribution company within a period of four months from the expiry of the relevant financial year:

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.

- vi. Where a new electricity distribution company is established after the commencement of these regulations, such electricity distribution company shall conduct its first annual energy audit on completion of the first financial year from the date of being notified as designated consumer.

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6. INTRODUCTION OF DISCOM (DC)

6.1 Name & Address of Designated Consumers

Name of the DISCOM	Department of Power, Government of Arunachal Pradesh		
DISCOM's Address			
City/Town/Village	Itanagar		
District	Papun Pare		
State	Arunachal Pradesh	Pin	791111

6.2 Name & Contact details of Energy Manager and authorised signatory of DC (Nodal Officer)

Nodal Officer Details*	
Nodal Officer Name (Designated at DISCOM's)	Tasso Hinda
Designation	Chief Engineer (Com) cum CEI
Address	Commercial Zone cum Electrical Inspectorate Department of Power, Vidyut Bhawan
Energy Manager Details*	
Name	Made Nalo
Designation	Superintending Engineer
EM Registration No.	NA
Address	Commercial Zone cum Electrical Inspectorate Department of Power, Vidyut Bhawan

6.3 Summary profile of DCs (Assets, Energy Flow, Consumer Base, salient features etc.)**6.4 Assets**

Number of circles	8
Number of divisions	31
Number of sub-divisions	63
Number of total feeders [including LT]	6434
Number of metered consumers	140310
Number of unmetered consumers	158137
Number of total consumers	298447
Metering available at consumer end	47%
Number of conventionally metered Distribution Transformers	627
Number of DTs with communicable meters	0
Number of unmetered DTs	7107
Number of DTs	7734
DT metering available	8%
Number of total feeders	585
Feeder metering available	28%
Line length (ckt. km) at HT level	19574
Line length (km) at LT level	12869
Length of Aerial Bunched Cables	167.5
Length of Underground Cables	13.06
Total Line length (ct km)	32623.56
HT,LT ratio	1.52

6.5 Energy Flow

Name of Project/Station	Unit	Total
RHEP (NEEPCO)	MU	88.87
Free Energy (Received)	MU	164.12
LOKTAK (NHPC)	MU	23.21
KHANDONG (NEEPCO)	MU	0.00
KOPILI-I (NEEPCO)	MU	0.00
KOPILI-II (NEEPCO)	MU	0.00
DOYANG (NEEPCO)	MU	11.71
PARE (NEEPCO)	MU	30.74
Free Energy (Received)	MU	67.82
KAMENG (NEEPCO)	MU	53.18
Free Energy (Received)	MU	344.87
AGBPP (NEEPCO)	MU	96.55
AGTCCPP (NEEPCO)	MU	60.20
BgTPP (NTPC)	MU	157.22
ONGC TPCL (Palatana)	MU	142.92

Name of Project/Station	Unit	Total
FARAKKA (NTPC) Seller Per.	MU	20.04
KAHALGAON (NTPC) Seller Per.	MU	10.66
TALCHAR (NTPC) Seller Per.	MU	14.20
Banking Receipt	MU	66.05
Energy Import (IEX)	MU	6.15
Deviation Import	MU	39.37
Total Energy Import i/c Free	MU	1397.89
		0.00
Energy Export Outside the State		0.00
Energy Sale (IEX) APPCPL	MU	234.12
Banking Export	MU	71.52
Bilateral Sale	MU	130.42
RE Sale	MU	0.00
Deviation Export	MU	14.76
Total Energy Export Out Side	MU	450.81
Energy Injectected in State	MU	947.08
Net Energy Injected in State	MU	913.28
State Own Generation		
Sumbachu (HPDCL)	MWH	5.24
DHPD Generation	MWH	41.97
DIKSHI HEP	MWH	65.17
Free Energy (Received)	MWH	11.64
Solar Generation (APEDA)	MWH	0.96
Diesel Generation	MWH	0.28
Total State Own Generation	MWH	125.26
Net Input Energy	MWH	1038.54
Energy Sold in State	MWH	582.10

6.6 Consumer Base

Consumer Type	Number of consumers	% share
Residential	263299	88.42%
Agricultural	19	0.01%
Commercial/Industrial-LT	30180	10.86%
Commercial/Industrial-HT	381	0.17%
Others	1865	0.55%
Total	295744	100%

7. DISCUSSION & ANALYSIS

7.1 Energy accounts in previous years (FY2021-22)

Sr. No.	parameters	Unit	Value
1	Total Energy Input	MU	1329.06
2	Net Energy Input	MU	972.33
3	Energy Billed	MU	518.26
4	T&D Loss	MU	454.07
5	T&D Loss	%	46.7
6	Billed Amount	Rs. Cr	223.58
7	Collection Amount	Rs. Cr	175.00
8	Collection Efficiency	%	78.28
9	Collection against arrears	Rs. Cr	23.94
10	Total revenue collected	Rs. Cr	198.94
11	Aggregate Technical & Commercial Loss	%	58.28

7.2 Energy accounts and performance in the current year (FY2022-23)

Sr. No.	parameters	Unit	FY-2022-23
1	Energy purchased	MU	1397.894
2	State own Generation	MU	125.258
3	Total Energy Input	MU	1523.152
4	Energy Exported & sale	MU	450.815
5	Energy at DISCOM periphery (3-4)	MU	1072.337
6	Transmission Loss	MU	33.795
7	Energy available for sale (3)	MU	1038.542
8	Energy Billed	MU	582.102
9	T&D Loss (4-5)	MU	456.440
10	T&D Loss (6/4)	%	43.96
11	Billed Amount	Rs. Cr	264.26

12	Collection Amount	Rs. Cr	206.32
13	Collection Efficiency (9/8)	%	78.08
14	Total revenue collected (9+11)	Rs. Cr	206.32
15	Aggregate Technical & Commercial Loss	%	56.25

7.3 Unit wise performance

7.4 Energy performance measures already taken and proposed for future

7.4.1 Proposed reforms

Based on the assessment of “As Is” scenario and a deep dive analysis of root causes, Department of Power, Arunachal Pradesh envisage to undertake following reforms for reducing its losses and strengthening of its distribution function.

S. No.	Area	Proposed reforms
1	Tariff and regulatory	<ul style="list-style-type: none"> ➤ Regulatory compliance and timely filling of Tariff and true up filings. ➤ Filing of True up petition for FY 2019-20, and FY 2020-21 in the present and ensuing financial year. ➤ Filing of True up and Tariff petition in ensuing years as per the regulatory timelines ➤ Capacity building of Regulatory team towards regulatory reforms, new interventions (EV, rooftop, storage, EA amendments etc.)
2	Operational loss related	<ul style="list-style-type: none"> ➤ Significant focus on loss reduction programs and optimization of HT:LT ratio under RDSS scheme. ➤ Distribution network strengthening for loss reduction and modernisation including improvement in HT/ LT Ratio, replacement of bare conductor, creation of new 33/ 11 kV Substation, augmentation of existing 33/11 KV substations, HVDS, feeder segregation, power factor improvement etc. ➤ Identification of high loss pockets with DT metering for identification and implementation of customized interventions for loss reduction.
3	Cost-related (Power	<ul style="list-style-type: none"> ➤ Enhancing Demand Side Management (DSM) initiatives in place for peak load reduction.

S. No.	Area	Proposed reforms
	purchase cost)	<ul style="list-style-type: none"> ➤ Review of PPAs with legacy issues of high-power purchase cost due to legacy contracts or high fixed costs. ➤ Deploying IT tools for technology-driven demand forecasting.
4	Revenue Related	<ul style="list-style-type: none"> ➤ Pre-paid Smart Meter and simple pre-paid meter installation. ➤ Liquidation framework of outstanding Government dues by respective departments and Government of Arunachal Pradesh.
5	Energy Accounting related	<ul style="list-style-type: none"> ➤ Implementation of smart/prepaid metering for all consumers for accurate consumer level energy accounts mapping. ➤ Metering of Feeders for centralized monitoring and energy accounting ➤ Metering of DTs for DT level energy accounting ➤ Setting up a dedicated centralized energy accounting cell for Feeder level monitoring and mapping of energy accounts. ➤ Onboarding of feeders on the National Power Portal
6	Reliability and O&M Related	<ul style="list-style-type: none"> ➤ Infrastructure works for loss reduction ➤ Infrastructure works for System modernization

The reforms initiatives already implemented by Department of Power, Arunachal Pradesh:

- Installed 24,013 pre-paid energy meters at consumer's premises of Itanagar and Naharlagun towns in the State Capital Complex.
- The revenue collection of these two towns through pre-paid energy meter is very encouraging.
- Smart Pre-Paid meters to be included in the RDSS in the available network areas and simple pre-paid meters in the no network areas.
- With the support of GOI, online energy billing is enabled in 9 R-APDRP towns and online billing shall also be activated soon in 16 more towns under IPDS Phase-II.
- Conducting periodic and regular energy accounting
- Deployment of a dedicated IT wing for management of IT/OT services.

7.4.2 Steps for performance improvement

The key steps and works proposed to be undertaken by the Department of Power, Arunachal Pradesh based on the analysis are summarized as below.

Consumer and system metering

The summary of interventions and initiatives proposed for consumer and system metering are discussed as below-

Summary of work

The following works are proposed under consumer and system metering.

Consumer Metering:

Table 1 Proposed Work-Consumer Metering

Works	Existing Consumers	Physical Target 2022-23	Physical Target 2022-23	Physical Target 2023-24	Physical Target 2024-25	Total Outlay (Rs. Cr.)
Domestic	249422	0	20000	149650	79772	172.47
Agriculture	19	0	19	-	-	
Industrial	320	0	320	-	-	
Government Departments	3483	0	3483	-	-	
Commercial	28752	0	28752	-	-	
Bulk	5450	0	5450	-	-	
Total	287446	0	58024	149650	79772	

Note: No growth rate has been considered on the existing consumer base.

System Metering:

Table 2: Proposed Work-System Metering

Works	Existing	Physical Target 2022-23	Physical Target 2022-23	Physical Target 2023-24	Physical Target 2024-25	Total Outlay (Rs. Cr.)
DT Metering	10,116	0	5058	5058	-	23.27
Feeder Metering	579	0	290	289	-	2.43
Boundary Meter	109	0	50	59	-	0.46

Note: No Growth rate has been considered on existing consumers.

Envisaged impact of Metering on Distribution performance

The key impact areas are:

- Robust metering infrastructure shall assist in strengthening the energy accounting practices of Department of Power, Arunachal Pradesh leading to accurate estimation of losses and subsidy requirements under subsidised consumer categories.
- This shall also assist in enhancing the billing efficiency and collection efficiency resulting to reduction of gap between ACS and ARR.
- Metering of distribution infrastructure shall also assist in assessing the infrastructure loading and implementing interventions for load optimisation for enhanced quality and reliability of supply.

Infrastructure works for loss reduction

The summary of interventions and initiatives proposed for infrastructure works for loss reduction are discussed as below.

Summary of work

The key works proposed to be undertaken by Department of Power, Arunachal Pradesh for reduction of losses shall include as tabulated below.

Table 3 Proposed Work-Loss Reduction

S. No.	Description (Loss-Reduction)	Units	Quantity	Amount
				(In Lakhs)
1	IT/OT	Job	1	3530.00
2	HVDS (Construction of 11 kV line in the lengthy LT Overhead Line areas)			
a	11 KV Line	Ckm	2474.39	35205.67
b	Distribution Transformer	Nos	2108.00	23352.92
c	LT Line	km	843.20	14104.65
3	<u>Feeder Bifurcation (Replacement of 33/0.415 KV infra with 11/0.415 KV Infra)</u>			
a	11 KV Line	Ckm	468.45	6516.14
b	Distribution Transformer	Nos	520.00	7174.93
c	LT Line	km	213.20	3565.56
4	<u>11 KV infra for Downlinking with 33/11 KV Sub-station under Comprehensive Scheme by PGCIL</u>			
a	11 KV Line	Ckm	583.88	8121.77
5	Cabling Works	Km.	13007.91	46309.98
	Total (Loss Reduction)-			147881.62

Envisaged impact on Distribution performance

The proposed works shall assist in

- Accurate energy accounting of all categories of consumers.
- Improve HT:LT ratio to reduce technical and commercial losses.
- Enhance system reliability for improved quality of supply.

Infrastructure works for system modernization

The key works proposed to be undertaken by Department of Power, Arunachal Pradesh for system modernization shall include the following.

Summary of work

The key works proposed to be undertaken by Department of Power, Arunachal Pradesh for system modernization shall include as tabulated below.

Table 4 Proposed Work-Modernization

S. No.	Particulars (Modernization)	Units	Quantity	Amount (In Lakhs)
1	New Power Substation	Nos.	37.00	34336.82
2	Augmentation of Power Substation	Nos.	58.00	14761.02
3	33 KV New Line (Ckm)	Ckm	2018.30	48852.24
4	Augmentation of 33 KV Line	Ckm	863.50	10172.20
5	Augmentation of 11KV Line	Ckm	2661.70	17752.77
	Total			125875.05

Envisaged impact on distribution performance

- The proposed works shall assist in enhancing the system availability and reliability.
- Augmentation of Sub-station will reduce the load on existing PTRs by capacity enhancement of PTRs. This will further help in reducing the PTR failure rate and further help in SAIFI improvement.

Help in maintaining the voltage regulation and reducing the overloading on existing network.

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7.4.3 Result Evaluation Framework

Based on the identified set of Reforms, Department of Power, Arunachal Pradesh has identified a set of Result Parameters which shall form the basis of Result Evaluation Matrix against which annual performance of Department of Power, Arunachal Pradesh may be assessed for allocation of funds under the scheme.

The proposed result evaluation framework for Department of Power, Arunachal Pradesh is presented as below.

Table 5 Result Evaluation Framework

S.No	Result Parameter	Units	Maximum Marks	Base Year	Baseline Values	Targets				Remarks
						FY2022	FY2023	FY2024	FY2025	
A	Financial Stability (60% weightage)									
1	ACS-ARR Gap (revenue on cash basis & subsidy received basis excluding regulatory income & UDAY grants)	Rs./ kWh	30	FY-21 [FY-20]	0.12 [0.00]	0.27	0.00	0.00	0.00	
2	AT&C Loss	%	30	FY-21 [FY-20]	52.21% [40.09%]	50.49%	46.02%	38.89%	26.36%	
3	No. of creditor days	Days receivable	10	FY-21 [FY-20]	60 [79]	60	50	40	30	Not a corporate body.
4	No. of debtor days		10	FY-21 [FY-20]	511 [439]	500	300	150	50	
5	Progress in putting Govt. Offices on smart prepaid meters [Target: 3483 Nos.]	%	10	FY-21	0.00%	0%	100%	-	-	
6	Outstanding/ Overdue Government Dues	Rs. Crore	5	FY-21	18.14	18.14	0	0	0	

S.No	Result Parameter	Units	Maximum Marks	Base Year	Baseline Values	Targets				Remarks
						FY2022	FY2023	FY2024	FY2025	
7	Automatic pass through of fuel adjustment charge (FAC)	Yes/No	5	fY-21	No	No	Yes	Yes	Yes	
	Sub Total		100							
B	Outcomes of Infra works (20% weightage)									
1	Hours of supply (Rural)	Avg. Hours/Day	20	FY-21	16.98	16.98	18.00	21.00	22.00	
2	Hours of supply (Urban)	Avg. Hours/Day	15	FY-21	19.38	19.38	21.5	22.5	23.5	
3	SAIFI (Rural)	Nos/Year	15	FY-21	109	109	70	50	30	
4	SAIFI (Urban)	Nos/Year	10	FY-21	136	136	100	60	30	
5	% Age of Energy accounting being published [Target: 453 Nos.]	%	15	FY-21	39.96%	39.96%	100%	100%	100%	
6	DT Failure Rate	%	10	FY-21	4.32%	4.32%	3.50%	3.00%	2.75%	
7	Data availability in the National Feeder Monitoring System / NPP [Target: 453 Nos.]	%	15	FY-21	39.96%	39.96%	100%	100%	100%	
	Sub Total		100							
C	Infrastructure Works (10% weightage)									
1	Metering									

S.No	Result Parameter	Units	Maximum Marks	Base Year	Baseline Values	Targets				Remarks
						FY2022	FY2023	FY2024	FY2025	
a	Consumer Smart Prepaid/ Simple Prepaid Metering [Target: 2,87,446 nos.]	%	15	FY-21	0%	0%	20%	80%	100%	
b	Smart DT Metering [Target: 10,116 nos.]	%	15	FY-21	0%	0%	50%	100%	100%	
c	Smart Feeder Metering [Target: 688 nos.]	%	10	FY-21	0%	0%	50%	100%	100%	
2	Construction of 11 KV line in the Lengthy LT Overhead Line Areas [Target: HT Line: 2474.39 Ckm, DTR: 2108 Nos., LT Line: 843.20 Km]	%	15	FY-21	0%	0%	20%	60%	100%	
3	Replacement of 33/0.415 KV infra with 11/0.415 KV Infra [Target: HT Line: 468.45 Ckm, DTR: 520 Nos., LT Line: 213.20 Km]	%	15	FY-22	0%	0%	20%	60%	100%	
4	11 KV infra for Downlinking with 33/11 KV Sub-station under Comprehensive Scheme by PGCIL [Target: 583.88 Ckm]	%	15	FY-23	0%	0%	20%	60%	100%	
5	Cabling Works [Target: In Natural Disaster Prone area: 329.08 Km, Reconductoring Works: 37702.45 Km, Service cable for the Consumer: 8278.44 Km]	%	15	FY-24	0%	0%	20%	60%	100%	
	Sub Total		100							
D	Policy and Structural Reforms (10% weightage)									

S.No	Result Parameter	Units	Maximum Marks	Base Year	Baseline Values	Targets				Remarks
						FY2022	FY2023	FY2024	FY2025	
1	Training of Discom Officials (achievement as against targets set out annually as per board approved training policy)	Man-days	10	FY-21	0	10	20	30	40	
2	Existence of minimum 3-Tier Consumer Grievance Redressal Forum	no. of tiers	15	FY-21		100%	100%	100%	100%	
3	Alignment to Rights of Consumer rules 2020 8 Key parameters: 1) Release of Connections 2) Testing of Meters 3) Replacement of Meters 4) Issuance of no dues Certificates 5) Provision for payment of claims on deviation from SoPs 6) Assessment of Rooftop Solar Feasibility 7) Connection of rooftop solar after installation 8) Regulations for ensuring predetermined demand charges for up to 150kW	no. of parameters	25	FY-21	0 parameters	0 parameters	2 parameters	4 parameters	8 parameters	
4	Non-manual meter reading [Target: 287446 Nos.]	%	15	FY-21	8.35%	8.35%	65%	83%	100%	
5	Digital Payment (Target: [287446 Nos.]	%	15	FY-21	8.35%	8.35%	65%	83%	100%	
6	Meter Energy Sales	%	10	FY-21	54.96%	60.00%	70%	80%	100%	

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S.No	Result Parameter	Units	Maximum Marks	Base Year	Baseline Values	Targets				Remarks
						FY2022	FY2023	FY2024	FY2025	
7	Setting up of Energy Management Cell including enabling demand forecasting and scheduling tools.	Yes/No	10	FY-21	No	No	Yes	Yes	Yes	
	Sub Total		100							

7.4.4 Action plan II:

The milestones and outlay proposed under the RDSS scheme for Department of Power, Arunachal Pradesh are summarised as below:

Metering Works

Table 6 Target-Metering works

S. No.	Description (Metering)	Units	Quantity	Amount (In Cr.)
1	Consumer Metering	Nos.	287446	172.47
2	DT Metering	Nos.	10116	23.27
3	Feeder Metering	Nos.	579	2.43
4	Boundary Metering	Nos.	109	0.46
	Total		298250	198.62

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Distribution infrastructure work for loss reduction

Table 7 Target-Loss Reduction

S. No.	Description (Loss-Reduction)	Units	Quantity	Amount
				(In Lakhs)
1	IT/OT	Job	1	3530.00
2	HVDS (Construction of 11 kV line in the lengthy LT Overhead Line areas)			
a	11 KV Line	Ckm	2474.39	35205.67
b	Distribution Transformer	Nos	2108.00	23352.92
c	LT Line	km	843.20	14104.65
3	<u>Feeder Bifurcation (Replacement of 33/0.415 KV infra with 11/0.415 KV Infra)</u>			
a	11 KV Line	Ckm	468.45	6516.14
b	Distribution Transformer	Nos	520.00	7174.93
c	LT Line	km	213.20	3565.56
4	<u>11 KV infra for Downlinking with 33/11 KV Sub-station under Comprehensive Scheme by PGCIL</u>			
a	11 KV Line	Ckm	583.88	8121.77
5	Cabling Works	Km.	13007.91	46309.98
	Total (Loss Reduction)-			147881.62

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Distribution infrastructure work for system modernisation*Table 8 Target-Modernization*

S. No.	Particulars (Modernization)	Units	Quantity	Amount (In Lakhs)
1	New Power Substation	Nos.	37.00	34336.82
2	Augmentation of Power Substation	Nos.	58.00	14761.02
3	33 KV New Line	Ckm	2018.30	48852.24
4	Augmentation of 33 KV Line	Ckm	863.50	10172.20
5	Augmentation of 11KV Line	Ckm	2661.70	17752.77
	Total			125875.05

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7.5 Critical analysis by Energy Auditor

- i. Stress given to identify the gaps on accounting of the AT&C loss including T&D loss & billing efficiency. For improving billing efficiency an AI-based app that can autofill units consumed in discom bills. Bills are generated based on images captured by meter readers, so no manual overriding is possible. Though APDOP started the same.
- ii. Engagement of collection-based distribution franchisee in rural areas will improve efficiency. Collection-based distribution franchisee model will create rapid improvements in metering, billing, collection, and a reduction in AT & C loss. Simultaneously reduction of administrative overheads, and regularization of unauthorized connections as well.
- iii. Launching performance-based incentive schemes to reward employees for actions taken to maintain or reduce AT&C losses and ACS-ARR gap. Accountability for loss monitoring resides with dedicated substation and feeder-level managers. They have to regularly monitor MIS reports and have to institutionalized the following actions to ensure that there are no revenue leakages:
 - Investigating frequent zero and average billed connections through onsite visits, phone calls and notices
 - Removing service lines from permanently disconnected consumers to prevent misuse
 - Bringing all newly energized connections under the billing cycles
 - Identifying and investigating high loss and low consumption connections
- iv. All consumers are not shifted to smart meters yet. AMR System should be implemented for each incoming & outgoing feeder of every Sub-station with particular emphasis to Bulk Load Consumers. Technical loss at consumer end meters can be avoided if the following points are checked at regular interval for bulk load consumer
 - Poor accuracy of meters,
 - Large error in capital CTs / PTs,
 - Voltage drops in PT cables,
 - Loose connection in PT wire terminations,

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- Overburdened CT,
 - Incorrect multiplying factor,
 - Software bugs
- v. For DTR Metering AMR System should be implemented for detection of overload, unbalance load by DTR level smart meter.
- vi. Increase in HT/LT ratio – It is well known that for high HT/ LT ratio, the losses will be lesser. The losses for a given quantum of power supplied by a line are inversely proportional to the square of its operating voltage. Higher the operating voltage, lower will be the line losses. Therefore, by increasing the HT lines the losses will be reduced.
- vii. Connected load data acquisition process have to be completed asap to collect good amount fixed charges based on load. Besides, Connected load vs billing energy assessment need to be done and accordingly the load may be reassessed to increase fixed charges amount in billing
- viii. Loss Figures should be ascertained with actual Load Flow Study.
- ix. Calibration of all types of Meters should be done periodically.
- x. For ascertaining Sub-Division level losses proper accounting to be done.
- xi. To reduce technical loss, each & every Sub-Station should be in the Load Centre.
- xii. DISCOM should encourage industrial loads to shift to HT connection to reduce technical loss for distribution
- xiii. DISCOM may adapt special tamper proof paper seal for low and medium voltage service installation to detect pilferage at consumer service box
- xiv. It is suggested to replace rewirable fuse cut-outs at the service termination with MCB/MCCB inside an enclosure with special type of seals to prevent unauthorised access to service parts

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- xv. It is suggested to install specially designed anti-theft pillar box in pilfer prone pockets. Anti-theft pillar box comprises of door locking arrangement with insulated bus bar inside.
- xvi. Consumer awareness is required to reduce commercial loss by Media, Camp & Leaflets etc. Partnering with post offices and gram panchayats and deploying dedicated agents to improve rural collections may help discom with large rural territories to improve their collection efficiency. To educate consumers about electricity usage can shifts in consumer behaviour.
- xvii. Simplification and integration of payment method like use of digital channels (web, mobile apps, etc.) for billing and payments to improve collection efficiency.
- xviii. DISCOM need to create a centralized energy accounting and audit cell with adequately qualified personnel. Special Team comprising finance, technical & HR officials from Head Quarter to be deployed for surprise visit to the consumer's premises to reduce commercial loss. The team constantly should change its action plan with regard to mode, manner and timing of anti-pilferage activities. High end commercial & industrial consumer should be monitored by IT based system. IT based system should comprise of loss reduction cell information management, criminal case information management, inspection cum disconnection reporting, consumer information system database.
- xix. To reduce commercial loss HVDS (High Voltage Distribution System), AB Cable (Aerial Bunched Cable), should be used for power distribution purposes. Besides, in order to combat high loss/pilferage prone areas, co-axial cable may be used because of its inherent construction which will result in cable fault alarm if such attempts are made the pilferers.
- xx. Use of booster auto transformer in remote areas to control load voltage. In remote areas, the voltage available across load often fluctuates due to drop in feeder lines. Therefore, to compensate this fluctuation and keeping load voltage within permissible limits, booster auto transformers with feedback controller are to be used in load centre.

- xxi. To reduce technical loss & also to enhance reliability of power supply, UG Cables should be used in Urban Areas. Network Re-configuration, bifurcating feeders based on loading, re-routing feeders and replacing conductors to reduce technical losses.
- xxii. Segregation of loads at DTR level for different consumer categories like residential, agriculture etc will ease of monitoring and planning for loss minimization
- xxiii. Operational efficiencies of discom will be improved through smart metering and upgradation of the distribution infrastructure, including the segregation of agriculture feeders and strengthening the system.
- xxiv. Standard operating procedure to be developed and maintained by the DISCOM in each administrative and operation level for energy accounting, billing, collection, monitoring etc.

7.6 Inclusions & Exclusions

No inclusions & exclusions are made in this report

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*7.7 Detailed format to be annexed***8. NOTES OF THE EA/EM ALONG WITH QUERIES AND REPLIES TO DATA GAPS**

Sr. No.	Notes/queries by Energy Auditor	Replies from DISCOM
a	energy meter reading at 33/11kV level not available for all cases although the energy meter is available	Only 28% feeder metering is available, CT/PT are defective in some cases also
b	Energy data for feeder level at different voltage level not available	no such mechanism practiced yet. Although, DISCOM will start taking initiative to resolve that
c	Division wise standard operating procedure for energy accounting not available	no such mechanism practiced yet. Although, DISCOM will start taking initiative to resolve that
d	input energy at sub-division level is estimated rather metered	Absence of boundary meter at all sub-division level
e	Energy Accounting Data including SLDC ABT Meter Data available	Yes
f	Any private franchisee	No
g	Billing/ invoice available for purchased energy	Yes
h	Availability of computation data of agriculture consumption (approved by SERC)?	No
i	Availability of distribution electrical SLD division/sub-division wise	No
j	Availability of quarterly energy accounting report	Yes
k	Availability of any status report of defective metering CT & PT	no
L	No boundary meter is available. Then how the DISCOM calculate the division wise energy input	Division wise input energy data is not a measured data. Rather it is estimated by the DISCOM for their energy accounting keeping in mind the total net input energy to the DISCOM boundary is matched

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9. ANNEXURES

9.1 Introduction of Verification Firm

M/s EnCure Energy, Kolkata – 700030 is an “Energy Management Service & Solution” provider under the domain of a single umbrella. M/s EnCure Energy is a MSME organization. Udyam Regd. No. UDYAM-WB-14-0018632 and consisting of highly qualified and experienced technocrats, with deep understanding of energy efficiency & management to combat of climate change. Expertise with versatile domain knowledge is our DNA which helps us to deliver customized solutions on guarantee basis to our customers to optimize energy cost.

Our Domain

Audits

- ❖ Energy Audit, Water Balance Audit, Fire Safety Audit, Electrical Safety Audit, Hazop study, Earthing system audit, Compressed Air Audit, Power Quality & Harmonics Audit

Consultancy

- ❖ Energy Management advisory services, Carbon Footprint, Fuel switching, net zero, Renewable energy, Green Building [new & existing], Plant performance & reliability improvement, Solar PV Installation & Engineering

Project Engineering/Technical Solutions

- ❖ Implementation of energy saving measures on guarantee basis, IOT based energy monitoring system, Process Automation, Online leak sealing for high pressure steam & water line, Shutdown Overhauling, critical troubleshooting

Industry served:

- | | |
|-----------------------------------|-------------------------|
| • Thermal Power Plant (coal, Gas) | • Edible oil processing |
| • DISCOM | • Rice Mill |
| • Chemical/petrochemical | • Coke Oven Plant |
| • Commercial Buildings | • Ceramic |
| • Pulp & Paper | • Cement |
| • Iron & Steel | • Fertilizer |

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- Pharmaceuticals
- Dairy
- Leather processing
- Carbon Plant

9.2 Minutes of meeting with DISCOM team

Minutes of meeting between Dept. of Power (Govt. of Arunachal Pradesh) and EnCure Energy

Name of Work: Energy Audit (Accounting) for DISCOM for 2022-23

Date of MOM: 04.11.2023

Member's Involved:

Dept. of Power (Govt. of Arunachal Pradesh)

Mr. Made Nalo, SE (Com), Energy Manager

Mr. Zomba Nasho, EE (com)

Mr. Rajesh Sharma, JE (Com)

Mr. Minli Rumi, JE (Com)

EnCure Energy

Mr. Prodip Golder-AEA (BEE)

Mr. Somnath Sarkar-CEM, CMVP

Mr. Anirban Hazra- Sr. Manager

Following have been discussed and agreed upon:

1. Energy Audit (Accounting) at DISCOM of Dept. of Power (Govt. of Arunachal Pradesh) has been conducted at Vidyut Bhawan, Itanagar, Arunachal Pradesh where data verification and discussion happened with above mentioned personnel of Dept. of Power (Arunachal Pradesh)
2. Stress was given to identify the gap on accounting of the AT&C loss including T&D loss & collection efficiency
3. Audit team visited the energy injection points and sub-station on sample b and talked to SLDC & transmission department engineers to understand the process of energy accounting and record keeping
4. Audit team also visited divisional offices and had a joint meeting with technical & commercial officials to understand the approach followed by the DISCOM for energy accounting and record keeping.
5. Audit team checked the energy bills paid to power supplier to verify the energy input data at DISCOM boundary. Apart from DHPD, all other supplier submit invoice against each payment.

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6. Lot of gaps on data acquisition for energy input & sale at different voltage levels at DISCOM boundary was found as the DISCOM follows their own system of data acquisition which do not match with the format as set by BEE for accounting purpose
7. DT wise and feeder wise consumer data at each voltage level is not being recorded
8. Connected load at consumer level is not being recorded
9. DISCOM will submit the pending documents to the Audit team within 15 days and after review and verification of the same the audit team will submit the report.

9.3 Check List prepared by auditing Firm

parameters	List of documents
Energy Purchased	Energy Bills
State Generation	SLDC, REA
Energy exported/sale	Sale invoice, export meter reading
Infrastructure details	audit report, asset registrar, monthly planning & status report
Consumer details	MIS, software report
Energy Billed	MIS, software report
Collection	MIS, software report
Energy accounting	quarterly accounting sheet

9.4 Brief Approach, Scope & Methodology for audit

Followings are approach & methodology for the annual energy audit.

- i. Organized a kick off meeting at DISCOM office premises with energy accounting cell to understand Transmission & Distribution system from EHT network to LT network.
- ii. Visited 132kV substation, 33kV/11kV distribution station, outdoor DTR, Pole Mounted DTR, LT feeder Pillar Box randomly.
- iii. Understanding of all energy input points at different voltage level & energy metering or energy accounting & monitoring facilities with conventional metering, smart metering & prepaid metering system within the DISCOM boundary areas.
- iv. Understanding of energy flow between transmission and 33kV/11kV incoming distribution feeders, energy flow between 33kV outgoing and 11kV incoming feeders, energy flow between distribution transformer or high voltage distribution system to end-consumer including radial or ring main system, energy flow between Feeder to end-consumer & energy flow between 132kV/33kV/11kV directly to consumer.

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- v. Collection of data on energy received, sold, billed, Distribution losses, AT & C losses & collection efficiency for FY 2022-23 and verified these data with appropriate sources
- vi. Verification of the accuracy of the data collected in consultation with the energy as per standard practices.
- vii. Understanding of AT & C loss reduction measures taken by the DISCOM during last few years & potential scope for further loss reduction.

9.5 Infrastructure Details

9.6 Electrical Distribution System

No such electrical distribution system is available with DISCOM

9.7 Power Purchase Details

Name of Project/Station	Unit	Total
RHEP (NEEPCO)	MU	88.87
Free Energy (Received)	MU	164.12
LOKTAK (NHPC)	MU	23.21
KHANDONG (NEEPCO)	MU	0.00
KOPILI-I (NEEPCO)	MU	0.00
KOPILI-II (NEEPCO)	MU	0.00
DOYANG (NEEPCO)	MU	11.71
PARE (NEEPCO)	MU	30.74
Free Energy (Received)	MU	67.82
KAMENG (NEEPCO)	MU	53.18
Free Energy (Received)	MU	344.87
AGBPP (NEEPCO)	MU	96.55
AGTCCPP (NEEPCO)	MU	60.20
BgTPP (NTPC)	MU	157.22
ONGC TPCL (Palatana)	MU	142.92
FARAKKA (NTPC) Seller Per.	MU	20.04
KAHALGAON (NTPC) Seller Per.	MU	10.66
TALCHAR (NTPC) Seller Per.	MU	14.20
Banking Receipt	MU	66.05
Energy Import (IEX)	MU	6.15
Deviation Import	MU	39.37

9.8 Line Diagram (SLD)

SLD is not available with the DISCOM

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9.9 Category of service details (With Consumer and voltage-wise)**9.10 Detailed Formats to be annexed**

Refer to Chapter No. 7.7

9.11 List of documents verified with each parameter

parameters	documents verified
Energy Purchased	Energy Bills
State Generation	ABT meter reading, REA data, generator report
Energy exported/sale	Sale invoice, export meter reading
Infrastrure details	Internal documents, registrar
Consumer details	portal
Energy Billed	portal
Collection	portal
Energy accounting	quarterly accounting sheet
Energy injection in different voltage level	Not verified in absence of authentic data source

9.12 Brief Description of Unit

Arunachal Pradesh Department of Power (Department of Power, Arunachal Pradesh) is a deemed licensee in terms of Section 14 of the Electricity Act, 2003. It being an integrated utility is responsible for transmission and distribution of electricity in the State of Arunachal Pradesh and for trading of electricity. It is responsible for power supply in the State of Arunachal Pradesh.

The Department of Power also implements various Power Projects sanctioned and sponsored by the State and Central Governments. Hydro Power and Non-Conventional Energy activities, under the domain of this department, are independently functioning in the names of: Department of Hydro Power Development (DHPD) and Arunachal Pradesh Energy Development Agency (APEDA).

In the state of Arunachal Pradesh, there is a population density of 17 person per sq.km., in comparison with National average i.e., 464 persons per sq.km with migrating and shifting population. In that type of Geographical tough terrain, The Govt. of India has been assisting the state DISCOMs/ Department of Power through various schemes to strengthen the infrastructure and make them operationally efficient and financially viable. Significant improvements have been witnessed in power distribution sector with the implementation of DDUGJY and IPDS schemes wherein the distribution infrastructure has been upgraded in rural

and urban areas respectively. Likewise, with the success of SAUBHAGYA scheme, massive universal household (HH) electrification has been achieved within a record timeframe.

As such, despite the above reforms, the Average AT&C losses and the consequent ACS-ARR gap continue to be high and the crucial objective of 24x7 power supply is not fully achieved. It is with this aim and the Government of India's commitment for providing 24x7 uninterrupted, quality, reliable and affordable power supply, that the Revamped Reforms Based and Results Linked Distribution Sector Scheme has been formulated by Ministry of Power for supporting DISCOMs/ Department of Power to undertake reforms and improve performance in a time bound manner. The prime objectives of the scheme are to bring down (i) AT&C Losses to 12-15% by 2024-25 and (ii) ACS-ARR gap to zero by 2024-25.

To reduce the energy losses in the state, it has taken several initiatives like:

- Installed 24,013 pre-paid energy meters at consumer's premises of Itanagar and Naharlagun towns in the State Capital Complex.
- The revenue collection of these two towns through pre-paid energy meter is very encouraging.
- Smart Pre-Paid meters to be included in the RDSS in the available network areas and simple pre-paid meters in the no network areas.
- With the support of GOI, online energy billing enabled in 9 R-APDRP towns and online billing shall also be activated soon in 16 more towns under IPDS Phase-II.

9.13 List of Parameters arrived through calculation or formulae with list of documents as source of data

parameters calculated	Source documents verified
Transmission Loss	ABT meter reading (import & export), SLDC report
T&D Loss	ABT meter reading, energy bills, MIS data
Collection efficiency	MIS data
ACS-ARR gap	uday website

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10. CERTIFICATION

This part shall indicate certification by ACCREDITED ENERGY AUDITOR (AEA) stating that:

- i. The data collection has been carried out diligently and truthfully
- ii. All reasonable professional skill and due diligence had been taken in preparing the energy audit report and content thereof are a true representation of the facts
- iii. Adequate training provided to personnel involved in daily operations after implementation of recommendations and
- i. The energy audit has been carried out in accordance with the Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit (Accounting) in Electricity Distribution Companies) Regulations, 2021, published vide notification No.18/1/BEE/DISCOM/2021, dated the 15th April, 2021 in the Gazette of India, Extraordinary, Part III, Section 4, as required under sub-section (1) of section 58 of the Energy Conservation Act, 2001 (52 of 2001)

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Signature:

Seals:

