ANNUAL ENERGY AUDIT REPORT
OF TP NORTHERN ODISHA DISTRIBUTION LIMITED
(TPNODL)
[DC Registration No.-DIS0038OD]

Submitted to:

TP NORTHERN ODISHA DISTRIBUTION LIMITED

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Submitted by:

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ACKNOWLEDGEMENT

Power Tech Consultants (PTC) places on record its sincere thanks to management of TP Northern Odisha Distribution Limited (TPNODL) for entrusting the task of conducting Energy Audit of TPNODL.

PTC acknowledges with gratitude the wholehearted support and co-operation extended by Mr. Bhaskar Sarkar, CEO, TPNODL; Mr. Dushyant Kr. Tyagi (Chief of Operation), Mr. Manish Kriplani (HoG EA), Mrs. Malancha Ghose, AGM (Elect.); Mr. Amit Kumar (HoG OT), Mr. Pravakar Sahoo (Mgr. Finance), Mr. Sumit Parasar and Operation & Project Department while carrying out the study at TPNODL.

PTC sincerely thanks to all the officials and staff members of TPNODL who have rendered their all possible cooperation and assistance to the study team during the entire period of the Audit.

M/s. Power Tech Consultants
(Bibhu Charan Swain)
Authorised Signatory

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POWER TECH CONSULTANTS

AUDIT TEAM DETAILS

1. Mr. Bibhu Charan Swain, Sr. Consultant & Accredited Energy Auditor, Regd. No. –AEA-0121
2. Mr. Subhranshu Sekhar Rath, General Manager
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4. Mr. Nirjhar Biswal, (Asst. Manager Project)
5. Mr. Suraj Kumar Bhujabala, (Asst. Manager Project)
6. Mr. Subhash Mallick, (Project Associate)
7. Mr. Suman Sourav Nayak, (Project Associate)

CERTIFICATE

We certify the following

- The data collection has been carried out diligently and truthfully.
- All data measuring devices used by the auditor are in good working condition, have been calibrated and have valid certificates from the authorized approved agencies and tampering of such devices has not occurred.
- All reasonable professional skill, care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts.
- Adequate training provided to personnel involved in daily operations for implementation of recommendations.
- The energy audit has been carried out in accordance with the BEE (Manner and Intervals for Conduct of Energy Audit in electricity distribution companies) Regulations, 2021.

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POWER TECH CONSULTANTS

EXECUTIVE SUMMARY

TP Northern Odisha Distribution Limited (TPNODL) is a joint venture of Tata Power (51%) and Govt of Odisha (49%) on the Public-Private Partnership (PPP) model. TPNODL licensed area is spread over a geography of 27857 Sq.Km and serves a registered consumer base of 2.008 million. TPNODL has been carrying out the business of distribution and Retail Supply Licensee. TPNODL has been carrying out the business of distribution and retail supply of electricity in the 5 districts of Odisha namely, Balasore, Bhadrak, Jajpur, Keonjhar and Mayurbhanj. The Company is operating through 5 Circles, 16 Divisions, 50 Subdivisions, 159 Sections with a Corporate Office based at Balasore. The business of TPNODL utility is governed by the provisions of license issued by Hon'ble Odisha Electricity Regulatory Commission (OERC) for business of distribution and retail supply of electricity in North Odisha.

It receives electrical power at a sub transmission voltage of 33KV from OPTCL 220/132/33 kV Grid Substations and then distributes the power at 33KV / 11KV / 440V / 230V depending on the demand of the consumers. TPNODL receives electrical power at 33kV level from 26 numbers of Grid Sub stations (GSS) out of which 3 nos. TS are rated at 220/33kV, and 23 nos. at 132/33kV located within and in the vicinity of TPNODL operational area.

TPNODL has taken many steps for improving its supply network like commissioning of new 33/11kV S/s, replacing bare conductors by A-B cable, upgradation of power transformers, uprating of 33kV conductors, installation of circuit breakers etc.

Fact sheet of TPNODL:

Supply Area	27857 Sq. kms.
Maximum Demand	774.978 MVA
Power Transformer Installed Capacity	2457 MVA
No. of distribution Substations	70429
Distribution Transformer (DT) **Installed Capacity**	2584 MVA
HT Mains-33 kV	2868 K.M
HT Mains-11 kV	37069 K.M
LT Mains	66300 K.M
No of 33 kV Feeders	91
No of 11 kV Feeders	720
No of 33/11 kV Sub Station	215
No of Power Transformer	488

The Energy and Performance Fact Sheet of TPNODL for the last 2 financial years is furnished below.

PARTICULARS	FY 19-20	FY 20-21
Total Sale (MU)	4722.178	3921.633
T & D Loss (%)	13.19%	20.63%
Billing Efficiency (%)	86.81%	79.37%
Billing To Consumers (Rs. in Crs.)	2535.72	2125.49
Collection Received (Rs. in Crs.)	2190.31	2003.99
Collection Efficiency (%)	86.38%	89.58%
AT& C Loss (%)	25.01%	25.17%

ENERGY CONSERVATION MEASURES:

DETAILS OF ENERGY CONSERVATION MEASURES RECOMMENDED IN THE ENERGY AUDIT REPORT [2022-23]							
Sl. No.	**Energy Saving Measures**	**Investment (In crores)**	**Targeted Annual Energy Savings in MU**	**Targeted Financial Savings in Rupees Crore**	**Payback Period**	**Date of Completion of measure / likely completion**	**Remarks**
A	**Establishment of Meter Testing Lab**	**2.17**					
B	**Loss Reduction**						
	Equipment for Meter data downloading	0.16					
	AMR enabled equipment	1.37					
	Conversion of LT Bare conductor to AB Cable	13.1					
	Field Testing equipment - Metering and enforcement	1.76					
	Total (B)	**16.39**	112.07	40.23	4.91	FY 2022-23	As per the annual reduction in T&D loss target of Hon'ble OERC and detailed note attached
C	**Network Reliability**						
	33 KV Network refurbishment & AB switch	22.96					
	Refurbishment of 33KV/11KV Primary Substation (PSS)	16.29					
	11 KV Network refurbishment & AB switch	26.13					

	Refurbishment of 11KV/0.415 KV Dsitribution Substation (DSS)	8.9					
	Installation of LV protection at DSS	6.49					
	Installation of Auto reclosure /Sectionalizers,RMUs, & FPIs	5.07					
	Trolley Mounted Pad Substations	1.15					
	Testing equipment for PSS	4.9					
	Earthing of Power Transformers and Distribution Transformers	0.81					
	33KV & 11 KV Lightning Arrestor	1.65					
	Total (C)	**94.35**					
D	**Load Growth**						
	Augmentation from 5 MVA to 8 MVA Power Transformer	8.7					
	Augmentation from 200/250 to 315 KVA Distribution Transformer	5.19					
	Augmentation 63/25 to 100 KVA Distribution Transformer	4.08					
	Addition of 11 kV Overhead Line	1.68					
	Addition of 33 kV Overhead Line	2.06					
	Total (D)	**21.71**					
E	**Technology & Civil Infrastructure**						
	Data Center (DC) Development Cost	5.39					
	IT Infrastructure Hardware Cost	5.31					
	End user Devices i.e. Laptop, desktop, Printer, scanner	16.02					
	Software Licenses	15					
	Communication Network Infrastructure	4.98					

	at DC and office locations						
	Mini SCADA Implementation (20 nos ODSSP & 10 nos Old PSS)	2.55					
	GIS Implementation for One Division	3					
	Smart Metering Infrastructure (HES & MDM on 4G/ NBIOT Communication)	10.5					
	Total (E)	**62.75**					
Grand Total		**197.37**	**112.07**	**40.23**	**4.91**		

CALCULATION OF PAYBACK PERIOD:

Approved sale of TPNODL as approved by commission FY 202-23= 4915.30

Calculated T&D Loss of TPNODL for FY 2020-21= 20.63%

Target T&D Loss as approved by Hon'ble OERC for FY 2020-21=18.35%

Hence Targeted Annual Energy Savings in MU = 4915.30*(20.63%-18.35%) = 112.37 MU

Approved Bulk Supply Price of GRIDCO for FY 2022-23= Rs.3.31 per Unit

Approved Transmission Tariff of OPTCL for fy 2022-23= Rs.0.28 per Unit

Hence financial saving of TPNODL due to T&D loss reduction= (3.31-0.28)*112.07/10=40.23 Cr.Rs.

Total investment approved by Hon'ble OERC for T&D Loss=197.37 Cr. Rs.

Simple Payback period = TOTAL INVESTMENT / SAVINGS = 197.37/40.23=4.91 Years

The present annual energy audit is conducted in compliance with BEE (Manner and Intervals for Conduct of Energy Audit in electricity distribution companies), Regulations 2021 by Power Tech Consultants.

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2.0 SUMMARY OF CRITICAL ANALYSIS AND MAJOR OBSERVATIONS AND RECOMMENDATION

The observations and critical comments with regards of the energy data as furnished in the Pro-forma by TPNODL is furnished as under.

1. There are around 2208 nos. conventionally metered Distribution Transformers (DTR) are reported in Cell F-17 of "Infrastructure Details" sheet of the Pro-forma, however during field audit and study it was found that the meter readings are not taken and meters are not communicating as far as DTR metering are concerned. It is recommended that DTR metering should be made functional and meter reading should be taken on Regular basis.

2. The 11/0.415 kV DTRs is considered under LT system as per the current practice followed by TPNODL.

3. The Cell F-10, F-11 and F-15 of "Infrastructure Details" sheet of the Pro-forma the numbers of meters are verified with the Performance report as submitted by TPNODL to OERC, however same is not matching with category wise metering status report as submitted in the MIS of TPNODL. It is recommended that category wise metering and un-metering status should be made available in electronic mode / Software application mode. in future for proper verification.

4. In Cell D-25-26-27 of the "Infrastructure Details" sheet of the Pro-forma in the line length of AB cable, there should be provision for separate entry for line length of AB cable, Underground Cable, 66kV, 33kV. TPNODL may request BEE/SDA for necessary changes in the Pro-forma.

5. The Cell C-28 of "Infrastructure Details" sheet of the Pro-forma may be read and considered as Energy Purchase Particular. TPNODL may request BEE/SDA for necessary changes in the Pro-forma.

6. There is no separate segregation of input energy and sale to consumers at 33kV and 11kV levels as per the prevailing practice of TPNODL. However in Cell B-68 to B-79 of the "Infrastructure Details" sheet of the Pro-forma [Ref Row 4(ii) and 4(iii)], there is a requirement to fill the data of 11kV and 33kV voltage wise energy input and energy sale. TPNODL has clubbed both the 33kV and 11kV energy input and energy sale and provided the data in 11kV row. It is recommended that in future TPNODL is required to segregate the 11kV and 33kV input energy and energy sale.

7. In the Pro-Forma it is recommended that after Row-76 of "Infrastructure Details" sheet there has to be another row having provision to incorporate the energy supplied to 33/11 KV, 33/0.415 Substations.

8. In the Cell A:F-90 under the heading Energy Accounting Summary of "Infrastructure Details" sheet of the Pro-forma [Ref Row 5(ii) and 5(iii)], TPNODL has reported HT input by reverse calculating the difference of total sale and HT sale and assuming 8% loss in the HT system, which is not the correct approach. Since majority of the 33kV feeders are metered at GSS end and all the 33kV consumers are supplied with meters and majority of the outgoing 11KV feeders in the PSS are being metered, therefore TPNODL is in a position to capture the total input energy and energy sale at 33KV system. In view of the same it is recommended TPNODL should take a corrective approach to capture 33kV and 11kV input energy and energy sale as per the meter data and should not consider the normative approach of 8% distribution loss in HT systems.

9. During the field study it was observed that 33KV meters are installed at Grid Substation (GSS) interface points and at each consumer point. However 33kV meters are not installed at the input point to the 33/11 kV substation (PSS).

10. The energy generated from solar rooftops is being metered but the meter readings are properly captured by TPNODL in financial years 2020-21. Therefore, the Capacity Utilization Factor (CUF) of 19% has been considered to calculate the solar energy generated from the solar rooftop from each solar plant and accordingly injected energy has been derived.

11. Supporting documents in the Pro-forma Division wise losses sheet could not be verified.

12. In the Cell S-11 & S-12 of "Form input energy" sheet of the Pro-forma the remarks couldn't be entered as the cell is protected. TPNODL may request BEE/SDA for necessary changes in the Pro-forma.

13. In the Cell R-23-24 of "Form input energy" sheet of the Pro-forma the length of AB cable and length of underground cable may be considered as length of LT-AB cable and length of LT underground cable.

14. In cell no P-28 of "Form input energy" sheet of the pro-forma the (period from–- to --) may be considered as 1st April 2020-31st March 2021. TPNODL may request BEE/SDA for necessary changes in the Pro-forma.

15. In the cell D-29 of "Form input energy" sheet of the pro-forma, the voltage level unit should be in kV, instead of kVA. Again in Cell E-29 & F-29 "Form input energy" sheet of the pro forma the unit of division & subdivision (KVA) may be edited. TPNODL may request BEE/SDA for necessary changes in the Pro-forma.

16. Station consumption at OPTCL Grid Substation is considered as Export for adjustment purpose in the BSP Bill of GRIDCO and hence same are mentioned accordingly in the "Form input energy" sheet of the pro-forma.

17. In the sheet namely "Form-input energy" data are not matching with BST billing of GRIDCO and OERC performance report. Further reconciliation with TPNODL is required.

18. In the sheet namely "Details of Input Energy Sources" of the pro-forma,TPNODL informed that they have not received any energy from any Generators at Transmission Periphery rather they used to procure all the input energy from GRIDCO who procures from various generators. It is a fact that Odisha is having a single buyer model in which GRIDCO procures energy from all Generators and sells the energy to DISCOM for distribution to various consumers. However TPNODL has provided the list and details of CGP, IPP and all generating plants at Transmission level as well embedded generation in DISCOM areas but it could not provide the details such as Circle Load, Energy Received at Circle, DivisionIt is recommended that TPNODL may collects exact list of Generators and their details accordingly and accordingly may fill up the sheet namely "Details of Received Sources" in the pro-forma.

19. TPNODL informed that they have not completed 100% metering of the 11KV feeder and accordingly submitted the received energy at the 11kV feeders where they have installed the meter. Further TPNODL submitted that they have not installed meters at DTR and wherever the earlier meters were installed in DT level, the data were not captured in regular interval due to lack of metering, billing personnel and majority of meters are also not working at DTR level. TPNODL has also informed that the consumers are not properly mapped or indexed to each 11KV/33KV feeder. In view of the same TPNODL couldn't submit the data at Cell K-3 (Received at Feeder), Cell L-3(Feeder consumption), Cell M-3(Final net export at feeder level) in the "Details of Feeder Levels'' sheet of the Pro-forma due to which T&D loss and AT&C loss of feeder wise losses could not be computed.

The various loss reduction recommendations are furnished below.

1. It is recommended that TPNODL should pray before the Hon'ble Commission for tariff rationalisation measures to be adopted for HT / EHT Consumers so that HT / EHT Industries will be incentivised to procure power from DISCOM without depending much on Open Access. TPNODL may be required to incentivise the Industrial Consumption by taking up better tariff rationalisation measures in future tariff hearing process, as increase in HT / EHT consumption will help in reducing the T&D loss and AT & C loss.

2. It is found that the % of defective meters are more in consumer categories like Kutri Jyoti, Agro, Allied Agro, Agricultural, Street Lighting and Specified Public purpose. It is

recommended to give special emphasize on Kutri Jyoti, Agro, Allied Agro, Agricultural, Street Lighting and specified Public purpose category consumers for replacement of defective meters with correct one. In the next tariff hearing process TPNODL may propose to the Hon'ble Commission DBT based subsidy for these consumers in which the subsidy linked with the above category consumer can be transferred through Direct Benefit Transfer (DBT) Scheme based on the correct meter reading. In case the meter is tampered and found to be defective, then the transfer of subsidy may be stopped till the meter is replaced with the correct meter.

3. It is found that the state and central government are implementing a number of electrification projects in which meters are becoming defective and has stopped working after a few months of installations. Currently very few meter manufacturers have been approved by TPNODL. It is recommended that TPNODL should empanel a number of quality meter manufacturers from where the contractor should procure meters and install in Government sponsored projects and the meter manufacturers should issue guarantee certificate of each meter for a period of 5 years in favour of the local DISCOM where the project is being implemented so that in case of any defective meter is found by the DISCOM, then same can be replaced by the meter manufacturers directly. TPNODL should inform both State and Central Government implementing agencies regarding the % increase in defective meters happening in their sponsored scheme so that they can take appropriate remedial measures.

4. It is recommended that TPNODL should initiate dialogue with Urban Local Bodies and the Agricultural Department regarding higher % defective meters found in street lights and agricultural sectors. It is recommended that the TPNODL should involve Government Machinery and political people for awareness creation and to reduce meter tampering and theft of electricity. TPNODL should initiate dialogue with the Agricultural Department regarding higher % of agricultural connections having no meters and take early action for providing connections with meters. It is recommended that the TPNODL should involve the Government Machinery and Agricultural Department for awareness creation for metered power supply connection and to reduce meter tampering. It is proposed that the subsidy meant for Agriculture Category Consumer should be Aadhar linked and should be transferred through Direct Benefit Transfer (DBT) Scheme based on the correct meter reading. In case there is no meter or meter is tampered and found to be defective, then the transfer of electricity tariff subsidy as well as other Agriculture Subsidy of the Agriculture Department may be stopped till the defective meter is replaced with the correct meter.

5. It is proposed that TPNODL should promote Energy Efficient Lighting System (LED Bulbs, Tube lights and Energy Efficient Fans) in association with BEE / EESL / Private ESCO in its utility area. The availability of LED Bulbs, Tube Lights, BLDC Fans, IE3 Meters which are supposed to be distributed to consumers through BEE / EESL / Private ESCO as part of the Utility based Demand Side Management Program are not available in plenty. TPNODL may discuss with BEE / EESL / Private ESCO to open more outlets and increase the LED Lights, Super Efficient AC and Fans Distribution.

6. **Promoting the use of renewable energy (Solar) through facilitation**:

   Hon'ble Commission has notified Net Metering Scheme for Solar Roof Top Project in the consumer premises. TPNODL should popularize the scheme for LT consumers and provide prompt support and cooperation to the consumer for net metering agreement and solar project interconnection with DISCOM systems. Once Solar Interconnection happens at the LT systems, this will improve the voltage profile and reduce LT loss. Also the RPO of GRIDCO / DISCOM can be compiled which may reduce the BSP in future and will lead to financial savings for DISCOM.

7. At present Hon'ble OERC has implemented kVAh billing for the HT/ EHT/ Commercial / MSME and Industrial consumers. In view of the kVAh billing, the consumer which are having low power factor are paying higher energy bills, still the awareness about kVAh billing is not there and consumers are operating with low Power Factors. TPNODL may carry out special drives for awareness and sensitisation about kVAh billing. This may lead to more numbers of APFC installation and improvement in Power Factor and will lower the burden on the existing infrastructure. TPNODL may sign MoU with ESCO / AFPC installer under the Utility based Demand Side Management program so that APFC installer will assess the data base of Consumers with low power factor, take necessary action for installation of APFC Panels in consultation with Consumers directly.

8. Exploring opportunities in industrial segments (using efficient motors, pumps, compressors, capacitor bank, etc). TPNODL can coordinate and inform BEE / EESL / Private ESCO to provide the Industrial LED lighting Solution, IE3 Motors in RESCO / PMC level as per the provision of DSM Regulations. This will facilitate Demand Side Management in a long way.

9. TPNODL should conduct more nos. of Consumer awareness programs on saving electricity, electricity wastage, power theft, using electricity during off peak hour, using star rated equipment.

3.0 BACKGROUND

Energy Conservation has become a top most priority in today's scenario in order to have a sustainable growth, productivity, enhancement & environmental protection. Considering the vast potential of energy savings and benefits of energy efficiency as per the report prepared by National Development Council (NDC) Committee on power, Govt. of India enacted the Energy Conservation Act 2001. The aim of EC Act 2001 is to provide the much-needed legal framework and other institutional arrangements so that various energy efficiency improvement drives can be easily launched at the state and national level. In order to implement the various provisions under the EC Act 2001, the Government of India established the Bureau of Energy Efficiency (BEE) on 1st March 2002 for development of policies and strategies with a thrust on self regulation and market principles, with the primary objective of reducing energy intensity of the Indian Economy and to enact and enforce energy efficiency through various regulatory and promotional measures.

Role of BEE

BEE coordinates with designated consumers, designated agencies and other organizations and recognize, identify and utilize the existing resources and infrastructure, in performing the functions assigned to it under the Energy Conservation Act. The Energy Conservation Act provides for regulatory and promotional functions.

The Major Promotional Functions of BEE include:

- Create awareness and disseminate information on energy efficiency and conservation
- Arrange and organize training of personnel and specialists in the techniques for efficient use of energy and its conservation
- Strengthen consultancy services in the field of energy conservation
- Promote research and development
- Develop testing and certification procedures and promote testing facilities
- Formulate and facilitate implementation of pilot projects and demonstration projects
- Promote use of energy efficient processes, equipment, devices and system
- Take steps to encourage preferential treatment for use of energy efficient equipment or appliances
- Promote innovative financing of energy efficiency projects
- Give financial assistance to institutions for promoting efficient use of energy and its conservation
- Prepare educational curriculum on efficient use of energy and its conservation
- Implement international co-operation programmes relating to efficient use of energy and its conservation

Perform Achieve and Trade (PAT) Scheme

National Mission of Enhanced Energy Efficiency (NMEEE) is one of the eight national missions of the NAPCC released by the Prime Minister on 30th June 2008. BEE has been entrusted with the task of preparing the implementation plan for NMEEE. PAT scheme is formulated under National Mission for Enhanced Energy Efficiency (NMEEE) which is one of eight plans in the National Action Plan on Climate Change (NAPCC).

PAT is a regulatory instrument framed by BEE and Ministry of Power to reduce specific energy consumption in energy intensive industries and reduce T & D loss in DISCOMs with an associated market based mechanism to enhance the cost effectiveness through certification of excess energy saving which can be traded in power exchange.

Purpose of Audit and Accounting Report

DISCOMs are currently focusing on Energy Conservation and Energy Efficiency to a larger extent for reducing the T & D Loss and improving the performance. Efficient Energy management, Usage of Energy Efficient Technologies and adopting best-practices for reduction T & D Loss would help Utility to improve their billings, collection, energy sale and profitability.

As per the PAT scheme of BEE, TPNODL being a DISCOM having annual AT & C losses more than 1000 Million kWh i.e. 86000 Metric Tonne of Oil Equivalent (mtoe) is a Designated Consumer as per EC Act 2001.

The main focus of the audit is to establish T & D Loss for the year 2020-21, collection of technical information like annual energy consumption, nos. of connections, nos. of disconnections, connected load and % of total connected load, energy billed, net input energy, power factor, total supply hour, scheduled outage, scheduled supply hours, unscheduled outage, available supply hours and evaluation of T & D loss, AT & C loss and Billing Efficiency of utility, finding out deviations from the baseline T & D loss, evaluations of energy management systems, exploring future energy conservation measures, energy saving potentials and providing recommendation for the same.

In line with Section 14(g) of the Energy Conservation(EC) Act, the Central Government has notified targets (in the form of Specific Energy Consumption) for Designated Consumers (DCs) on 26th October 2021 under the PAT cycle-VII. The baseline Distribution loss of TPNODL has been fixed as 18.74% for baseline year 2018-19 with baseline net input energy 5575.61MU. TPNODL has been directed to reduce its T&D Loss to 17.60 % by Target Year 2024-25.

BEE (Manner and Intervals for Conduct of Energy Audit in electricity distribution companies), Regulations 2021 has been notified on 6th October 2021 and as per Regulation 3 of the said Regulations, it is required that the TPNODL to conduct the annual energy audit by an Accredited Energy Auditor and submit the report to BEE and SDA.

The management of TPNODL evinced keen interest in availing the services of PTC for conducting Annual Energy Audit of the TPNODL. The proposal for conducting energy audit of the DISCOM was accepted by the management of TPNODL vide their work order no 4800000385 dated 15.09.2021. Accordingly, PTC has been entrusted with the work of conducting the annual energy audit and submission of reports for the same. The field study, measurement and audit activities by PTC was conducted at site from 21st October 2021 to 22nd October 2021, 7th February 2022 to 9th February 2022, 16th February 2022, from 12th April 2022 to 13th April 2022, 21st May 2022 and the report has been prepared based on the field study data, available technical data as well as information / inputs received from TPNODL.

4.0 INTRODUCTION ABOUT DISCOMS (DC)

TP Northern Odisha Distribution Limited (TPNODL) is a joint venture of Tata Power (51%) and Govt of Odisha (49%) on the Public-Private Partnership (PPP) model. Govt. of Odisha (GoO)'s share is held by it through its 100% owned company GRIDCO. TPNODL was vested in the Utility of NESCO for distributing and retail supply of electricity in the northern part of Odisha, through a Vesting Order issued by the Hon'ble Odisha Electricity Regulatory Commission (OERC).

The business of TPNODL utility is governed by the provisions of license issued by Hon'ble Odisha Electricity Regulatory Commission (OERC) for distribution and retail supply of electricity in North Odisha.

TPNODL procures power from GRIDCO which is a state owned company, engaged in the business of purchase of electricity in bulk from various generators located inside Odisha and the state share of power from Central generators. GRIDCO supplies power to all power distribution utilities, including TPNODL under the existing Bulk Supply Agreement between TPNODL and the GRIDCO. The power procurement price is the Bulk Supply Price at which GRIDCO supplies power to Distribution utilities which is determined by Hon'ble OERC and apportioned based on the ability of each Discom to pay the energy charges to GRIDCO.

TPNODL licensed area is spread over a geography of 27857 Sq.Km and serves the registered consumer base of 1.9 million with a peak load of around 1263 MW. It receives electrical power at a sub transmission voltage of 33KV from OPTCL 220/132/33 kV Grid Substations and then distributes the power at 33KV / 11KV / 440V / 230V depending on the demand of the consumers. For effective operations, license area is divided in 5 circles which is further sub divided in 16 Divisions, 50 Sub-division & 159 sections which manages the commercial and O&M activities in order to serve its consumer.

The details of administrative set up TPNODL are furnished below.

Name and Address of Designated Consumer:

TP Northern Odisha Distribution Limited (TPNODL)
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NAME AND CONTACT DETAILS OF ENERGY MANAGER AND AUTHORIZED SIGNATORY OF DC

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The details of organisational set up of TPNODL are furnished below:

DETAILS	As on 31st March 2020	As on 31st March 2021
No. of Circles	5	5
No. of Divisions	16	16
No. of Subdivisions	50	50
No. of Sections	159	159

4.1 SUMMARY PROFILE OF TPNODL

TPNODL receives electrical power at 33kV level from 26 numbers of Grid Sub stations (GSS) out of which 3 nos. TS are rated at 220/33 KV, and 23 nos. at 132/33KV located within and in the vicinity of TPNODL operational area. TPNODL distributes the power at 33kV / 11kV / 415V / 230V depending on the demand of the consumers.

At present, there are 91 numbers of 33 kV feeders with a combined circuit length of approximately 2788 Ckt. KMs supplying power to 215 numbers of 33/11kV Primary Substations The 33kV supply is stepped down to 11kV level through 484 numbers of 33/11kV power transformers with an installed capacity of 2191 MVA at these primary substations. Nearly 720 numbers of 11 kV feeders emanates from the 33/11 kV primary substations having cumulative length of approximately 36865 Ckt. KMs and supply power to HT consumers connected at 11 kV level and LT customers connected to 11/0.415 kV & 11/0.230 kV distribution substations. 69646 numbers of distribution transformers are installed in all five circles with an installed capacity of 2457 MVA. The length of the LT network is approximately 66262 Ckt. KMs. These LT feeders supply power to three phase and single-phase consumers.

The Details of Network Systems of TPNODL are furnished below:

Network System	As on 31st March 2020	As on 31st March 2021
Length of 33 KV Line (km.)	2650	2868
Length of 11 KV Line (km.)	32534	37069
Length of LT KV Line (km.)	54927	66300
Length of LT AB Cable (km.)	NA	NA

The Details of Assets under TPNODL as on March 2021 are furnished below:

ASSETS	As on 31st March 2020	As on 31st March 2021
No. of 33 KV feeders (Including GRIDCO interface)	91	91
No. of 11 KV feeders	696	720
No. of 33 / 11 kv POWER Transformers	462	488
No. of Distribution Transformers (11/0.4 & 33/ 0.4 kv)	64563	70429

Consumer Base of TPNODL:

The details of total numbers of Consumers in TPNODL area is furnished below:

Consumer Category	Total Number of Connections (Nos)
Residential	1866761
Agricultural	26314
Commercial/Industrial-LT	88299
Commercial/Industrial-HT	441
Others	26314
Total	2008133

COMMENT ON THE ABOVE TABLE

The data provided in the above table for consumer categories like Commercial/Industrial-HT numbers (441) and others (24314) is not matching as provided in the OERC performance report by TPNODL.

5.0 DISCUSSION AND ANALYSIS

The main objective of Energy Audit is to establish the following.

- Energy Input to the System
- Energy utilized / sold (Energy Sales) to the consumer
- Energy losses in the System.
- To assess the Efficiency of the System
- To identify the area of high T&D losses
- To assess the extent of Theft & Pilferage
- To take appropriate steps for making the system technically more efficient and financially sustainable

Energy audit distinctly addresses the problems of energy losses. Hence any savings in energy usage and reduction of losses directly leads to the profitability of the utility.

Energy Accounts of Previous Year

TPNODL has purchased around 5439.434 MU of Energy from GRIDCO in FY 2019-20 and has billed around 4722.178 MU of energy to its various consumers and thus has a T&D Loss of around 13.19% in FY 2019-20 as per the performance review report of TPNODL submitted to Hon'ble OERC.

Energy Accounts and performance of TPNODL in Current Year

Category wise nos. of Consumers:

TPNODL is licensed to distribute electricity to consumers and collect revenue. The different categories of consumers in TPNODL are as per the following.

- EHT
- HT
- Domestic
- Kutir Jyoti
- L.T. General (Com)
- Agriculture
- Agro
- Allied-Agro
- Street Lighting
- PWW
- Small Industry
- Medium Industry
- Specified Pub. Purpose (P.I.)

5.1 DETAILS OF CATEGORY WISE NOS. OF CONSUMERS AND THEIR ANNUAL ENERGY CONSUMPTION, CONTRACT DEMAND, CORRECT METER, WITHOUT METER AND DEFECT METER FOR THE LAST FINANCIAL YEAR

Category wise no. of consumer under TPNODL

Category	FY 2020-21	
	Live Cons. (No's)	% of Total Live Consumers
EHT	36	0.001%
HT	557	0.027%
Domestic	1747928	87.042%
Kutir Jyoti	118806	5.916%
L.T. General (Com)	88299	4.397%
Agriculture	26314	1.310%
Agro	1455	0.072%
Allied-Agro	38	0.001%
Street Lighting	1091	0.054%
PWW	3923	0.195%
Small Industry	4304	0.214%
Medium Industry	1030	0.051%
Specified Pub. Purpose (P.I.)	14352	0.714%
Total	2008133	100%

OBSERVATIONS & RECOMMENDATIONS.

- From the above table it is found that the total consumer in TPNODL till FY 2020-21 is 2008133.
- It is also found that among all categories the percentage of Domestic category consumers is highest around 87.042 % in FY 2020-2021.
- Whereas percentage of nos. of HT consumers around 0.027 % in FY 2020-21 and percentage of nos. of EHT consumers around 0.001 % in FY 2020-21.
- The decrease in % of HT and EHT Consumers may be due to the fact that no substantial nos. of HT/ EHT new consumers has come up in the region

Category wise Connected Contract Demand under TPNODL

Category	FY 2020-21	
	CD (KW)	% w.r.t. total CD
EHT	570050	18.94%
HT	196249	6.52%
Domestic	1712185	56.89%
Kutir Jyoti	24805	0.82%
L.T. General (Com)	236962	7.87%
Agriculture	104055	3.46%
Agro	20750	0.69%
Allied-Agro	583	0.02%
Street Lighting	5165	0.17%
PWW	25186	0.84%
Small Industry	39928	1.33%
Medium Industry	45796	1.52%
Specified Pub. Purpose (P.I.)	27669	0.92%
Total	3009383	100.00%

OBSERVATIONS & RECOMMENDATIONS

- From the above table it is found that total contract demand in TPNODL is 3009383 kW in FY 2020-21.
- Among all categories the percentage of CD in Domestic category consumer is highest around 56.89 %.
- Whereas percentage of CD in HT consumers around 6.52 % in FY 2020-21. Percentage of CD in Both HT and EHT consumers are low. This may be due to fact that a nos. of EHT consumer have come up with their CGP and reduced the contract demand and also have started availing power through open access. It is recommended that TPNODL should pray for tariff rationalisation before Hon'ble OERC. TPNODL may be required to incentivise the Industrial Consumption by taking up better tariff rationalisation measures in future tariff hearing process, as increase in HT / EHT consumption will help in reducing the T&D loss and AT & C loss.

Category wise no. of defect meter under TPNODL

Category	FY 2020-21		
	Live Cons. (No's)	No. of Defect Meter	% w.r.t. Total cons. In the category
EHT	36	0	0.00%
HT	557	0	0.00%
Domestic	1747928	137599	7.87%
Kutir Jyoti	118806	35886	30.21%
L.T. General (Com)	88299	5273	5.97%
Agriculture	26314	4498	17.09%
Agro	1455	100	6.87%
Allied-Agro	38	2	5.26%
Street Lighting	1091	86	7.88%
PWW	3923	302	7.70%
Small Industry	4304	73	1.70%
Medium Industry	1030	10	0.97%
Specified Pub. Purpose (P.I.)	14352	1207	8.41%
Total	2008133	185036	9.21%

OBSERVATIONS & RECOMMENDATIONS

- From the above table, the no. of defect meter in TPNODL in FY 2020-21 is 185036.
- The % of defective meters should be reduced by doing the replacement of defected meters with new meters and by taking strict vigilance measures.
- Among all categories the percentage of no. of defect meter is highest in Kutir Jyoti category which is around 30.21% FY 2020-21.
- The % of defect meters is also high (17.09%) in Agriculture category in comparison to other category.
- It is recommend to give special emphasize on Kutri Jyoti, Agro, Allied Agro, Agricultural, Street Lighting and specified Public purpose category consumer for replacement of defective meters with correct one. It is also proposed that the subsidy linked with the above category consumer may be transferred through Direct Benefit Transfer (DBT) Scheme based on the correct meter reading. In case meter is tampered and found to be defective, then the transfer of subsidy may be stopped till the meter is replaced with correct meter.

- It is found that the state and central government are implementing a no. of electrification project in which meters are becoming defective and stopped working after few months of installations. Currently very few meters manufacturers have been approved by TPNODL. It is recommended that TPNODL should empanel a nos. of quality meter manufacturers from where the contractor should procure meters and install in Government sponsored project and the meter manufacturer should issue guarantee certificate of each meter for a period of 5 years in favour of the local DISCOM where the project is being implemented so that in case of any defective meter is found by the DISCOM, then same can be replaced by the meter manufacturers directly. TPNODL should inform both State and Central Government implementing agency regarding % increase in defective meters happening in their sponsored scheme so that they can take appropriate remedial measures.

- It is further recommended that TPNODL should initiate dialogue with Urban Local Bodies and Agricultural Department regarding higher % defective meters found in street light and agricultural sector. It is recommended that the TPNODL should involve Government Machinery and political people for awareness creation and to reduce meter tampering.

Category wise no. of Correct Meter under TPNODL

Category	FY 2020-21		
	Total Cons. (No's)	No. of correct meters	% w.r.t. Total cons. In the category
EHT	36	36	100.00%
HT	557	557	100.00%
Domestic	1747928	1521773	87.06%
Kutir Jyoti	118806	73472	61.84%
L.T. General (Com)	88299	82447	93.37%
Agriculture	26314	16972	64.50%
Agro	1455	1346	92.51%
Allied-Agro	38	36	94.74%
Street Lighting	1091	366	33.55%
PWW	3923	3585	91.38%
Small Industry	4304	4231	98.30%
Medium Industry	1030	1020	99.03%
Specified Pub. Purpose (P.I.)	14352	12103	84.33%
Total	2008133	1717944	85.55%

Category wise no. of without meter under TPNODL

Category	FY 2020-21		
	Total Cons. (No's)	No. of without meter	% w.r.t. Total cons. In the category
EHT	36	0	0.00%
HT	557	0	0.00%
Domestic	1747928	88556	5.07%
Kutir Jyoti	118806	9448	7.95%
L.T. General (Com)	88299	579	0.66%
Agriculture	26314	4844	18.41%
Agro	1455	9	0.62%
Allied-Agro	38	0	0.00%
Street Lighting	1091	639	58.57%
PWW	3923	36	0.92%
Small Industry	4304	0	0.00%
Medium Industry	1030	0	0.00%
Specified Pub. Purpose (P.I.)	14352	1042	7.26%
Total	2008133	105153	5.24%

OBSERVATIONS & RECOMMENDATIONS

- From the above table it is found that the total nos. of consumer without meter in TPNODL is 105153 in FY 2020-21.
- The percentage of no. of consumers without meter in Agriculture around 18.41% in FY 2020-21 and as compared to other category the percentage of without meter in Agricultural Sector is high.
- So it is recommend to give special emphasize for correct meter installation in Agricultural category. It is further recommended that TPNODL should initiate dialogue with Agricultural Department regarding higher % without meters consumer found in agricultural sector. It is recommended that the TPNODL should involve Government Machinery and Agricultural Department for awareness creation for metered power supply connection and to reduce meter tampering.
- Percentage of no. of without meter in Street lighting is around 58.57% and as compared to other category the percentage of defect meters in street light is higher and needs attention.
- It is also proposed that the subsidy meant for Agriculture Category Consumer should be Aadhar linked and should be transferred through Direct Benefit Transfer (DBT) Scheme based on the correct meter reading. In case there is no meter or meter is tampered and found to be defective, then the transfer of electricity tariff subsidy as well as other Agriculture Subsidy of the Agriculture Department may be stopped till the defective meter is replaced with correct meter.

CONSUMER LEDGER DATA

Month	Bill Status	CD	% of CD wrt Total CD	Unit Consumption (kWh)	% of Unit Consumption wrt Bill Status	EC Charge	% of Bill Amount wrt Bill Status	ED Charge	% of ED Charged
Apr 2020	AC	18801	60%	3568789	73%	13479654	72%	381389	4%
	LF	5006	16%	796300	16%	3061335	16%	119772	4%
	PL	5897	19%	546935	11%	2116159	11%	81966	4%
	Blank	1392	4%	0	0%	0	0%	0	
	Total	31096	100%	4912024	100%	18657149	100%	583126	4%
May 2020	AC	21274	68%	2517256	67%	9468514	66%	325926	4%
	LF	4993	16%	795638	21%	3061519	21%	119800	4%
	PL	3443	11%	435165	12%	1754374	12%	67562	4%
	Blank	1396	4%	0	0%	0	0%	0	
	Total	31106	100%	3748059	100%	14284407	100%	513288	4%
Jun 2020	AC	21308	68%	2453390	73%	9493267	74%	364825	4%
	LF	4988	16%	573726	17%	2060417	16%	80566	4%
	PL	3470	11%	330361	10%	1338371	10%	51157	4%
	Blank	1396	4%	0	0%	0	0%	0	
	Total	31162	100%	3357477	100%	12892056	100%	496548	4%
Jul 2020	AC	20991	67%	228226	20%	8778287	72%	338169	4%
	LF	4955	16%	570650	49%	2051986	17%	80229	4%
	PL	3884	12%	358854	31%	1434611	12%	54882	4%
	Blank	1395	4%	0	0%	0	0%	0	
	Total	31225	100%	1157730	100%	12264884	100%	473280	4%
Aug 2020	AC	21056	67%	2476398	72%	9724269	73%	373467	4%
	LF	5030	16%	580337	17%	2096457	16%	82008	4%
	PL	3923	12%	365295	11%	1439490	11%	53665	4%
	Blank	1399	4%	0	0%	0	0%	-15	
	Total	31407	100%	3422030	100%	13260216	100%	509125	4%
Sep 2020	AC	20844	66%	2412688	71%	9442058	72%	365495	4%
	LF	5101	16%	584500	17%	2115857	16%	82784	4%
	PL	4115	13%	388733	11%	1533842	12%	58818	4%
	Blank	1399	4%	0	0%	0	0%	0	
	Total	31460	100%	3385921	100%	13091757	100%	507097	4%
Oct 2020	AC	21165	67%	1959638	68%	7774658	68%	300509	4%
	LF	4980	16%	575654	20%	2197773	19%	87825	4%
	PL	3988	13%	363673	13%	1500201	13%	57706	4%
	Blank	1401	4%	0	0%	0	0%	0	
	Total	31533	100%	2898965	100%	11472633	100%	446040	4%
Nov 2020	AC	21422	68%	1202761	55%	4431381	54%	166352	4%
	LF	4883	15%	593294	27%	2279964	28%	89297	4%
	PL	3974	13%	375556	17%	1539527	19%	58858	4%
	Blank	1402	4%	0	0%	0	0%	0	
	Total	31681	100%	2171611	100%	8250872	100%	314507	4%
Dec 2020	AC	21265	67%	1213933	56%	4590106	55%	174716	4%
	LF	4982	16%	599820	28%	2306829	28%	90372	4%
	PL	4028	13%	363088	17%	1466764	18%	56097	4%
	Blank	1408	4%	0	0%	0	0%	0	
	Total	31683	100%	2176841	100%	8363700	100%	321185	4%

Jan 2021	**AC**	21507	68%	1241499	57%	4658452	56%	177385	4%
	LF	4865	15%	578166	26%	2214811	27%	86694	4%
	PL	4003	13%	366023	17%	1484293	18%	56950	4%
	Blank	1407	4%	0	0%	0	0%	0	
	Total	31783	100%	2185688	100%	8357556	100%	321028	4%
Feb 2021	**AC**	22158	69%	1703401	65%	6619002	65%	251611	4%
	LF	4800	15%	563455	22%	2156700	21%	84367	4%
	PL	3680	11%	334195	13%	1356037	13%	51813	4%
	Blank	1419	4%	0	0%	0	0%	0	
	Total	32057	100%	2601051	100%	10131739	100%	387791	4%
Mar 2021	**AC**	21636	67%	2800143	75%	12055435	77%	472696	4%
	LF	4919	15%	572895	15%	2199310	14%	86051	4%
	PL	4306	13%	358923	10%	1428655	9%	55315	4%
	Blank	1420	4%	0	0%	0	0%	0	
	Total	32282	100%	3731961	100%	15683401	100%	614062	4%

OBSERVATION & RECCOMENDATION

From the consumer ledger data it was analysed that the provisional billing is around 15% & the load factor billing is around 17% where as actual billing based on energy meter reading is around 70%.

Because of this higher provisional billing and load factor billing, it can be assumed that the total billing has been inflated. This might be a cause of reporting lower T&D loss or based on current calculation method adopted by TPNODL.

In view of the above, it is proposed that the load factor billing and provisional billing should be reduced significantly and should be contained within 2%-5%.Further, we have computed electricity duty calculation particularly for LT consumer. Based on the Ledger data, we found the calculation made by TPNODL for ED payable to Govt is in order.

5.2 BILLED AMOUNT AND ARREAR STATUS OF TPNODL

Total Energy Billed, Amount billed, Gross Amount Collected by the DISCOM for FY 2020-21 is furnished below:

ANNUAL BILLED AMOUNT IN CRORES				
Financial Year	**Total Energy Billed**	**Amount Billed**	**Gross Amount Collected**	**Amount Collected w/o Arrears**
	Million kWh	Rs. Crs	Rs. Crs	Rs. Crs
FY 2020-21	3921.633	2125.487	2003.990	NA

Arrears Status for FY 2020-21 is furnished below:

Category	**FY 2020-21**	**% of Growth of Arrear**
EHT		
HT		
Domestic		
Kutir Jyoti		
L.T. General (Com)		
Agriculture		
Agro		
Allied-Agro		
Street Lighting		
PWW		
Small Industry		
Medium Industry		
Specified Pub. Purpose (P.I.)		
Total		

COMMENT ON THE ABOVE TABLE

The above table related to Arrears Status for last financial year was not made available. TPNODL is recommended to provide as per above so that necessary comments can be furnished.

5.3 METERED/UNMETERED ENERGY SALE OF TPNODL

Annual energy consumption of the consumers in TPNODL for FY 2020-21 is given below.

Annual Metered/ Unmetered Energy Consumption (in MU) under TPNODL

ANNUAL METERED/UNMETERED ENERGY CONSUMPTION IN MU				
Financial Year	**Estimated unaccounted energy/theft**	**Metered Energy Sales**	**Unmetered Energy Sales**	**Annual Energy Consumption**
FY 2020-21	1019.602	3393.026	528.607	3921.633

% of Metered, Unmetered & Unaccounted Energy Consumption

% OF METERED/UNMETERED & UNACCOUNTED ENERGY CONSUMPTION				
Financial Year	**Total Annual Energy Consumption**	**Estimated unaccounted energy/theft in %**	**Metered Energy Sales in %**	**Unmetered Energy Sales in %**
FY 2020-21	3921.633	25.999	86.520	13.479

OBSERVATIONS & RECOMMENDATIONS

- It is found that Metered Energy sale is 86.52 % for FY 2020-21.
- It is found that Unmetered Energy sale is 13.479 % for FY 2020-21 .
- It is found that unaccounted theft was 25.999 % for FY 2020-21.
- Though the unaccounted energy and theft has reduced but still it is at a level of 25.999 % which is very high. It is recommended to decrease the unaccounted / theft energy through strict vigilance measures and awareness campaigns. Also meters are to be supplied to avoid unmetered energy consumption in future.

5.4 LOSSES IN DISTRIBUTION NETWORK

The losses in a distribution network are classified into three categories i.e. Transmission & Distribution (T&D) Loss, Technical Loss and Commercial loss.

- T&D loss is the difference between Energy Supplied to a network and the total Energy Billed.
  It includes both Technical & Commercial loss.

- T&D Loss =Input Energy to the System- Energy Billed to the Consumer

- Distribution (T&D) Loss = Input Energy Supplied to DISCOM system (-) Energy Billed to consumer by DISCOM

- % Distribution (T&D) Loss = [Input Energy (-) Energy Billed] x 100 ÷ [Input Energy]

1. Technical loss or line loss occurs mainly due to the heating effects, loose bindings, earthing problem, unbalancing, inadequate size of conductors, shifting of load centre, low power factor/reactive losses etc. This loss is difficult to calculate and the most accurate method is the load flow study using network analysis software.

   The Technical losses in the system comprises of the following

   - 33 kV & 11 kV Line Losses
   - Distribution Transformer Losses (Iron & Copper losses)
   - L.T. Line Losses
   - Miscellaneous Technical Losses
   - Losses due to Loose Jump Connections in the line
   - Losses due to Short Circuits & Earth Faults
   - Losses in Service Mains of Installations.
   - Losses incurred in CT"S & Current Coils of Energy Meters.

2. Commercial Loss is the difference between T & D loss and Technical loss.
   Commercial Loss = Distribution Loss (-) Technical Loss

   The commercial losses comprises of the following

   - Mistakes in the billing.
   - Meters not recording (MNR)
   - Meters not recording correctly
   - Meters by passed due to defects/ intentionally
   - Meters not read & billed.
   - Theft and pilferage.

5.4.1 CALCULATION OF T&D LOSS

Distribution Loss or T&D loss is the difference between energy supplied to a network and the total energy billed. It includes both technical and commercial losses.

Sample Calculation:

A typical calculation for T&D Loss for FY 2020-21 is furnished below.

The total demand of TPNODL for FY 2020-21= 774.978 MVA

The total Energy Input to TPNODL for FY 2020-21= 4941.190 MU

BST Bill (P/U) = 341

BST Bill of GRIDCO of TPNODL for FY 2020-21 = Energy input (MU) x BST Bill (P/U)/10)+0.0713
=4941.190 x (341/10)+.0713=1685.017 Crs

Total Energy sale to all consumer i.e. EHT, HT and LT for FY 2020-21 =3921.633 MU

Energy sale to EHT consumer = 1424.984 MU

Energy sale to HT consumer = 388.865 MU

Energy sale to LT consumer = 2107.784 MU

For HT Category of T & D Loss is assumed at 8%

T & D Loss in LT Category = 1-(Energy sale to LT consumer in MU)/ ((Total Energy input in MU - Energy sale to EHT consumer in MU) – ((Energy input in MU - Energy sale to EHT consumer in MU) x 8%) - Energy sale to HT consumer in MU))

= 1-(2107.784) MU/((4941.190 MU-1424.984 MU) - ((4941.190 MU-1424.984 MU)*8%)-388.865 MU))

= 1-74.06

=25.94 %

T & D Loss in HT & LT Category = 1-(((Energy sale to HT consumer in MU+ Energy sale to LT consumer in MU)/ (Total Energy input in MU- Energy sale to EHT consumer in MU)))

=1-(((388.865 MU+2107.784 MU)/ (4941.190 MU-1424.984 MU)))

=1-((2496.649)/(3516.206)) =28.996 %

Overall T & D Loss of TPNODL for FY 2020-21= 1- Total Energy sale to consumer including EHT, HT and LT in MU/ Total Energy input in MU

=1-(3921.633 MU/4941.190 MU)

=**20.633 %**

Based on the above methodology T&D loss for FY 2020-21 is calculated & furnished below:

PARTICULARS	FY 2020-21
BULK SUPPLY	
Demand (MVA)	774.978
Energy input (MU)	4941.190
SALE TO CONSUMERS (MU)	
EHT	1424.984
HT	388.865
LT	2107.784

TOTAL SALE (MU)	3921.633
T & D LOSS (%)	
HT & LT T&D Loss	29 %
OVERALL T & D LOSS (%)	20.63 %

Month wise T & D loss FY 2020-21 is furnished below:

Table3.1: T&D LOSS FOR FY 2020-21

PARTICULARS	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	TOTAL
BULK SUPPLY													
Demand (MVA)	721.853	834.585	836.699	840.265	980.503	732.851	786.201	680.279	652.064	723.769	632.817	877.847	774.978
Energy input (MU)	350.347	396.942	428.407	471.371	441.484	450.754	418.941	366.748	362.517	386.045	375.469	492.165	4941.19
SALETO CONSUMERS (MU)													
EHT	145.397	88.01	107.189	112.594	116.174	114.165	107.117	109.262	126.445	130.253	137.892	130.486	1424.984
HT	33.748	21.466	29.987	34.592	36.385	30.088	34.512	29.83	32.39	33.707	33.994	38.166	388.865
LT	157.44	184.186	205.395	189.138	192.805	202.533	199.225	163.619	150.563	145.203	148.012	169.665	2107.784
TOTALSALE (MU)	336.585	293.662	342.571	336.324	345.364	346.786	340.854	302.711	309.398	309.163	319.898	338.317	3921.633
T & D LOSS (%)													
HT & LT	6.71%	33.43%	26.72%	37.64%	29.55%	30.89%	25.04%	24.87%	22.50%	30.06%	23.39%	42.54%	29.00%
OVERALL (%)	3.93%	26.02%	20.04%	28.65%	21.77%	23.07%	18.64%	17.46%	14.65%	19.92%	14.80%	31.26%	20.63%

5.4.2 CALCULATION OF AT&C LOSS

AGGREGATE TECHNICAL & COMMERCIAL (AT&C) LOSS:

Aggregate Technical & Commercial Loss (AT&C Loss) is defined as the summation of all technical as well as commercial power loss that occurs due to electrical power flow through sub-transmission and distribution network.

Technical Loss is defined as the summation of Power Loss through 33 kV, 11 kV line and LT Line Loss including Transformer Loss and others.

Commercial Loss is defined as the summation of Power Loss occurring due to Theft/ Pilferage, Deficient meter, Inefficiency in Billing & Unrealized Revenue due to Collection Inefficiency.

COMPUTATION OF AT& C LOSS

Aggregate Technical & Commercial Loss (AT&C) is computed from the actual meter readings of the meter installed at various locations in the system.

Sample Calculation:

A typical calculation AT&C loss for FY 2020-21 is furnished below.

The total demand of TPNODL for FY 2020-21 = 774.978 MVA

The total Energy Input to TPNODL for FY 2020-21 = 4941.190 MU

The total Energy sale by TPNODL for FY 2020-21 =3921.633 MU

Overall Billing Efficiency (%) for FY 2020-21 = Total Sale in MU/ Total input in MU

Total Sale in MU/ Total input in MU= 3921.633 /4941.190 = 79.36 %

Overall Collection Efficiency (%) for FY 2020-21 = Total Collection Received (Rs. in Crs.) / Total Billing to Consumers (Rs. in Crs.)= Rs.2003.99 Crs/Rs.2125.49 Crs = 94.29 %

AT & C Loss (%) for FY 2020-21

AT & C Loss (%) = 1-{Collection Efficiency (%) x Billing Efficiency (%)}

Overall AT & C Loss (%) for FY 2020-21 = 1-(94.29% x 79.36%)

= 25.18 %

AT & C Loss for FY 2020-21 is furnished below:

Particulars	FY 2020-21
Total Sale (MU)	3921.633
T & D Loss (%)	20.63%
Billing Efficiency (%)	79.37%
Billing To Consumers (Rs. in Crs.)	2125.49
Collection Received (Rs. in Crs.)	2003.99
Collection Efficiency (%)	94.28%
AT & C Loss (%)	25.17%

Month wise AT & C loss for last financial year is furnished below:

Table3. 4: AT&C LOSS FOR FY 2020-21

PARTICULARS	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	TOTAL
SALETO CONSUMERS (MU)													
TOTAL SALE (MU)	336.585	293.662	342.571	336.324	345.364	346.786	340.854	302.711	309.398	309.163	319.898	338.317	3921.633
T & D LOSS (%)													
OVERALL (%)	3.93 %	26.02 %	20.04 %	28.65 %	21.77 %	23.07 %	18.64 %	17.46 %	14.65 %	19.92 %	14.80 %	31.26 %	20.63 %
Billing Efficiency (%)													
OVERALL (%)	96.07 %	73.98 %	79.96 %	71.35 %	78.23 %	76.93 %	81.36 %	82.54 %	85.35 %	80.08 %	85.20 %	68.74 %	79.37 %
BILLING TO CONSUMERS (Rs. in Crs.)													
TOTAL	185.81	153.01	176.27	180.55	186.51	181.01	178.75	168.06	174.24	174.04	179.72	187.5	2125.49
COLLECTION RECEIVED (Rs. in Crs.)													
TOTAL	102.72	133.54	131.92	158.41	143.36	136.84	158.22	159.57	188.28	249.37	158.51	283.26	2003.99
COLLECTION EFFICIENCY (%)													
OVERALL (%)	55.28 %	87.27 %	74.84 %	87.73 %	76.86 %	75.60 %	88.51 %	94.95 %	108.05%	143.28%	88.20 %	151.07%	94.28 %
AT & C LOSS(%)													
OVERALL (%)	46.89 %	35.43 %	40.16 %	37.40 %	39.87 %	41.84 %	27.98 %	21.63 %	7.78 %	-14.75 %	24.86 %	-3.85 %	25.17 %

Sample Study

Calculation of Technical loss of 33KV feeder line loss (33KV to 11KV)

The 33 KV feeder line loss and 33/11 kV power transformer loss is calculated by comparing the energy inputs received at the 33 kV feeder emanating from OPTCL substation with the output energy in the 11KV outgoing feeder of the 33/11 kV substation.

Energy Audit calculation for Panikoili 33KV feeder:

CONSUMER	METER NO	MF	CONSUMPTION (KW)			
			Oct-21	Nov-21	Dec-21	Jan-22
PANIKOILI PSS	NES82766	120000	36,97,620	26,69,180	24,07,800	24,19,380
KRUPALI RICE MILL	NES52189	1500	1,90,765	1,35,835	1,43,985	2,80,196
ASHRIBAD AGRO PRODUCT	NSC94606	1200	1,19,496	3,888	52,008	1,67,790
SRIKRUPALU STEEL &CASTING	NES52148	1500	11,805	31,860	68,445	56,885
ASHIRBAD AGRO PRODUCTS PLTD	NES50346	1800	6,81,410	2,85,084	5,32,404	6,72,007
HAREKRISHNA RICE MILL	NSC94507	1200	3,65,190	3,16,292	32,328	3,36,341
KRUPALU SOLVENT	NES83175	1200	98,896	9,492	39,852	1,49,034
NOBEL GAS	NSC10723	1200	5,316	5,064	4,764	4,606
HP PETROL PUMP	NDT00068	1	1,095	909	1,082	10,048
TOTAL			**51,71,593**	**34,57,604**	**32,82,668**	**40,96,287**
NIKOILI FEEDER CONSU	**2984330**	**400**	**53,71,920**	**35,13,640**	**33,36,072**	**42,05,232**
%AGE LOSS			**3.73%**	**1.59%**	**1.60%**	**2.59%**

However we recommend the following format for conducting future energy audit in 33 kV feeders. TPNODL may adopt the same.

33KV QUARTERLY ENERGY AUDIT REPORT													
SL.NO.	132/33 KV or 220/33KV Grid Name	33 KV Feeder Name	Electrical Length of the Feeder	Total INPUT in MU=A	CONSUMPTION BY 33KV CONSUMER IF ANY=B	NAME OF 33/11KV S/S	11KV Feeder Name	FDR_CD	INPUT IN 11KV FEEDERS IN MU=C1,C2,C3	TOTAL INPUT TO THE 11KV FEEDERS CORRESPONDING TO 33/11KV S/S=C=C1+C2+C3	TOTAL(33KV CONSUMER +11KV FEEDERS*) Consumption in MU (B)=D=B+C	LOSS IN MU E=(D-A)	AVERAGE % LOSS (E/A*100)
1													

Sample Study

The T&D Loss of various 11 kV feeders as conducted by TPNODL has been reproduced as under.

Sno	Circle	Division	PSS	Name Of Light House Feeder	Meter Sl No.	Total Consumer Count	Cummlative Loss %
1	Balasore	BED	CITY	Town Feeder	NES50712	5281	20%
4	Balasore	BED	Digraniya	BANIAMANDIR	NES50712	2865	21%
5	Balasore	BED	Swadhinpadiya	BALARAMGADI	ORU21097	1754	19%
8	Balasore	BED	Swadhinpadiya	GABAGAON	ORU21098	1876	23%
9	Balasore	BED	Goaplgaon	Ranipatna	2984461	2079	45%
10	Balasore	BED	Goaplgaon	Suelpur Feeder	2984471	4269	22%
11	Balasore	BED	Ganeshwarpur	Town Feeder	NES50712	1979	34%
12	Balasore	BED	Sovarampur	Sambhalpur	X0430106	2577	10%
13	Balasore	CED	Bhalkasuni	Berhampur(Telipal)	NES50855	2992	46%
14	Balasore	CED	Bhalkasuni	Sajanagarh	NES508074	7346	17%
15	Balasore	CED	FULADI	FULADI	X0528147	3573	33%
16	Balasore	CED	FULADI	Nagaram	X0528170	918	19%
17	Balasore	CED	FULADI	Padampur	X0528164	2153	10%
19	Balasore	JED	DEHURDA	Town	NES82791	3146	46%
21	Balasore	JED	DEHURDA	CHAUKI	NES82727	2108	10%
22	Balasore	JED	DEHURDA	JAIRAMPUR	NES82726	4796	10%
23	Balasore	JED	DEHURDA	ALALBINDHA	NSC10811	1635	31%
25	Balasore	JED	Kamarda	BANIAMANDIR	NES50712	2865	28%
26	Balasore	SED	Oupada	Oupada	NSC92263	1944	19%
27	Balasore	SED	Khantapada	Panpana	1200095	3457	24%
28	Balasore	SED	Gandibed	Chandagochhi	X0667508	4036	41%
29	Balasore	SED	Dungura	Dungura	NSC92146	4355	21%
30	Balasore	SED	Khaira	Khaira Bazar	NSC92296	1225	15%
31	Balasore	BTED	Basta	Head Quarter	NES50712	2257	29%
34	Keonjhar	JOED	JHUMPURA	JHUMPURA	X0282735	3265	24%
35	Keonjhar	AED	ANANDPUR	FAKIRPUR	NES50799	2001	29%
36	Keonjhar	AED	GHASIPURA	SALAPADA	NES83189	3301	21%
37	Keonjhar	AED	SAINKUL	BHAGANAI	16192172	1536	36%
38	Keonjhar	AED	BIDYADHARPUR	SOSO	NES50875	1966	38%
39	Baripada	BPED	Shamakhunta	Bhanjpur	NES50837	2801	33%
40	Baripada	BPED	Kochilakhunta	Kochilakhunta	NES82802	379	32%
41	Baripada	BPED	Rasgovindpur	Rasgovindpur	NES83209	1532	33%
42	Baripada	BPED	Stadium	Ambika	NES50663	3566	26%
43	Baripada	BPED	Shamakhunta	Rangamatia	NES50680	912	25%
45	Baripada	BPED	Betnoti	Betnoti Town	NES82735	4395	20%
46	Baripada	BPED	Bangiriposi	Bangiriposi	NES82783	3379	37%
47	Baripada	BPED	Baisinga	Baisinga	NES83225	4830	40%
48	Baripada	BPED	Jharpokharia	Jharpokharia	NES82710	4817	41%
49	Baripada	BPED	Chhancha	CKT House	NES50727	4061	15%
50	Baripada	RED	Thakurmunda	Thakurmunda	NES50739	3421	49%
51	BHADRAK	BSED	BARPADA	BARPADA	X0528151	595	33%
52	BHADRAK	BSED	BARPADA	KAUPUR	KAU22343	4494	11%
54	BHADRAK	BNED	BIDEIPUR	BALIMUNDA	2984473	6912	28%
55	BHADRAK	BNED	BASUDEVPUR	PADMAPUR	2984497	10645	17%
56	BHADRAK	BNED	BASUDEVPUR	BAZAR	2984496	4251	19%
58	BHADRAK	BNED	DHAMARA	DOSINGA	X0440742	4454	32%
62	BHADRAK	BNED	ERAM	BARAPUR	X0528111	3849	23%
63	BHADRAK	BNED	POWERHOUSE	CHARAMPA-I	2984467	4172	11%
65	Jajpur	JAJPUR ROAD	CHORDA	SAPAGHADIA	XE430070	4861	45%
66	Jajpur	JAJPUR ROAD	BYASASAROBAR	RACHHIPUR	18137892	5110	17%
67	Jajpur	JAJPUR ROAD	RAGADI	RAGADI	ORU21108	4074	27%
68	Jajpur	PANIKOILI	SALAKANA	BT ROAD	WBBC1851	4543	33%
69	Jajpur	DUBURI	DUBURI	PANKAPAL	X0282744	1817	29%
70	Jajpur	DUBURI	DAMODARPUR	MANGALPUR	1200144	1635	34%
71	Jajpur	JAJPUR TOWN	JAJPUR TOWN	GOKHANA	NES83273	1555	36%
72	Jajpur	JAJPUR TOWN	DHAMDHADA	KHANDARA	NES51970	2003	38%
73	Jajpur	BINJHARPUR	MAINDA	MAINDA	WBBC1841	6384	36%
74	Jajpur	BINJHARPUR	MAINDA	CHHIKANA	WBBC1842	2879	27%
75	Jajpur	BINJHARPUR	MNASARA	KANTIPUR	WBBC1840	2794	27%
76	Jajpur	BINJHARPUR	MNASARA	KALYANPUR	NES82704	1105	23%
77	Jajpur	DASRATHPUR	BOULANGA	MANGALPUR	X0423918	7161	18%
78	Jajpur	DASRATHPUR	KANTIPADIA	NANDIPUR	X0440758	2884	43%
79	Jajpur	KUAKHIA	MATHASAHI	MADHUBAN	WBBC1849	3906	24%
81	Jajpur	BARI	BARI	BARI	WBBC1837	12565	14%
82	Jajpur	BARI	RATNAGIRI	RATNAGIRI	WBBC1848	3805	35%
84	Jajpur	DHARMASALA	JARKA	NAGPAL	X0282755	1450	38%
85	Jajpur	DHARMASALA	NARSINGHPUR	KUNDAPATANA	1200088	1260	35%
86	Jajpur	DHARMASALA	KABATABANDHA	BALRAMPUR	NES83274	3240	23%

However we recommend the following format for conducting future energy audit in 11 kV feeders. TPNODL may adopt the same.

Calculation of 11 kV & LT loss

11KV QUARTERLY ENERGY AUDIT REPORT													
Name of Distribution Division	Name of 11KV Feeder	No of DTR	Total DTR Capacity in KVA	No of Consumer	Previous Reading-X	Present Reading-Y	MF	Input in MU, (Z=(Y-X)*MF)	Billing to HT Consumer	Billing to LT Consumer	Total Units Billed in MU	Loss in MU	Loss in %age

Sample Study

Calculation of loss (i.e. 33KV to consumer level)

CALCULATION OF AVERAGE T & D LOSS OF DTs UNDER TPNODL (2020-21)												
SL. NO	Name of 11 kV Feeder and Loss in MU	DTR Capacity in KVA	No Of Consumer under DTR	AVG T & D LOSS CALCULATION						Avg Loss of the Quarter	Avg Loss of the previous Quarter	DTR Loading in %
				MONTHS TAKEN FOR AVERAGE CALCULATION	TOTAL UNITS ADVANCED (IN MU)	TOTAL UNITS BILLED (IN MU)	LOSS OF UNITS (IN MU)	AVG NO OF BILL GENERATED	T & D LOSS(%)	T & D LOSS(%)	T & D LOSS(%)	
1												
2												
3												
4												
5												
6												
7												
8												
9												

The above table related to **CALCULATION OF AVERAGE T & D LOSS OF DTs UNDER TPNODL (2020-21)** was not made available. TPNODL is recommended to provide T&D Loss of DT as per above so that necessary comments can be provided.

RECOMMENDATION

- We propose to adopt the following methodology for carrying out future energy audits by TPNODL.
- 33 kV System Loss should be estimated as the difference of sending end energy from the 220 / 132 / 33 kV Grid Sub-Station and receiving end energy of Primary Substation including energy sent out to Bulk consumers at 33 kV level.
- 33 kV Loss should be computed considering one month consumption by taking meter reading of all the incoming 33 kV feeders of Primary Sub-Station including bulk 33 kV consumer and related 33 kV outgoing feeders of Grid Sub-Station.
- Thus the total 33 kV loss should be found out as
- 33 kV line loss = Σ(33 kV O/G Feeder meter reading at GRID SUB-STATION - Σ(33 kV I/C meter reading at PRIMARY SUBSTATION + 33 kV I/C meter reading at HT Bulk))
- Computation of 33/11 kV transformer loss: Σ 33 kV I/C meter reading at primary Substation –Σ 11 kV O/G meter reading at primary Substation

- **COMPUTATION OF 11 kV LOSS:**

Energy Loss of 11 kV feeders should be arrived at by the difference between the sending end energy i.e. 11 kV outgoing feeders of PRIMARY SUB-STATION and Energy recorded at LV side of DTR including Bulk consumer connected in the same 11 kV feeder.
11 kV Loss should be computed considering one month's energy consumption by taking the meter reading of the 11 kV feeder of Primary Substation and all the DTR meter reading connected in the same 11 kV feeder and bulk consumer connected in the same 11 kV feeder.

Thus the total 11 kV loss for this circle found out as

11 kV line loss = Σ(11 kV O/G Feeder meter reading at PRIMARY SUBSTATION – Σ All DTRs' meter reading connected to that 11 kV feeder) – Σ 11 kV I/C meter reading at HT Bulk.

- **COMPUTATION OF LT LOSS:**

Energy Loss of LT feeders should be arrived at by the difference between the sending end energy i.e. Distribution Transformer (DTR) and Energy recorded at consumer meters of LT consumers connected in the same DTR.

LT Loss should be computed considering one month's energy consumption by taking meter reading of DTR and the entire Consumers' meter reading connected to the same DTR.

Thus the total LT line loss for these circles is found out as

LT line loss = Σ (11/0.44 KV DTR meter reading – Σ All consumers' meter reading connected to that DTR)

- **COMPUTATION OF COMMERCIAL LOSS:**

Commercial Loss may be found out as

= AT&C Loss – Technical Loss

= {(1 – Billing Efficiency x Collection Efficiency) x 100} – (33 kV loss + 33/11 kV transformer loss) + (11 kV Line Loss + LT Line Loss)

The Billing efficiency, Collection Efficiency, Energy Billed and Energy to be collected from the TPNODL.

Technical Loss i.e.; 33 kV, 11 kV and LT Line Losses to be computed as mentioned above.

Hence Total amount of Commercial Loss has been arrived by deducting all other components from AT&C Loss.

RECOMMENDATION

- Energy loss due to theft/ pilferage:

During Field Survey it was observed that there is some energy lost due to theft/ pilferage in the Power system. It needs to be prevented by checking periodically.

- Defective meters :

Considerable percentage of defective meters is one of the reasons for provisional billing and consequential commercial losses in the DISCOM. Some energy meters installed at the consumer premises are found to be defective.

In other cases, it was found that the consumers deliberately conceal the information regarding defective meters. With the assistance of the local linemen/ meter reader, the consumer takes the benefit of provisional billings, resulting in commercial loss. It needs to prevent by strict vigilance measures and quality meter replacement programme.

- **COMPUTATION OF LOSS DUE TO UNREALIZED REVENUE**

Unrealized revenue is the revenue which is not realized due to non-payment by the consumers. Hence Energy loss due to unrealized revenue is the amount of energy loss converted from equivalent revenue loss.
Hence the total loss due to unrealized revenue found out as
Loss due to Unrealized Revenue= Σ (Energy Billed – Collections in MU)

RECOMMENDATION

Technical loss recommendation

- Reduction in Transmission losses:
- Improvement in power factor
- Reconduct ring of transmission line
- Conversion of single circuit to double circuit

Reduction of Transformer losses:

- Improvement of die electric strength of transformer oil
- Improvement of Power factor
- Thermography of primary/ secondary cable/ bus terminations
- Reduction of contact resistance of terminations
- Regular checking and replacement of silica Gel

Reduction of Bus losses

- Visual inspection of bus for detection any loose connections or oxidation
- Thermography of bus section for thermal imaging to detect any hot spots/ joints
- Reduction in contact resistance by proper termination after cleaning & tightening of contacts
- Replacement of bus by that of higher cross section & of material of higher conductivity (copper in place of Aluminium) if necessary.

6.0 DEMAND SIDE MANAGEMENT (DSM), ENERGY EFFICIENCY & CONSERVATION:

Demand Side Management (DSM) is applied to energy efficiency measures that would modify or reduce end-user's energy demand. It is basically the selection, planning and implementation of measures intended to have an influence on the demand either caused directly or indirectly by the utility's programs.

Hon'ble OERC has framed Odisha Electricity Regulatory Commission (Demand Side Management) Regulations, 2011, based on which DISCOM has to prepare the action plan and take measures for implementation of DSM Regulations.

TPNODL has established a Distribution System Operations Control Centre i.e. (DSOCC) (ABT Cell) in its Head Office for management of load at 33KV and 11KV feeder level, so that it can adhere to allotted drawl schedule of SLDC.

Following DSM measures and energy conservation options are proposed to be implemented in TPNODL.

Promoting the use of renewable energy (Solar) through facilitation:

It is proposed that TPNODL should promote Energy Efficient Lighting System (LED Bulbs, Tube lights and Energy Efficient Fans) in association with BEE / EESL / Private ESCO in its utility area. The availability of LED Bulbs, Tube Lights, BLDC Fans, IE3 Meters which are supposed to be distributed to consumers through BEE / EESL / Private ESCO as part of the Utility based Demand Side Management Program are not available in plenty. TPNODL may discuss with BEE / EESL / Private ESCO to open more outlets in each section and increase the LED Lights, Super Efficient AC and Fans Distribution.

Promoting the use of renewable energy (Solar) through facilitation:

Hon'ble Commission has notified Net Metering Scheme for Solar Roof Top Project in the consumer premises. Further Hon'ble Commission has amended the net metering regulation and allowed Group Net Metering and Virtual Net Metering. TPNODL should popularize these net metering scheme for LT consumers and provide prompt support and cooperation to the consumer for net metering agreement and solar project interconnection with DISCOM systems. Once Solar Interconnection happens at the LT systems, this will improve the voltage profile and reduce LT loss. Also the RPO of GRIDCO / DISCOM can be compiled which may reduce the BSP in future and will lead to financial savings for DISCOM.

Senstisation Program on kVAh Billing

At present Hon'ble OERC has implemented kVAh billing for the HT/ EHT/ Commercial / MSME and Industrial consumers. In view of the kVAh billing, the consumer which are having low power factor are paying higher energy bills, still the awareness about kVAh billing is not there and consumers are operating with low Power Factors. TPNODL may carry out special drives for awareness and sensitisation about kVAh billing. This may lead to more numbers of APFC installation and improvement in Power Factor and will lower the burden on the existing infrastructure. TPNODL may sign MoU with ESCO / AFPC installer under the Utility based Demand Side Management program so that APFC

installer will assess the data base of Consumers with low power factor, take necessary action for installation of APFC Panels in consultation with Consumers directly.

Facilitating Industrial Energy Efficiency

TPNODL can facilitate DSM measures in industrial segments by promoting use of energy efficient motors, pumps, compressors, capacitor bank, etc. TPNODL needs to coordinate and inform BEE / EESL / Private ESCO to provide the Industrial LED lighting Solution, IE3 Motors, Energy Efficient in ESCO / PMC model as per the provision of DSM Regulations. This will facilitate Demand Side Management in a long way.

Consumer Awareness Program

TPNODL should conduct more nos. of Consumer awareness programs on saving electricity, electricity wastage, power theft, using electricity during off peak hour, using star rated equipment.

6.1 ANALYSIS OF BLOCK WISE DRAWAL PATTERN

The monthly average 15 minute block wise drawl pattern may be made available in a tabular form as per the following.

BLOCK WISE MONTHLYAVERAGE DRAWAL LOAD PATTERN											
15 Min Block	Apr-	May-	Jun-	Jul-	Aug-	Oct-	Nov-	Dec-	Jan	Feb	Mar

The above table related to **Block Wise Drawal Pattern which** was not made available. TPNODL is recommended to provide Month wise Drawal Pattern so that necessary comments can be provided.

6.2 ENERGY EFFICIENCY IN DEMAND SIDE MANAGEMENT

The purpose of Energy Efficiency and Demand Side Management should be to reduce the load during peak period and enhance load during the non-peak period.

DSM activity should be also carried out to protect the Environment and to win the trust of consumers. The DSM can be carried out at three levels:

A) DISCOM level
B) Consumer Level
C) Using technology like energy storage

The DSM activities are to be initiated by DISCOM however need to be carried out by consumers. DISCOM can only manage a few DSM activities like voltage regulation and power factor regulation.
It is proposed that enough data are required to be generated by carrying out consumer load Research and third party experts should be engaged.

DSM programmes need skill about energy conservation and art of Communication with a consumer. It is better to engage Energy Manager/ Energy Auditors in a DSM cell. Awareness program on DSM should be conducted. Based on the analysis of data and third party survey report and action plan to be prepared for submission to Hon'ble OERC.

At the consumer level, the involvement of consumers is must for the success of demand side management. Awareness, Incentives, penalties and legislation are four main tools to involve consumers. The DSM scheme should be formulated based on these four tools.

Awareness is the key to the success of the DSM programme. However at present no such awareness programs on DSM are being conducted by DISCOM and it is proposed to implement the same.

6.3 ENERGY ACCOUNTING

In order to segregate the losses further in technical & commercial category, it is necessary to have energy meters at key locations in the distribution system. At present the meters are installed up to 11 kV feeders outgoing from each substation. It is proposed that DTR metering should be taken up in mission mode to check the theft and commercial loss.

7.0 FIELD STUDY

Visit to Sovarampur 33/11 kV PSS.
Division: BED, BALASORE, Sub Div-1, Section-3

OBSERVATIONS:

- One no. of 33 KV supply is connected from Balasore 132/33 kV OPTCL Grid, Remuna Balasore.
- A 33kV Panther conductor in size of 232 Sq mm with conductor length 5.2 km (approx.) connected from OPTCL Grid. There is one number of 100 kVA, 33/0.415 KV Station Transformer.
- Tapping 33 kV One is going to Srijung PSS under CED through Sovarampur PSS
- There are two nos. of 5 MVA Power Transformers in the Structure.
- One 5 MVA PTR, make is MARSON's, Kolkata and another 5 MVA PTR make Vijay Electrical Limited, Hyderabad have been installed.
- Three nos. of 11 kV Feeder emanating from structure 33/11kV.
- Three 11 kV Control Relay Panel installed inside panel room. AB switch is operating manually.
- Three feeders are in the name of Sahadev Khuntia, Balia and Samalpur Feeder emanating from Sovarampur PSS.
- Three phase outgoing SECURE make Energy Meter are in active conditions for Samalpur 11 KV feeder emanating from 5 MVA PTR, Vijay Electrical make.
- Reading of kWh, kVARh, kVAh, kW, kVA etc. are being shown in the energy meter.
- We found the Sahadev Khuntia o/g energy meter only fixed on the pole but not in operation mode.
- AB switch is manually working.
- Incoming feeder instruments like voltmeter showing reading but Ammeter is not working.
- Total number of consumers is around 1500.
- Technical loss of Samalpur feeder is 14.73%. Average Power available is 20-22%. Billing efficiency is 95%.
- Drawal current for Samalpur feeder varies from off peak 90 Amps to Peak hr 130 Amps.
- Safety tools like Rubber mat were not available inside panel room; Earthing kits were not available for measurement of Earthing Current.
- The Earthing Chamber has to be closed to avoid accidents.
- OTI and WTI indicator not functioning through control cable. It means indicators are not working.
- Outgoing VCB operates manually.
- Consumers paying their electricity bill through Cheque and cash mode.

Physical Visit to Sovarampur 33/11 kV PSS

33 kV Control Panel

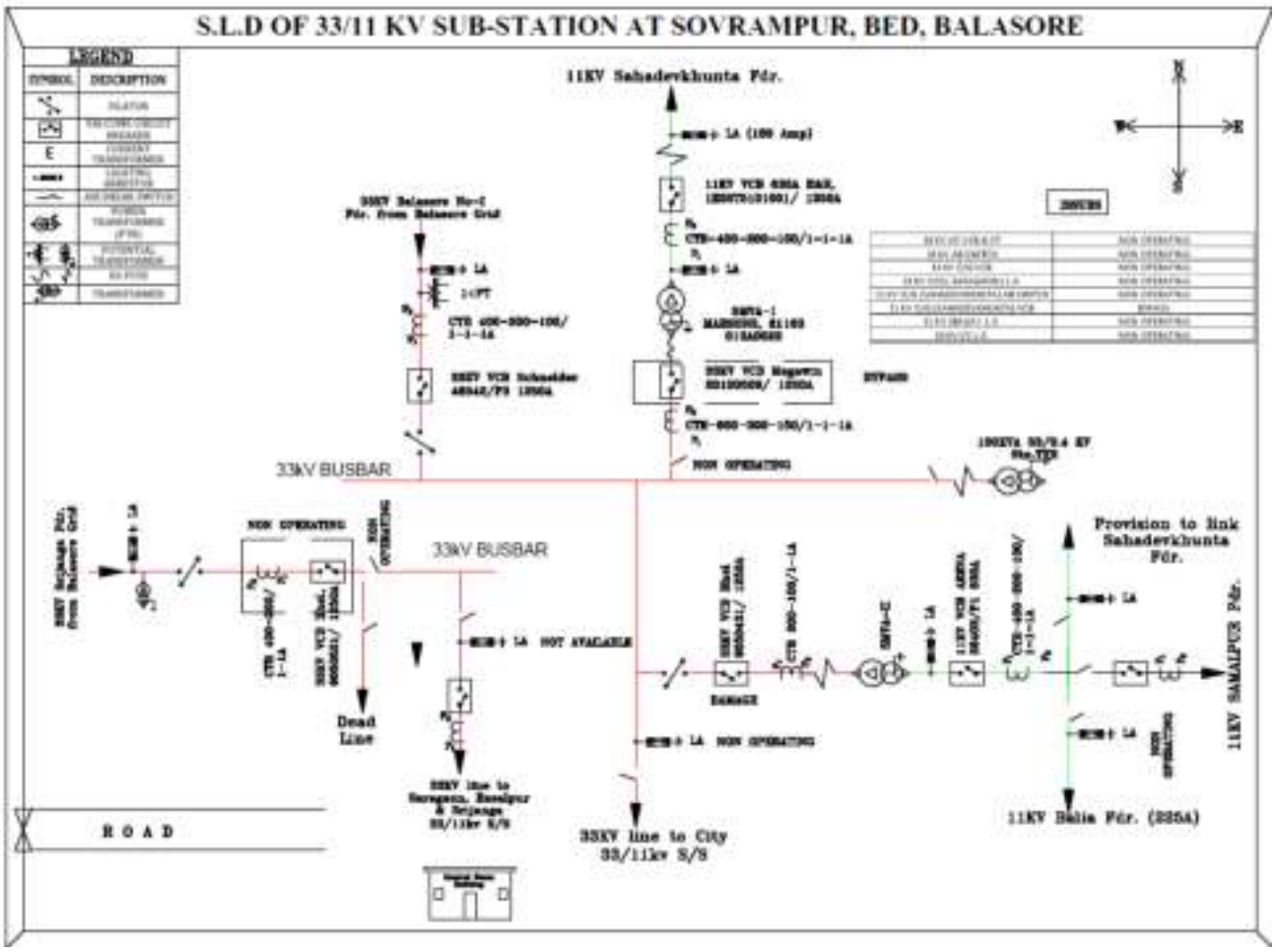
11 kV Control Panel

Meters working correctly

Log Book Maintenance

Silica Gel in Transformer

Earthing


S.L.D OF 33/11 KV SUB-STATION AT SOVRAMPUR, BED, BALASORE
LEGEND
11KV Sahadevkhunta Fdr.
33kV BUSBAR
33kV BUSBAR
Dead Line
ROAD
33KV line to City 33/11kv S/S
Provision to link Sahadevkhunta Fdr.
11KV SAMALPUR Fdr.
11KV Bella Fdr. (2254)

Visit to Ganeswarpur 33/11 KV PSS.
Division: BED, BALASORE, Sub Div-1, Section-3
OBSERVATIONS:

- One 33kV supply is connected from Balasore 132/33 kV OPTCL grid.
- There are three nos. of 5 MVA Power Transformers. Two numbers of 5 MVA Power Transformers are of Areva make and another one number of 5 MVA Power Transformer is of Capital make.
- There is one number of 100 KVA 33/0.415 kV Station Transformer.
- The 33kV conductor length is approx. 2.4 kms. The 33 kV Panther conductor size is 232mm2.
- Three numbers of 11 KV feeders are emanating from PSS. The names of the 11 KV feeder are Town Feeder, Kuruda feeder, Januganj feeder.
- Town feeders are emanating from the middle of 5 MVA Power Transformer of capital make.
- Kuruda village 11kV feeder is emanating from a 5 MVA Power Transformer of Areva make
- Total Feeder length is 145 kms.
- All the O/G feeder energy meters are working properly.
- The 11kV Town Feeder is of DOG conductor size 100 mm2 (approx.).
- The length is 18 kms.
- AB switches are being operated manually with a lot of difficulty.
- The total number of consumers is around 4275.
- Total coverage billing is 75%.
- Billing efficiency is 95 % and Technical loss is 23 %.
- 11 KV CR panel is installed outside of panel room.
- Register for outgoing reading are being maintained regularly.

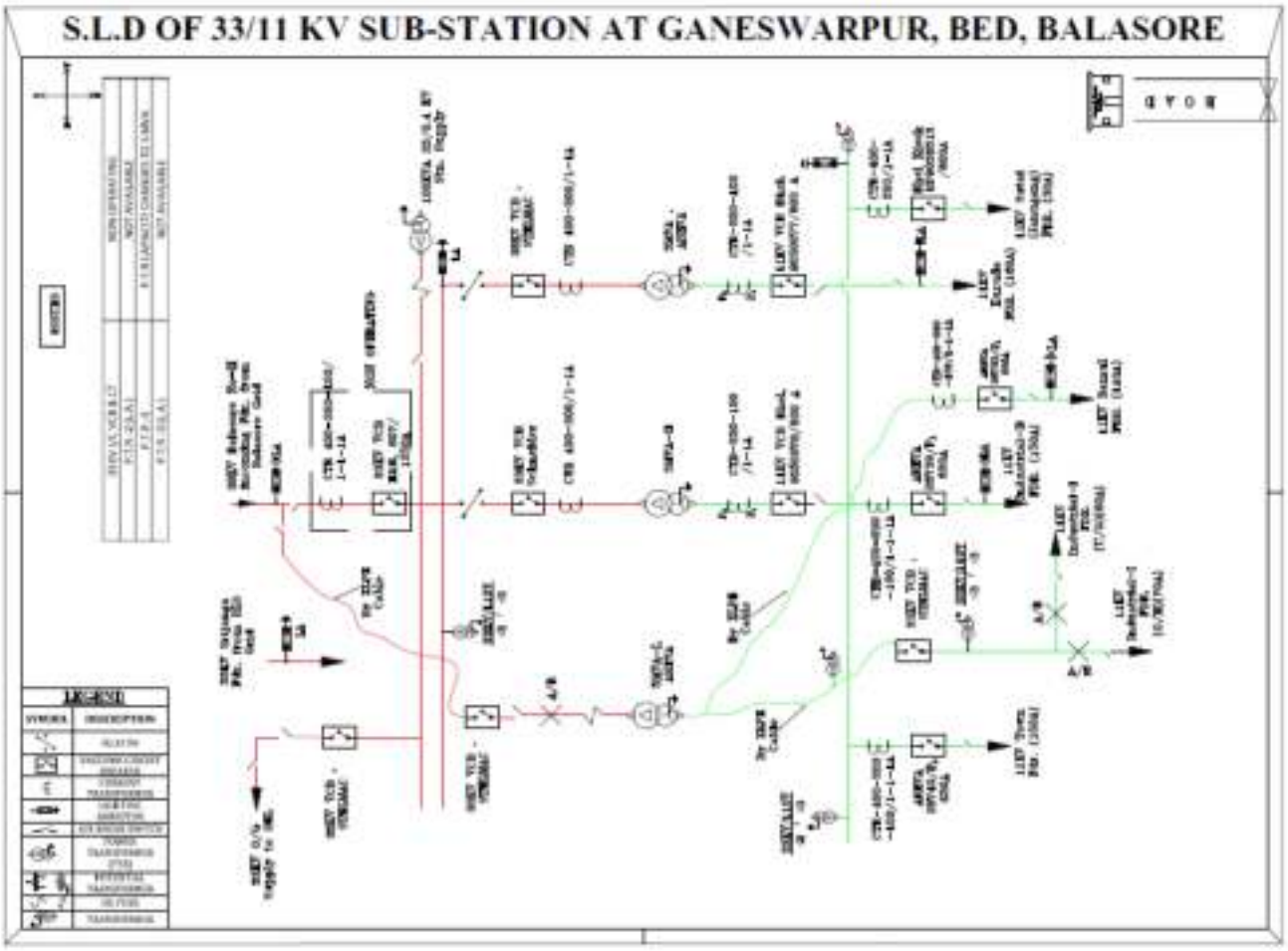
11 kV and 33 kV Control Panels at Ganeswarpur 33/11 kV PSS.

Silica Gel of transformer

Earthing

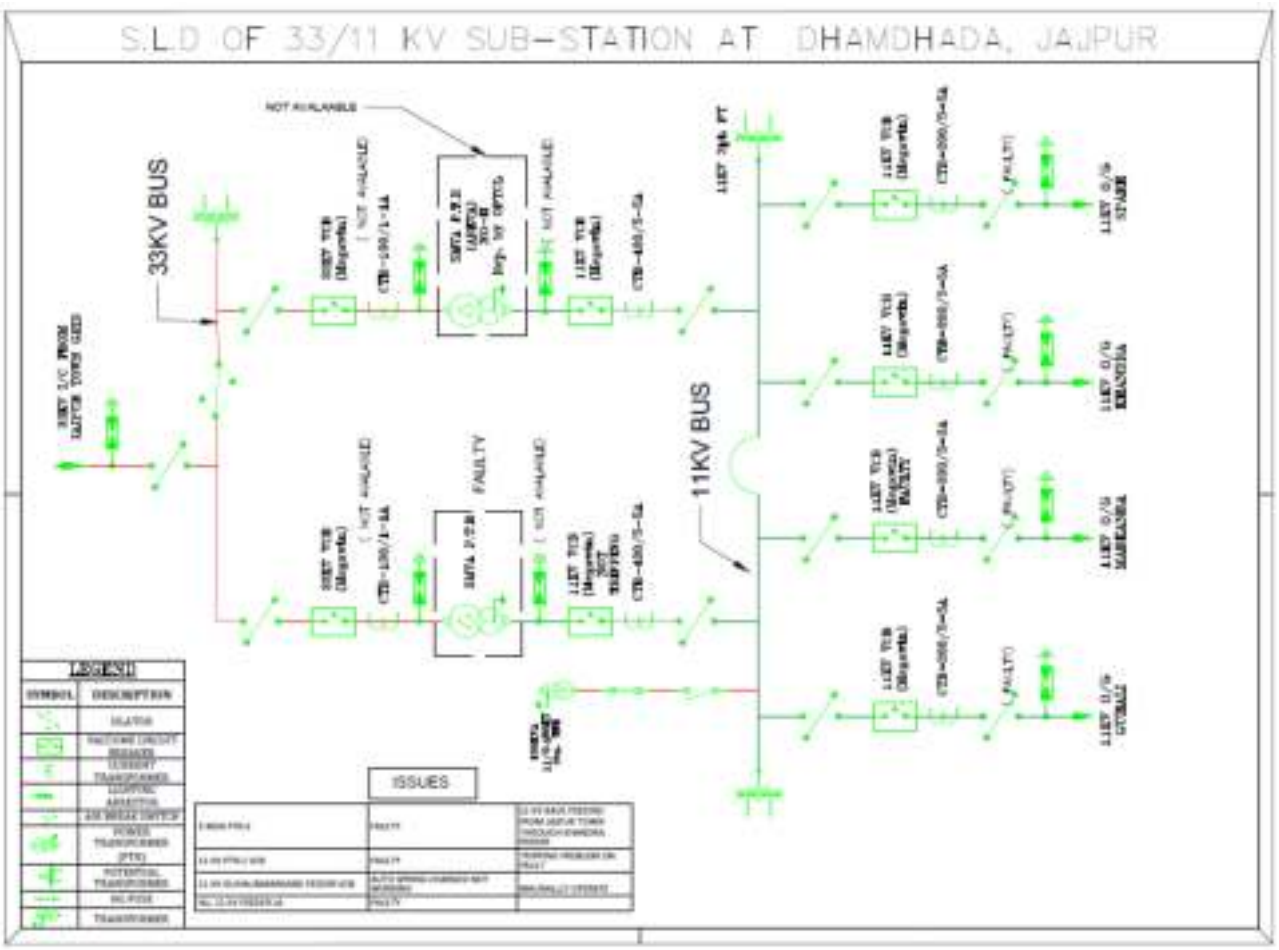
Checking the working of Meters

Log Book Maintenance

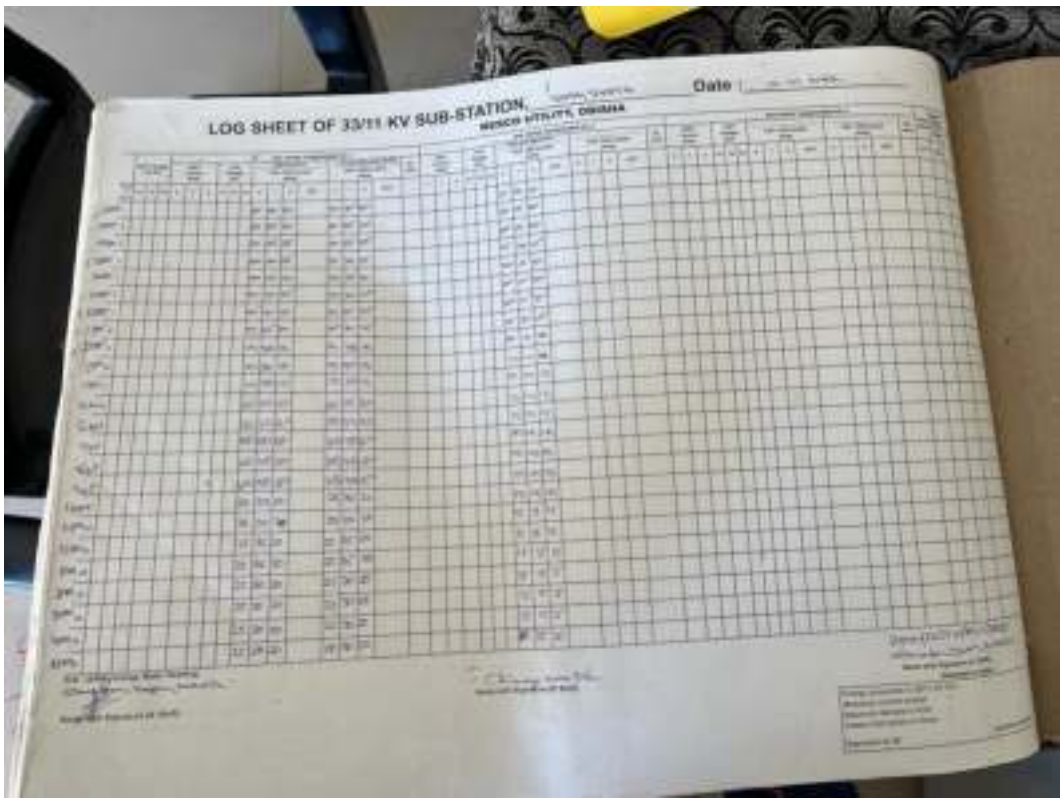

S.L.D OF 33/11 KV SUB-STATION AT GANESWARPUR, BED, BALASORE
LEGEND

Visit to Dhamdhanda 33/11 KV PSS.

- The 33kV supply is connected from Jajpur Town 132/33 kV grid.
- Three numbers of 11 KV feeders are emanating from PSS. The names of the 11 KV feeders are Khandura, Guhali, Markandapur.
- There is one 5 MVA Power transformer
- The 33kV conductor length is approx. 5kms. The 33 kV conductor size is 100 mm2.
- The 11kV Feeder is of conductor size 55 mm2 (approx).
- There are 3 11Kv VCB's out of which two are for Markandapur & Khandura feeders.



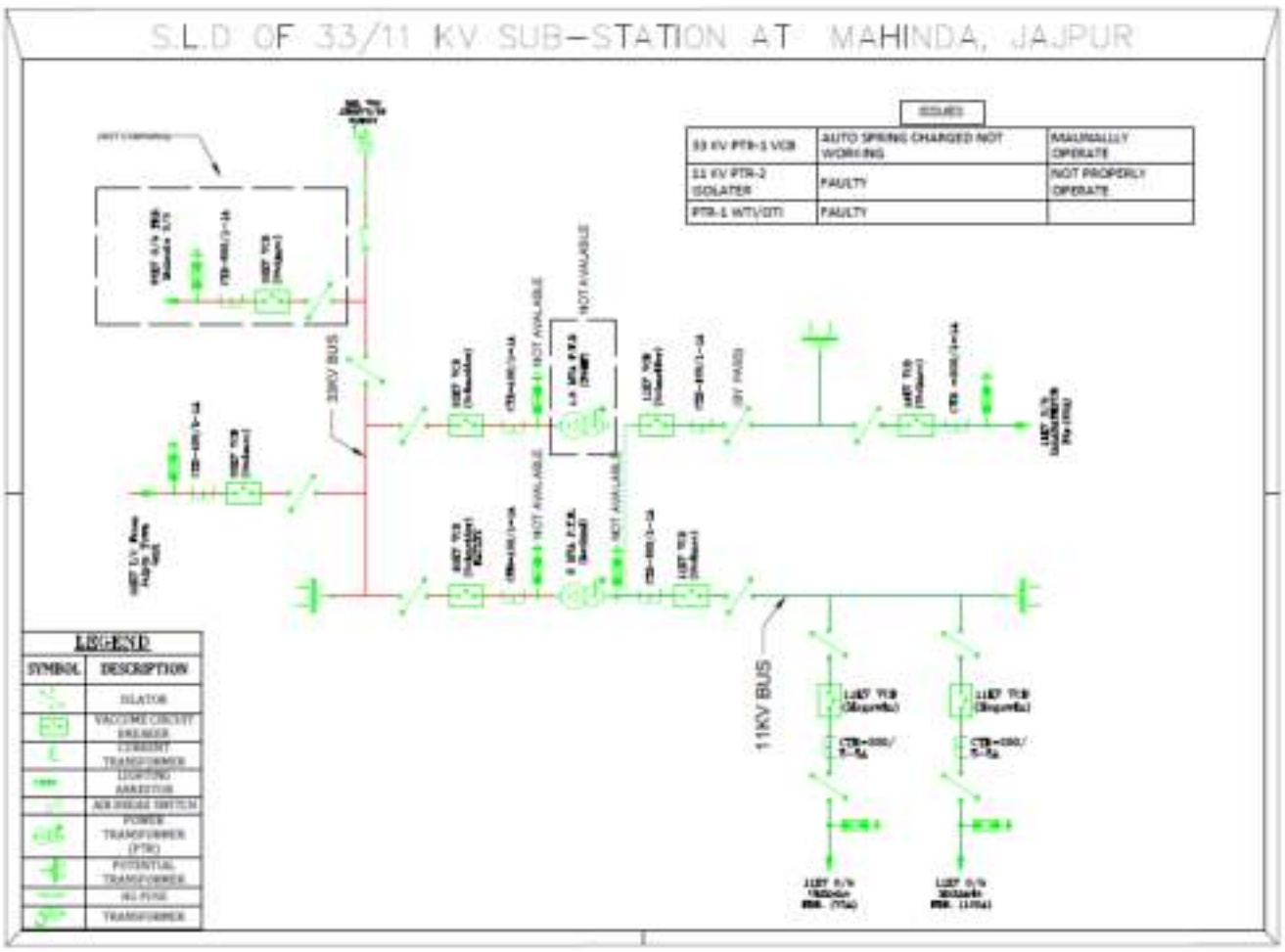
Visit to 33/11 kV PSS



Log book maintenance

Visit to Mahinda 33/11 KV PSS.

- The 33kV supply is connected from Jajpur Town 132/33 kV grid.
- Three numbers of 11 KV feeders are emanating from PSS. The names of the 11 KV feeders are Mainda feeder, Chikana feeder & Jagannathpur feeder.
- There is one 5 MVA Power transformer
- The 33kV conductor length is approx. 12kms. The 33 kV conductor size is 100 mm2.
- The 11kV Feeder is of conductor size 55 mm2 (approx).
- There was an oil leakage in Mainda substation power transformer.
- There was an alarm issue in Jagganathpur feeder control panel.

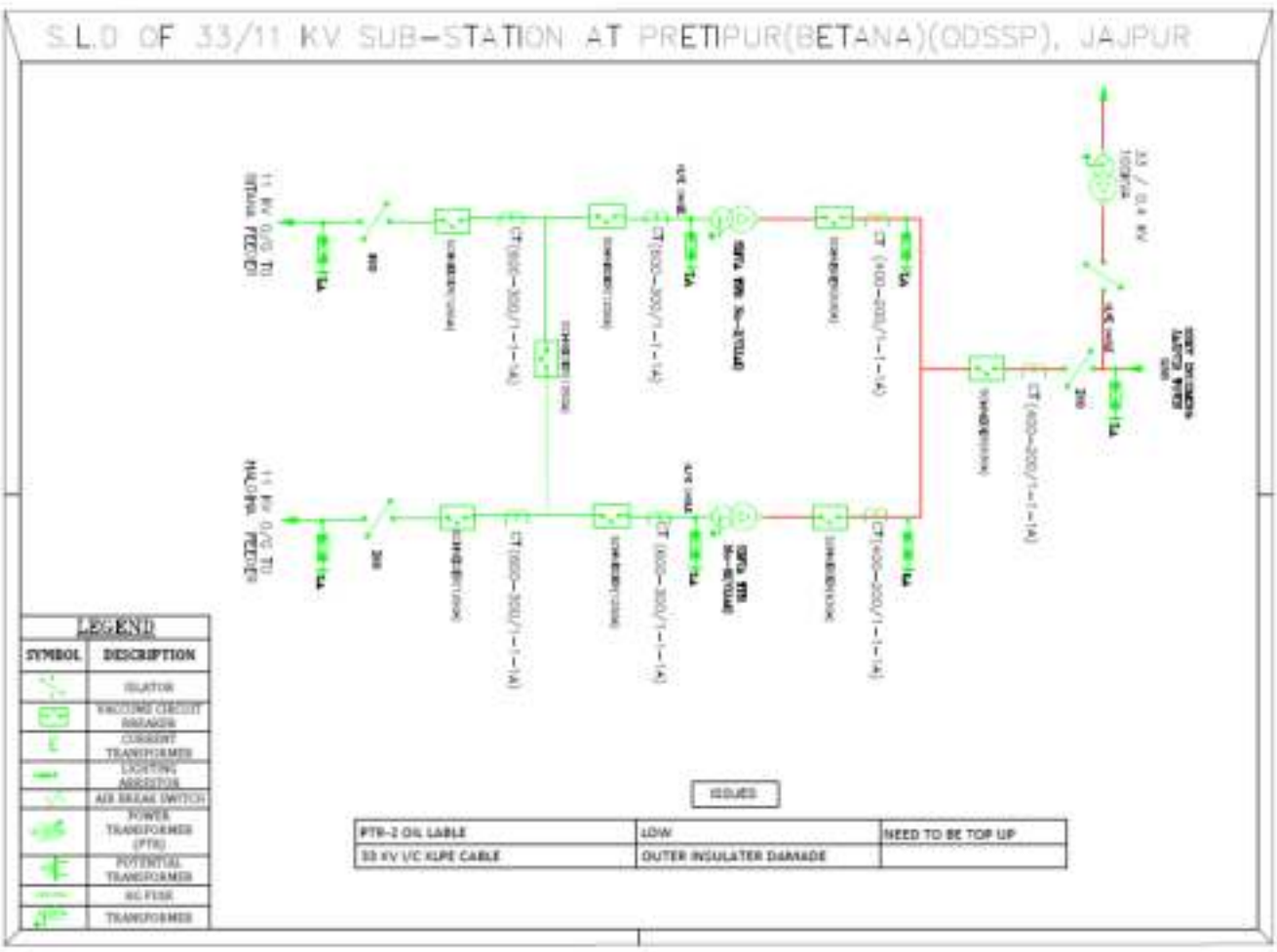


Jagannathpur feeder control panel

Mainda substation Power Transformer

Visit to PRETIPUR (BETANA)(ODSSP) 33/11 KV PSS.

- The 33kV supply is connected from Jajpur Town 132/33 kV grid.
- Two numbers of 11 KV feeders are emanating from PSS. The names of the 11 KV feeders are Bitana feeder & Haladidhia feeder.
- There is one 5 MVA Power transformer
- The 33kV conductor length is approx. 25kms. The 33 kV conductor size is 100 mm2.
- The 11kV Feeder is of conductor size 55 mm2 (approx).
- There are around 2200 & 1500 LT consumers in Haldidhia and Bitana feeder respectively.



Visit to 33/11 kV PSS.

33kV and 11kV control panel

8.0 DETAILS OF VARIOUS SYSTEM IMPROVEMENT & LOSS REDUCTION PROJECT PROPOSED TO BE UNDERTAKEN BY TPNODL

8.1 CAPEX PROGRAMME

To address the challenges and reduction of AT & C loss and quality power supply to consumers, TPNODL has proposed to take up a detailed CAPEX (Capital Expenditure) plan in the FY 2021-22 under the different heads. TPNODL has submitted that it has inherited the power distribution network in dilapidated state at some places, which is not compliant with the requisite statutory standards and poses threat to consumers, staff etc. Further, underrated/ undersized/ worn out conductors, poor earthing, presence of either faulty equipments or non-availability of equipments/ switchgears/ protection devices are creating potential safety hazards to the employees, consumers, children, animals, public, etc.

TPNODL has identified several challenges related to Safety, 33kV/11kV/0.415kV/0.230kV network, Metering infrastructure, Customer Services and Technology usage. The scope of CAPEX includes renovation/modernization of existing and new 33/11KV S/S, re-conduct ring of 33KV & 11KV lines, implementation of HVDS system and AB conduct ring, installation of theft proof energy meters etc. The capital investments have been proposed under the following broad cost centers that shall be aligned with multiple initiatives and schemes so as to reduce AT & C losses, improve system reliability and augment the network to support continuous load growth. Further, a need is also felt to improve the existing facilities and infrastructure to provide a better consumer experience.

TPNODL has categorised the various activities of the Capital Investment Plan under 5 major broad subheads.

- Statutory Compliance/Safety
- Loss Reduction
- Reliability Improvement
- Load Growth
- Technology & Civil Infrastructure

TPNODL proposed Capital Expenditure of INR 275.4 Crores. for FY 21-22 to carry out various activities under the 5 major categories. Hon'ble Commission has accorded approval of INR258.78Crs against the CAPEX Plan of Rs.275.40Crs submitted by TPNODL for the FY 2021-22 vide order dated 18.9.2021 in Case No. 41 of 2021.

Out of the above, we have considered CAPEX related to Loss Reduction, Reliability Improvement, Technology Intervention under the scope present Energy Account Audit as we feel that these major will lead to T&D Loss Reduction and AT&C Loss Reduction.

Establishment of Meter Testing Lab

As per the clause no. 102 (d) of OERC Supply code 2019 "The licensee/supplier shall set up appropriate number of accredited testing laboratories or utilize the services of other accredited testing

laboratories. The licensee/supplier shall take immediate action to get the accreditations of their existing meter testing laboratories from NABL, if not already done"
Presently there is no meter testing laboratory facility at TPNODL. New meter testing labs are proposed to be developed in TPNODL at 2 locations (Balasore & Jajpur) to cater to meter testing requirements.
Meter testing group is responsible for performing the following testing activities on day to day basis:

- Sample meters are to be tested in NABL accredited lab prior to installation, to ensure high quality of the meters.
- As per Requirement of Statutory testing, meters installed at Grids, HT & LT customers' needs to be tested in pre-defined time, based on voltage level, on which meter is serving. Officials have to undertake testing of these meters at site as per IS 15707, with calibrated standard meters, specific for defined voltage levels. In order to perform these testing, sufficient equipment are not available with TPNODL.
- Consumer complaints regarding fast / slow meters after meter installation / during life cycle of meters need to be addressed by testing meters at site as per IS 15707. In order to perform these testing, sufficient equipment are not available with TPNODL. There is requirement of new meter testing bench and details of CAPEX or around Rs.2.2 shall be required is mentioned below.

Material	Qty. (No.)
SINGLE PHASE 20 POSITION BENCH	2
THREE PHASE 20 POSITION BENCH	2
SINGLE PHASE/ THREE PHASE PHANTOM LOAD TEST BENCH	2

These labs will ensure the statutory requirement of meter testing across TPNODL.

Loss Reduction

During limited site inspections, energy meters were not found at consumer's premises which were energized under Saubhagya scheme, an initiative of GoI. Further, at number of places where energy meters are installed and available at site, the same are not functioning properly. The above issues are resulting into reduction in billing efficiency, high AT&C losses, increased provisional billing, defective bills, and increased consumer complaints leading to customer dissatisfaction. Errors in bills leads to non-payment of bills and thus hampers the collection efficiency. It is required to test meters on-site to detect any abnormality/theft thereby reducing AT&C losses. The Electronics meters have capacity for recording data in its memory. This meter data is required to be analysed for detecting any metering abnormality.

Therefore with an aim for reduction in T&D loss, following activities are proposed to be implemented:

- Data collection & analysis for detecting problematic meters.
- Energy Monitoring System (AMR)
- LT bare to ABC Conversion
- On-site testing of meters to detect any metering abnormalities/theft.

CMRI for Meter data downloading - Metering and enforcement

At present in TPNODL there is no practice of collecting data from the meters installed at site. It is proposed to procure around 82 nos. of CMRI's for data collection & analysis. This will help in identification of any problematic meters & take corrective action. The details are furnished as under.

Description	Qty
CMRI for Meter data downloading	82

GSM Modem for AMR Communication

The proposed AMR will offer multiple benefits to the DISCOM as well as consumers. It is proposed to install around 2500 nos. AMR with GSM Modem for consumers having load above 20 KW. This will improve revenue cycle of the DISCOM. TPNODL will be able to control the billing and collection for these consumers effectively. Less billing disputes as 100% correct bills issued on actual meter readings. The details are furnished as under.

Description	Qty. (No.)
GSM MODEM for AMR Communication	2500

LT Bare Line to AB cable conversion

In TPNODL, LT network plays important role of the Power supply distribution system and spread across TPNODL licensed area for power distribution. The bare overhead used is more prone to transient fault due to tree branch touching or any foreign particle fall on the line. Due to this, consumer's experiences frequent fault however, this can be reduced by structured maintenance. Moreover, Bare conductor is easier to maintain and faster to restore during any fault but at the same time, it requires more clearances. These bare conductor lines are more subject to electricity theft through direct hooking and thus causing revenue leakage in the system. LT AB cables exists in the system and constitute approx. 66 % of the total LT network across TPNODL.

To improve the safety factor, minimize the safety accident risk, reduce the chances of fault & strengthen existing 415V network, it is suggested for replacement of overhead bare conductors with new aerial bundled cables. This in turn will help in providing reliable power supply for all consumers & stakeholders.

Moreover, during the survey, it is observed that LT bare conductor are more prone to hooking result into direct theft of the electricity. To avoid direct hooking, it is proposed to convert LT OH bare conductor into LT AB cable. This will help in eliminating the direct theft and thus protecting the

revenue leakage. This will also results in reduced direct 'hooking' done on bare LT conductor lines thereby reducing commercial losses drastically in theft prone areas. LT Bare Line to ABC conversion would encompass following scope:

- LT Bare shall be replaced with LT ABC.
- Erection of mid span pole.
- Earthing of every 5th Pole and poles which are installed across the road.
- Erection of Mid span pole wherever the span length is more than 40 Mtrs to reduce the Sag.
- Installation of Distribution Box and removing of jumbling of service line cables

Benefit to customer:
By executing the proposals as made in this head, 415V network can be strengthened and we would be able to serve the consumers in much better way. Following benefits are envisaged from this investment:

- Reliable Power supply to the Consumers since bare conductor will get converted into insulated cable.
- Comparatively safer than the LT Bare conductor and eliminate the element of risk if comes in proximity.
- Simpler installation, as crossbars and insulators are not required.
- Suitable for congested lanes as well.
- Electricity theft is becoming hard as hooking would not be possible.
- Less required maintenance and necessary inspections of lines.

Field Testing Equipment

As per Requirement of Statutory testing, meters installed at Grids, HT & LT customers' needs to be tested in pre-defined time, based on voltage level, on which meter is serving. Officials have to undertake testing of these meters at site as per IS 15707, with calibrated standard meters, specific for defined voltage levels. In order to perform these testing, sufficient equipments are not available with TPNODL. This will also help in identifying faulty meters at site & take required corrective action. Consumer complaints regarding fast / slow meters after meter installation / during life cycle of meters need to be addressed by testing meters at site as per IS 15707. In order to perform these testing, sufficient equipments are not available with TPNODL. The details of the proposed testing equipment for LT & HT meters at site is given below.

Testing equipment	Qty. (No.)
LT meter 3 phase meter- testing equipment (onsite testing)	12
HT meter- testing equipment (onsite testing)	16
HT-CTPT testing equipment	6
12 V Battery (for AC power supply to CT-PT error testing equipment at site)	5
Portable Calibrated load box	35
Single phase meter testing equipment (onsite testing)	60
TRMS Value Measuring Clamp on Meter With high Accuracy and High Insulation Class	60
CMRI with Bluetooth, Memory 500 MB	82
IR+PI Value Measurement in Step of 500V to 5kV (Megger)	65

Summary of CAPEX Proposed for AT&C Loss Reduction:

S. No.	Major Category	Activity	DPR Cost TPNODL(In Crores.)
2	Loss Reduction	Equipment for Meter data downloading	0.28
		Equipment for AMR enabled equipment	1.37
		Conversion of LT Bare conductor to AB Cable	13.56
		Field Testing equipment - Metering and enforcement	1.76
		Total (2)	**16.97**

Network Reliability

TPNODL have many long overhead feeders. The present power distribution network is in bad condition resulting into frequent tripping's and as a result consumer are not getting reliable and quality power supply. There are total 215 numbers of 33/11kV Primary Substations.

Category of Feeder	In FY - 18-19		In FY -19-20		In FY -20-21	
	No. of tripping	Duration of tripping	No. of tripping	Duration of tripping	No. of tripping	Duration of tripping
	No.	Min	No.	Min	No.	Min
ALL 33 kV Incoming Feeders	5260	838	5968	872	3359	614
ALL 11 kV outgoing Feeders	350582	88397	466528	95962	247894	45448

From the table it can be seen that the number of tripping's are extremely high when compared to best in class utilities.

TPNODL proposed to implement the following actions to improve the reliability of power supply

- Identification and replacement of faulty / sick equipment causing frequent tripping.
- Introduction of technology to ensure faster restoration of supply in case of any tripping.

Most faults that occur on overhead lines are transient faults caused by lightning and tree branches touching the live line conductor. The transient fault caused by lightning results in damage to insulators if lightning arresters are not provided or not working. Transient faults caused by tree branches interfering with line conductor are removed immediately by operation of a protection relay.

Regular inspection of feeders followed by tree trimming regularly helps to minimize transient faults and in most cases trial recloser are found to be successful in feeder with higher transient fault. However, each time the feeders are tripped due to transient fault, all customers connected to the feeder experience outage. Utilities at times finds it difficult to identify the exact reason of the fault. In a long distribution feeder with many unprotected branches, it becomes difficult to identify the faulty and healthy sections of the feeder.

TPNODL intends to use auto reclosers, sectionalizers, and fault passage indicators to improve the reliability of overhead feeders. Apart from installing the above stated equipment, it is also planned to introduce AB switches at 33kV & 11kV long feeders so as to sectionalize at the appropriate location for any planned / unplanned shutdown thereby reducing the no. of affected consumers.

As discussed earlier, most of the LT feeders emanating from 11/0.415/0.230kV distribution substations don't have protection and control as a result, fault in any one LT circuit is likely to affect the supply of all customers connected on the same DT. Same is true with maintenance outages. To overcome this situation, TPNODL is planning to provide circuit breakers on LT feeders for control and protection of the feeder.

Various initiatives proposed to improve the reliability of power supply in 11kV and downstream network are given below

- 33 kV &11 kV Network refurbishment to ensure Horizontal / Vertical clearances and as per Load flow distribution planning done by GRIDCO.
- Primary Substation (PSS) Distribution Substation (DSS) Refurbishment.
- Installation of Auto Reclosure & Sectionalizers in important and critical feeders.
- Installation of Communicable overhead FPIs for faster identification of faults.

- Installation of LV protection at Distribution substation to arrest the LT faults at LT level itself instead escalating to the 11kV feeder level.
- Replacement of Battery & Battery Charger to strengthen the DC protection system in 33/11kV Grid Substations.
- Installation of AB switches at 33kV & 11kV lengthy feeders for improving Reliability during planned / unplanned outages.
- Proposal for Trolley mounted pad substations.
- Installation of Lightning arrestors.

Refurbishment of 33 kV & 11 kV Network:

TPNODL has 2788 Ckt.KMs of 33kV and 36865 Ckt.KMs of 11kV feeders under its operational area. Besides, 66262 Ckt.KMs of LT feeders provide power to the end customers. To ensure safety of equipment and human beings / animals, refurbishment of 33kV, 11kV and LV lines are required in phased manner starting from critical area where movement of public / animals is high.

Proposed works in the refurbishment job are as follows:

- Straightening of tilted poles, earthing, correction and replacement of damaged poles, insulators, and accessories.
- Restringing of conductor to increase the vertical clearance by reducing the sag and replacement of the conductor in the sections having multiple joints.
- Replacement of weak Jumpers and connections and binding wire joints with wedge connector to remove hotspots.

Proposed work in Refurbishment of Primary Substations (PSS) are as follows:

The Power distribution network & its equipment health is a critical factor for ensuring reliable & quality power supply to the end consumers.
Work in the refurbishment of PSS are-

- Replacement of the sick equipment (VCB, CT/PT, CRP, Isolator, etc) and AB switches in Power substation (PSS).
- Provision of new / additional earthing as per site requirement.
- Replacement of damaged support structure at PSS. This includes MS / GI structure
- Dismantling of existing structure and erection of new structure at same location.
- Replacement of Battery and Charger.
- Replacement of all undersize bus bars with standard size to remove hotspot.

Refurbishment of Distribution Substation (DSS):

Distribution Substation (DSS) comprises various equipment which perform specific tasks to ensure delivery of power supply at appropriate voltage to the end consumers. Main components are 11 kV Switching device, 11 kV Protection, Distribution Transformer, LV Protection, Earthing, fencing and O/G LV feeders.

Proposed work in Refurbishment of Distribution Substations (PSS) are as follows:

- Detailed technical inspection and testing of the equipment.
- Replacement of damaged support structure at DSS. This includes MS / GI structure,channels etc. dismantling of existing structure and erection of new structure at same location has been considered in scope of the work.
- Installation of palm connectors at HT and LT side of Distribution Transformers and ensuring that all connections are through palm connectors.
- Replacement of all undersized conductors with standard size to remove hotspot and replacement / provision of AB switch, DD Fuse units, LT ACB or MCCB.

Installation of Auto reclosers / Sectionalizers, FPI, RMU AB switches and LV protection at DSS

Sectionalizers can isolate the faulty sections of the feeder while re- energizing the rest of the feeder. TPNODL currently has many very long overhead feeders. It is observed that multiple 11kV feeders are controlled through a single 11kV breaker or AB switch in some primary substation. Fault in any 11kV feeder or maintenance activity in 11kV breaker at primary substation affects the supply of consumers connected on all 11kV feeders controlled from that breaker. To improve reliability of power supply at such substations installation of auto-recloser, sectionalizers and Ring Main Units (RMU) is being proposed to be implemented in phase manner.

TPNODL is also planning to install RMUs to improve reliability. AB switches are also proposed at lengthy 33kV & 11kV Feeders to have provision of isolation of section during any planned / unplanned outages.

This will help in improving the reliability since currently entire feeder is forced tripped for such outages. Installation of overhead Fault Passage Indicators (O/H FPIs) is proposed for faster identification and restoration of faults on long 11kV feeders with multiple sections.

S.No.	Description	UOM	Quantity Considered in 1st Phase (Nos.)	Amount in Crore
1	Supply and Installation of Auto-reclosers	EA	10	1.34
2	Supply and Installation of Sectionalisers	EA	30	3.91
3	Supply and Installation of FPIs	SET	30	0.2
4	Supply and Installation of 4 Way RMUs	EA	10	1.32
5	Installation of AB Switch on 33KV Feeders	EA	58	1.84
6	Installation of AB Switch on 11KV Feeders	EA	190	5.31
	Total			**13.92**

Circle	Auto-recloser	Sectionalizer	FPI	RMU	33 kV AB Switches	11 kV AB Switches
Balasore	2	6	6	2	12	65
Baripada	2	6	6	2	10	46
Bhadrak	2	6	6	2	12	25
Jajpur	2	6	6	2	10	32
Keonjhar	2	6	6	2	14	22
Total	**10**	**30**	**30**	**10**	**58**	**190**

Installation of LV protection at DSS

Any fault occurred during LT shifts to the 11kV System due to which 11kV feeders trips most of the time. The Tripping on 11kV feeders has an impact on SAIFI and SAIDI and more and more consumers are being affected by the fault, which in turn reduces the reliability of the system. To reduce the effect of LT fault on the 11kV System, it is recommended to install the MCCB on Pole Mounting substation for 100 kVA and 250 KVA Distribution Substations and ACB on 500 KVA Substations.

S.No.	Description	UOM	LT Protection requirement in DSS (Nos.)	Quantity Considered in 1st Phase (Nos.)	Amount (in Crores)
1	Supply and Installation of MCCB-100 KVA	EA	6966	447	1.96
2	Supply and Installation of MCCB-250 KVA	EA	498	180	2.08
3	Supply and Installation of ACB-500 KVA	EA	159	72	2.70
Total			**7623**	**699**	**6.74**

Summary of CAPEX Proposed for Network Reliability:

S. No.	Major Category	Activity	DPR Cost TPNODL(In Crores.)
3	Reliability	33 KV Network refurbishment & AB switch	22.96
		Refurbishment of 33KV/11KV Primary Substation (PSS)	17.5
		11 KV Network refurbishment & AB switch	26.13
		Refurbishment of 11KV/0.415 KV Dsitribution Substation (DSS)	8.99
		Installation of LV protection at DSS	6.74
		Installation of Auto reclosure / Sectionalizers ,RMUs, &FPIs	6.77
		Trolley Mounted Pad Substations	2.34
		Underground cable Fault Locating Van and oil filtration machine	3
		Testing equipment for PSS	6.48
		Earthing of Power Transformers and Distribution Transformers	0.91
		33KV & 11 KV Lightning Arrestor	1.69
		Total (3)	**103.51**

Augmentation of 33KV& 11KV Line, Power Transformers & Distribution Transformer (DT)

Every year DISCOM have to release applied new connection. To meet this consumer growth, both network infrastructure needs to be extended, strengthened, or augmented and new energy meters to be installed to release the new connection. Some of the connections can be released from the existing network and some may require augmentation/addition/extension before release of new connection. Also, with the increase in consumer base there is load on DTR. Few DTR's get overloaded & get burnt. Below table shows the details of Burnt transformers in FY2020-21.

Circle	PTR burnt		DTR Burnt	
	No.	Capacity (MVA)	No.	Capacity (MVA)
Balasore	5	17.6	766	35.98
Bhadrak	5	22.45	310	17.98
Baripada	0	0	476	18.15
Jajpur road	4	21.15	342	16.60
Keonjhar	2	13	326	12.37
Total	16	74.2	2220	101.10

Hence it is proposed to carrying out network extension/ augmentation/addition, to cater to the load growth and meet new demand.

Augmentation of 11kV new line:

Most of the 33/11kV Primary Substation (PSS) have a single incoming 33kV source. With failure of a single existing 33kV source the entire 33/11kV PSS gets shut down thereby causing shutdown to all the downstream 11kV & LT network consumers. It is also observed that HT consumers on 33kV and 11kV are being fed through a tapping point instead of a dedicated feeder.
There are multiple HT consumers also mixed with incoming source of 33/11kV PSS. In case of technical fault at one of the HT consumers leads to tripping of incoming source and another connected HT consumer. To overcome this issue, it is proposed to study to establish link lines from alternative available sources. At present 11kV feeders are radial and do not have ring connectivity with another 11kV feeder as per N-1 philosophy. It is proposed to study ring connectivity between nearest
11kV feeder in the vicinity and adjacent PSS 11kV feeders.

Addition/ Augmentation of Power Transformers:

To cater the increasing load demand, PTR augmentation is required to avoid any overloading and N-1 fail situations. Also, to ensure reliable power supply to consumers, PTRs have to be kept at optimum loading so as to avoid any mechanical stress on the transformers due to overloading.

To avoid any overloading issues especially in urban areas where the load growth is high, it is required to augment some of the power transformers in city areas which are overloaded /may get overloaded considering load growth for the coming years. It will give benefit to consumers as follows:

- Reliable power supply by ensuring N-1 reliability at PTR level.

- Reduce over-burdening of existing PTRs thereby reducing power cuts.

Augmentation of Distribution Transformer:

Also, to ensure reliable power supply to our consumers, Distribution Transformers need to be kept at optimum loading to avoid any mechanical stress on the transformers due to overloading. When a distribution transformer loading exceeds 80% of the rated capacity of the transformer, then it is "overloaded".

To avoid these overloading issues especially in urban areas where the load growth is high. It will provide benefit to consumers as follows:

- Reliable power supply by reducing chances of fault in network, thereby reducing power interruptions
- Reduce over-burdening of existing Distribution transformers thereby reducing power cuts.

Summary of CAPEX Proposed for Network Load Growth:

S. No.	Major Category	Activity	DPR Cost TPNODL(In Crores.)
4	Load Growth	Augmentation from 5 MVA to 8 MVA Power Transformer	8.96
		Augmentation from 200/250 to 315 KVA Distribution Transformer	5.19
		Augmentation 63/25 to 100 KVA Distribution Transformer	4.11
		Addition of 11 kV Overhead Line	1.68
		Addition of 33 kV Overhead Line	2.06
		Total	**22**

Technology Infrastructure

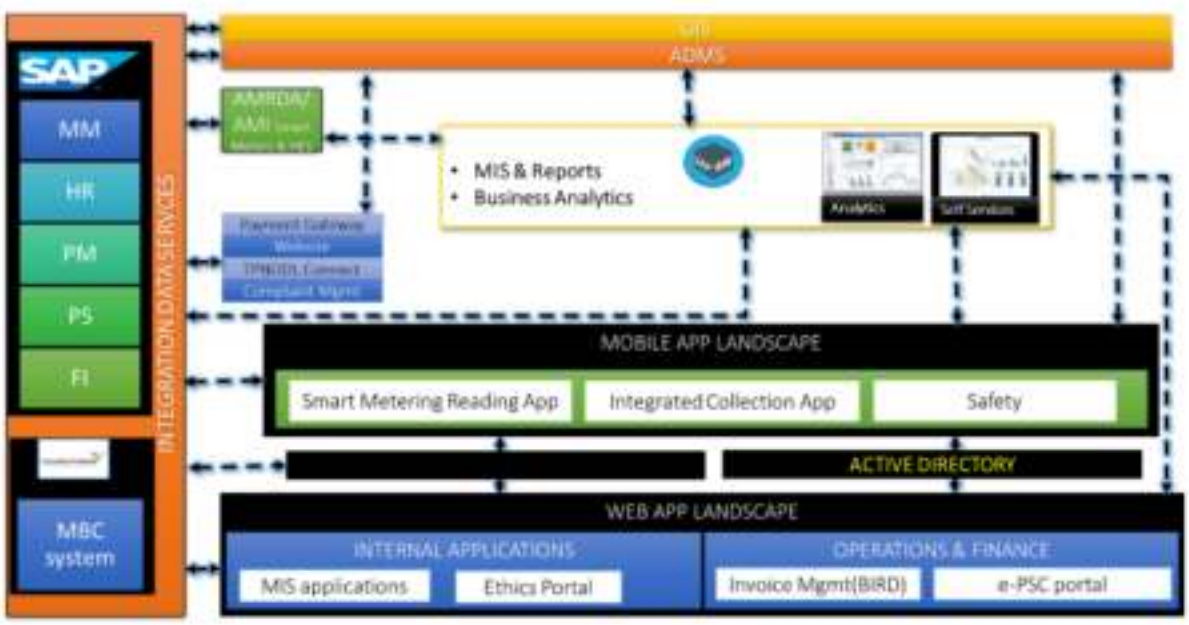
Information technology (IT) Landscape:

Operational efficiencies when matched with Technological applications, results into great face change for a utility. As far as technology is concerned earlier utilities (NESCO) had not done investment in technology till start of MBC & ERP implementation Govt. funded IPDS schemes but could not managed to roll out resulting into defeating the very purpose of the scheme. There is no investment done on Operational technologies like SCADA/DMS/OMS, GIS etc.

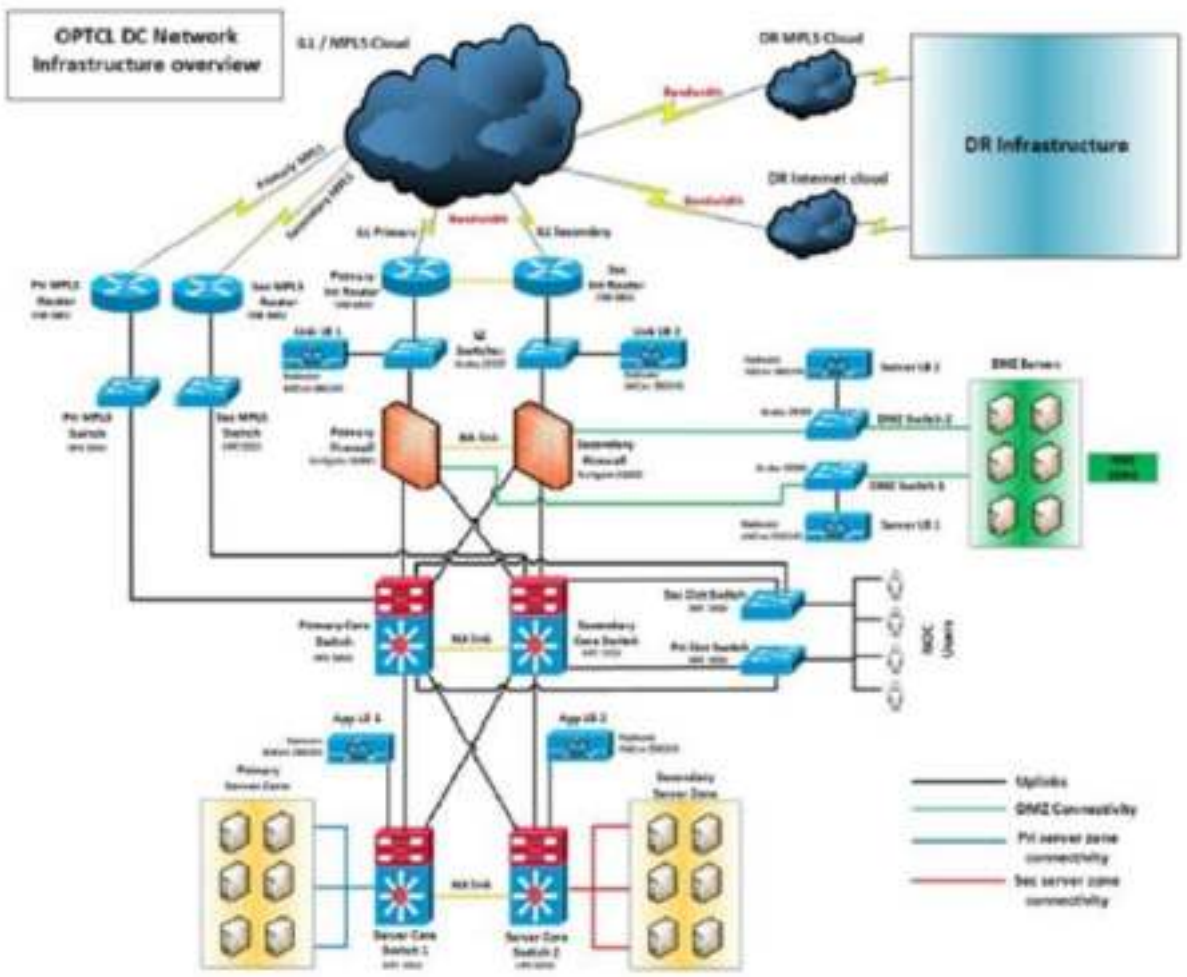
Key technological interventions like Fluent Grid's MBC (Meter Reading, billing, and collection), ERP on SAP platform (Procure to pay module. Plant Maintenance, HR Module etc.), GIS, and SCADA are proposed to be implemented in a phased manner by TPNODL.

Similarly, other interventions like Smart metering, Analytics, Smartphone based spot billing are proposed to be implemented to unleash the full potential of technology and reap the consequent benefits.

The IPDS scheme Fluent Grid is implementing Customer Care Solution, Meter, Billing & Collection, New Connection and other Commercial Process, Energy Audit, MIS, Various ERP Modules. Apart from this, It is proposed to rollout Smart Metering MDM and HES system for consumers above 5 KW along with various mobility landscapes. The IT-OT landscape shall be proposed as follows.



IT-OT Connectivity Design



Key considerations for IT Landscape Transformation

Development of back end IT Infrastructure for Smart Metering Smart Meters and metering system are the technology that is currently available in the market and is a preferred solution to adopt for consumer metering. GoI has also given mandate to replace all 25 Crores meters by smart meters in next 3 years. In line with the national mission and as a pilot project, it is proposed to roll out Smart Meter (SM) project under Advance Metering Infrastructure (AMI). The proposed Smart Metering AMI will offer multiple benefits to the DISCOM as well as consumers.

The benefits are as follows:

- TPNODL will be able to control the entire billing and collection very effectively
- Less billing disputes as 100% correct bills issued on actual meter readings.
- The revenue cycle can be managed much better by spreading the meter reading dates.

Summary of Proposed Smart Metering Project cost

Description	Activity	DPR Cost (In Crores.)
Smart Metering (AMI)	Installation of Smart Meters IT infrastructure, software like HES & MDM for 1 Lakh consumers (Phase-1)	10.5

Operational Technology Landscape-SCADA Implementation

Currently there are total 215 numbers of 33/11 kV substations in TPNODL areas out of which 99 no. of substations are developed/being developed under ODSSP scheme and at present 64 ODSSP are taken into service.

Name of Circle	BALASORE	BHADRAK	JAJPUR ROAD	KEONJHAR	BARIPADA	Total
Total Substations	58	33	34	40	50	215
ODSSP S/Stns (64 taken in service out of 99)	23	14	18	27	17	99

While Non ODSSP/Old Substations would take some time for modernization/revamping for making it SCADA ready, substations under ODSSP (being SCADA ready) can be very quickly integrated to centralized Control Center. These substations are equipped with capabilities of being remotely managed with help of communicable devices viz. relays, IED, RTUs, etc. These new substations shall bring in higher levels of operational efficiency and system performance. TPNODL area is prone to frequent disaster situations such as cyclone, etc. and these substations shall not only help in managing the load efficiently but also reduce system downtime. Further, to harness the remote management capabilities of these substations it is must that these substations are integrated to Supervisory Control and Data Acquisition (SCADA) System. Through this system, all these substations shall be connected to a centralized control centre for the purpose remote monitoring, control & operations.

As a Phase wise approach, it is considered that in FY22 20 nos. ODSSP substations & 10 nos old PSS would be connected to SCADA. However, it is very pertinent to mention that SCADA is very effective for load management and effective and efficient operational execution. Over the period of time to convert old PSS into SCADA enabled PSS, it is required to scale up SCADA infrastructure at Power System Control level and Data center equipment level with DR enablement along with proven SCADA software. Also, installing the devices/ new equipment in field to make them SCADA compatible is also must. Overall. This system requires investment which will be justified by the operational excellence in power management and efficient restoration. In FY22, we have kept limited Capex to make the data compatibility with ODSSP substations.

Description	FY22
Mini SCADA	2.55 Cr.

GIS Implementation

TPNODL is also planning to implement GIS system to have better asset management and its topology which will further facilitate to implement OT technologies by integrating with GIS. System once implemented will strengthen various other business processes viz. energy audit process, technical feasibility, dues verification, network planning. GIS will be backbone for Electrical linear and nonlinear asset repository as well as its connectivity topology. Being a large geography, GIS will be implemented in two parts: 1) GIS Software & its integration 2) GIS Data Creation PAN TPNODL. In FY 21-22, it is proposed to implement the GIS software and its implementation with limited IT infrastructure and user's licenses which will be subsequently added with data for all divisions with scalability of infrastructure and user's licenses. CAPEX proposed for implementation of GIS in FY 21-22 is

Description	FY22
GIS Implementation	7.91 Cr.

Benefits of Proposed IT Landscape Following are the key benefits of the Proposed Solution:

- Adoption of very strong integrated application landscape for enterprise wide implementation
- Ensure secured services to customers to safe guard the confidentiality, integrity and availability of IT systems
- Integrated processes with strong access control
- Drive the culture of safety and ethics among the workforce and all stakeholders
- Ensure customer delight and effective solutions for addressing needs
- Stringent data integrity to avoid any revenue leakage
- Increased Billing and collection efficiency
- Enhanced user experience with extensive standard features & functionalities
- Standardized process workflow across organization
- Centralized data base for synchronized data.
- Enhanced integration and automation capabilities with Non-SAP applications
- Using SAP standard capabilities combined with customer presentment platforms for a delightful customer experience

Summary of CAPEX Proposed for Technology

S. No.	Major Category	Activity	DPR Cost TPNODL(In Crores.)
5	Technology & Civil Infrastructure	Data Center (DC) Development Cost	5.39
		IT Infrastructure Hardware Cost	5.31
		End user Devices i.e. Laptop, desktop, Printer, scanner	16.34
		Software Licenses	15
		Communication Network Infrastructure at DC and office locations	4.98
		Mini SCADA Implementation (20 nos ODSSP & 10 nos Old PSS)	2.55
		GIS Implementation for One Division	7.91
		Smart Metering Infrastructure (HES & MDM on 4G/ NBIOT Communication)	10.5
		Call Center Implementation (System & Infrastructure)	5
		Civil Infrastructure (Office Buildings,Meter Test Lab, Customer Care center, Records Rooms, Power System Control)	17.3
		Establishment of DT workshop	3.6
		High mast light in the Center store	0.75
		Assets for Offices	5.23
		Building shed for material storage with racking system	3.25
		Total (5)	**103.11**

8.2 ENERGY BILL PAYMENT OPTION AND CUSTOMER CARE

Following in house activities are planned to be implemented at TPNODL for customer care and will be part of the Implementation Program.

Customer Touch Points:

To improve the customer experience, customer touch points need to be augmented for providing ease of connectivity and single touch point at offices. Accordingly, following initiatives are proposed:

Establishing 50 seat Call Centre:

Call Centre is a convenient mode for providing service on 24X7 basis thereby customer is not required to go through the hardship of visiting the office. This demands the overhauling of existing infrastructure of call centre to improve the Call Centre connectivity. Keeping in mind to provide ease in customer experience, a unified Call Centre (one no. for TPNODL/franchise customers) is imperative to be made operational. Considering the customer base of 19 Lakh consumers and providing service at call is the preferred mode of service in utility sector, initially, infrastructure of existing 4 seats call centre is proposed to enhance to 50 seats Call Centre at Balasore. To establish the one of the state of art call center, it is required to commission call center telephony equipment for inbound and outbound, interfaced with multiple option to connect and further integration with business system to auto response and feedback from consumers

Payment Gateway

A centralized proprietary payment gateway is planned to be established which would seamlessly integrate with all collection touch points like website, mobile app, counters, partner agencies, mobile wallets into a single repository where verification and validation of payments would be done and would be posted to the SAP Billing platform to ensure no GIGO and keep the billing system safe and secured from direct external exposure.

Website

Content management System with dynamic website would be placed with integrations to payment gateway and other key systems.

TPNODL Connect

Mobile app which would run on all devices and with ease of use features and enablement for customer satisfaction

Suraksha Portal & Behavior based Safety app

As safety is a key aspect and needs to be woven in the company culture, best practices followed at Tata Power DDL will be implemented

BIRD

Bill Inward Recipient Desk is an application for submission, approval and processing of vendors invoices online, check status of the invoice and track the same

e-PSC Application

Platform to capture and evaluate reliability indices and a backbone to power system control team.

Complaint management system & Anubhav Portal

This is end to end feedback capture and CAPA closure with information dissemination to all stakeholders is planned to be implemented to bring transparency and effective response to customer needs.

Mobile Apps

- SMRD – Smart Meter Reading Devices - Mobile App for Meter Reading, Bill Distribution & follow up. Integration with SAP and Real time Reading uploading to SAP for Billing, OCR based meter reading to be in place
- TPNODL Connect - Bill Payment , Employee Verification ,Outage Information, My Account enabled with Billing, Consumption & Payment History, Register & track Complaints ,Smart Meter Data ,Offer & Schemes ,Report Safety issues, Apply New Connection, Streetlight Complaints & Energy Conservation Tips.
- Collection Mobile app will be integrated with the Payment Gateway application and billing system for up-to-date information

SUMMARY OF ENERGY CONSERVATION MEASURES

DETAILS OF ENERGY CONSERVATION MEASURES RECOMMENDED IN THE ENERGY AUDIT REPORT [2022-23]							
Sl. No.	**Energy Saving Measures**	**Investment (In crores)**	**Targeted Annual Energy Savings in MU**	**Targeted Financial Savings in Rupees Crore**	**Payback Period**	**Date of Completion of measure / likely completion**	**Remarks**
A	**Establishment of Meter Testing Lab**	**2.17**					
B	**Loss Reduction**		112.07	40.23	4.91	FY 2022-23	As per the annual reduction in T&D loss target of Hon'ble OERC and detailed note attached
	Equipment for Meter data downloading	0.16					
	AMR enabled equipment	1.37					
	Conversion of LT Bare conductor to AB Cable	13.1					
	Field Testing equipment - Metering and enforcement	1.76					
	Total (B)	**16.39**					
C	**Network Reliability**						

	33 KV Network refurbishment & AB switch	22.96					
	Refurbishment of 33KV/11KV Primary Substation (PSS)	16.29					
	11 KV Network refurbishment & AB switch	26.13					
	Refurbishment of 11KV/0.415 KV Dsitribution Substation (DSS)	8.9					
	Installation of LV protection at DSS	6.49					
	Installation of Auto reclosure /Sectionalizers,RMUs, & FPIs	5.07					
	Trolley Mounted Pad Substations	1.15					
	Testing equipment for PSS	4.9					
	Earthing of Power Transformers and Distribution Transformers	0.81					
	33KV & 11 KV Lightning Arrestor	1.65					
	Total (C)	**94.35**					
D	**Load Growth**						
	Augmentation from 5 MVA to 8 MVA Power Transformer	8.7					
	Augmentation from 200/250 to 315 KVA Distribution Transformer	5.19					
	Augmentation 63/25 to 100 KVA Distribution Transformer	4.08					
	Addition of 11 kV Overhead Line	1.68					
	Addition of 33 kV Overhead Line	2.06					
	Total (D)	**21.71**					
E	**Technology & Civil Infrastructure**						

	Data Center (DC) Development Cost	5.39					
	IT Infrastructure Hardware Cost	5.31					
	End user Devices i.e. Laptop, desktop, Printer, scanner	16.02					
	Software Licenses	15					
	Communication Network Infrastructure at DC and office locations	4.98					
	Mini SCADA Implementation (20 nos ODSSP & 10 nos Old PSS)	2.55					
	GIS Implementation for One Division	3					
	Smart Metering Infrastructure (HES & MDM on 4G/ NBIOT Communication)	10.5					
	Total (E)	**62.75**					
Grand Total		**197.37**	**112.07**	**40.23**	**4.91**		

CALCULATION OF SIMPLE PAYBACK PERIOD

Approved sale of TPNODL as approved by commission FY 202-23= 4915.30

Calculated T&D Loss of TPNODL for FY 2020-21= 20.63%

Target T&D Loss as approved by Hon'ble OERC for FY 2020-21=18.35%

Hence Targeted Annual Energy Savings in MU = 4915.30*(20.63%-18.35%) = 112.37 MU

Approved Bulk Supply Price of GRIDCO for FY 2022-23= Rs.3.31 per Unit

Approved Transmission Tariff of OPTCL for fy 2022-23= Rs.0.28 per Unit

Hence financial saving of TPNODL due to T&D loss reduction= (3.31-0.28)*112.07/10=40.23 Cr.Rs.

Total investment approved by Hon'ble OERC for T&D Loss=197.37 Cr. Rs.

Simple Payback period = TOTAL INVESTMENT / SAVINGS = 197.37/40.23=4.91 Years

CONCLUSION

In line with Section 14(g) of the Energy Conservation(EC) Act, the Central Government has notified targets (in the form of Specific Energy Consumption) for Designated Consumers (DCs) on 26th October 2021under the PAT cycle-VII. The baseline Distribution loss of TPNODL has been fixed as 18.74% for baseline year 2018-19 to with baseline net input energy 5575.61MU. TPNODL has been directed to reduce its T&D Loss to 17.60 % in Target Year 2024-25.

TPNODL Management has endeavoured for continual improvement in its drive for achieving energy efficiency by adopting various energy saving measures with most energy efficient technology. Considering the trend in their energy performance, it is expected that TPNODL may get a target for further reduction of its T & D Loss from its present level. Hence, TPNODL should focus to achieve the future target by adopting a strict energy conservation plan and energy efficiency measures.

Overall, the TPNODL management has a very progressive outlook and is open to ideas involving moderate to low investment, to improve the Energy Efficiency. Hence we feel TPNODL management needs to put best effort to achieve Energy Conservation in future.

COMPLETION CERTIFICATE

Ref. No: TPNODL/PTC/2022
Date: 10th June 2022

To
M/s. Power Tech Consultants
K-8-82, Kalinga Nagar, Ghatikia
Bhubaneswar-751029
Phone-0674-2954256
Email: pwrtch@gmail.com

Subject: Work Completion and Acceptance Letter to Annual Energy Audit report of TPNODL for FY 2020-21 under PAT Scheme

Ref: Our Work Order No – PO No: 4800000365dated 15th September 2022

Dear Sir,

It is to validate that M/s. Power Tech Consultants has completed Annual Energy Audit of TP Northern Odisha Distribution Limited (TPNODL), Januganj, Remuna Golei, Dist.: Balasore, Odisha-756019 for FY 2020-21 under PAT Scheme and submitted the Audit Report. We here by accord our concurrence and acceptance to the report submitted by M/s. Power Tech Consultants.

Thanking you.

Yours faithfully,

Name: Dushyant Tyagi

Designation: Chief Commercial Services & CSR

Organisation: TP NORTHERN ODISHA DISTRIBUTION LIMITED

Seal:

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(A Tata Power & Odisha Government Joint Venture)
Registered & Corporate Office: Januganj, RemunaGolei, Balasore – 756 019, Odisha, India
Phone: +91 6782 244865, Email: contactus@tpnodl.com, Website: www.tpnodl.com
CIN: U40106OR2021SGC035951